

**POLICE COMMUNICATIONS
2000
RIVERSIDE COUNTY**

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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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POLICE COMMUNICATIONS 2000 - RIVERSIDE COUNTY

Introduction

As our society becomes mobile and moves westward to the sunbelt of Arizona, New Mexico and California they bring with them more population, more cars, and more problems. One of the major areas showing a rapid growth is Riverside County, California.

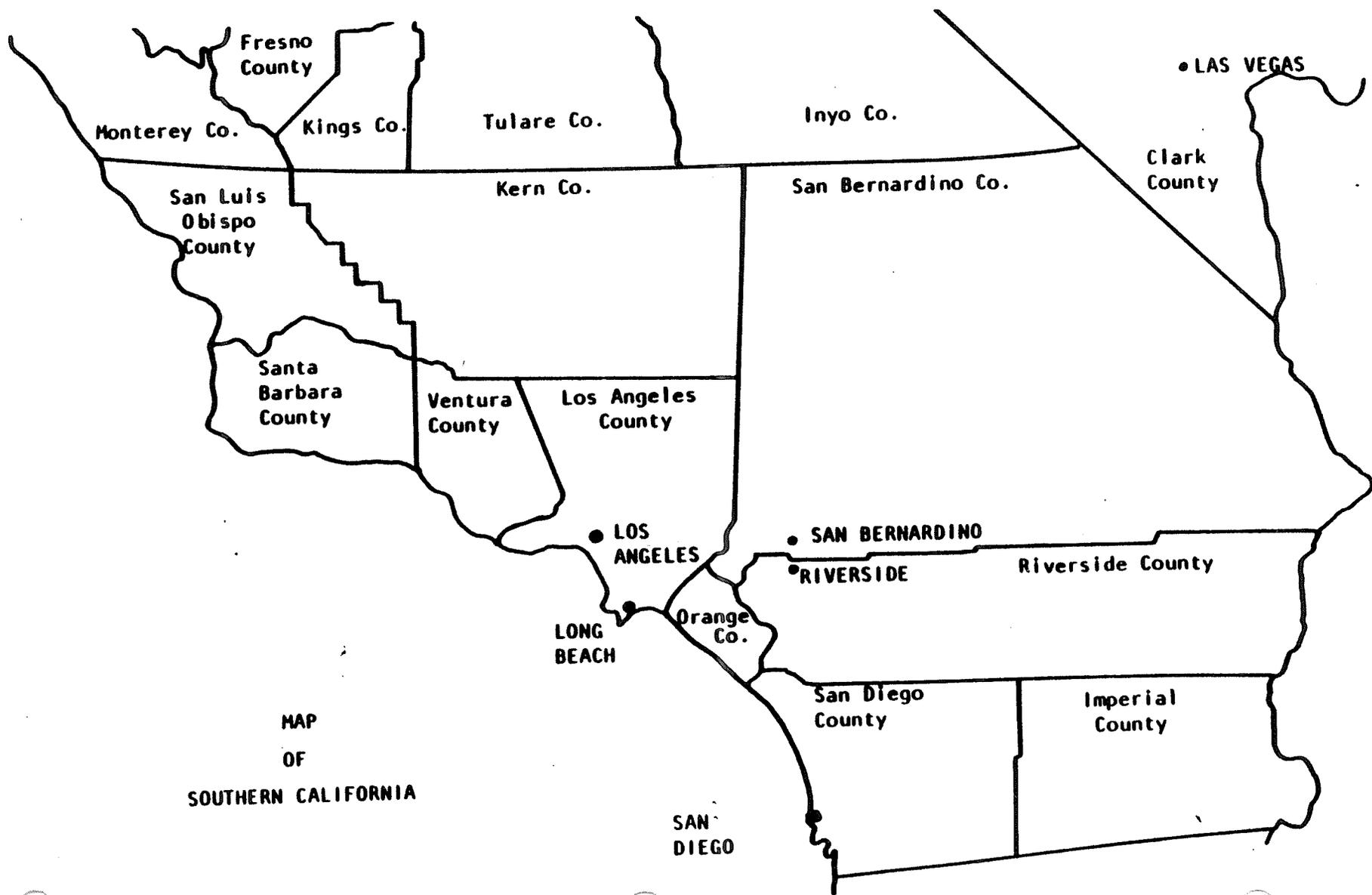
The County of Riverside is located in Southern California and stretches from within seven miles of the Pacific Ocean to the state of Arizona. The County is approximately One Hundred Eighty miles long, from east to west, and forty miles wide from north to south, for a total area of Seven Thousand Three Hundred square miles. The western portion lies within the greater Los Angeles basin and the southern edge of the county borders San Diego County. The terrain ranges from two hundred thirty-four feet below sea level to eleven thousand feet above.

It has a population of 795,100 [1985] and a projected population of 1,201,500 in the year 2000 making it one of the fastest growing communities in the country.

Approximately 90 percent of this present and projected population is concentrated in the northwest portion of the county, in and around the City of Riverside in proximate to the major population centers in Los Angeles County, San Bernardino County, and Orange County. Heavy frequency utilization in these three counties to the rest of Riverside County affect the choices available to the County of Riverside in the design of future law enforcement communications.

Mountain ranges generally run east and west along the northern and southern edges of the county, providing some isolation from San Bernardino County to the North and Imperial and San Diego Counties to the South.(Fig. 1)

F



MAP
OF
SOUTHERN CALIFORNIA

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Statement of Need

Voice radio operation is becoming extremely crowded in the metropolitan areas of the county due to population and police communication need increases. Manpower increases generate radio messages, which in turn generate a need for additional frequencies.

Other public safety agencies, not in operation ten years ago, now are operating and feel an additional need for radio communication. Along with this additional need, High-Tec has taken additional frequency away from voice communication [digital, computer link, vehicle locators, trackers].

Police officers, where ever they are, will still be required to voice communicate with each other immediately over short and long ranges. As population areas grow this becomes more and more difficult due to range restrictions, interference, and quantity of communication units.

This command college project will try to explore what avenues of relief will be available in the near and far future [5 - 15 years]. It will look at recommended

alternatives to voice communication and a possible
recommendation and/or solution.

Statement of Objectives

This project will try to identify where radio communications will be in the future by:

- a. Where they are now;
- b. Where they should be;
- c. Where they will be.

It will compare trends or forecasts of how they will effect other agencies or programs with:

- a. Financial resources
- b. Technological resources
- c. Personnel policy or theory of law
enforcement administration

It will create the best possible solution or scenarios to the problem and select the "best" option feasible or available and develop it into a more representative solution. It will also develop a strategic plan on the solution. Along with a strategic plan it will design a Implementation plan for the strategic plan.

Communications Requirements & Problems

In light of operational experience, what will the mobile communications requirements be for public safety entities over the next fifteen years? The population growth in the Riverside/San Bernardino primary metropolitan statistical area "PMSA" is projected to be forty-one percent from 1980 to 1990 and from 1990 to 2000 will be another twenty-nine percent. This information was forecasted by the SCAG-82 Growth Forecast Policy. This alone will cause at least a proportional increase in the need to transfer voice and digital information to vehicular units and field police personnel. The future spectrum requirements will depend largely on proven technology introduced by the industry to speed information transfer using reduced bandwidth. A minimum of seventy-five voice channels will be required to implement a coordinated county wide public safety communications plan. Currently the law enforcement agencies within the county operate in at least three non-compatible bands and the Fire Departments operate in at least two non-compatible bands. They are not frequency compatible with the neighboring counties (FIG 2).

The requirements for a true, reliable communications system are:

- A. Clear transmission capability

- B. Adequate openings for transmissions
- C. Non-Interference of radio frequencies
- D. Adequate range for local jurisdictions

In this area Riverside County has current problems that address each of the above needs.

There is clear transmission capability except in those areas that have joint use of a frequency or natural barriers that affect the clarity of the radio spectrum.

Due to the increase in Calls for Service based on population increases the need for additional radio transmission is increased to where frequencies are crowded and sometimes unusable. Interference has been noted by adjacent counties and other local agencies generating the requirement for reduced antenna power or directional antennas.

Because most of the county population resides in western or south-western parts of the county, radio transmission range is affected by numerous natural objectives with steep hills being the major obstacle.

<u>LAW ENFORCEMENT AGENCY</u>	<u>CURRENT RADIO UNITS</u>	<u>YEAR 2000 UNITS</u>	<u>CHANNEL ALLOCATION (CURRENT/FUTURE)</u>
Sheriff	755 (VHF)	1133	8T/12T + 4C/6C
District Attorney	55 (VHF)	78	Incl. w/Sheriff
Coroner	25 (VHF)	45	Incl. w/Sheriff
Marshall (E & W)	50 (VHF)	75	Incl. w/Sheriff
Banning P.D.	44 (VHF)	66	1C/1C
Beaumont P.D.	17 (VHF)	26	1C/1C*
Blythe P.D.	24 (VHF)	36	1C/1C*
Cathedral City P.D.	23 (UHF)	35	1C/1C*
Coachella P.D.	22 (VHF)	33	1C/1C*
Corona P.D.	69 (VHF)	104	1C/2C
Desert Hot Spg. P.D.	13 (VHF)	30	1C/1C*
Hemet P.D.	30 (VHF)	45	1C/1C*
Indio P.D.	65 (VHF)	98	1C/2C*
Palm Springs P.D.	118 (UHF)	177	2C/3C
Perris P.D.	20 (VHF)	30	1C/1C*
Riverside P.D.	250 (UHF)	375	4C/5T
San Jacinto P.D.	37 (VHF)	56	1C/1C
UC at Riverside	25 (VHF)	38	1C/1C*
Law Enforcement PT-PT			CLEMARS VHF
Law Enforcement Tactical/Emergency			3C
Law Enforcement Car-Car			1C
TOTALS	2903 Units	2438 Units	8T/17T + 22C/24C

LEGEND: T = Trunked VHF = 150 MHz Band
 C = Conventional UHF = 460 MHz Band

*May require channel sharing due to light channel loading.

CURRENT RADIO COMMUNICATIONS

The county Division of Communications is responsible for the operation of the Sheriff's Office Law Enforcement Communication System. This system provides support to the Sheriff's responsibilities throughout the unincorporated areas of the County and provides support, under contract, to some incorporated communities. It must provide coordination among zones of the Sheriff's Office and intra-communications for local city law enforcement officials, the California Highway Patrol [CHP] and other county and state law enforcement agencies.

The Sheriff's Office communications system is a wide area, VHF high band system. It includes remote satellite receivers and repeaters located throughout the county to provide necessary coverage (Fig 3). These sites are connected by a county wide microwave system using three hundred channel capacity (Fig 4).

The City of Riverside, Palm Springs and Cathedral City have radio communications systems operating in UHF frequency range. The rest of the local government police departments in the County operate on VHF frequencies. In some areas inter agency communications are provided by sharing frequencies owned by the Sheriff's Department

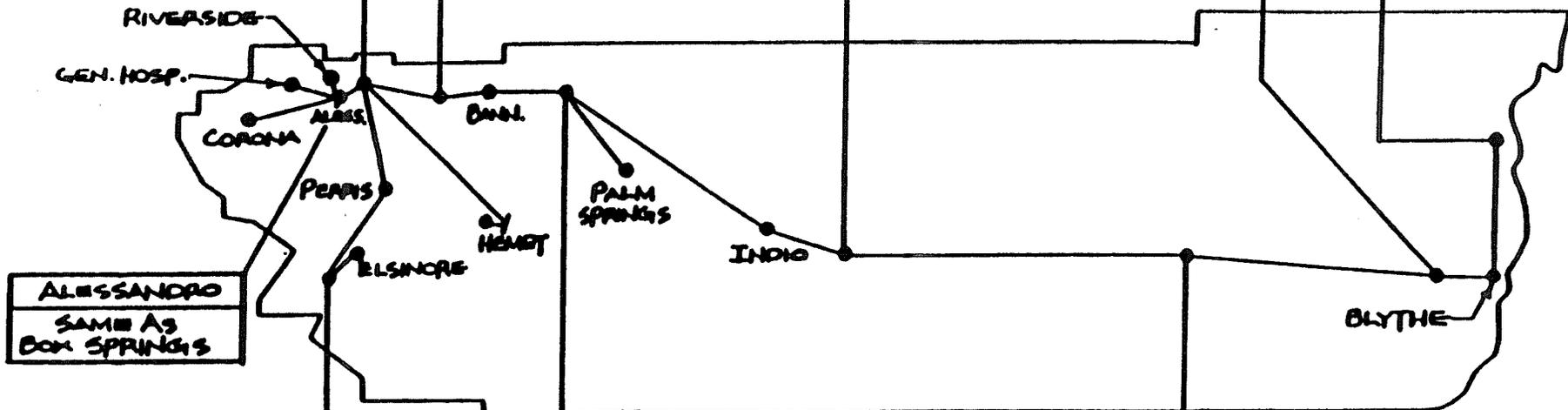
BOX SPRINGS		
	XMTA	RCVA
F1	158.850	159.435
F2	158.970	159.345
F5	159.015	159.465
F6	158.760	159.315

MT DAVID		
	XMTA	RCVA
F3	158.820	159.450
F6	158.760	159.315

CACTUS CITY		
	XMTA	RCVA
F5	159.015	159.465
F6	158.760	159.315

BLACK ROCK		
	XMTA	RCVA
F1	158.850	159.435
F5	159.015	159.465
F6	158.760	159.315

BIG MARIA		
	XMTA	RCVA
F1	158.850	159.435



ALESSANDRO		
SAME AS BOX SPRINGS		

ELSINORE PK		
	XMTA	RCVA
F3	158.820	159.450
F5	159.015	159.465
F6	158.760	159.315
F1	158.850	159.435
F2	158.970	159.345

WHITEWATER		
	XMTA	RCVA
F4	158.775	159.405
F5	159.015	159.465
F6	158.760	159.315

CHUCKAWALLA		
	XMTA	RCVA
F1	158.850	159.435

and/or by using receiver scans installed in the law enforcement vehicles.

The University of California at Riverside [UCR] maintains a VHF high band radio system, with a base station located at the main campus in the City of Riverside. Other law enforcement support agencies, such as the District Attorney's Office, Coroner, and Marshal's Office operate radios on the Sheriff's Office frequencies.

All agencies in the County are served by an enhanced 911 system that appears to meet the needs of the County. The 911 system is planned and forecasted to serve the County and local cities through the year 2000. The volume of calls supports the forecasted population increase in Call for Service increase. It is expected that the anticipated fifty percent population growth in the next fifteen years will increase this work load to the point that major increases in man power and equipment will be needed in the very near future.

The present Sheriff's Department radio network operates in the 159 Mhz band with many compromises due to the close channel spacing (25 Mhz), co-channel user interference and high noise radio sites. Over the six frequencies

installed in Sheriff's patrol cars only four frequencies are in the police radio service. Five of the frequencies cannot be used County wide since they are co-channelled with other users.

Police officers using these frequencies with the Sheriff's Department have expressed concern for their safety in remote areas since they are unable to communicate using portable radios and frequencies are not available to accommodate mobile extenders. Officers in the urbanized western county area simply avoid the use of radio when the channel is congested. In the Riverside Sheriff's Department, deputies have indicated they collectively avoid an average of One Hundred Fifty messages a day, thus resulting in a compromise of their safety in a degraded level of service (15).

QUESTIONS OF THE FUTURE

"Are certain geographic areas more likely than others to need additional communications capacity between now and the end of this century?" Certain geographic areas are more likely than others to need additional communications capacity. Some areas within Riverside County are experiencing phenomenal growth this requiring greater additional channel capacity much sooner. The fastest growth is occurring in the already frequency congested portion of the County. The population growth for Riverside County from 1985 to 2000 is projected to increase from 795,100 to 1,201,500 (51 percent). Many cities in the rapidly urbanizing western county area will experience even faster growth rates.

Another question that will need to be answered is "What new public safety communications applications are foreseen over the next sixteen years?" It is felt that in the next decade and a half there will be a need for data communications to address the areas of digital and voice networks which are more developed than what we have today. We do not have sufficient experience or insight to predict the spectrum requirement, however, it is anticipated the

county will provide mobile data access capability to all agencies within the county, since the county maintains many of the data bases and provides the message switching for accessing state and national data bases.

"Is there a need for increased coordination with federal agencies in the areas of law enforcement and fire protection?" This area raises questions in the areas of band incompatibility, increased need for secure communication, and digital technology. As we approach the year 2000 there are several questions relative to police communications in Riverside County besides those which we have already mentioned.

What proportion of public safety communications requirements will be needed for emergency and non-emergency purposes?

What is the anticipated growth requirements for these purposes?

Is there a need for a nationwide continuous frequency allocation for public safety purposes?

System Requirements

Public safety communication systems exist to permit the efficient application of law enforcement resources for those items necessary for the protection of life and property.

To obtain these goals the communications systems must include the following capabilities:

- a. The system must permit rapid access by public safety personnel on a routine basis to various justice data base information.
- b. The system must be flexible and have adequate capacity to respond to planned and unplanned requirements in the areas of emergencies and natural disasters.
- c. There must be the capacity to expand throughout the local agencies jurisdiction and into neighboring jurisdictions to respond to mutual aid requirements.
- d. In times of emergency or in life threatening situations it must provide operating units with instantaneous access to supervisory resources and to other resources of the same of related agencies that may contribute to the safety and

effectiveness of the units involved.

- e. There must be available security for private frequencies equal to the jobs being performed of the people utilizing those frequencies.
- f. It should be adaptable to permit future development of other public safety needs as appropriate.
- g. It must allow the accurate, rapid transfer of data among county, state and national data bases.

These goals were established by the same group of people who brainstormed to establish trends.

FORECASTING RESEARCH

In forecasting the trends, I gathered a group of five people. A police chief, a police supervisor, a police officer, a communications planner, and a utility planner. A brainstorming session generated thirty-five possible trends that could affect public safety communications.

I then had the group reduce the number down to a workable figure. This was done by letting people comment on the list and then ranking the list. The result was the list of trends (Table I).

I then let the group evaluate the listed trends using a form similar to one used in Workshop I of the Command College, but it went to 2000 rather than 1995. I did not have them forecast a net impact. I then charted their forecasting using broken lines for the high forecast, dashes for the low forecast and solid for pre-1985 and the mean forecast. (Table II-1 to II-7)

In the area of critical event evaluation I used a group of people who are employed in the public sector; law enforcement, education, library science, communications, and military communications (Table III). This group reviewed the trends forecasted by the first group and then

brainstormed critical events that could affect radio communications in the entire public sector, basically law enforcement or public safety.

Here again they picked out five critical events and how they felt each event would affect communications as a whole in the public safety concept. A cross impact evaluation form was used and came up with the results shown. An analysis was not conducted (Table IV).

The trends that resulted from the brainstorming and the results were as follows:

Trend A. Will narrow Band FM be used in the future?
The high probability was 75%. The low probability 49% and the forecast was 61%.

Trend B. Will Digital Dispatch be used by agencies in 2000?
The high probability was 69%. The low probability was 13% and the forecast was 45%.

Trend C. Will Law Enforcement Agencies be using "Trunking" in the year 2000?
The high probability was 33%. The low probability

was 16% and the forecast was 23%.

Trend D. Will the County be using Satellite Communications in the future?

The high probability was 78%. The low probability was 36% and the forecast was 67%.

Trend E. Will the probability of lower cost for radios increase?

The high probability was 128%. The low probability 59% and the forecast 72%.

Trend F. What will be the need for new frequencies?

The high estimate was 100+. The low estimate was 68 and the forecast was 83.

Trend G. What will radio unit growth be by units?

The high estimate is 1400+. The low estimate is 1150+ and the forecast is 1300+ units.

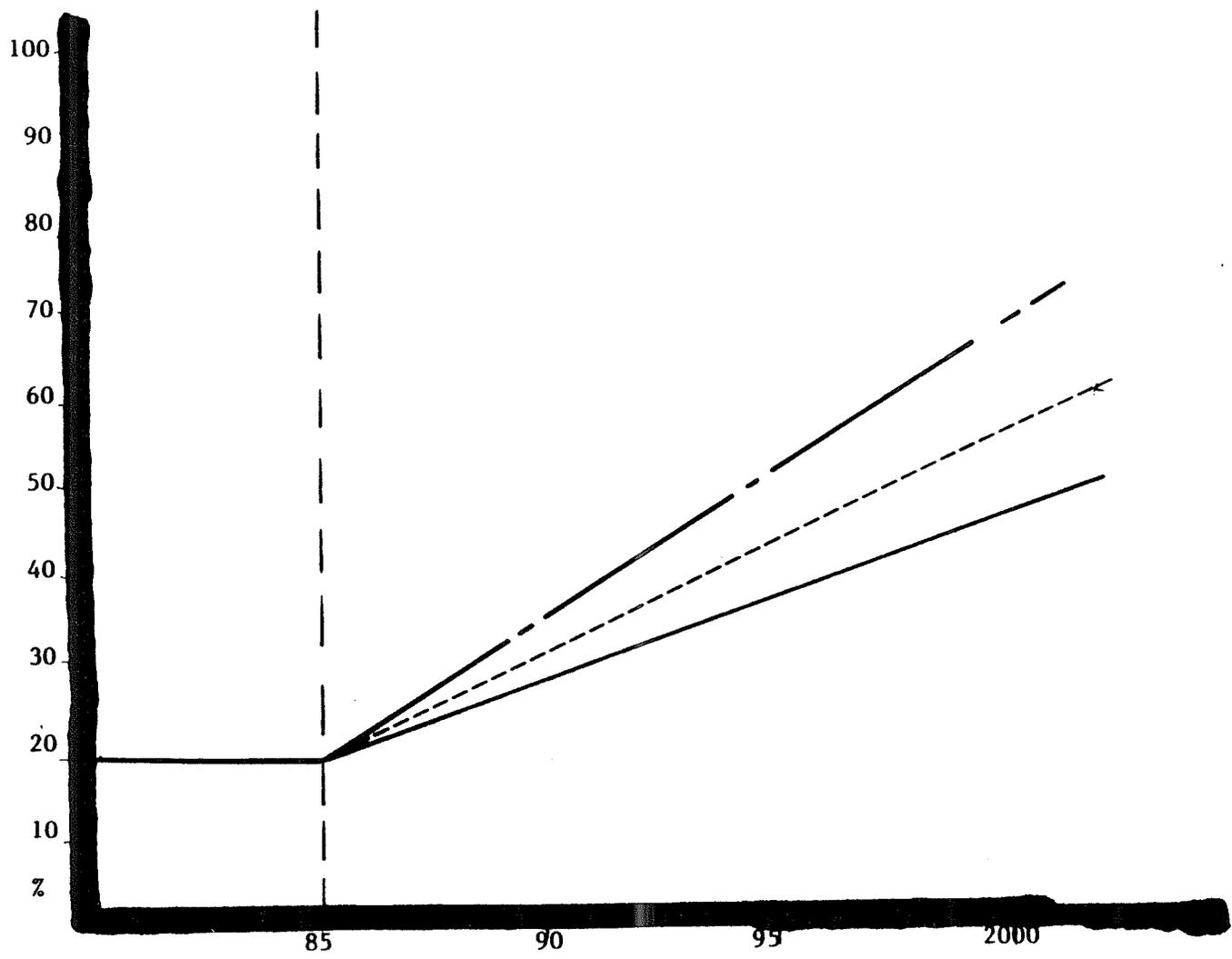
Trends

There are a number of emerging trends and events in police communications which should be monitored along with the events that relate from them:

TRENDS	EVENTS
a. Narrow band frequencies	a. Compatible equipment modification
b. Digital dispatch	b. Limited use in emergency responses
c. Trunking	c. Spectrum efficiency would improve
d. Satellite transmissions	d. Cost prohibitive
e. Procurement costs	e. Scientific advances reduced cost
f. Frequencies	f. Spectrum availability/suitability
g. Radio units growth	g. Agencies expand radio units

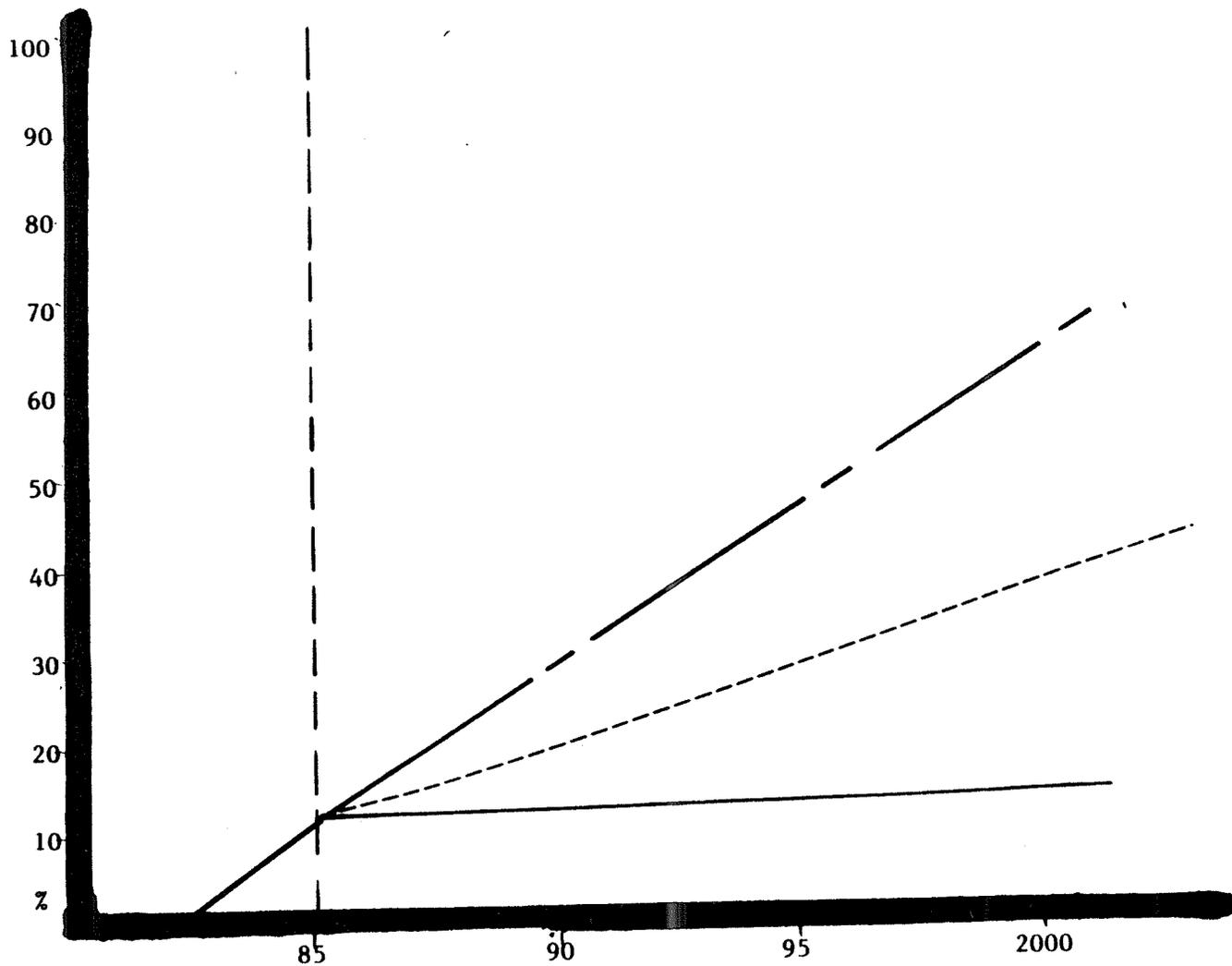
TABLE II

TABLE II-1



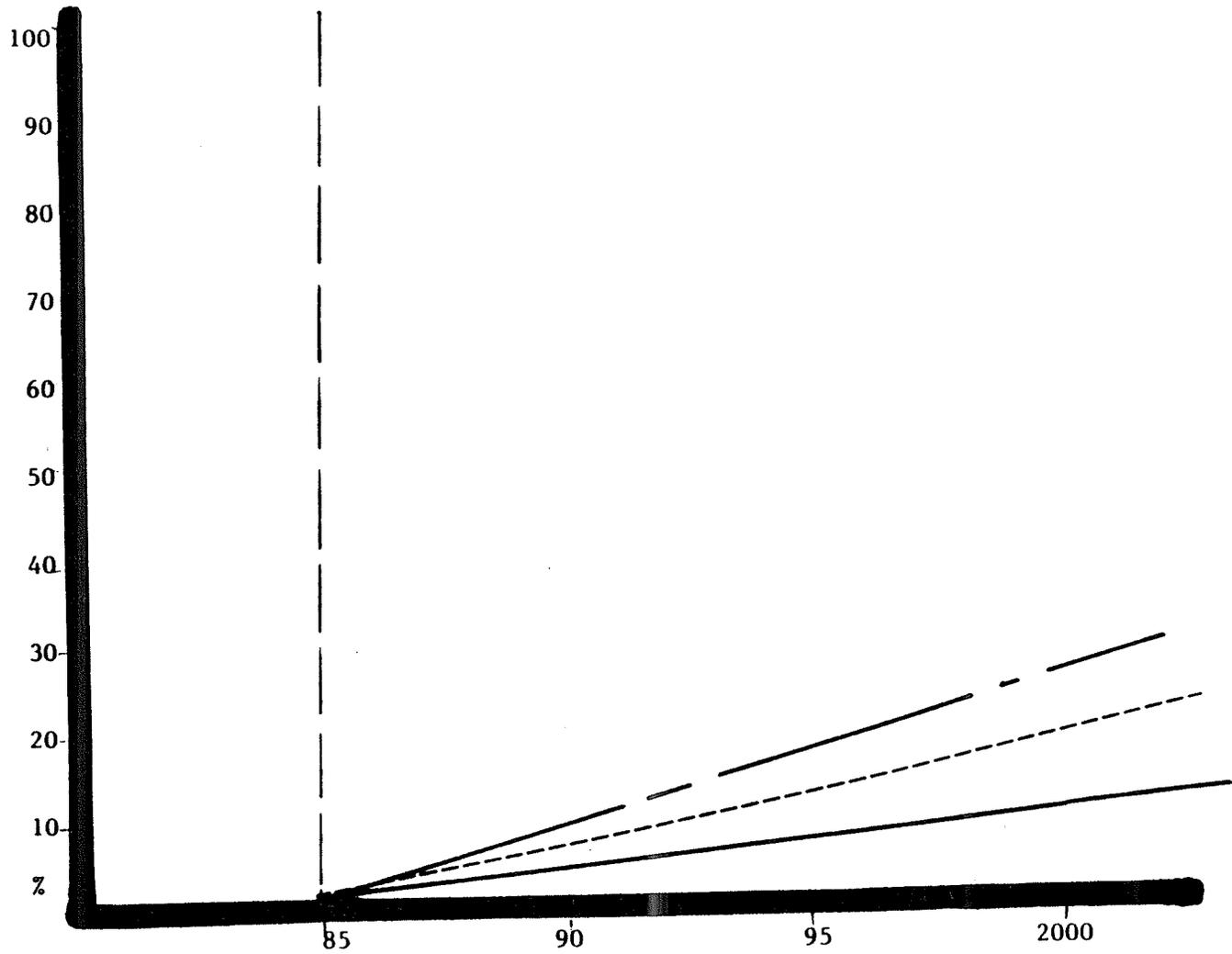
TREND: NARROW BAND FM. WILL NARROW BAND FM BE USED IN THE FUTURE

TABLE 11-2



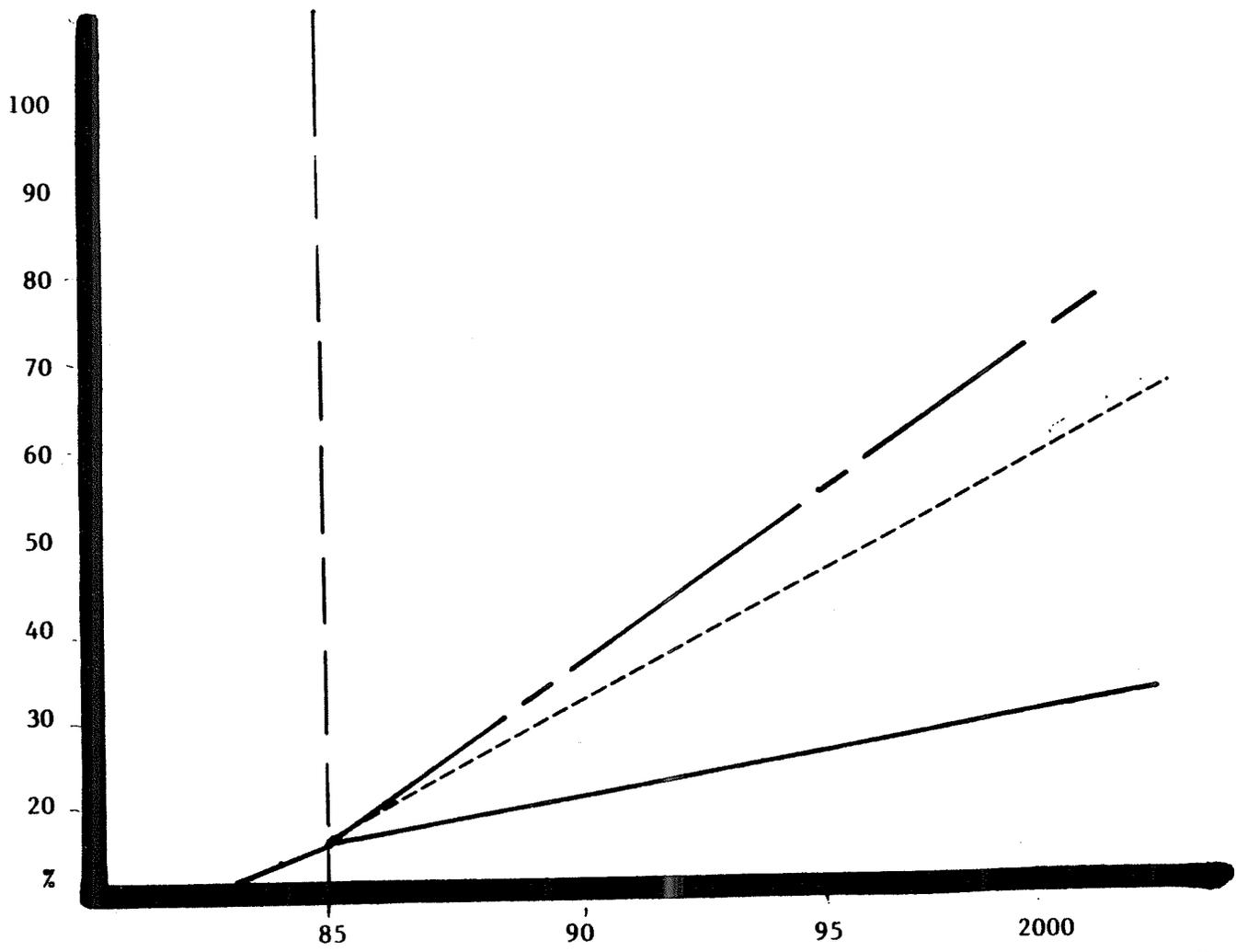
TREND: DIGITAL DISPATCH. WILL DIGITAL DISPATCH BE USED BY AGENCIES IN 2000

TABLE II-3



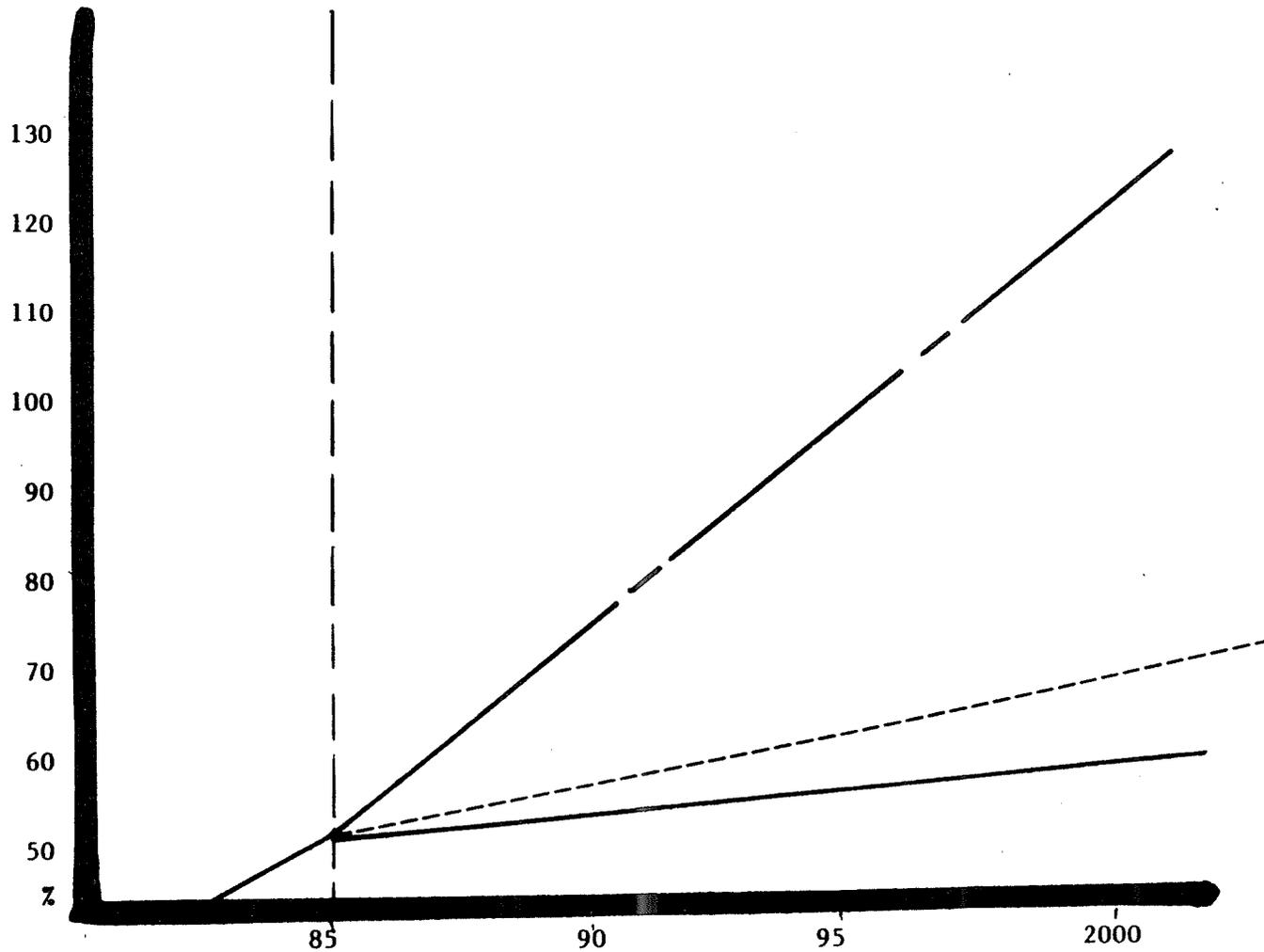
TREND: TRUNKING. WILL LAW ENFORCEMENT AGENCIES BE USING "TRUNKING" IN THE YEAR 2000

TABLE II-4



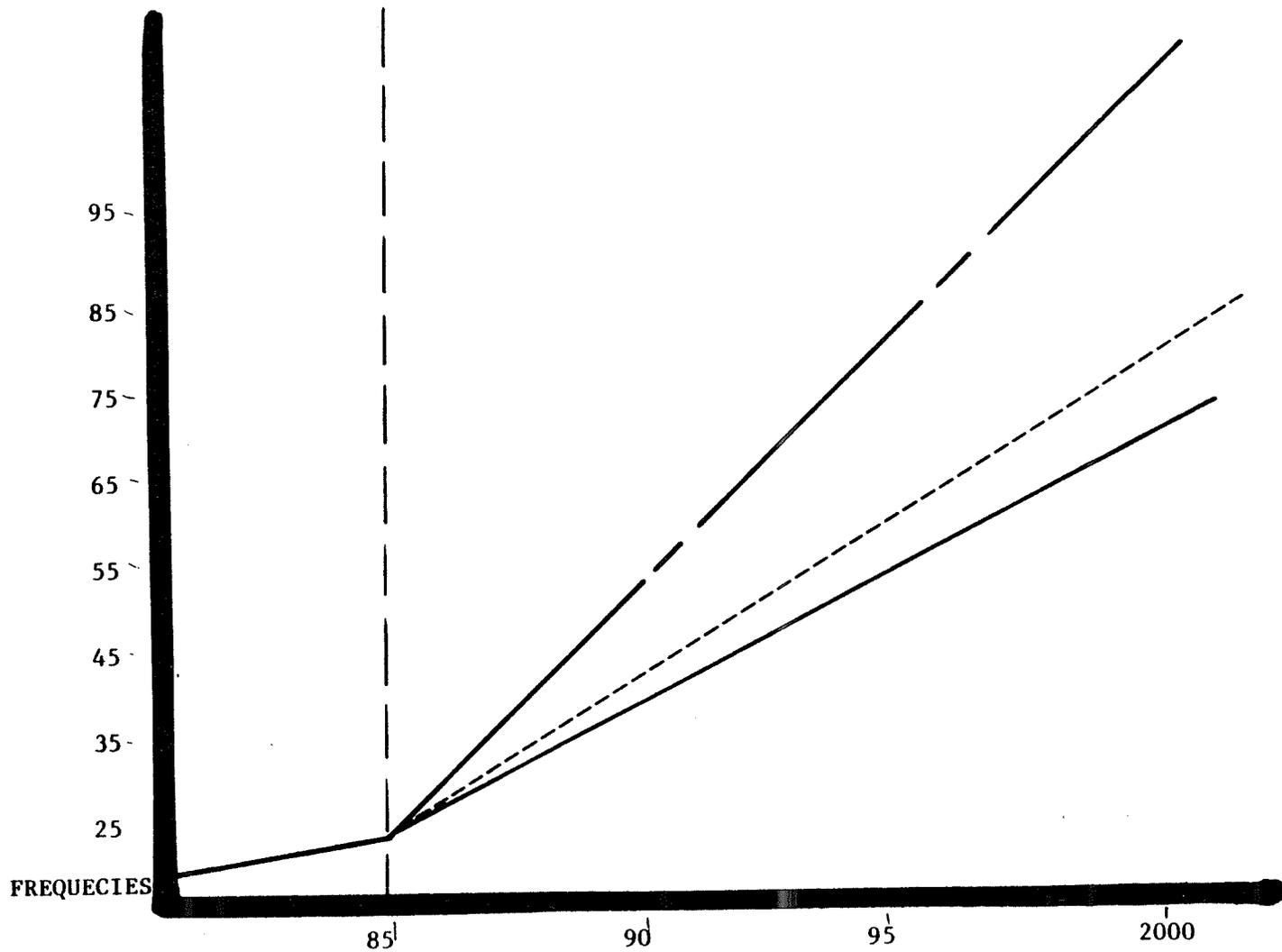
TREND: SATELLITE TRANSMISSION. WILL THE COUNTY BE USING SATELLITE COMMUNICATIONS IN THE FUTURE

TABLE II-5



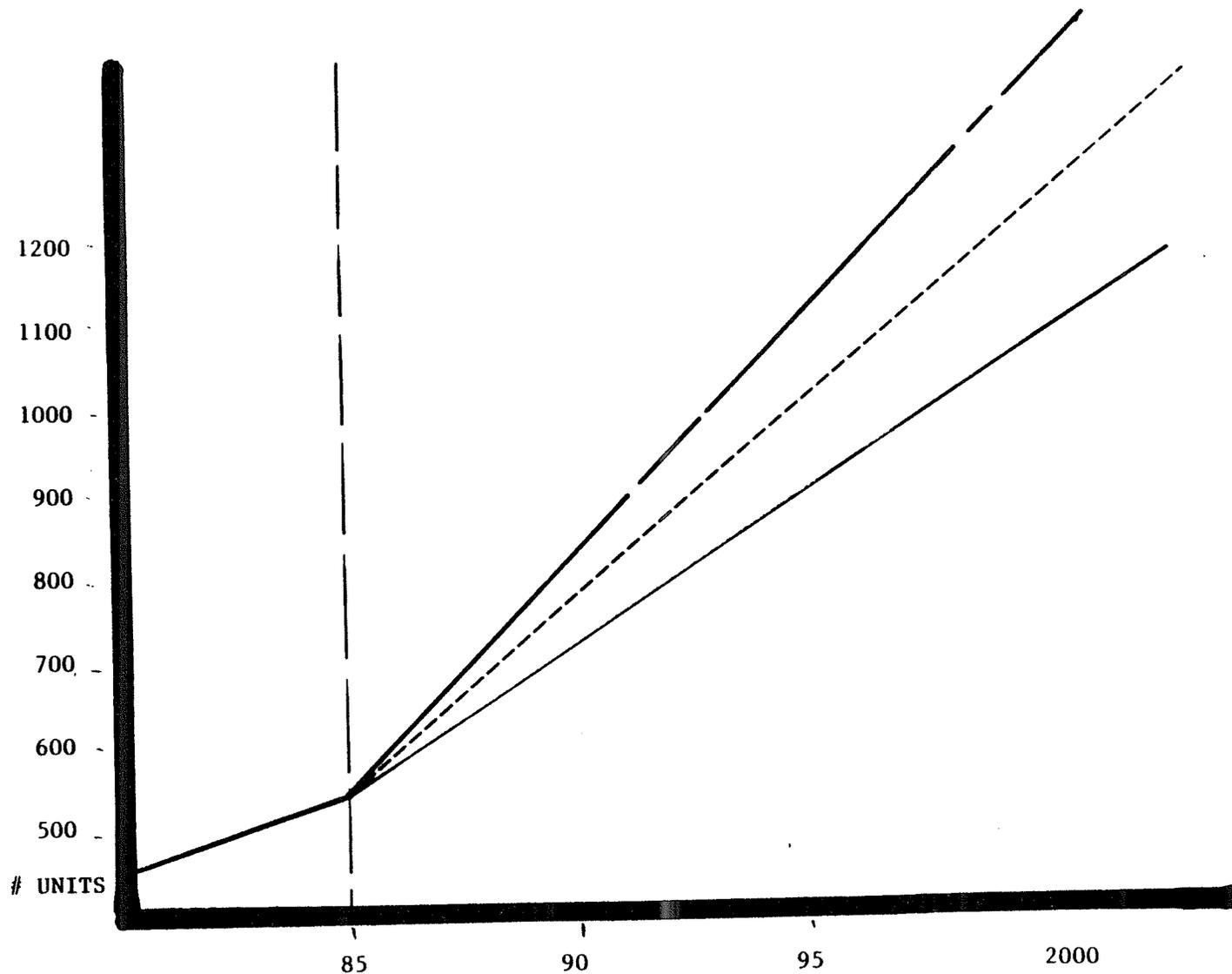
TREND: PROCUREMENT COSTS. WILL THE PROBABILITY OF LOWER COST FOR RADIO EQUIPMENT INCREASE

TABLE II-6



TREND: FREQUENCIES - NEED. WHAT WILL THE NEED BE FOR FREQUENCIES

TABLE
II-7



TREND: RADIO UNIT GROWTH. WHAT WILL RADIO UNIT GROWTH BE BY UNITS

Critical Events

There are several critical events which, if they occur, would drastically or significantly effect police effect police communications in law enforcement in the year 2000. The events listed below were identified by some of the Chief's of Police of Riverside County, Communications personnel in the county government, and private utility planners within the county.

<u>EVENT</u>	<u>2000 PROBABILITY</u>
1. LOSS OF REVENUE SHARING (FEDERAL) Because of increasing budget deficits the Federal Government will reduce or eliminate all revenue sharing to local governments and county governments.	78%
2. TAX REFORM (PROPOSITION 13 TYPE) The probability of another tax initiative or tax reform and its effects on local and county government could be staggering. The first budget items to be eliminated would be capital outlay.	34%
3. IMPORT CURTAILMENT (JAPAN EMBARGO) The Federal Government places an embargo on communications and electronics equipment from Japan. This embargo is to allow the American companies to regain a large portion of the market that they lost in the past.	25%
4. FEDERAL CONTROL OF COMMUNICATIONS The congress realizing there is a problem in frequen-	9%

cies in public safety regulates and controls by central federal dispatch centers all public safety communications.

5. REGIONAL POLICING, REDUCING RADIO NEEDS

49*

State of California enacts legislation to regionalize police agencies to eliminate the small agencies of less than 25 personnel thereby reducing the number of communication dispatch centers, thereby reducing the number of radio frequencies needed.

TABLE III

Cross Impact Evaluation

The attached Table IV shows the relationship to various events as related to each other. These impacts are those items that, if they occurred, would have an affect on other impacts.

The percentages are forecasts of the affecting possibility if the event occurred.

An example would be in the first impact, "The loss of Revenue Sharing." If there was a loss of revenue sharing it is forecasted that tax reform would decrease from a probability of 34% to 16%. Import curtailment would decrease from 26% to 5%. Federal Control would increase from 9% probability to 11%. Finally, Regional Policing increases from 49% to 59%.

The other imports are forecasted in the same manner as shown in Table IV.

CROSS-IMPACT EVALUATION

If there is a loss of revenue sharing

THE PROBABILITY OF...

Tax Reform	(34%)	DECREASES to 16%
Import Curtailment	(26%)	DECREASES to 5%
Federal Control	(09%)	INCREASES to 11%
Regional Policing	(49%)	INCREASES to 59%

If there is a tax reform

THE PROBABILITY OF...

Loss of revenue sharing	(78%)	DOES NOT CHANGE
Import curtailment	(26%)	DECREASES to 22%
Federal Control	(09%)	DECREASES to 7%
Regional policing	(49%)	INCREASES to 65%

If there is an import curtailment

THE PROBABILITY OF...

Loss of revenue sharing	(78%)	DECREASES to 58%
Tax reform	(34%)	DECREASES to 26%
Federal Control	(09%)	DECREASES to 6%
Regional policing	(49%)	DECREASES to 31%

If there is federal control

THE PROBABILITY OF...

Loss of revenue sharing	(78%)	DECREASES to 50%
Tax reform	(34%)	DECREASES to 20%
Import curtailment	(26%)	INCREASES to 46%
Regional policing	(49%)	DECREASES to 35%

If there is regional policy

THE PROBABILITY OF...

Loss of revenue sharing	(78%)	DECREASES to 71%
Tax reform	(34%)	DECREASES to 12%
Import curtailment	(26%)	DECREASES to 21%
Federal control	(09%)	DECREASES to 3%

TABLE IV

Scenario A

The year is 2000, the County of Riverside has grown rapidly in population. It is now 1.2 million people and new cities have been established in the desert area and the Perris Valley. Sun City, Romoland, Nuevo have been annexed by Hemet, Perris and Moreno Valley. Moreno Valley, which incorporated in 1985, at 60,000 population, is now 120,000 population. This city also has the newest police department which has 220 employees. The other cities which have incorporated based on their size have decided to contract with the Riverside County Sheriff's Department.

All of the public safety communications systems have been stretched beyond their capabilities.

The standard public safety dispatching center now has computer aided dispatch. Whereby the dispatcher only needs to type in the information of a call for service and the computer decides which car to dispatch and gives a printout or a readout on the screen of how many units are left in service and what their status is. All of the patrol cars have CRT's and keyboards in them. This enables the officers to query all data bases of which the county is hooked up with, without having to go through the

dispatch center. This process enables the voice network to have reduced traffic, but the digital network is extremely heavy in traffic.

Law enforcement within Riverside County has become more centralized. The Riverside County Marshal's Office has again become one office rather than two offices. The Sheriff's Department as usual covers all unincorporated area, plus those areas of incorporation which decided to contract with the County.

To enable inter-agency communication, the County in 1995, decided to move into the trunking system in the 800 Mhz frequency band. This required one hundred additional antenna sites established to cover ninety percent of all areas within the County. This left ten percent of dead space where no radio communications could be received or transmitted. Utilizing the trunking system an officer or a patrol car in one city could communicate with its own dispatch center without interfering with any other agency. Upon leaving the jurisdiction or range of the base station of that jurisdiction the dispatcher could then transfer that radio frequency in the patrol unit to the dispatch center of the adjoining jurisdiction simply by updating the computer.

All agencies also established a vehicle locator system which was enabled by the low cost of electronic equipment. The vehicle locator system enabled dispatch centers to visually be able to identify where their police units were. The system also had a sub-system which alerted the dispatch center if an officer were in trouble or went down and was not able to make radio contact with their dispatch center.

Satellite transmissions are being used to relay basic data systems from the national data bases. This included NCIC and NLETS. It was thought that satellite transmissions systems would be usable for the local county, but the cost was unbearable for the local agencies and the county to provide such costs.

Also in the late nineteen eighties the revenue sharing from the Federal government was cut 100 percent and for the last ten years it has not been renewed.

With the current system any officer in any jurisdiction can communicate with any other officer in any other jurisdiction at any time. This again is enabled by the dispatcher keying in the different frequencies into their

local computer, which is hooked up to the main digital switcher in the County of Riverside, located in the City of Riverside.

Futurists are forecasting that in the year 2015 communications will be utilized with laser beams for point to point contact, and also bouncing laser beams off of satellites for longer range transmissions. These are only forecasts, as the futurists also predict that the money supply for the local agencies will continue to be in tight demand.

Scenario B

Proposition 13A was enacted in 1987 reducing budgets as did proposition 13 in the 1970 era. Revenue sharing from the Federal Government ceased in 1987 to enable the Federal Government to reduce their deficit. Most local agencies went to regional dispatch centers in 1995. Today we still have regional dispatch centers which were generated to reduce the number of radio frequencies required for public safety radio communication. The thought behind these regional dispatch centers was to reduce the requirement for the number of radio frequencies as two or three jurisdictions would be on the same frequency. However, this has caused mass confusion in frequency jamming on the radio frequencies that are being utilized.

Due to the loss of funds the state legislature enacted legislation that removed police departments of less than twenty-five people and made them into regional police departments. These regional police departments competed with the Sheriff's Office for law enforcement jurisdiction, but only covered those agencies that had contiguous borders, with an example being Riverside and Moreno Valley.

Federal control of frequencies has taken away from the local frequency coordinating committees the ability to coordinate who would use which frequency in which area. The local agency frequency coordinating committee was the main coordinator in the late 1980's to try and resolve jammed frequencies in Southern California. Now the Federal Government is the sole controlling allocator of frequencies. This Federal establishment due to its bureaucracy has created a delay of two to three years to obtain new frequencies, change antenna sites, or increase mobile units.

Radio equipment costs have sky rocketed due to a Japanese embargo on less expensive electronic equipment. This embargo has had world wide effect. We still use Japanese parts, assembled in United States plants, but with Japanese production methods. It would seem that we are taking away from one hand of a money provider and giving it to another.

The county communication system now operates in the UHF frequency band. Utilizing regional dispatch centers and regional police departments there is more communications between the agencies than there was in the 1980's. Officers are able to communicate with any other patrol

unit or station based on one of the frequencies they select in the mobile radios.

The mobile radio which is now in police units and fire units has ten frequencies. One frequency is for the western part of the county, one frequency for the eastern part of the county, one frequency for the entire county, two frequencies for a voice network to reach the dispatch centers computer operations, and one frequency or in the area of large agencies two frequencies, frequencies for communicating voice communication with local dispatch center.

This UHF frequency system with the ten frequencies has enabled better communications, however, there are still large areas of dead spots as UHF communications has extremely short range and is almost entirely line of sight.

Approximately half the agencies have computer terminals within the control units, which enables them to communicate with the data bases directly thereby freeing up the voice frequencies. However, these digital frequencies are becoming extremely congested and at times are causing scrambled signals coming back from the base

computer, therefore resulting in no message back to the officer. This congested activity is resulting in officers disregarding the use of the CRT within the patrol unit due to the feeling that they feel it is useless to try to get an answer when they know they will not.

The Riverside County Communications Director is again looking at the future for different aspects of communications. He is exploring the use of fiber optics connecting the different dispatch centers along with expanded microwave systems and narrow band FM. The narrow band FM system seems the most feasible at this time as it does not require expensive equipment outlays. It would allow more agencies to use one basic frequency than the one or two agencies that use those same frequencies in the 1980's.

Scenario C

The year is 2000. Revenue sharing ceased in 1987 and has not returned. The Federal budget still operates in a deficit mode. Local governments are stymied in raising new money due to Proposition 13A, which reduced their ability to create new taxes or revenue gathering sources. The local agencies are not able to buy new equipment or replace outdated or unusable radios due to that lack of funds.

Officers in public safety are tending not to use radios, therefore the response time is becoming extremely high. The reason for the non-use of the radios is the lack of confidence in their credibility into being able to receive a transmission or for the dispatch center to hear their transmissions. The citizens are upset at the lack of response time of public safety personnel and want something done about the situation, but are unwilling to vote any tax increases, which now require a 75 percent majority.

Seven new cities have formed in Riverside County in the last five years. They formed small cities of approximately 10 to 15 thousand. They had to share radio frequencies with other counties and agencies to enable

their public safety operations to operate. Their fire protection was provided by the California Division of Forestry, which in the past few years has been providing fire protection to almost all local governments within the County. This was caused again, by reduction in revenues from property taxes, etc. The Sheriff's Department has been unwilling or unable to provide contract service for these cities as their radio communications are extremely stretched to the limit.

Paramedic service is loosing credibility due to no radio capability even when they are within two miles from the hospital. This radio communication problem is caused by extreme crowding of the frequencies and overrun from adjoining frequencies of other local government services such as public works, parks and recreation, refuge collection.

Television channels in the area, from channel 14 to channel 19, are being used by large agencies for radio communications in the public safety sector. However, this current procedure is interfering with local television because of high power output required of the agencies to cover the geographical area they represent. This is creating unhappiness with the local citizenry because they

are losing their television reception of their regular stations.

Computers are in ninety percent of all homes at this time. They are used in lieu of telephones, the mail system, and the banking system. Money is transferred from checking accounts directly to pay accounts of the local businesses. These computer systems are tying up telephone lines and microwave/radio communication lines. This utilization of microwave and telecommunication lines is effecting the availability of radio frequencies for public safety in the Southern California area.

The radio frequency problem extends from the north with the City of Bakersfield all the way to the south, which includes San Diego, Calexico, and Blythe.

Unless there is relief in sight, small cities will divest themselves of police departments and try to contract with other county agencies for service. If that cannot be accomplished dis-incorporation will result. The Sheriff, as previously stated, has indicated he will not absorb any further new contracts for incorporated cities. However, if dis-incorporation is followed through, the Sheriff would be required to provide law enforcement to those

areas. It is felt that if dis-incorporation does occur and the Sheriff is required to provide law enforcement to those dis-incorporated areas that the level of service would drop below that of what it was in the early 1980's.

It should be noted that in those beginning years of the 1980's that the citizenry was totally disenchanted with the fire and police protection they were receiving from the County and was one of the main causes for numerous residential areas to incorporate to insure a higher level of service.

In conducting these interviews it was found that there are many pros and cons to the 800 Mhz frequency spectrum and trunking capability. There is the feeling that at the present time that there is not enough development in both utilization or control of trunking systems.

Other thoughts are that you must look to the future and "Guess" what the systems will be like. There is a chance of making the wrong guess but the probability factor must be taken into consideration.

The majority of those interviewed feel that 800 Mhz is the only alternative available to law enforcement during the

next fifteen years. There will be frequencies made available as law enforcement moves to 800 Mhz, however there will probably be taken over by local government and other municipal service agencies.

It is felt that even when movement of frequencies takes place, law enforcement will be hesitant to release the frequencies they already "own" or are licensed. This trend to not release frequencies will last until the proposed new system has become operational and has a high credibility with public safety executives.

RESEARCH OF 800 Mhz

In discussing the future of radio communications in Riverside County I contacted Mr. Gary Gray, Chief Orange County Communications, and asked for his personal insight into current public safety communications and what was in the future for all (11).

He related that radio communications in the current frequency spectrum low band VHF, high band VHF, and UHF are extremely crowded in the Southern California area. APCO of which Gray is past president and is the national organization of public safety communications officer was asked by the Federal Communications Commission (FCC) to do a study in the late 1970's regarding the 900 Mhz (Not 800 Mhz) band and Trunking.

This "Project 16" pointed out that the opening of the 900 Mhz band by the FCC offered the Public Safety Communications community the opportunity to develop communications systems having significantly enhanced capabilities.(1) The advent of trunked communication systems, as mandated by the FCC, coupled with the development of technically feasible and economical digital address techniques, makes possible an entirely new approach to public safety communications systems design.

Communication systems using these concepts [trunking] can be organized by the use of digital addresses for each system user, rather than relying on preassigned frequencies to provide individual communication lengths. The inherent flexibility of these digital addressing techniques permits the incorporation of highly flexible commands/control concepts, the use of group and discreet unit addressing, flexible, centrally controllable, system configuration and reconfiguration, and other management tools heretofore utilized by public safety communications designers.

The applications of these techniques makes possible the growth of a single agencies system into one capable of supporting all of the mobile radio communications requirements of a community while at the same time maintaining the necessary operational prerogatives and priorities of individual using agencies.

Project 16 addressed such characteristics as:

- a. Channel access times
- b. Automated priority recognition
- c. Data systems interface
- d. Individuality of system users

- e. Command/control flexibility
- f. System growth capability
- g. Frequency utilization
- i. Reliability

It also listed desirable features that may be selected should they be required by individual procuring agencies. The intention was to bring about a system concept that will satisfy the minimum needs of all potential users and that will also permit the inclusion of more complex requirements that may be needed by some communities or may become desirable at some point in the future. The project described a multi-channel mobile communication system that employed digital addressing techniques and frequency switching systems to optimize user flexibility and channel access. The system concept envisioned a central switching unit that, upon request for service, identifies an unused channel. A signaling system, coupled with the assignment of digital addresses to all units of the system, directed the units between which communication is desired to automatically switch to the selected channel.(1)

By having the address include both group and discrete elements, groups of units can be switched to the selected

frequency if desired. In this way the multiple unit communications requirements of public safety users can be satisfied. By assigning different group addresses to different functions [or agencies], separate users can maintain a requisite level of communication integrity or privacy.

This addressing technique greatly enhances system flexibility. The number of individual, functional assignments can be determined by the number of group addresses used, rather than by the number of frequencies assigned to the system. The system defined by this project specified that no less than 100 group addresses would be available.

The operation of this system is basically controlled by the configuration of the system controller. This switch can be configured such that its protocols may be altered to fit differing operational needs. Group addresses that normally operate independently of each other can be combined for emergency actions. Automatic priorities can be assigned [or reassigned] to specific group addresses. Features such as automatic status reporting and mobile digital access can be included at the choice procuring agency.

As stated this was a result of Project 16 which was developed in the late 70's by APCO on a grant from the FCC. It was not intended to provide a specific system design. The true purpose of the project was to spell out what the system must do to meet the needs of the public safety community, now and in the future (4).

I interviewed Lt. Bud Wenke of the Los Angeles Sheriff's Office and we discussed what their agency had done in the area of communications research as it was known that they had also been involved in 800 Mhz trunking, and the 500 Mhz area.

Lt. Wenke advised that in looking at the 800 Mhz area the sheriff's department of Los Angeles county had decided to not go the route of extremely high frequency for the following reasons:

1. Geographic coverage
2. Frequencies
3. Channel loading
4. Trunked simulcast
5. Changing of systems
6. Portable radio ranges [two watts]

In addressing this area Lt. Wenke stated that to utilize 800 Mhz and or trunking they would have to increase frequencies and increase powers of transmitters tremendously and doubling of radio sights from forty to eighty to accommodate a system of this design.

Lt. Wenke also discussed the area of frequencies and channel loading. With the restriction of one hundred radios either mobil or handi-talkies to one channel (Trunked), the sheriff's department felt that this would be unrealistic for their priorities and operation procedures. They also looked at trunk simulcast broadcasting which could or could not assist this system. They looked into the area of how the system is so rapidly changing and if they had purchased or developed a system in the trunking area where it might be obsolete in the next five years rather than being valid for fifteen to twenty years. The last concern of the Sheriff's Department was the power of the portable radios the officers would carry. This would be by system design limited to two watts, which the Sheriff's Department felt was totally unacceptable due to the large desolate areas they must cover in the northern part of the county where they have desert and would be long ranges from receiving sights.

The Los Angeles Sheriff's Department in the 1980's approached the FCC to obtain television channel frequencies in the area of channel fourteen to channel twenty. They were successful in being awarded a television channel in the five hundred Mhz range. The Los Angeles Sheriff's Department has decided to enlarge upon this system rather than go to a trunking or 800 Mhz area (16).

Another interview was conducted with Mr. Bob Yates of the Los Angeles Parking Department, which currently uses an 800 Mhz trunked system. He revealed that the Los Angeles Parking Department has utilized the 800 Mhz system with a trunking option for the last four years. Mr. Yates stated that for his type of operation, which requires radio communication but not on a priority basis, the trunk system is working very effectively. Mr. Yates did state that prior to obtaining their own separate frequency they had been assigned to the Los Angeles Police Department operations frequency. While in that mode they were able to assist the police department a lot more than they currently are because of the rapid ease of communication with officers on patrol in the police department.

Mr. Yates stated that he had no experience factor of law enforcement utilization of an 800 Mhz trunked system but felt that it may have its usefulness if developed adequately. This would entail taking into consideration the requirements of law enforcement for rapid access to a main station, in the ease or the availability of patrol officers in the field being able to hear other units when they make their transmissions. Mr. Yates stated that he was unaware of any law enforcement agencies in California that were currently using an 800 Mhz trunked system (17).

An interview was conducted with Mr. Ben Nunnally of Motorola International. During the interview with Mr. Nunnally it was found out that there currently are one hundred and twelve government or private agencies that are using an 800 trunked system within the United States. Most of these are located east of the Rocky Mountains. None of those 800 Mhz systems currently in California are utilized by law enforcement systems or public safety operations except for fire control. Those agencies in California who have developed or put on order an 800 Mhz system are still in the development or awaiting shipment phase. Mr. Nunnally also stated that the different type systems currently being produced are called Privacy Plus, Smart Net, Simulcast, Spectra-Tac, System Search, and

AMSS.

Of the agencies that currently have on order or have installed a trunking system, which is supplied by Motorola, they are the Oklahoma Department of Public Safety; Arlington County, Virginia Police Department; State Patrol of Utah; Kansas City, Missouri; Miami, Florida; Kansas City, Kansas Police Department; Pittsburgh, Pennsylvania; Orange County Sheriff's Department, Florida; Orange County, California Fire Department; and Rocky Mountain, North Carolina Police Department.

Of the units most available or already accepted by their agencies would be those in Arlington, Virginia; Rocky Mountain, North Carolina; and Miami, Florida. Problems in the Miami, Florida system were identified along the range of:

1. Lengthy time delays for microphone activation
2. Slow response in trunk selection
3. Poor acceptance by patrol officers
4. Mistrust by management personnel

The City of Saint Petersburg, Florida has recently issued a contract to Motorola to purchase an updated Smart Net

800 Mhz trunk system, which will be utilized by both police and fire communications. Personnel at Saint Petersburg are closely following the problems developed by the Miami, Florida operation. Motorola Radio Incorporated supplied a list which is attached as an exhibit to this project of those agencies currently on order or having accepted with no issues private trunked systems. Mr. Nunnally stated that as far as he knew no other major manufacturer has an operationally developed trunked system. General Electric and Standard Radio Corporation are currently in design process of a system that would be acceptable to public safety personnel. Other type trunk systems have been in operation for many years according to Mr. Nunnally. These include basic telephone systems and central office switching systems currently in use. He stated that when a telephone call is made the system seeks out an unused line or channel and automatically switches to that unused line to enable a call to go through. This enables a public communications company to have many more lines of access to different areas rather than single dedicated lines for every telephone on both ends of a conversation (14).

In talking with Deputy Chief Cable of the Los Angeles Sheriff's Department, he echoed Lt. Wenke's findings on

trunked and 800 Mhz systems. He stated that the sheriff's department is always interested in obtaining additional frequencies for sheriff operations but he is aware as well as are other major law enforcement agencies in Southern California that frequency spectrum is at its maximum and another area must be developed. He feels that 800 Mhz may be the spectrum to enter into, but is not necessarily convinced that trunking is the way to go (8).

In talking with Chief Joe Casey and his personnel of the Nashville Police Department it was found that they to had investigated an 800 Mhz trunked system. But after entailed and detailed review of the options available they decided that because of cost limitations and at that time the lack of development of the system without proven successes that a different system was more to their liking. However they did find that the concept of 800 Mhz and trunking system if developed correctly would possibly work in law enforcement as long as certain priorities for certain types of calls and or operations was developed (9).

Currently both the San Bernardino County Sheriff's Department and the Riverside County Communications Department are studying in separate projects but

coordinated through the same consultant the option of developing an 800 Mhz system. The study from the County of Riverside is much further along in development to the phase where system design and implementation may be the next step.

Both counties have contracted with a consultant from Tallahassee Florida to work on new radio communications. Most of the research from written sources has been derived from these consultants papers and reports. Mr. Gene Buzzi has stated that he feels 800 Mhz is the only area to seek additional frequencies in Southern California.

Mr. Buzzi has given evidence before the FCC to plans for Riverside County to develop a system in this spectrum. This evidence was presented in the format of splitting channel or frequency spreads from the current 25 Mhz requirement to 12 1/2 Mhz requirement. This would enable more frequencies to be allocated throughout a large geographical area. This concept was accepted by the FCC in mid 1986. However the FCC stated that prior to any major 800 Mhz systems being adopted in the future that a national plan would have to be developed.

It was felt that in developing a national plan that it

would take many years to get total cooperation or coordination from all the public safety agencies in the United States. The FCC requested APCO to do the coordination of this plan. Further testimony was then given to the FCC to request that these restrictions of developing an 800 Mhz system be reduced from a national plan to a regional plan and sub-regional plans. This is currently being staffed by the FCC and a decision which seems to be favorable will be forthcoming in the early part of 1987 (7).

Strategic Plan

After having reviewed all data that was obtained from research through brainstorming, and NGT, the three scenarios were written with a futuristic approach. The three scenarios covered the possible utilization of an 800 Mhz radio system and two aspects using digital radios and other forecasted scientific developments.

It was decided to concentrate on the 800 Mhz system. The following discussion and recommendations were made based on interviews, personal observation, and review of literature.

Implementation Plan

In early 1985 the County of Riverside through its Department of Communications realized that there was a short coming of radio frequencies available for public safety communications. The Director, Mr. James Rothrock, asks the Riverside County Chiefs of Police if they were interested in researching this problem. The Riverside Chiefs of Police Association had already become concerned about the crowding and useability of radio frequencies. They had created a communications sub committee or their organization and were beginning to study different alternatives to crowded frequencies.

When the County Communications Department and the Police Chiefs got together they developed a guideline or desires of what they needed in the future. These desires were very close to those developed through the research conducted in this paper already. A big concern was if a new system was developed where would the funds come from to pay for this system. Either it would be through local government contribution, county government contribution, or some type of tax initiative.

The county board of supervisors on their own initiative, directed their communications director to proceed with a

feasibility study and request for proposals from selected vendors in the field of public safety radio communications.

The firm of Omnicrom Incorporated, located in Florida, was selected to do the research into a new radio system for county wide law enforcement public safety. This firm began their initial data gathering by distributing an information questionnaire which asked the forecasted and actual number of radios currently on hand, along with number of vehicles that would be currently utilized and those in the future. It was also asked the type of radio communications currently had and what would be needed in the future in regards to frequencies. This questionnaire and some of its results are attached to the rear of this project for review (TABLE V).

Upon completion of the data gathering project a recommendation was received from the consultant to explore the 800 Mhz system and its trunking capabilities. The consultant was invited to present his findings and recommendations to the Riverside County Chiefs of Police Association, whereby numerous members were very concerned about the following:

- a. Cost

- b. Reliability
- c. Need to purchase additional equipment after making recent purchases
- e. Credibility and utilization of the trunking system

The consultant was able to persuade the association to support the 800 Mhz system in doctrine rather than in actuality at the present time. The consultant was directed by both the County Department of Communications and the Police Chiefs Association to proceed with this development to the point of where it would be accepted on the national level by the Federal Communications Commission.

Upon receiving direction from both groups, the consultant proceeded to give testimony before the FCC demonstrating the need for dedicated 800 Mhz in the Southern California area of San Bernardino and Riverside County. It is explained of the numerous frequencies that are currently crowded in both the VHF band and UHF band. The FCC in late 1986 approved in concept the use of the 800 Mhz and a trunking system for utilization in law enforcement. However, as previously stated it made the decision in a written order that a national plan for utilization of 800

Mhz for law enforcement or public safety must be developed.

The consultant then returned to Riverside County and briefed the County Communications Director and the Police Chief's Committee on radio communication on the results of the FCC's order. It was recommended by the consultant that further testimony be given, asking that the 800 band be split at twelve and a half Mhz rather than the current of twenty-five and that rather than having a national plan approved prior to utilization by anyone, that regional or sub-regional plans need only be developed for entry into the 800 Mhz filed. This was presented again to the Police Chiefs Association and was adopted in principal and direction was given to the consultant to proceed with that plan.

It is anticipated that when the FCC receives testimony on this new recommendation that it will be approved. However, there are many people and organizations that will continue to fight the dedication of 800 Mhz to law enforcement. These include the following:

- a. One member of the FCC Board
- b. Members of the broadcast industry
- c. Members of the ham radio system

It is felt that other supporters and non supporters of the system will surface as this plan is developed, as it is a first step in 800 Mhz for regions covering large land and population areas.

It is anticipated that if there is a negative consideration by people or organizations that the law enforcement society will have to demonstrate either through politics or local meetings that the 800 Mhz system is the only way to proceed. It will also have to convince those people concerned that law enforcement in the United States must have one of the highest priorities so that our society can continue with its growth.

Upon acceptance of the plan by the FCC, and resolutions of any concerns by any special interest groups, it is anticipated that the following will take place.

The County Board of Supervisors, upon the recommendation of the Communications Department, will place on the ballot a bond issue for public safety communications in the amount of Forty Million Dollars. It is anticipated that this may take place as soon as 1988. Upon successful completion of a bond election request for proposals or

bids will be issued to various vendors to develop an 800 Mhz system with twelve and one half Mhz channel spacing. Upon a successful bid application process the vendor will be selected.

Portions of the bid proposal will include re-outfitting all law enforcement agencies with 800 Mhz radios, taking into consideration those concerns of the Riverside County law enforcement administrators. The proposal will also include the installation testing and debugging of equipment, which is part of the contract issued.

A tentative system design will be similar to that currently in operation in Orange County California. There will be county wide communications between emergency personnel during disasters, and emergency situations. There will be channels available for field personnel to contact different stations within the county for needed information. There will be channels available for normal voice communications with an officers respective station, and there will be channels available for digital transmissions for utilization in CRT's within patrol vehicles.

Additional frequencies will be available for expansion as

new technology is developed.

A small concern which has been discussed is that all local government agencies will have to support the system and support the bond issue. It is felt that through the cooperation of the public safety administrators that their governing bodies will support the system. An example of this type of support was present in 1986 when the CAL-ID System was developed in Riverside County. Here, it was required that each agency submit funds based on their population. These funds that were requested by the county to support the system were provided after budgets had been developed. Being that some of these contributions were quite large it showed the dedication of the governing agencies to support crime prevention in Riverside County to the fullest extent possible.

TRANSITION PLAN-PALN AND ORGANIZE

The future of radio communications in public safety is a known need for Riverside County. The future radio communications system must be able to meet the needs of all the agencies involved and the requirements of the engineering design of such a system.

The TRANSITION plan will be conducted by the director of the Riverside County Communications department. He will receive advice and comments by the Communications Committee of the Riverside County Law Enforcement Administrators (RCLEA). The rationale for the change includes the need for something new because the old is not working. This is because of the need for expanded frequencies, and increasing population.

The plan will cover the area of Riverside County and its public safety environment. It will start with the law enforcement side of public safety and then after implementation it will include others such as fire and civil disaster preparedness.

It is felt that the commitment from the agencies and people concerned are already in place. There will be little need to convince people that the system must be

developed. The executive team would consist of the communications department personnel selected by the director of that department and the members of the RCLEA group who would represent the law enforcement executives. This team meeting would define roles and responsibilities for the plan and development. They would also analyze the changes or resistance to change that might come up during implementation.

The director of the communications department would handle all media announcements and questions regarding the project. He would establish the time frame for announcements and decisions. The executive team would supply feedback from their sources and agencies to assist in making decisions.

The tasks and workflow of the team or plan would be the sole responsibility of the director and the staff of the communications department. They are the people that will be ultimately responsible, therefore they must be given the authority to run the operation and make the decisions with policy being set by the executive team.

During the planning for the project numerous presentations were made by both the communications department and by at

least one of the vendors, Motorola, Inc.

There would be no new organization to develop in this project as it is not a new concept. It is more of an updating of a currently installed communications system. There is a concern about the way that funds are to be raised to fund the project.

Funding of the project is expected to be on a county wide bond issue. This will raise concerns of numerous people who are against new taxes or raising of funds in any way. The responsibility of this area will rest with the director and RCLEA to convince those doubters that there is indeed a need.

The design of the project is well defined. The only further design of the system needed is what each agency wants in the way of networking or single channels for their radio system to include channel sharing. System design will be developed by the vendor with the goals established by the director and RCLEA. Selection of the vendor would be by established Riverside County procurement procedures within constraints set by law.

Phase II-IMPLEMENT

There is not much of a need to move people or functions in this project as the current manpower allocation of the department is solid. There will be a project manager appointed with an assistant who will spend 100% of their time on the system. Funding will come from the task base of the county and agencies involved in the system which is estimated to be 100% of all agencies. He will be the one to decide when to have meetings and devise the training of those people needed to establish the project. The vendor, of course, will be responsible for training of new personnel in the operation of the new equipment which will be installed.

Any studies required for the project will be conducted by both the vendor and the project manager. Support staff for the manager will come from within the county communications department.

There will be a need to integrate the financial system of the system once the project is operational. This will require agencies to support the system on an annual basis above what they do now for their own communications system. It is sort of like a matching fund system except it will be proportional on the population of the agency

supplying funds.

There must be established an approval system for development and review of development. This will consist of the communications director and the RCLEA representative as they will be the eyes and ears of the major end users of the system. There should be no freelancing by any of the personnel assigned to the project where they make major decisions with out consent of the governing agencies.

Phase III-FORMALIZE

Once the organization is established the committees needed will be put in place and become operational. The required personnel will be put in place and allowed to commence with their duties. Accounting procedures will be established by the county auditor and these will undoubtedly be screened by the local agencies own auditors.

Formal logs will be kept to keep a history of the project and its development and continual vendor documentation will be required to show what is occurring. Communications will be very open with the participating agencies. The Executive Team will be available and involved in trouble

shooting and as a resource.

Phase IV-EVALUATE

There will be continual evaluation by both written reports and on-site inspections by the RCLEA committee to insure that the needs of all participating agencies are being met by the system.

Continual evaluation will be made of the transition from the old communication system to the new one. This is of the utmost importance as agencies will be brought on line one at a time therefore splitting the communications ability of each other to talk to each other.

Once the system is established and final turn-key operation is established it is felt that the current monitoring of the system will continue as it is currently done today. That being, through the meetings of the RCLEA on a regular basis with problems being discussed as they occur.

Conclusions and Recommendations

Based on the research that has been conducted for this project the first recommendation is that more research be conducted in the future. There are many areas that were not able to be covered due to time and distance restraints.

The 800 Mhz radio system in the opinion of the writer is the only direction currently for the future available for public safety radio communications based on knowledge known at the present time. If in the future, innovations in development bring up a different system, then these should also be investigated for utilization.

The 800 Mhz concept will undoubtedly be developed and accepted by the County of Riverside within the next three years. Even though the current system is currently over crowded some slight modifications will be made that will enable the County to wait this three years prior to installation of a new system. The concerns generated by the Riverside Law Enforcement Administrators will be resolved prior to any contract award.

The problem for Riverside County is that the air waves in law enforcement are becoming extremely crowded due to

population and crime increases. Both of these factors cause more need for radio spectrum. The advent of mobile terminals in cars will cause additional drain on available frequencies.

The result of these increases will affect those areas previously identified.

- a. Need for clear transmission capability
- b. Adequate air time availability
- c. Non-interference of frequencies
- d. Adequate range for transmissions

To meet these needs the County of Riverside must continue with their strategic plan to update their law enforcement radio capability.

They have already completed their needs survey and ascertained the need for frequencies and radio units.

They have looked at the possibility of remaining on their current spectrum or going to another spectrum (800 Mhz).

They have approved the fee to modify the current operating requirements and system design for 800 Mhz.

The future of development of an acceptable communication system for the County of Riverside must continue. In the near future, requirements for hardware must be established and purchase proposals developed. After purchasing, equipment debugging must take place.

The main hinderance to all of this being accomplished will be the availability of funds. Bond issues, taxes, and other sources of funding must be investigated concurrently with system development. Failure to do these together will create a lag time that will affect the state of the art at the time of operational acceptance.

800 MHZ - ALL THE WAY

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Figure 5

Private Trunked Systems

	<u>Customer</u>	<u>System Type</u>	<u>Users</u>
1	People Gas, IL	Privacy Plus	Utility
2	Louisville, KY	Privacy Plus	Public Works
3	New Jersey Transit (old)	Privacy Plus	Administrative
4	Brigham Young Univ, UT	Privacy Plus	Administrative
5	Air Inc. Los Angeles, CA	Privacy Plus	Airlines
6	Omaha Public Power, NE	Simulcast	Utility
7	American Natural Gas, ND	Privacy Plus	Gasification
8	Amoco, NM (Brownfield)	Simulcast	Petroleum
9	Lewisville, TX	Smartnet	Police, Fire
10	Tampa Electric Co. FL	Simulcast	Utility
11	Gulf Oil, TX (Chevron)	Simulcast	Oil
12	Air Inc. - Chicago, IL	Smartnet	Airlines
13	Air Inc. - Nemark, N.J.	Privacy Plus	Airlines
14	Air Inc. - San Francisco	Privacy Plus	Airlines
15	Salt Lake City, UT	Privacy Plus	Public Works
16	Amoco Odessa, TX (Andrews)	Simulcast	Petroleum
17	Air Inc. - Boston, MA	Privacy Plus	Airlines
18	Air Inc. - Dallas/Fort W,	Smartnet	Airlines
19	Air Inc. - Denver, CO	Privacy Plus	Airlines
20	Amoco Whiting, IN	Smartnet	Refinery
21	Oklahoma, Dept Pub Safety	AMSS	Police, Public Safety
22	Arlington County, VA	Smartnet	Police, Fire, Pub Works
23	Utah, State of	Smartnet	Police, Public Safety
24	Cobb County, GA	Privacy Plus	Public Works
25	Atlanta, GA	Privacy Plus	Public Works
26	Kansas City, MO	Privacy Plus	Police, Local Govt.
27	Maricopa County, AZ	Smartnet	Police
28	Dow Chemical, TX	Smartnet	Refinery
29	DOT, Los Angeles, Ca	Smartnet	Police, Local Govt.
30	Dekalb County, GA	Simulcast	Police, Local Govt.
31	Public Syc of Colo.	Spectra-TAC	Utility
32	Tulsa, OK	Smartnet	Police, Fire, Local Govt.
33	Greenfield, WI	Smartnet	Police, Fire, Pub Works
34	Massport, MA	Smartnet	Port Authority
35	Chesterfield County, VA	Simulcast	Police, Fire
36	Carrolton, TX	Smartnet	Police
37	So. Calif. Edison, CA	Smartnet	Utility
38	Orleans Parish Sch Brd, LA	Smartnet	Security, Buses
39	Federal Express, KS	Smartnet	Industrial
40	NYC Taxi & Limo, NY	Smartnet	Taxi & Limo
41	Niagra Mohawk Power, NY	Smartnet	Utility
42	Marion Labs, MO	Smartnet	Industrial, Security
43	Miami, FL	Spectra-TAC	Police, Fire
44	Con Edison, NY	Smartnet	Power, Security
45	Kansas City, KS	Smartnet	Police, Local Govt.
46	Lake County, OH	Smartnet	Police, Local Govt.

Private Trunked Systems - Continued
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	<u>Customer</u>	<u>System Type</u>	<u>Users</u>
47	Kitsap County, MA	Smartnet	Transit
48	Calif. Dept of Transport.	System Search	Police
49	General Motors-Detroit,MI	AMSS	Industrial,Security
50	Pittsburg, PA	Smartnet	Police,Local Govt.
51	Lockheed, CA	Smartnet	Industrial,Security
52	Rocky Mount, NC	Smartnet	Police,Local Govt.
53	Missouri City, TX	Smartnet	Police,Local Govt.
54	Jefferson Parish, LA	Smartnet	Police, Fire
55	Texas Instruments, TX	Smartnet	Industrial
56	St.James Parish, LA	Smartnet	Police, Fire
57	Texarkana, AR	Smartnet	Police, Fire
58	Bossier City, LA	Smartnet	Police, Fire
59	Mayne County, MI	Smartnet	Police, Fire
60	Austin Water Dept., TX	Smartnet	Water Dept.
61	Fayetteville, AR	Smartnet	Police, Fire
62	New Jersey State Police	Simulcast	Police
63	Houston Light & Power, TX	Smartnet	Utility
64	Nipsco, IN	Smartnet	Utility
65	St. Charles, MO	Smartnet	Police, Fire
66	Northern States Power, MN	Smartnet	Utility
67	Sante Fe, NM	Smartnet	Police, Fire
68	North Slope, AK	Smartnet	Police, Fire
69	Virginia Beach, VA	Simulcast	Police, Fire
70	Chrysler Corp, MI	Smartnet	Industrial
71	Air Inc. - Miami	Smartnet	Airlines
72	Air Inc. - NY City/JFK	Smartnet	Airlines
73	NCR - Dayton, OH	Smartnet	Police, Fire
74	Knox County, TN	Simulcast	Police, Fire
75	NYC Health & Hosp., NY	Smartnet	Administration,Security
76	Pacific Gas & Elect, CA	Smartnet	Utility
77	Air Inc. - Nashville, TN	Smartnet	Airlines
78	Arkansas State Police	AMSS	Police
79	Mecklenburg Co., NC	Smartnet	Local Government
80	Orange County, CA	Simulcast	Police, Fire
81	Shea-naa Foods, AZ	Smartnet	Industrial
82	Air Inc. - Atlanta, GA	Smartnet	Airlines
83	Air Inc. - Houston, TX	Smartnet	Airlines
84	Air Inc. - Detroit, MI	Smartnet	Airlines
85	Chicago-O'Hare, IL	Smartnet	Administration,Security
86	Mammoth Ski Area, CA	Spectra-TAC	Administration,Security
87	New Jersey Transit (new)	Simulcast	Transit
88	Geauga County, OH	Smartnet	Police, Local Govt.
89	Kissinmee, FL	Smartnet	Police, Fire
90	Anne Arundel Co., MD	Simulcast	Police, Fire
91	Shell Oil, LA	Smartnet	Refinery
92	Cleveland Elect., OG (CEI)	Simulcast	Utility
93	Mashtenaw County, MI	Smartnet	Police, Fire
94	Arlington, TX	Smartnet	Police,Fire, Local Gov

Private Trunked Systems - Continued
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	<u>Customer</u>	<u>System Type</u>	<u>Users</u>
95	Jefferson County, AL	AMSS	Sheriff, Public Works
96	Fulton County, GA	System Search	Police, Fire, Local Govt.
97	Detroit, MI	Smartnet	Public Service
98	Lafayette, LA	Smartnet	Police, Fire
99	Air Inc., Annapolis, MD/TBD	Smartnet	Airlines
100	Canton, OH	Simulcast	Police, Fire
101	Chevron, CA	Smartnet	Oil
102	Air Inc.-Raleigh/Durhas	Smartnet	Airlines
103	Air Inc.-Minneapolis	Smartnet	Airlines
104	Seminole County, FL	Spectra-TAC	Police, Fire, Local Govt.
105	Indianapolis, IN	Simulcast	Police, Fire
106	Mill (Duke) Pwr Supply, NC	Smartnet	Utility
107	Roanoake County, VA	Smartnet	Police
108	Teape, AZ	Smartnet	Police, Fire, Local
109	Glendale, AZ	Smartnet	Police, Fire, Local
110	Virginia Beach, VA	Smartnet	Police, Fire, Local
111	Portsmouth, VA	Smartnet	Police, Fire, Local
112	Louisiana State Police	AMSS	Police