

BY THE U.S. GENERAL ACCOUNTING OFFICE

**Report To The Honorable Pete Wilson
United States Senate**

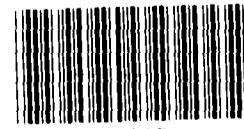
**The Los Angeles County Sheriff's
Request For Radio Frequencies**

In September 1981, the Los Angeles County Sheriff petitioned the Federal Communications Commission (FCC) for additional radio frequencies to alleviate what he maintained were serious deficiencies in his communications system and those of other police and fire departments. The Sheriff originally proposed that FCC transfer frequencies from UHF television to public safety agencies for nationwide emergency communications. Subsequently, the Sheriff modified his proposal and suggested that possibilities existed for more sharing of UHF frequencies between public safety and broadcasting.

An evaluation of the Sheriff's immediate problems and public safety's nationwide, long-term needs is difficult. Sufficient data to document and measure them are lacking, and generally accepted criteria on what constitutes adequate emergency communications have not been developed.

Feasible solutions acceptable to both the Sheriff and broadcasters are unlikely. The UHF band is a valuable portion of the radio frequency spectrum, and the broadcasting industry is strongly opposed to surrendering some of it to public safety agencies. Moreover, considerable disagreement about technical solutions has been expressed. The broadcasting industry's claims that new technology can solve public safety's communication problems without additional frequencies from UHF television have proven especially controversial.

FCC has been evaluating the Sheriff's immediate needs and plans to respond during the summer of 1984. Additionally, FCC has recently initiated a study of present and future communications requirements of the nation's public safety agencies which it expects to complete in 1985.



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UNITED STATES GENERAL ACCOUNTING OFFICE

WASHINGTON, D.C. 20548

RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-215869

The Honorable Pete Wilson
United States Senate

Dear Senator Wilson:

In response to your July 29, 1983, letter and subsequent discussions with your office, we have reviewed several matters concerning a petition (RM 3975) the Los Angeles County Sheriff's Department filed with the Federal Communications Commission (FCC) in September 1981 and a supplement to the petition filed in November 1983. The petition requests additional frequencies from that part of the radio spectrum¹ currently allocated for ultra high frequency (UHF) television channels 14 through 20. The Sheriff maintains that these frequencies are needed to eliminate saturated conditions on present frequencies, improve the Department's ability to communicate with other public safety agencies,² and build a hand-held radio system for patrol officers. For effective emergency communications, the Sheriff believes that additional frequencies are needed not only by his department but also by police and fire departments nationwide. He believes that the UHF television spectrum is neither heavily nor efficiently used by broadcasters and that part of this spectrum could be more productively used by public safety agencies.

¹The radio spectrum refers to the range of radio waves which may be used to transmit information by electromagnetic energy. The "radio" spectrum is used for a wide variety of functions such as radio and television broadcasting, the dispatch of delivery vehicles, and air and sea navigation. A fundamental mission of FCC is allocating or setting aside segments of the radio spectrum for the use of particular non-federal radio services and assigning specific frequencies within those segments for the operation of individual radio stations. Allocation of the radio spectrum to federal agencies is handled by the National Telecommunications and Information Administration, Department of Commerce. (See appendix V for additional technical information on the radio spectrum.)

²The "public safety radio services" under FCC's regulations include uses of radio communications by local government, police and fire departments, highway maintenance crews, and forestry conservation workers.

At your office's request, we reviewed the following matters:

- the seriousness of the Sheriff's communication problems and proposed solutions,
- FCC's actions in response to the Sheriff's petition, and
- major policy issues raised by the Sheriff's petition regarding FCC's management of the radio spectrum.

We found that evaluating the seriousness of the Sheriff's communication problems and feasible solutions is difficult. With virtually the entire radio spectrum suitable for land mobile³ communications already allocated for specific uses, additional frequencies for public safety agencies would have to be "reallocated" or taken away from someone else, such as UHF television. While the Sheriff's Department considers its present frequencies inadequate, we found that criteria and sufficient data were not available for us to measure the seriousness of its problems. FCC and the Department have each analyzed data collected by FCC on the Department's frequency use and come to contrary conclusions. FCC staff evaluating the Sheriff's petition, along with broadcasters, have suggested the Sheriff's and public safety's communication systems can be improved without reallocating UHF television channels, for example, by using new technology. However, weighing the costs and benefits of these proposals is complicated by disagreements on technical issues, especially the suitability of new technology for public safety communications.

FCC staff evaluating the petition were concerned about the merits of the Sheriff's request, including the practicality of the proposed reallocation of frequencies and the persuasiveness of the supporting evidence. According to the FCC staff, the Sheriff's supplement in November 1983, which modified his petition, more clearly described the Sheriff's problem by distinguishing between his immediate needs and the nationwide public safety communication needs. FCC's staff are evaluating the Sheriff's immediate needs and plan to make their recommendations to the Commission during the summer of 1984.

We identified four major issues which are raised by the Sheriff's petition and go beyond his Department's individual needs. These issues involve the development of criteria for public safety communications, FCC's long-range planning, the adoption of new technology by public safety agencies, and the identification of the part or parts of the radio spectrum that are best suited for public safety use. FCC has initiated a public safety

³The public safety radio service is part of a larger "private land mobile radio service" which also includes radio users, such as businesses and taxicabs, that require both voice and non-voice communication between a radio unit at a fixed place and a mobile unit, or between two or more mobile units.

spectrum allocation study and intends to develop a plan which will consider these and other issues.

THE SHERIFF REQUESTED REALLOCATION
OF RADIO FREQUENCIES

On September 1, 1981, the Sheriff of Los Angeles County petitioned FCC for additional radio frequencies to alleviate what he maintained were serious communication problems existing in his Department and other public safety agencies throughout the nation. The petition cited two specific problems. First, the Department's existing frequencies were saturated and so heavily used during busy periods that important messages were delayed. Second, communication between the Department and other public safety agencies during mutual aid situations was difficult because of "fragmented" frequencies. The petition noted that frequencies allocated by FCC to public safety services are not contiguous but are fragmented into five widely separated bands of the radio spectrum. Due to equipment limitations, public safety agencies using frequencies on one band cannot easily communicate with agencies in surrounding jurisdictions whose radios may operate on a different band.

To obtain the additional radio frequencies, the petition requested that FCC rules be changed to reallocate all the frequencies reserved for UHF television channels 14 through 20 to land mobile services, including public safety. Presently, only one or two of these channels are used by land mobile services in 13 major urban areas, including two channels in Los Angeles. The petition proposed that FCC order all television stations operating on channels 14 through 20 to move to other channels within 5 years of the effective date of the new rules. Although some 160 public safety agencies strongly supported it, broadcasters have vigorously opposed it.

On November 4, 1983, before FCC reached a decision, the Sheriff filed a supplement. Officials from the Sheriff's Department stated it was filed to better explain their needs, to propose a solution less objectionable to broadcasters, and because they saw no signs that FCC would approve the petition. The supplement highlighted the same general problems as the petition, modified the Sheriff's proposed solution for obtaining additional frequencies, and distinguished the Sheriff's immediate needs from his broader nationwide concern for emergency communications. It also stated that another serious deficiency in the Department's current system was the lack of portable, hand-held radios for patrol officers to communicate while away from their vehicles.

Whereas the Sheriff originally proposed relocating television stations operating on channels 14 through 20, the supplement proposed that more UHF channels be obtained for land mobile services through a more efficient use of the radio spectrum. Under this revised proposal, all existing UHF television stations would continue operating on their present channels. Rather than calling

for a reallocation of UHF frequencies from broadcasting to land mobile, the Sheriff views his proposal as allowing greater sharing of the UHF spectrum.

The Sheriff stressed that his supplement was premised on his belief that FCC must develop a comprehensive 20-year spectrum allocation plan for land mobile services which will accord appropriate priority to the needs of public safety agencies. The Sheriff's supplement recognized that the analysis and work necessary for nationwide implementation of such a plan would be a long-term undertaking for FCC. In the meantime, the Sheriff emphasized his need for immediate relief based on an "extremely critical problem" in Los Angeles County. The Sheriff proposed that FCC assign frequencies from UHF channel 19 for public safety use in the Los Angeles area after their temporary use for the 1984 Olympics. FCC has allowed Olympic organizers to use channel 19 for land mobile radio communication support in such areas as security and coordination of athletic events. Channel 19 is not and cannot be used in Los Angeles for television broadcasting because of potential interference to television channel 18 transmitting from San Bernardino. However, the Sheriff's telecommunications consultant believes that with certain technical adjustments public safety use may be possible without causing such interference.⁴

Additional information on the Sheriff's Department, its communication requirements, and its petition including the supplement is contained in appendix I.

THE SHERIFF'S PROBLEMS AND POSSIBLE SOLUTIONS

We did not determine whether the Sheriff has demonstrated a need for frequencies or weigh the costs and benefits of alternative solutions because this is being done as part of FCC's rule-making process (described in appendix VI). However, your office's interest in understanding the Sheriff's communication problems and alternatives led us to examine his information concerning them and his estimate of required additional frequencies. We found that the Sheriff considers his present frequencies saturated and fragmented but that criteria and data were not sufficient to evaluate these problems.

The Department's supporting information indicated that its problems could be serious and that the Sheriff's request for frequencies from the UHF television band might resolve them. For example, our limited analysis of 240 hours of radio traffic showed that some of the Department's frequencies are at times heavily

⁴Whether television transmissions interfere with each other or whether land mobile use interferes with television reception depends on various factors, including the relative strength of the signals.

used. We also listened to three hours of taped conversations from the Department's dispatch channels and identified times when they were in heavy use and occasions when some messages appeared to interfere with others being sent. But we also found periods when little activity occurred. Department officials said they recognize their channels are not continually busy, but they maintained that their system has to handle radio traffic during their busiest times.

Obtaining adequate data to measure the Department's problems is difficult. Based on our examination (see appendix II for details), the Department's supporting data was not sufficient to clearly measure the severity of its problems. FCC staff agreed that it is difficult to obtain adequate data on a petitioner's need for spectrum and noted that FCC spectrum allocation decisions often involve the Commissioners' subjective judgments.

Even with better data, the seriousness of the Sheriff's problems and their resolution would be difficult to determine because of technical disagreements and lack of criteria on adequate public safety communications. FCC staff explained to us that evaluating whether frequencies are saturated is more an art than a science and many factors must be considered. Such factors include the average message length, the type of message (emergency or administrative), and the degree of discipline in radio use. One FCC engineer, who has studied land mobile services communications requirements, also pointed out that developing criteria for police and fire communications systems can become very emotional when lives are at stake. Under such conditions, there should be no wait, but for less serious messages it is difficult to judge how long an officer should have to wait for an open radio channel.

In addition to its saturation problem, the Department has stressed its need for a hand-held radio system for its patrol officers and a capability to communicate effectively with neighboring public safety agencies operating on different bands of the radio spectrum. No one we talked with during our review disagreed with these requirements. We did find, however, considerable disagreement over what was the best way to meet the Department's needs.

FCC staff told us that possible solutions to the Sheriff's problems, other than what his petition proposes, include the use of new equipment and technology; more sharing of frequencies with local government agencies, such as highway maintenance; the allocation of additional frequencies, but not as many as the Sheriff wants or not from that part of the spectrum where he wants them; or a combination of these solutions.

Assessing the costs and benefits of these alternatives is complicated by technical disagreements among FCC staff, television broadcasters, and the Sheriff's Department. It is especially uncertain whether technological advances can resolve the Sheriff's problems without additional spectrum. The broadcasting industry

is opposed to the Sheriff's request for additional frequencies from the UHF spectrum because it believes that certain new technologies can improve the Sheriff's communications system without the need for reallocation. The Sheriff's Department disagrees and believes that these approaches are neither proven nor cost-effective. (The differing views of the Sheriff's Department and broadcasters are discussed in appendix III.)

One example of a technical disagreement involves the Sheriff's Department's claim that there is "sufficient likelihood" that public safety radio use of frequencies from channel 19 is possible without causing interference to other television channels. An engineering statement from a telecommunications consultant supports its position, but another engineering statement submitted to FCC by a broadcasting trade association states that ". . . Channel 19 is not suitable for public safety use in Los Angeles . . ." In July 1984, FCC staff agreed to the Sheriff's request that he conduct an on-the-air test of public safety use of channel 19.

The Department maintains that the special circumstances of public safety agencies require proven, readily available, and cost-efficient equipment. The Department contends that the emergency environment pervading police and fire operations is not the place to use what it considers experimental equipment. These special requirements and constraints can limit the FCC's alternatives for improving a public safety communication system.

FCC's RESPONSE TO SHERIFF'S PETITION

FCC's response to the Sheriff's petition covers two separate time periods: (1) September 1981 until October 1983 during which FCC staff processed the original petition and (2) the period following November 4, 1983, when the Sheriff filed his supplement, to the present. FCC staff found the Sheriff's original petition controversial, whereas they found the supplement more realistic and easier to handle because the Sheriff distinguished between his immediate needs and the nationwide requirements of public safety agencies. A chronology of FCC actions on the petition and supplement is included in appendix IV.

Because we reviewed only the Sheriff's petition and the supplement, we did not determine whether FCC handled this petition any differently from other petitions. However, we did find that FCC has no formal procedures setting forth how it evaluates petitions to change its rules or regulations. FCC's Deputy Chief Scientist for Policy, Office of Science and Technology, who is coordinating the staff's response to the Sheriff's petition, told us that petitions for rulemaking are handled case-by-case. Typical considerations include the nature and significance of the request, the relationship of the request to other FCC proceedings, the urgency of the request, whether other petitions have priority, how well the petition is supported, and staff resources available to evaluate the request and prepare a formal response.

The Deputy Chief Scientist also told us that before making major spectrum reallocation decisions such as the one requested by the Sheriff, FCC must evaluate whether the needs of the petition are supported; what alternatives are available to meet the petitioner's needs; where the frequencies should come from; and how important the uses being made of the frequencies that could be reallocated to the petitioner are.

FCC response to Sheriff's
original petition

FCC took about 2 years to prepare a response to the Sheriff's original petition. The response was scheduled to be presented at a Commission meeting on November 10, 1983. However, this response was postponed when the Sheriff's counsel notified FCC that a supplement would be filed.

A major reason for the time taken to process the original petition was that FCC held the petition in abeyance from about the spring of 1982 until July 1983 while two FCC studies were being completed. One study dealt with the sharing of UHF television spectrum by full power television stations, low power television stations,⁵ and land mobile services, and a second study assessed future requirements of land mobile communications and alternate methods for meeting those requirements. FCC staff felt that these studies might suggest alternatives to the Sheriff's proposal.

During July through October 1983 and following its review of the draft studies, FCC staff considered various approaches for providing some additional frequencies to the Sheriff. Subsequently, these approaches were rejected and the staff considered dismissing the petition on the bases that alternatives, including the use of new technology, were available to public safety users and that a convincing case for reallocation of UHF television channels was not made. However, before the petition could be brought before the Commission for a decision, the Sheriff's counsel notified FCC in October that the Sheriff was planning to file a

⁵On March 4, 1982, the Commission adopted an order creating the low power television service. This new service was intended to facilitate entry into broadcasting by groups and individuals including minorities who are new to the industry. A low power television station, transmitting at relatively low power, can be licensed on any available channel--including channels 14 through 20--provided it does not cause interference to full service stations. The Commission's decision placed public safety agencies in competition with low power television applicants and full power stations for use of UHF television channels. Recognizing this competition, the Commission directed its Office of Science and Technology to study the technical feasibility of sharing the UHF television band among full power stations, low power stations, and land mobile services in the 10 most congested land mobile markets, including Los Angeles.

supplement. Because the supplement substantially changed the Sheriff's original petition, FCC was required to take a fresh look at it.

FCC concerns about original petition

In our discussions with FCC staff regarding the merits of the Sheriff's original petition, they cited concerns that the Sheriff's proposal was controversial and unrealistic. They cited the strong opposition from broadcasters and the earlier reallocation of UHF television channels to land mobile services in the 1970's. The staff noted that, in the early 1970's, FCC had addressed the needs of public safety and reallocated UHF television channels 70 through 83 to land mobile and public safety services. Concurrently, FCC allowed these services to use one or two of UHF television channels 14 through 20 in 13 major urban areas, including Los Angeles.

In addition, the staff believed that the original petition lacked clarity and convincing evidence. We noted, however, that FCC did not request more information from the Sheriff or provide guidance on additional supporting evidence his Department should file. FCC staff in the Office of Science and Technology told us that they normally rely on the petitioner to provide all relevant information in the petition.

FCC response to Sheriff's supplement

Since the Sheriff filed his supplement in November 1983, FCC has been evaluating the Sheriff's immediate needs. Specifically, FCC has

- conducted a 7-week monitoring study to establish the level of traffic on the Sheriff's communication system,
- requested that the Sheriff answer a list of questions dealing with technical matters, such as his position on the use of new technology to resolve his communication problems,
- assigned a staff member in the Chairman's office to assure that FCC offices are moving forward to a timely resolution of the petition,
- established as a deadline the summer of 1984 to respond to the petition, and
- agreed to the Sheriff's request that he conduct an on-the-air test to evaluate public safety use of channel 19.

FCC also began to address the need for a long-range spectrum allocation plan in November 1983 by studying safety agencies' current and future communications requirements. This represents FCC's initial effort to comply with section 9(a) of FCC's

Authorization Act of 1983 (Public Law 98-214) for a public safety spectrum allocation plan.

FCC has not yet established a timetable for the public safety spectrum allocation plan because how it proceeds will depend on the findings of its public safety study, scheduled for completion in March 1985. However, an extension of 3 months for filing of public comments in connection with the study, granted by FCC in April 1984, could postpone it. Also, FCC's fiscal year 1985 budget request to Congress reduced by one work-year the professional staff assigned to the study and stated that this "will slow the completion of the work significantly."

Department disputes results
of FCC monitoring study

The results of FCC's 7-week monitoring study, released in March 1984, concluded that the Sheriff's frequencies are "less occupied than is indicated in his [the Sheriff's] petition." The collection of monitoring data and the related analysis were performed by FCC's Field Operations Bureau which has primary responsibility for monitoring the radio spectrum to ensure that channels remain usable and free of interference. Officials from both FCC and the Sheriff's Department regarded the monitoring study as an important factor in evaluating the level of frequency congestion on the Department's frequencies.

The Department viewed FCC's finding as adversely affecting the Department's prior statements of congested radio frequencies. Consequently, on June 25, 1984, the Department provided FCC with a formal written response disputing the results of FCC's monitoring study. The Department found that FCC's analysis was significantly flawed and included errors and omissions such as the failure to consider the different requirements of frequencies used for surveillance and other covert activities as compared with frequencies used for dispatching patrol officers. Using the same raw data collected by FCC, the Department with the assistance of a public safety communications consulting firm prepared its own analysis and concluded that its frequencies were as occupied as the Department said they were. The Department also emphasized that there were other important issues, such as the need for a portable radio system for patrol officers, besides the question of how busy its frequencies are.

The head of the Field Operations Bureau told us that his bureau does not plan a response to the Department's criticisms. He said both his study and the Department's response have been turned over to the Office of Science and Technology for its review and consideration.

MAJOR POLICY ISSUES RAISED
BY SHERIFF'S PETITION

FCC staff and the Sheriff's Department have agreed that the radio spectrum is insufficient to satisfy the demands of all potential users. The result of this scarcity is increasingly intense competition among the various claimants. Consequently, the Sheriff's petition is a good example of the type of spectrum allocation decisions that will confront the FCC during what has been called the telecommunications revolution.

In our review of the Sheriff's petition and FCC's response, we identified four major issues which go beyond the needs of an individual radio user and relate to how FCC manages the radio spectrum.

- How should FCC plan for and anticipate future public safety demands for radio spectrum?
- Would a contiguous block of frequencies for public safety be preferable to the present fragmentation?
- Is state-of-the-art technology suitable for public safety uses?
- Can specific criteria be developed to judge the adequacy of public safety communications?

FCC intends to consider these and related issues in its effort to prepare a public safety spectrum allocation plan and study. FCC's study will evaluate public safety communications requirements over the next 16 years, the availability and suitability of different frequency bands for such usage, and the ability of new technologies to improve their use. The study director told us that the study may also look at the question of criteria for public safety communication systems.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our objective was to respond to your interest in certain matters involving the Sheriff's petition. We reviewed FCC documents which are part of the official record on RM-3975. At the Sheriff's Department in Los Angeles County, we reviewed data and other information supporting the Department's communications problems. We also discussed the petition with FCC staff; the FCC Chairman's office; Commissioner Mimi Weyforth Dawson; officials from the Sheriff's Department; representatives of the broadcasting industry; police and fire departments in the Washington, D.C., and Los Angeles metropolitan areas; and public safety trade associations. A detailed discussion of our scope and methodology related to our review of the Sheriff's communication problems is contained in appendix II.

We conducted our work from September 1983 to March 1984. Our review was performed in accordance with generally accepted government auditing standards.

AGENCY COMMENTS

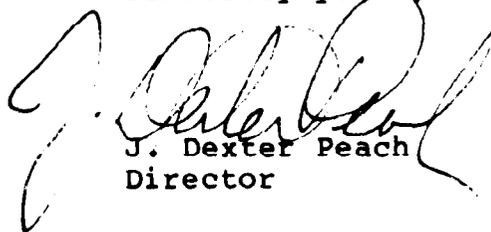
We requested comments on this report from FCC and the Sheriff. The FCC did not provide us agency comments approved by the full Commission. Its Managing Director, however, did provide a brief written staff commentary which stated that the report is both thorough and fair. The commentary also included a few suggested revisions on technical matters which we have made as appropriate.

In its comments the Sheriff's Department raised six concerns that it had with our draft report. Generally, these concerns involved information on the Department's communication problems and use of channel 19 that the Department believed was lacking or misplaced in our report. We have added information relating to the Department's concerns where appropriate. The Department's comments and our specific responses are included in appendix VII.

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As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 14 days from the date of the report. At that time we will send copies of the report to the Chairman, Federal Communications Commission, and the Los Angeles County Sheriff. We will also send copies to interested parties and make copies available to others on request.

Sincerely yours,



J. Dexter Peach
Director

C o n t e n t s

GLOSSARY

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ABBREVIATIONS

FCC	Federal Communications Commission
GAO	General Accounting Office
LASD	Los Angeles County Sheriff's Department
MDT	mobile digital terminals
MHz	megahertz, or one million cycles per second
OST	Office of Science and Technology
UHF	ultra high frequency
VHF	very high frequency

GLOSSARY

Allocation	The process by which FCC segments the radio frequency spectrum into frequency bands reserved for different types of wireless communications services.
Alphanumeric	Consisting of both letters and numbers, as well as other symbols.
Amplitude compandor	A device that reduces the amplitude of loud syllables and increases the amplitude of quiet passages to achieve a transmitted signal more even (compressed) in power level. After transmission and reception, the signal is restored (expanded) to its original form (compressor plus expandor equals "compandor").
Amplitude modulation (AM)	Radio signals in which information is transmitted by varying the amplitude (strength) of the signal.
Band	A range of contiguous frequencies within two definite frequency limits and allocated for a definite purpose or service.
Bandwidth	The amount of spectrum space needed to transmit information at the rate and with the quality required by the system used.
Cellular radio	Mobile radio systems which rely on coordinated re-use of available channels within an area. Under a cellular system, a city is divided into geographic units, or "cells." Calls made from a moving vehicle can be switched from cell to cell, and frequency to frequency, without interrupting the conversation.
Direct broadcast satellite	A telecommunications service in which satellites broadcast television and other communications signals directly to receiving antennas at the consumer's location.
Frequency	The number of complete oscillations per second of a radio wave.
Frequency modulation (FM)	Radio signals in which information is transmitted by varying the frequency of the signal.

Gigahertz	One billion hertz.
Hertz	A unit of measurement for radio frequencies equal to one complete cycle of electrical oscillation.
Interference	The confusion of received radio signals due to stray or undesired signals.
Kilohertz	One thousand hertz.
Land mobile radio	Voice and non-voice radio communication between a fixed place and a moving vehicle or person, or between two or more moving vehicles or persons.
Low power television	Small UHF or VHF stations operating at less than full power within a limited geographic area.
Megahertz	One million hertz.
Memorandum, Opinion and Order (MO&O)	A formal FCC order used to (1) terminate a Notice of Inquiry after comments have been received and evaluated, (2) modify an initial FCC decision, or (3) deny a petition for reconsideration.
Notice of Inquiry (NOI)	A formal request by the FCC for information or comments by the public on a particular subject.
Notice of Proposed Rulemaking (NPRM)	A formal FCC notification to the public, asking for comment on a proposed change to FCC regulations.
Petition for Reconsideration	A formal appeal made by interested parties in response to an FCC final action.
Petition for Rulemaking	A formal or informal request from an interested person to initiate a change in FCC regulations (see "rulemaking"). A petition may be based on a court decision, legislation, or a perceived problem with FCC's rules.
Public safety radio services	Five separate radio services dedicated to the safeguarding of life and property by territorial, state, county and local governments. The services include police, fire, highway maintenance, forestry-conservation, and local government operations.

Radio frequency spectrum	The range of radio frequencies from 10 kilohertz to 300 gigahertz used by all wireless communication, such as radio, television, and radar.
Reallocation	The process by which radio spectrum previously assigned to one wireless communication service is taken away and allocated to another service.
Report and Order	A published decision by the FCC to amend or not amend its rules following a Notice of Proposed Rulemaking.
Rulemaking	The process by which FCC establishes and changes its regulations.
Ultra high frequency (UHF) band	The frequency range from 300 megahertz to 3 gigahertz. Television channels 14 to 69 broadcast on a portion of the UHF band.
Very high frequency (VHF) band	The frequency range from 30 to 300 megahertz. Television channels 2 to 13 broadcast on a portion of the VHF band.

INFORMATION ON THE LOS ANGELES COUNTY SHERIFF'S
DEPARTMENT'S PETITION FOR ADDITIONAL FREQUENCIES

In September 1981, the Los Angeles County Sheriff's Department (LASD), one of the largest law enforcement agencies in the country, filed a petition with FCC because LASD was planning to expand its radio system at a cost of over \$25 million and wanted 110 new frequencies. By November 1983, FCC had not issued a final decision on the petition, but LASD believed FCC would not approve it. In an attempt to augment the petition and strengthen prospects for approval, LASD filed a supplement revising certain points and reemphasizing others.

The main issues LASD presents in its petition as supplemented are that public safety agencies in major metropolitan areas of the country are operating on frequencies that are so overcrowded and widely separated that they cannot meet growing demands to provide services; the Los Angeles area and LASD, in particular, need immediate relief; and this relief should come by reallocating frequencies that have been allocated for television services.

In its plans for an expanded system and in its request to FCC for 110 new frequencies, LASD has stated that it operates two distinct radio systems that are saturated and that do not operate on frequencies in the same region of the spectrum. As another problem, LASD states that its field personnel do not have the hand-held radio system that they need to be able to communicate while away from their vehicles. LASD's plans for an expanded system to overcome all of these problems will require:

- LASD to use more efficient radio communications equipment,
- LASD to implement a hand-held radio system for patrol deputies in the field,
- FCC to provide similar UHF frequencies for all of LASD's radio communications, and
- FCC to provide additional, similar UHF frequencies that could be used by other public safety agencies to communicate with LASD.

BACKGROUND ON LASD'S ENVIRONMENT,
COMMUNICATIONS, AND PETITION TO FCC

Los Angeles County covers an area of 4,083 square miles with 83 incorporated cities, additional unincorporated areas, and a population of 7.5 million. The LASD provides law enforcement services to a 3,716 square mile area, 35 of the cities, the unincorporated areas, and about 2 million people. Some cities in the county provide their own police services, such as the cities of Los Angeles (50 square miles and about 3 million people), Long Beach (50 square miles and 373,000 people), Torrance (20 square

miles, 133,000 people), and Pasadena (23 square miles and 123,000 people).

According to its petition, LASD is the nation's largest sheriff's department and the sixth largest law enforcement agency, with over 7,800 personnel, 1,200 vehicles and 18 aircraft. It provides a wide range of law enforcement services including patrol, investigation, jail, court, laboratory and transportation. In addition, it provides disaster relief, rescue, and aid to other public safety agencies within the county. Twenty LASD stations and two substations located throughout the county help provide these services. Data for fiscal years 1981 to 1983 shows that LASD handles about 260,000 cases annually, including offenses such as homicide, rape, assault, forgery, narcotics, drunk driving, missing persons, suicide attempts, and traffic accidents.

LASD's current communication system

LASD's radio communications support its various services and link activities together for command, control, and coordination purposes. Two distinct radio systems (a VHF system and a UHF system) are in operation with limited interface between each other.

The VHF system was placed into service in 1975 and operates on 35 frequencies in the 39 MHz portion of the VHF band and, as configured at the time of our review, provides 23 channels.¹ Eleven of the 23 channels are used for dispatch operations (e.g., responding to calls for police services, providing information and assistance to deputies, etc.), and 10 others are used for tactical operations including vehicle-to-vehicle and vehicle-to-station communications. Two more channels support tactical covert operations.

The UHF system was introduced in 1978 and operates on 20 frequencies in the 470-473 MHz portion of the UHF band, providing 10 tactical channels of two frequencies each that LASD uses for investigative work. Three channels can be used county-wide. One of the three is an emergency channel which is tied into the VHF dispatch system. Each of the remaining seven covers only specific regional areas of the county.

Both systems are supported by a vast array of equipment at a Sheriff's Radio Center, at each station and throughout the county. According to LASD, these systems include the use of more than 21 computers, 125 video terminals, and 1,200 mobile and 900 hand-held radios. The systems operate on an extensive, county-owned microwave system linking mountaintop sites to the 20 LASD

¹Eleven of LASD's UHF channels used one frequency and twelve channels used two frequencies. Using two frequencies for a channel offers the advantage that both parties to the conversation can speak and be heard at the same time.

stations and other service facilities. The primary functions of the Sheriff's Radio Center are to provide command, control, and coordination; dispatch patrol deputies who answer calls for police services; and process deputies' requests for assistance and information.

LASD's petition to FCC

LASD officials said they considered their radio system overburdened² as early as 1978 and began planning to change it. LASD identified problems to be overcome and planned how increased communications requirements could be handled using different types of equipment and numbers of personnel and frequencies. According to LASD officials, LASD selected from various possible designs a system which would provide expanded capabilities, use new equipment, and allow for future growth.

However, this preferred design required different frequencies which LASD asked FCC to provide. According to LASD officials, they determined that there was a lack of available frequencies not only for this new system but also for public safety needs generally. They said the problem was related to FCC's allocating television services a disproportionate share of frequencies which public safety agencies needed. Consequently, LASD petitioned FCC to reallocate television frequencies to meet high priority public safety needs.

In September 1981, LASD filed its original petition with FCC. The main issues were that: (1) public safety agencies in major metropolitan areas of the country need additional frequencies to meet critical, growing demands for services, (2) the Los Angeles area needed immediate relief, and (3) this relief should come by reallocating some of the frequencies that FCC had allocated for television services.

The petition stated that FCC actions had created an imbalance in the frequencies available for public safety and for television use. LASD stated that FCC had promoted inefficient use in television services by allocating more frequencies than were needed and by protecting television broadcasters. Also, it stated that FCC allocated radio frequencies to public safety agencies that were so far apart that these agencies could not easily talk to each other on equipment that is available.

As corrective measures, the petition specifically requested that FCC

²LASD has used various terms to describe radio communications conditions and problems. LASD officials said that the terms "overburdened," "saturated," and "congested" were used somewhat interchangeably to describe problems where the channel cannot handle the workload; the terms "loaded," "100 percent loaded," and "fully loaded" were used somewhat interchangeably to describe a channel operating at full capacity but without problems.

- permit the land mobile and television services nationwide to share seven UHF television channels, license no new stations on these channels, and relocate existing television stations off these channels over time and with federal funding,
- ensure that frequencies are used more efficiently in providing television services,
- permit agencies with large radio systems to reserve frequencies for future growth, and
- quickly allocate television channels 15 and 16 for police and fire services in the Los Angeles area.

As an additional point, LASD said it required 110 frequencies to meet immediate and future needs for mandated services.

Two years after the original petition was filed, LASD filed a supplement to it. LASD officials said they filed this supplement because they had additional information, wanted to clarify some points that they believed some other public safety agencies had misinterpreted, and saw no positive signs that FCC would approve the original petition.

The LASD supplement, filed in November 1983, identified generally the same problems and needs for frequencies as the original petition. But LASD officials said they tried to emphasize in the supplement the need for immediate relief in the Los Angeles area and recognize that meeting the broader needs of public safety would take longer. The supplement provided additional information and examples to show that LASD's radio system was overburdened, inadequate, and in need of expansion and why it could not have the system it needs without 110 new frequencies. LASD also emphasized its need for a hand-held radio system for its patrol officers.

The supplement proposed somewhat different solutions from the original petition to strengthen its chances for approval, according to LASD officials. For one, the supplement proposed that no existing television station would have to relocate. Also, it emphasized that FCC could create new UHF television channels through more efficient spectrum utilization techniques. In addition, it requested less spectrum to meet the immediate needs of public safety in Los Angeles, although it still requested two television channels to meet the long-term needs of public safety in large metropolitan areas. Specifically, the supplement requested that FCC

- study frequency utilization and adopt techniques to make additional UHF frequencies available throughout the United States,
- allocate sufficient UHF television channels for land mobile use,

- reserve two television channels below channel 21 for public safety use in the largest 20 metropolitan areas, and
- immediately assign UHF-television channel 19 for public safety use in the Los Angeles area.

LASD'S COMMUNICATIONS PROBLEMS AND PROPOSED SOLUTIONS

LASD claims that (1) its present radio system is saturated, or overloaded, and needs "considerable expansion" in order to provide required services and (2) its frequencies are fragmented to a point where deputies cannot in some instances talk directly with each other or with field officials of other public safety agencies in the Los Angeles area. As part of the needed expansion, LASD states that it needs to provide all field personnel with hand-held radios to extend their communications ability and enhance their safety. Furthermore, LASD has determined that the hand-held radios needed will require UHF frequencies and that fragmentation problems can be avoided if its other radio equipment operates on these same frequencies. It also claims that county-wide frequencies similar to those it will use should be available for joint operations with other law enforcement agencies. LASD has used these defined needs as a basis for requesting the 110 entirely new frequencies that it is attempting to obtain in its petition to FCC. LASD officials estimate this expansion will cost in excess of \$25 million. The following sections discuss LASD's basic communications problems and its proposed solutions in more detail.

Saturation problem and solutions

LASD officials told us that saturation can pose a serious problem because it can affect the time an officer must wait to send an important message. For example, if an officer is trying to communicate that his life or that of a citizen is in danger, a frequency must be immediately available. They agreed that saturation can be a less serious problem when less important messages have to be sent and delays in sending them will not jeopardize life or property. A routine request for a tow truck, for example, might be delayed without consequences. However, they said that routine messages can increase the chances of the channel not being available when needed for important messages, and there is the possibility that a "routine" event can turn into a critical situation. According to LASD officials, different techniques are employed by LASD to ensure that important messages are not delayed. For instance, radio traffic is moved from one channel to another. Also, LASD keeps certain channels available for emergency messages.

LASD states that the solutions to its saturation problem are to obtain new frequencies from the UHF band and to apply more efficient radio communications technology. LASD states that the application of digital technology can provide a significant increase in its mobile communications capability. LASD expects to

reduce by as much as 75 percent the amount of air time currently used by adding mobile digital terminal (MDT) equipment. This reduction will occur because MDT equipment will allow officers to substitute one form of communications, "voice radio," with another, "digital radio," and officers will be able to send and receive messages without the constant use of voice communications. In addition, digital messages are sent accurately and instantly (that is, transmissions take less than a second), and are received directly from computer data bases, bypassing the dispatcher.

MDT will be particularly useful for deputies on patrol, LASD officials said, because much of the information they need on vehicles, property, and individuals is already recorded and maintained in various computerized data bases. Lacking MDTs, this information must be transmitted verbally. For example, an officer in the field needing computer-stored data has to send a verbal radio message to a dispatcher who repeats it for accuracy. The dispatcher uses a data terminal to query the data system with a written message and receives a written response. The written response is then relayed verbally back to the officer who might again repeat it to ensure it was received accurately.

Fragmentation problems and solutions

LASD uses the term fragmented to describe situations where frequencies not close together on the radio-band are assigned to a public safety agency or several agencies needing to talk to each other. Serious fragmentation problems could be alleviated, LASD believes, if all public safety agencies were on similar frequencies, and in Los Angeles, if LASD and these other users had a number of similar frequencies that could be shared.

LASD officials told us that fragmentation is a problem when users need to talk to each other but cannot because equipment in use can send and receive on only a small range of frequencies. LASD officials said that although they have frequencies 431 MHz apart, most hand-held radios LASD now uses can receive and send messages only on frequencies separated by no more than a range of 2 to 5 MHz. LASD officials said newer UHF models are available which can transmit across a bandwidth of 12 MHz, and that equipment to span a greater bandwidth is being developed from existing technology. Nevertheless, they said even the newer equipment would not be sufficient to cover their VHF and UHF frequencies from 39 MHz to 470 MHz.

The seriousness of the problem will be determined by the need to communicate and the equipment that is available. For example, when all communications can be handled on frequencies within the operating bandwidth of one radio, fewer problems will exist. However, if messages need to be sent and the radios used operate on frequencies outside the bandwidth of one radio, additional radio equipment must be used. As the need increases to communicate but the equipment used operates on different and widely separated frequencies, the need for additional equipment will also increase.

LASD officials said the problem is that their VHF radios cannot be used with UHF radios. They also said the problem exists when various public safety agencies' officials in the field want to talk to each other directly but cannot because their radios operate on different frequencies. Communications in such instances are possible but cumbersome, LASD officials said, because a field officer has to send a message on his frequency to his dispatch center where it is relayed to another dispatch center and then sent to the other agency's official on his frequency.

LASD officials said that to meet current users' needs to talk directly with each other, they must have access to additional radio equipment that will handle the frequencies being used. Consequently, some vehicles must be equipped with several radios. LASD claims a better solution is for it and other public safety agencies in Los Angeles to have a five-channel mutual aid system that LASD believes will provide sufficient capacity for normal interagency use and major operations.

Hand-held radio problems and solutions

LASD believes that it needs additional radio communications capability in the form of hand-held radios for all patrol deputies. Although all organizations do not yet have them, the criminal justice community in California has adopted hand-held radios as a desired standard. Two reasons LASD gives for patrol deputies not currently having hand-held radios are that VHF (39 MHz band) frequencies are ill-suited for portable use because they do not penetrate buildings well, the antenna required are too long, and there are interference problems. Furthermore, the UHF (470 MHz) frequencies which could be used for hand-held radios are needed for other operations.

LASD's petition to FCC also points out that officers need hand-held radios because they often have to leave their vehicles to meet police requirements. Without hand-held radios, communications are interrupted until the officers are able to return to their vehicles. Moreover, according to LASD, most investigations, searches, shootings, and arrests do not occur in close proximity to patrol vehicles. LASD has illustrated this situation by an example. Two deputies were checking a suspicious person in a car when the suspect began a struggle with one of the deputies. The suspect wrestled the service revolver from the deputy, shot both deputies, and then ran from the scene. One deputy was partially paralyzed and was unable to get to the patrol car radio to call for help. The other deputy was slightly wounded but chased the suspect. When the suspect ran inside a house, the deputy attempted to prevent the suspect from escaping and in the process was shot and killed. LASD concluded that if these deputies had hand-held radios, they could have called for help and advised others of their location.

In planning to place a major hand-held radio system into service, LASD officials said they are concerned with both

saturation and fragmentation. LASD wants to avoid further saturation because it anticipates that the addition of hand-held radios will increase the use of the radio system. They also stated that fragmentation would continue to be a problem as long as hand-held and vehicle radios remain on widely separated frequencies.

LASD's choice of new frequencies

LASD has concluded that a minimum bandwidth of 12 MHz of UHF frequencies (two television channels) should be available to public safety agencies in major metropolitan areas to support their radio communications needs and to avoid saturation and fragmentation problems. LASD has also concluded that these frequencies should come by sharing UHF frequencies allocated for television channels 14 to 20 (the UHF band).³ The sharing, according to LASD, would not impact existing television stations and would be possible through more efficient spectrum utilization techniques to make use of vacant channels and create additional channels. For immediate relief in Los Angeles, LASD considers frequencies allocated for channel 19 to be the most feasible choice for additional use by public safety, although the frequencies used for television channel 16 would be an acceptable alternative. LASD officials said they selected these channels because they are currently unused in the Los Angeles area and have the bandwidth and frequency characteristics LASD wants.

LASD said it carefully studied alternative choices of frequencies to meet immediate requirements in Los Angeles. VHF frequencies in the 39 MHz band were ruled out as being unreliable, incompatible with the UHF system, and subject to interference and other problems. While it considered upper VHF frequencies (150 MHz) a better band than the UHF frequencies (470 to 512 MHz), LASD concluded that the number of frequencies needed are not available. LASD officials said that higher UHF frequencies such as those in the 800 MHz band would present other problems. For example, they said that significantly more equipment would be needed to cover the same geographical area.

³In the early 1970's, FCC allowed land mobile services including public safety to use one or two of UHF television channels 14 through 20 in 13 major urban areas. In Los Angeles FCC assigned channels 14 and 20 for land mobile use. LASD's engineering consultant found that frequencies on these channels available for public safety are loaded to capacity and any expanded use is precluded.

DATA AND OTHER INFORMATION SUPPORTING
LOS ANGELES COUNTY SHERIFF'S DEPARTMENT'S
NEED FOR ADDITIONAL FREQUENCIES

This appendix discusses our examination of data and other information provided to us by the Los Angeles County Sheriff's Department (LASD) supporting its need for radio frequencies and including the specific number of frequencies required for an improved communication system. Our examination showed that while LASD considers its present frequencies saturated and fragmented, criteria and sufficient data were not available to clearly measure these conditions and determine the extent of LASD's problems. In addition, the number of frequencies LASD will actually need to support its expanded radio system is only an estimate. While tentative plans have been developed showing the radio channels LASD anticipates establishing, these plans do not demonstrate how the workload of radio messages and air time will be distributed on the new system's frequencies.

Furthermore, LASD has developed an alternate plan for expanding its radio system if FCC denies LASD's request for new frequencies. LASD officials said that the alternate plan was not the system that LASD needs and was developed as a way to at least provide some relief.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objective of our examination of LASD's supporting data and other information was to better understand its communications problems and needs. We reviewed the original and supplemental petition along with other documents LASD has filed with FCC. At LASD we toured facilities and identified how personnel, equipment, and frequencies were used in the current radio communication system. We discussed issues in the petition with officials in LASD's Communications and Fleet Management Bureau, Technical Services Division, including the project manager for the Sheriff's Mobile Digital Communications Project Task Force and his staff. We also reviewed information on how frequencies were being used, what the problems were, and how new equipment and frequencies could be used to alleviate these problems.

Furthermore, we discussed the issues LASD has identified with other public safety agency and communications officials in the Los Angeles, California, and Washington, D.C., areas. Included were officials from the Orange County Communications Department, the Los Angeles County Communications Department, the Los Angeles Police Department, the South Bay Regional Communications Authority in southern California, and communications departments of Fairfax County, Virginia, and Baltimore County, Maryland.

We reviewed a 1979 FCC study of frequency usage in Los Angeles and San Diego, California, and a 1984 FCC study of LASD's

frequency usage during a 7-week period. We also reviewed an outside consulting study completed in 1982. The firm that did this study, System Development Corporation (SDC), had designed LASD's existing radio system and is a potential contractor to design the new system.

Generally accepted criteria to clearly measure what constitutes effective and efficient use of frequencies for public safety agencies were not available; therefore, we analyzed LASD's radio communications problems in terms of criteria LASD used. LASD had usage criteria that applied to 21 of 55 frequencies it has been using, but no usage criteria existed for the other 34. The 21 frequencies are used for dispatch operations where deputies respond to emergencies and complaints, request assistance, etc. The other frequencies support tactical operations which include all other types of communications (e.g., surveillance, vehicle-to-vehicle, administrative messages, etc). Moreover, summary data on frequency usage covered only 20 dispatch and 8 of the tactical frequencies; it was also limited to the most recent 1 to 2 months and additional data that LASD retained from its own past analyses. Consequently, our examination was limited by availability of frequency usage criteria and data.

We supplemented our examination of this data by listening to and analyzing 3 hours of taped radio conversations on LASD's radio system. LASD estimated it had an inventory of about 236,000 hours of such tapes. Although we did not try to representatively sample this inventory, the 3 hours we listened to provided further insight into the nature of LASD's communications problems and were used for some limited testing of LASD's frequency usage data.

CRITERIA ARE NOT AVAILABLE TO MEASURE
THE SEVERITY OF LASD'S PROBLEMS

Generally accepted criteria were not available for clearly measuring whether LASD's radio frequencies are efficiently used, saturated, or excessively fragmented. FCC has limited criteria for the number of police radios that should be on each UHF frequency, but none for VHF frequencies where most of LASD's frequencies are. LASD has criteria to measure use of its VHF dispatch frequencies, but not for its other VHF or UHF frequencies. In addition, FCC and LASD officials could not identify any criteria that applied to the issue of fragmentation.

FCC and LASD officials referred us to "units-in-use" criteria developed by FCC related to the number of radios that should be in use on a radio channel. However, FCC has recognized that units-in-use is not as reliable as actual channel usage as a measure of saturation. Moreover, as most of LASD's frequencies are on VHF, we did not find the units-in-use criteria to be very useful in examining LASD's need for frequencies because the criteria apply only to UHF frequencies.

Nevertheless, information on FCC's efforts to establish criteria for UHF channels shows that FCC and users have discussed the matter. In January 1971, when FCC allowed land mobile and public safety services to share one or two UHF television channels in large cities, it adopted a criterion that 50 mobile units on a police radio channel would fully load it. As an additional criterion, FCC stated at that time that four hand-held radios would be considered the equivalent of one vehicle radio. FCC reported that users disagreed with these criteria on the basis that the criteria did not sufficiently consider the size of the user's system, the type of traffic, or the nature of the user's activity. Some users asked that FCC consider its criteria as only a guideline, and requested that 20 to 30 mobile units on a channel be identified as the guideline. Furthermore, some users asked that one hand-held radio be given the same weight as one vehicle radio.

FCC disagreed with changing the criteria or using them only as guidelines. As reasons, FCC said to use them as guidelines would eliminate the use of any consistent loading criteria, substituting them with case-by-case determination. FCC also stated that none of the users had offered any facts, based on existing operational experience, to show that hand-held radios generated as much traffic as vehicle radios. FCC noted that the ultimate channel loading criteria would be more sophisticated and complicated, and a units-in-use criterion was the only one available at that time.

FCC has reconsidered its decision on the equivalency of hand-held radios. FCC officials informed us in March 1984 that the loading criteria now equate mobile units to hand-held units on a one-to-one basis.

Lacking complete criteria, FCC and users develop their own as needed or rely on existing rules-of-thumb and piecemeal criteria to define their operating conditions and frequency needs. A 1979 FCC study on frequency usage in Los Angeles and San Diego, California, for example, introduced the terms "low," "substantial," and "very high" frequency occupancy in measuring the amount of time channels were in use. In our discussions with FCC officials on how the study established these categories, they said the terms appeared to be subjectively defined.

Communications officials at agencies we visited identified other criteria. Some said rules-of-thumb existed, but we did not find widespread agreement on what they were. One said the rule for a dispatch channel was that if it was in use over 30 minutes an hour it was considered to be saturated. Another thought that a frequency in use over 18 minutes in an hour was overloaded. Still another official knew of no loading criteria, except for FCC's units-in-use criteria, and questioned the meaningfulness of FCC's criteria. The waiting time for a radio user to gain access to an available frequency was an important factor mentioned by several users and FCC staff. They said that waiting time depended on the

average message time and the total time a frequency was in use. However, we found no generally accepted criteria on what is adequate waiting time for public safety agencies.

LASD officials said they use a criterion that a channel in use 20 minutes in an hour is an indicator of a loaded channel. They said, however, that this criterion applies only to dispatch channels, and that a similar criterion has not been developed for tactical channels because such channels are used for many different purposes, such as detective, court and jail activities, covert operations, and emergency messages. Also, they said that the time a channel is in use should include the time between sending a message and receiving a response, sometimes called a pause or an intra-message gap. They have determined, they said, that a patrol officer should not have to wait longer than 5 seconds to use a channel. Another criterion they mentioned was that if 30 cars were assigned to one channel, they considered the channel to be fully loaded.

We believe the diversity of opinions expressed illustrates the complexity involved in developing generally accepted criteria, but also suggests a need for them. In our opinion, generally accepted criteria would have provided a better basis for analyzing LASD's communication system. Lacking criteria that have been generally accepted by FCC and public safety agencies, we had to analyze data based on the criterion LASD has adopted.

SUFFICIENT DATA NOT AVAILABLE TO MEASURE
THE EXTENT OF LASD'S SATURATION PROBLEMS

Complete and sufficiently detailed data on LASD's radio system were not available during our review to measure the extent of LASD's saturation problems. Data on usage of LASD's radio system are automatically generated in two reports, one on the use of console terminal equipment at the Sheriff's Radio Center and the other on the use of individual radio channels and frequencies. We found that, for our purposes, these reports were limited in several ways. They collected data only on VHF channels which meant that data were available for only 28 of the 55 frequencies LASD uses. Furthermore, as the saturation criterion adopted by LASD was applicable only to its dispatch channels, data could be compared to LASD's criterion for only 20 of these 28 frequencies. In addition, only reports from recent months were available. Also, the way the data was reported made it difficult for us to verify or to use in assessing saturation problems. The availability of relatively few reports and the lack of complete and sufficiently detailed data, as well as the lack of generally accepted criteria, meant that we could not fully determine the extent of LASD's saturation problems.

LASD officials stated that the console usage report accurately reported VHF transmissions and receptions of messages, and that this data was used by the Department to calculate system-wide occupancy data. This report shows the time consoles at the

Sheriff's Radio Center are in use and the number of calls handled, along with other data. However, we were unable to rely on this report to assess saturation problems on LASD's dispatch channels. First, the data could not be easily verified because radio messages coming in on all radio channels could go to any of 16 consoles and, therefore, the data are reported by console and not by radio channel. Second, the data includes both tactical and dispatch channel activity. Without having data identified by frequency and by dispatch channels alone, we were unable to test the accuracy of the console usage report or determine the influence tactical channel usage was having on total reported radio traffic.

LASD officials said they used data from the console usage report to perform statistical analyses for their overall system which concluded, among other things, that:

- During a "peak" busy period of 1 hour each for 10 dispatch channels during April 1981, the system was 98 percent utilized.
- Waiting time to access a radio channel during average busy periods ranged from 1 minute and 26 seconds to 3 minutes and 46 seconds, and up to nearly 8 minutes during a peak busy hour.
- At a 98 percent utilization level, there was a 21 percent probability that a deputy using the radio would not be heard.

The second report, the frequency usage report, provides data on individual frequencies and dispatch channels that could be used to verify LASD's radio traffic and assess its saturation problems. But we were told by LASD officials that this report can overstate the amount of time that a frequency is actually in use. One way this can happen, according to them, is that one message can be received by more than one radio receiver. When this happens, the reported receiver time that a frequency is in use will include the times for all receivers on that frequency.

To determine how close reported frequency usage times might be to actual usage times, we analyzed 3 hours of radio taped conversations involving two dispatch channels. Each channel used two frequencies. For this analysis, we divided the 1-hour periods into 5-second intervals and recorded the lengths of time, to the nearest interval, that these messages took. We included the intra-message gap times as part of this time unless, in our opinion, this time was excessive and another message could be sent. Our analysis provided information not otherwise available and followed an approach LASD has used in the past.

The table below compares our estimates on usage times during these 1-hour periods with LASD's frequency usage data reports.

<u>Channel</u>	<u>Date</u>	<u>Time period</u>	<u>Reported frequency usage time</u>	<u>GAO estimated usage time</u>
14	11/18/83	8:00- 9:00 p.m.	44 minutes	28 minutes
14	11/18/83	10:00-11:00 p.m.	11 minutes	13 minutes
22	11/18/83	9:00-10:00 p.m.	21 minutes	29 minutes

For verification of our analysis, we then requested LASD to analyze channel 14 for the 1-hour period of 8:00 to 9:00 p.m. Their analysis, which recorded usage times to the nearest second, showed that the channel was in use only about 20 minutes during the hour.

Recognizing the limitations in the frequency usage summary data, we nevertheless analyzed the data for 240 hours to determine if there were indications that LASD's 10 dispatch channels (20 frequencies) might have exceeded its 20-minute in use per hour criterion. We selected 240 hours covering a 6-day period in November 1983. We included only times LASD told us were generally busy, 8:00 p.m. to midnight.

Our analysis is summarized by channel, below, and shows the number of hours where the reported usage time exceeded LASD's criterion. The table also shows the degree that the criterion was exceeded.

Analysis of LASD Frequency Usage Data Reports
Showing Times Dispatch Channels Were in Use
(11/14/83 to 11/19/83; 8:00 p.m. to Midnight)

<u>Channels^a</u>	<u>Total hours</u> <u>Reviewed</u>	<u>Analysis of hours in</u> <u>use 20 minutes or more</u>			
		<u>In use</u> <u>20</u> <u>minutes</u> <u>or more</u>	<u>20.0</u> <u>to 29.9</u> <u>minutes</u>	<u>30.0</u> <u>to 39.9</u> <u>minutes</u>	<u>40.0</u> <u>to 49.9</u> <u>minutes</u>
11	24	19	15	4	0
12	24	19	18	1	0
13	24	17	15	2	0
14	24	5	2	2	1 ^b
15	24	22	10	10	2
21	24	8	8	0	0
22	24	11	10	1	0
23	24	21	18	3	0
24	24	0	0	0	0
25	<u>24</u>	<u>3</u>	<u>3</u>	<u>0</u>	<u>0</u>
Total	<u>240</u>	<u>125</u>	<u>99</u>	<u>23</u>	<u>3</u>

^aEach channel uses two frequencies.

^bThis channel during this hour was reported as in use 44 minutes, but was actually in use only 20 minutes, according to LASD officials.

The table shows that channel usage times exceeded the criterion in 125 of these generally busy hours, that usage time during 23 hours was between 30 and 40 minutes, and for 3 hours it was over 40 minutes. For the remaining 115 of these generally busy hours, the criterion was not exceeded. As previously noted, LASD officials stated that adding intra-message gap times to this data would more accurately reflect the total time a channel was in use. LASD officials also said that summer months are busier for them than the month of November.

LASD could develop more complete information on its saturation problems, manually, from the tapes it has of actual radio operations. After we had completed our fieldwork, LASD began making some of these analyses. LASD has also used the tapes to identify examples of saturated conditions. For instance, they have reported that:

--A channel was in constant use for almost 5 minutes and radio car deputies were interfering with each other while trying to talk with the dispatcher. This meant, they said, that there was no vacant or available transmission time, and if another emergency had occurred it would have been difficult to communicate.

--A channel in use during a 9-minute period received calls from different units (1) pursuing a stolen vehicle, (2) aiding a baby in convulsions, (3) controlling traffic at a fatal accident, and (4) sending other messages. In this case, LASD said a request for rescue and an ambulance at the fatal accident had to wait because the channel was occupied by the stolen vehicle pursuit.

We identified still other examples of saturated conditions in the 3 hours of dispatch tapes we listened to, such as times when channels were in heavy use, times when important messages were being sent, and occasions when some messages appeared to interfere with others being sent.

However, periods exist when a message could be sent even though usage time for the hour exceeds the criterion. On one tape, for example, a pursuit used a 13-minute period on the channel, but during the remaining 47 minutes the channel was available for use about 31 minutes. This 47 minutes included six instances when the channel appeared to be available for periods of from 1.5 to 5.0 minutes. On another tape, the channel was also available about 50 percent of the time during the hour analyzed, and for a third tape, the channel was available for about 47 minutes during the hour.

LASD officials said they recognize that channels are not continually busy, but they maintained that their system has to handle additional radio traffic during their busiest times.

DATA ON LASD'S FRAGMENTATION PROBLEMS

During our review LASD officials emphasized that fragmentation was a serious problem. LASD has presented information it has developed to show the extent of its fragmentation problems in the petition and other documents submitted to FCC. This information is based on examples describing serious situations caused by fragmentation problems rather than any analytical study evaluating alternative solutions and documenting such measures as frequency of occurrence. LASD officials believe that their examples are sufficient to support the existence of a serious fragmentation problem and more study or analysis is unnecessary. They are convinced, as professionals and the ones most familiar with their radio system, that they have serious problems.

LASD officials told us that two types of problems are related to fragmentation. One is that deputies need to be able to talk directly with each other, but in some instances they cannot because some are limited to using VHF while others are confined to UHF. The other problem is that LASD deputies need to be able to talk directly with field officials of other public safety agencies in the Los Angeles area, but they cannot because these agencies have to operate on fragmented frequencies.

LASD states that its current means of communicating with other agencies is extremely cumbersome because it does not allow deputies in the field instantaneous access to talk with other deputies or with field officials from other public safety agencies. Agencies can communicate with each other by using dispatch-center-to-dispatch-center communications, and field units can talk to each other by going through their respective dispatch center. LASD officials said they also provide direct, one-way communications to all police departments by using existing dispatch frequencies and monitors placed at all police departments, which allows other agencies to receive LASD's crime broadcasts and emergency communications. However, LASD officials said that this approach to communications between field units does not provide the instantaneous two-way communications needed when, for example, an LASD deputy on the ground must coordinate with a Los Angeles (City) Police Department helicopter pilot in the air. LASD officials also identified a situation in which users could not communicate because they lacked a common frequency. In this situation, LASD and the Los Angeles County Fire Department were unable to coordinate an area evacuation in 1981 because each department used different radio bands.

LASD states that although tactical communications between agencies in the field can be accomplished on any of four radio channels currently available through the state of California, LASD does not use them. LASD said that 41 of the 47 police agencies in Los Angeles County are authorized to operate on these channels, under certain restrictions. LASD officials said that these frequencies are not close enough to LASD's 39 MHz or 470-473 MHz frequencies to be compatible with existing LASD equipment.

LASD'S PLANS FOR USING 110 FREQUENCIES ARE STILL TENTATIVE

LASD officials have tentative plans showing the dispatch and tactical radio channels they could establish with the 110 new frequencies they have requested, but these plans do not demonstrate how the workload of radio messages and air time will be distributed in the new system's frequencies. LASD officials are relying on the contractor who will design the new system to provide this information.

In its original petition LASD estimated that it requires 110 frequencies to support current and future radio communications needs. LASD officials told us this number was identified for a request-for-proposal they developed in 1980 and included in the original petition as a specific request that FCC could address. They said, however, that they still consider 110 to be the number of frequencies needed to meet current requirements and allow for growth.

These officials had plans showing how they could use all 110 frequencies, but said these plans are not final. The plans show radio channels that could be established to meet their needs.

However, the plans were not supplemented by any data that would show (1) the amount of radio traffic they expect to place on each channel, (2) how the overall workload of radio activity now and in the future will be handled on these channels, and (3) how this system will alleviate the saturation problems.

LASD officials told us that their contractor will develop additional data as part of the design for the expanded system. They showed us that the request-for-proposal being developed will require the contractor to develop a methodology to analyze the number of frequencies that will be necessary to meet projected radio requirements through the year 2000.

Pending a final design of the expanded system, the number of frequencies and how they will be used can change. In November 1983, for example, LASD's plans called for 92 frequencies for their own system and 10 for sharing, and they asked that 8 more be set aside for use as radio requirements increased. In a December 1983 assessment forwarded to FCC, LASD identified how it could use all 110 frequencies, without specifying that some were being requested to allow for growth.

LASD PLANS TO REPLACE ITS SYSTEM EVEN
IF NEW FREQUENCIES ARE NOT OBTAINED

LASD officials told us that they intend to replace their radio system even if FCC denies their request for 110 new frequencies. This intent is not stated in the original petition, in its supplement, or in LASD's answers to questions FCC asked in December 1983. LASD officials told us the alternate plan was not mentioned in these documents because it is not what LASD really needs and was devised only as a fallback plan if FCC denied the request. They pointed out that as managers they had to have alternative solutions to resolve their communications problems. FCC officials are now aware of this alternative plan.

According to LASD officials, the alternate plan using additional low VHF frequencies offers improvements over their current radio system, but not to the extent of the preferred plan presented in the petition, which would rely on UHF frequencies. The following table shows the use of VHF and UHF frequencies for different types of channels under LASD's current system and presents LASD's tentative decisions for the alternate and preferred plans as of March 12, 1984. Simplex channels use a single frequency for both sides of the conversation whereas duplex channels use two.

LASD's Current and Planned Use of Frequencies

Types of use	<u>Current system</u>		<u>Alternate plan</u>		<u>Preferred plan</u>	
	<u>Simplex</u>	<u>Duplex</u>	<u>Simplex</u>	<u>Duplex</u>	<u>Simplex</u>	<u>Duplex</u>
Dispatch						
VHF	1	20	-	28	-	-
UHF	-	2	-	-	-	28
Tactical						
VHF	10	-	10	-	-	-
UHF	-	14	-	12	-	32
Data						
VHF	-	-	-	10	-	-
UHF	-	-	2	-	-	12
Mutual Aid ^a						
VHF	-	-	-	-	-	-
UHF	-	-	-	-	-	10
Other ^b						
VHF	4	-	4	-	-	-
UHF	-	4	2	4	-	28
Total						
VHF	<u>15</u>	<u>20</u>	<u>14</u>	<u>38</u>	<u>-</u>	<u>-</u>
UHF	<u>-</u>	<u>20</u>	<u>4</u>	<u>16</u>	<u>-</u>	<u>110</u>
Total						
Simplex	<u>15</u>		<u>18</u>		<u>-</u>	
Duplex		<u>40</u>		<u>54</u>		<u>110</u>
Grand total		<u>55</u>		<u>72</u>		<u>110</u>

^aLASD stated that four other frequencies available for agencies to use in intersystems communications are not used by LASD for mutual aid because of equipment limitations and expense.

^bOther includes communications for detective, court and custody (jail) divisions, covert operations, emergency messages, and other special operations.

Although the plans are only tentative, the table shows that the alternate plan provides improvements over the current system in the form of additional channels, more duplex channels, and data channels. But the alternate plan does not provide the full duplex, UHF system with mutual aid channels requested for the preferred system.

LASD officials said they have already obtained the VHF frequencies needed for the alternative plan. They said these include three additional 39 MHz and fourteen 37 MHz frequencies.¹ As a result, LASD has a total of 72 frequencies it would use in the alternate system. But LASD officials emphasized that using the 37 MHz frequencies will separate their users even more than they have been and these frequencies are an undesirable fall-back alternative.

LASD officials said the plans will not be finalized until LASD selects a contractor to actually design and implement a system. They said LASD will use the alternate plan if new frequencies are not obtained and the preferred plan if they are. LASD has encouraged contractors who respond to its request-for-proposal to also offer any alternate approaches they consider more appropriate or effective.

As part of finalizing its plans for an expanded radio system, LASD must also decide which of the existing 72 frequencies it intends to relinquish. In its September 1981 petition, LASD stated that, if granted 110 new frequencies, it intended to abandon practically all of the frequencies it was using. On January 4, 1984, LASD officials told us they had not yet decided which frequencies would be relinquished. Subsequently, in a letter to FCC dated January 19, 1984, LASD said that the 110 new frequencies would be used to replace LASD's VHF frequencies.

¹These VHF frequencies have previously been allocated by FCC for public safety use; therefore, LASD did not have to petition FCC for them.

GAO SUMMARY OF VIEWS ON THE USE OF NEW
TECHNOLOGY AS A SOLUTION TO PUBLIC SAFETY AGENCIES'
COMMUNICATIONS PROBLEMS

This appendix focuses on four technologies--trunking, amplitude compandored single sideband (ACSB), cellular, and digital--which have been suggested by broadcasters and some FCC staff as a complete or partial solution to meeting the communication requirements of the Los Angeles County Sheriff's Department (LASD) and other public safety users throughout the nation without the need for a large reallocation of spectrum. LASD generally disputes these claims and maintains that the technologies are costly and/or lack proven capability. LASD feels that public safety agencies must utilize proven, reliable, cost-effective, and off-the-shelf land mobile equipment. FCC has recently initiated an inquiry to study further the utility of these and other technologies for public safety use.

Comments filed in FCC proceedings indicate that both the broadcasting industry and land mobile users believe that new technology could reduce land mobile's and public safety's need for spectrum. But differences between their two viewpoints relate to the technologies' present suitability for use by public safety agencies and how much of future demand would be met by new technology. Broadcasters point to an August 1983 report by Dale N. Hatfield Associates, a consulting firm, which concluded that all of the future land mobile spectrum requirements could be met by new technologies and, therefore, without additional spectrum reallocations to land mobile services. Specifically, the Hatfield report proposed a plan advocating the use of ACSB in conjunction with trunking techniques to increase by 10 times or more the capacity of public safety frequencies. (The Hatfield report was commissioned by associations and other representatives of the broadcasting industry.)

However, the land mobile users view it as unlikely that ACSB technology will be sufficiently developed in the near term to alleviate the spectrum shortage in major markets. The LASD, in particular, does not believe that the trunking, ACSB, and cellular innovations are suitable for its operational requirements but has taken a favorable view of digital technology.

TRUNKING

Trunking can be defined as an automatic method of temporarily assigning radio communication channels to users from a central pool of channels. In trunked systems from 5 to 20 channels are pooled together so that each mobile unit of the system can be automatically given access to any of the channels not then in use. The trunked system consists of a mobile relay (known as a "repeater") for each channel and a logic system (computer) for assigning the channels to mobiles and their corresponding control

stations when they want to send messages. The control station is generally the fixed dispatch point with which the mobile units wish to communicate. If there is any channel available from the pool of channels, the call will go through.

Views of proponents

FCC staff studies¹ and the Hatfield report have discussed the following benefits of trunking. Trunking has certain advantages over the conventional channel concept. When a conventional channel is in use, the caller must wait until the channel is free or search manually for a free channel, whereas a trunked system automatically scans a number of channels and assigns a vacant one when needed. The trunked system is often more spectrum-efficient, permitting idle channels to be assigned on an as-needed basis to users, thereby increasing the utilization of the radio channels. This allows fewer channels to satisfy the communications requirements for a greater number of users. The typical trunked system also allows flexibility of expansion, since more radios can be continuously added to the mobile fleet without the necessity of changes to the system.

Views of LASD

LASD maintains that trunking would be neither operationally nor financially feasible considering LASD's requirements. According to LASD, only one manufacturer markets a trunked hand-held radio and this radio operates only in the 800 MHz band. In addition, LASD states that the available trunked hand-held radios are extremely low powered, limiting their coverage, and are designed with a maximum of five frequencies, precluding their use throughout the entire county. LASD views these limitations of trunked hand-held radios as making them unsuitable for its planned comprehensive, integrated, hand-held radio system. Also, the Department asserts that implementation of a trunked 800 MHz radio system would require it to double the number of its transmitter sites from 20 to 40 at a cost of approximately \$600,000 per site.

It is the opinion of the Sheriff's Department that for its operations, which require short messages to many units over a wide area, trunking is no more spectrum-efficient than conventional technology and is not suitable for Los Angeles County.

AMPLITUDE COMPANDED SINGLE SIDEBAND

ACSB systems modify an amplitude modulated radio frequency signal to narrow the emission bandwidth to a fraction of that necessary for current frequency modulation systems. Whereas the

¹Implementing New Technology in the Land Mobile Radio Services, Office of Plans and Policy, FCC, September 1983. Future Private Land Mobile Telecommunications Requirements, Private Radio Bureau, FCC, August 1983.

current frequency modulation channel spacing is about 25 kHz, single sideband channel spacing may be as little as 5 kHz, meaning that several channels can be placed in the space now used by one, while yielding roughly comparable audio quality.

In 1977, a special UHF Task Force was formed by the FCC to study the allocation problems in the VHF-UHF bands because of a series of requests by a variety of services for more spectrum space from the spectrum allocated to UHF television. The need for more efficient use of the spectrum was clearly indicated. The Task Force's report issued in February 1978 concluded that it would be possible to produce a modulation technique able to compete with the quality and performance of the current frequency modulation system, but with channel spacing of 5 kHz instead of 25 kHz.

These claims of the UHF Task Force concerning improved single sideband created extensive controversy. Individuals and groups both inside and outside the FCC questioned the credibility of the technical conclusions. Since then, however, it has been increasingly accepted that single sideband modulation has the potential to permit more intensive spectrum use than frequency modulation.

ASCB equipment already has been placed into experimental service in the 150 MHz band, one of the most congested land mobile radio bands. Under developmental rules, the FCC has issued more than 275 authorizations for this type of equipment in order to test its effectiveness for land mobile communications. The FCC now believes it has sufficient information to propose rule changes to allow regular operation and licensing of narrowband systems. Consequently, on March 15, 1984, the FCC adopted a Notice of Proposed Rulemaking to propose authorizing narrow-band technologies for base and mobile communications in the land mobile radio services.

Views of proponents

The Hatfield report takes a positive view of ACSB. The report states that no fundamental problems have been identified with ACSB and that it is on its way to becoming a successful new narrow-band technology with great spectrum savings capability. The National Association of Broadcasters and the Association of Maximum Service Telecasters assert that single sideband techniques will provide a five-fold or greater increase in the number of land mobile channels compared with current frequency modulation technology. Other parties supporting the use of single sideband techniques include the National Association of Public Television Stations and the Association of Independent Television Stations.

Views of LASD

LASD states that its personnel have met with representatives of manufacturers of ACSB equipment and attended numerous operational demonstrations to assess the feasibility of using ACSB

technology to address its frequency saturation problems. These meetings have not convinced LASD of ACSB's worth. In comments submitted to FCC, LASD has stated that broadcasters' claims of clearly proven ACSB technology are "unfounded." LASD cites an FCC study² which concluded that the engineering and interference tradeoffs between ACSB and frequency modulation vary on a radio-service-by-radio-service basis and are highly dependent on the interference levels that can be tolerated in a particular radio service. Consequently, LASD emphasizes that ACSB is a viable communications option only under certain conditions. LASD maintains that its interference-free, high reliability, and operational requirements clearly indicate that "ACSB is not presently suited for its use." In addition, LASD states that although ACSB hand-held radios recently became available from manufacturers, these radios have limited channel capability compared to what is available from other types of hand-held radios.

DIGITAL COMMUNICATIONS

Digital technology will affect the amount of and need for communications capacity in the land mobile radio services. Digital technology is essential if communications systems are to obtain the benefits of computers. For example, digital technology can be used in a computer-aided dispatch system to send standard messages in less time than if voice were used or to quickly access information from data bases such as automobile registrants. It can also provide a high degree of security in data transmissions and in digitized voice applications for the user whose communications could otherwise be intercepted and subsequently misused. There are two basic types of digital communications--digital data systems and digital (or digitized) voice systems.

As the use of computers increases, the need for mobile radio users to communicate with those computers will also increase, and digitized bits of information will be necessary for that communication. Two-way alphanumeric data systems are required for computer communications. Communication with computers from access terminals in vehicles is necessary, as is communication from the computers back to the vehicles. Computers "speak" in digitized bit streams of information, and "understand" or "listen to" only those same bit streams.

The improvement in digital voice encoding and decoding systems over the past 5 years has led to their incorporation in land mobile transmitters and receivers. Currently, digital voice radio systems constitute the major application of digital technology in land mobile radio services. Their primary purpose is to provide secure voice messages. According to the FCC, systems implemented in the field to date require a bandwidth at least

²Amplitude Companded Sideband Compared to Conventional Frequency Modulation for VHF Mobile Radio, Office of Science and Technology, FCC, Oct. 1983.

equal to the bandwidth necessary for analog voice systems. Thus, digital voice systems have provided no spectrum savings in terms of bandwidth reduction. Other voice encoding systems are currently being developed which may reduce the bandwidth required to transmit a digital voice message.

Views of proponents

Broadcast interests, equipment manufacturers, and land mobile users have made positive comments in FCC proceedings as to the need for encouragement of digital technology. These groups envision digital technology as assisting in meeting the need for communications capacity, although they differ in their assessments of how much of the need will be met.

According to the FCC study on future land mobile requirements, an advantage of data transmission is that, by adjusting the bit rate, almost any size channel bandwidth can be used. Other advantages of two-way mobile data systems cited by the FCC include provision of a permanent written record of the received transmission; storage of messages in the receiver, thereby permitting the receiving party to access the information when convenient; and transmission of numeric and alphanumeric information with a reduced possibility of error, thereby reducing the need for repetition or clarification.

According to the FCC study, two-way digital data systems will be valuable as a partial substitute for some land mobile voice systems, although not many will be replaced by digital. The cost factor may be constraining as two-way digital data systems can double or triple the cost of a mobile installation. The FCC maintains there is no obvious technical reason why lower cost data systems cannot be produced, however, and the marketplace will likely cause that reduction if two-way data systems gain widespread support and utilization.

Dale N. Hatfield Associates has stated that recent research and field experience indicate a computer-controlled digital dispatch system with either electronic display, printer, or synthesized voice message output could carry 10 times as much traffic as conventional analog voice dispatch systems. Motorola, while recognizing that digital technology will increase spectrum efficiency, also notes that digital technology will increase demand for spectrum as additional uses are found for its capabilities. Consequently, Motorola states that spectrum savings from expanded use of data communications may be only modest.

Views of LASD

LASD accepts the advantages of digital technology and states that the technology can provide a significant increase in its communications capability. LASD examined mobile digital technology and its applicability to its operations. Based upon this examination, LASD determined that it would implement an advanced,

high speed, mobile digital system to reduce the level of saturation and provide increased operational capability and control, automate activity logs, and integrate with a hand-held radio system.

CELLULAR TECHNOLOGY

Cellular radios rely on coordinated re-use of available frequencies within an area. Under a cellular system, a city is divided into geographic units, or "cells," each with a relatively low power transmitter. Cells may range in size from 1 to 14 miles in radius. The cells are connected to a central switching point using telephone lines or microwave radio links. Because of the use of low power transmitters, frequencies can be re-used in other cells spaced such that there is no interference. The systems are generally designed to serve 25 to 30 cellular units per channel per cell. A moving vehicle can be "handed off" from cell to cell, and frequency to frequency, without interrupting the conversation.

Views of proponents

Although not necessarily endorsing cellular technology, FCC staff and the FCC study of future land mobile requirements have noted the potential of cellular technology to help meet land mobile's and public safety's growing requirements. A major advantage of cellular technology cited by FCC is that it is adaptable to greater spectrum efficiencies as user demand warrants. After all frequencies are loaded in the preliminary set of cells, a cellular system can split cells in order to handle more mobile radios. The FCC estimated that cellular technology will reduce private land mobile radio's spectrum requirements by 5 percent by 1990. According to the FCC, by the year 2000, the market for cellular radio will be more fully developed. Also, the cost of cellular radio is expected to decrease by the year 2000, and this will also have a positive impact on demand.

Views of LASD

LASD states that it has considered the use of the cellular radio concept as a means to alleviate channel saturation but determined that cellular would be neither operationally nor financially feasible. LASD maintains the use of a cellular system would require it to develop thousands of individual radio "cells" to fully cover the 4,083 square miles of Los Angeles County. All sites would have to be linked together by leased telephone lines as it believes there are insufficient microwave channels available on which to build the system. Due to the recurrent problem of severe earthquakes in the southern California area and the demonstrated inability of telephone systems to survive these earthquakes, a cellular system may have an extremely high failure potential when it is most needed. In addition, LASD states that a cellular radio system would require a hand-held radio operating in the 800 MHz band which would be subject to the same criticisms it has made regarding trunking.

The cost of developing thousands of radio sites in the varying topography of Los Angeles County and tying these sites together would be in the hundreds of millions of dollars, according to LASD. The Sheriff maintains that such an expense would not be accepted by the citizens of Los Angeles County.

FCC WILL STUDY UTILITY OF TECHNOLOGIES
FOR PUBLIC SAFETY USE

In an effort to propose an alternative solution to LASD's request for more UHF radio frequencies for public safety agencies, six television broadcast organizations jointly filed a Petition for Rulemaking with the FCC on December 27, 1983, requesting FCC to implement a public safety mobile communications plan set forth in the report by Dale N. Hatfield Associates. The report, published in August 1983, is titled A Plan for Meeting Public Safety Community Mobile Communications Requirements Through New Technologies and Advanced Spectrum Management Techniques. Specifically, the petition urged the FCC to mandate the use of ACSB and computer-controlled trunking techniques in the 150 MHz band, order consolidation of police communications in that band, and order sharing of frequencies by public safety agencies within designated regions of the country.

FCC dismissed the petition because FCC will be looking into the issue of public safety agencies' use of new technology as part of its study directed at evaluating the long-term spectrum requirement of public safety agencies. According to FCC, this study will provide the basis for developing the plan required by Section 9(a) of the Federal Communications Commission Authorization Act of 1983 to ensure that "the needs of state and local public safety authorities would be taken into account in making allocations of the electromagnetic spectrum." A Notice of Inquiry adopted on March 1, 1984, in connection with the study seeks comments concerning the utility of various technologies, including trunking, digital, cellular, and ACSB, to increase the capacity of existing public safety frequency assignments. Commenters are requested to specifically address equipment availability, cost impact, compatibility with existing systems, and reliability. Commenters are also requested to tell whether they are aware of any other technology now in the planning, experimental, or developmental stage which would permit expansion of existing communications systems in the presently assigned radio spectrum.

CHRONOLOGY OF FCC ACTION RELATED TO LOS ANGELESCOUNTY SHERIFF'S DEPARTMENT'S PETITION FORRULEMAKING (RM-3975)

- Aug. 24, 1981 Petition for rulemaking signed by Los Angeles County Sheriff. (A "rulemaking proceeding" is the term used by FCC to describe the administrative process whereby a person requests FCC to issue, amend, or repeal a rule or regulation.) The Sheriff's petition discussed communication problems existing in his Department and other public safety agencies throughout the nation. To alleviate these problems the petition requested changes to FCC rules which would reallocate UHF television channels 14 through 20 in their entirety to land mobile services including public safety agencies. Television stations currently operating on these channels would have to relocate to other channels.
- Sept. 1, 1981 Petition accepted by FCC for filing.
- Sept. 21, 1981 The petition, assigned file number RM-3975, was placed on Public Notice allowing interested persons to file statements in support or in opposition to the petition. (FCC considers these comments in evaluating the merits of a petition.)
- Nov. 5, 1981 The public comment period ended. Comments were due on October 21 and reply comments were due on November 5. The comments and reply comments were primarily from those parties having a stake in the outcome of the Sheriff's petition. Based on a list prepared by FCC, 213 comments were filed in support of the petition and 4 comments were filed in opposition. Of the 213 favorable comments, 191 were from local government and public safety organizations; of the 4 opposing comments, 3 were from broadcasting associations. Favorable reply comments were received from 71 local government and public safety organizations, and opposing comments were received from one broadcasting association.
- Jan. 12 1982 The petition was assigned to FCC's Spectrum Utilization Branch for appropriate processing including drafting a recommended response for the Commission's action. This Branch is part of the Office of Science and Technology (OST) which has primary responsibility for spectrum management and allocation issues. The petition was not assigned sooner because of limited staff and the need to complete work on other petitions.

- Feb. 1982 FCC staff analyzed current television usage of and low power television applications for UHF television channels. These analyses involved counting the number of television stations and low power television applications on each of the UHF channels 14 through 69 nationwide and were done, in part, to determine how usage and applications varied from channel to channel.
- Mar. 4, 1982 The Commission adopted an order creating the low power television service. Low power television was intended to facilitate entry into broadcasting by groups and individuals including minorities that are new to the industry. A low power station, operating at relatively low transmitting power, can be licensed on any available channel--including channels 14 through 20--provided it does not cause interference to full service stations. The Commission's decision placed public safety agencies in competition with both low power television applicants and full power stations for use of UHF channels. Recognizing the existence of this competition, the Commission directed its OST to study the technical feasibility of sharing the UHF television band among full power stations, low power stations, and land mobile services in the 10 most congested land mobile markets, including Los Angeles.
- March 1982 The Spectrum Utilization Branch requested assistance from OST's Technical Standards Branch regarding radio equipment costs in different frequency bands because the high cost of equipment in the 800 MHz band had been raised as a disadvantage by public safety users commenting on the petition. Broadcasters had commented that frequencies available in the 800 MHz band could help meet public safety requirements. The Technical Standards Branch informally requested information on radio equipment costs from five manufacturers. Responses were received from only two manufacturers, and no analysis was prepared.
- Spring 1982 Further action on the petition was held in abeyance by OST pending completion of the land mobile/low power television sharing study. FCC staff felt that information on technically feasible possibilities for sharing would be useful in evaluating alternative approaches for dealing with the Sheriff's petition. FCC staff considered the Sheriff's proposed solution to his needs to be only one of a number of possible approaches.

- July 1982 OST continued to hold the petition in abeyance. The OST staff cited another study underway by FCC's Private Radio Bureau that could provide potentially significant information useful for evaluating alternative ways to respond to the petition. This was a study (Docket 82-10) initiated by the Commission in the fall of 1981 to assess future requirements of land mobile telecommunications in 21 urban areas and alternative methods to meet those requirements.
- Nov. 5, 1982 Responsibility for evaluating RM-3975 was transferred to OST's Spectrum Planning Branch in response to staff changes.
- July 1983 Drafts of the land mobile/low power television sharing study and the future land mobile requirements report were given to the Spectrum Planning Branch for review.
- July - Aug. 1983 OST staff considered various technical approaches for providing some relief to the Sheriff's Department. Also under consideration was dismissing the petition on the bases that alternatives, including the use of new technology, were available and that a convincing case for a reallocation of UHF channels 14 through 20 had not been made.
- Sept. 16, 1983 FCC released the Final Report on Future Private Land Mobile Telecommunications Requirements. The report concluded that even with higher channel loading, widespread use of new technologies and technical flexibility, additional spectrum is necessary for the private land mobile radio services to provide for growth in communications capacity. Otherwise, communications will become unduly congested and hamper public safety and business productivity, particularly in Los Angeles/San Diego, New York, and Chicago.
- Oct. 1983 FCC released the report on Analysis of Technical Possibilities for Further Sharing of the UHF Television Band by the Land Mobile Services in the Top Ten Land Mobile Markets requested by the Commission on March 4, 1982, when it created the low power television service.
- Oct. 1983 The Sheriff's counsel notified the FCC Chairman's staff of the Sheriff's plans to file a supplement to his petition. Consequently, OST's plans for presenting a recommended response to the Commission at a meeting scheduled for November 10, 1983, were postponed.

- Nov. 3, 1983 The FCC Chairman and FCC's Chief Scientist, who is the head of OST, met with representatives of the Sheriff's Department who described the planned supplement.
- Nov. 4, 1983 The Sheriff filed a supplement to RM-3975. The supplement highlighted the same general problems as the original petition, emphasized the Sheriff's Department's immediate needs, and revised the Sheriff's approach for obtaining additional frequencies. The Sheriff requested immediate allocation of UHF television channel 19 for public safety use in Los Angeles and a long-term effort by FCC to provide additional land mobile frequencies from unused and newly created UHF television channels. The new UHF channels would be created by the adoption of more efficient spectrum utilization techniques.
- Nov. 15, 1983 FCC's Private Radio Bureau issued a Public Notice announcing that it would conduct a study of the current and future communications requirements of the public safety radio services.
- Nov. 17, 1983 Public Notice of the Sheriff's supplement was given and a public comment period was established. Interested parties were given 30 days to respond.
- Nov. 29, 1983 Representatives of various FCC offices met to discuss the status of the supplement, questions to ask the Sheriff for clarification of the supplement, and the possibility of selective monitoring of frequency use by the Sheriff's Department.
- Dec. 2, 1983 The Chief Scientist, OST, wrote to counsel for the Sheriff with a list of questions concerning issues arising from the supplement.
- Dec. 8, 1983 The Sheriff filed a response to the Chief Scientist's questions.
- Dec. 8, 1983 The Federal Communications Commission Authorization Act of 1983 (Public Law 98-214) was enacted. Section 9 (a) directs that funds authorized to be appropriated under the act be used by FCC "to establish a plan which adequately ensures that the needs of State and local public safety authorities would be taken into account in making allocations of the electromagnetic spectrum." According to FCC, its study of public safety communication requirements initiated on November 15, 1983, would be a first step towards development of the plan required by Public Law 98-214.

- Dec. 15, 1983 The Chief Scientist partially granted the National Association of Broadcasters' motion for an extension of time for filing comments and replies to the supplement. The date for filing comments was extended to January 20, 1984, and the 15-day reply period to February 6, 1984.
- December 1983 FCC Chairman and staff offices agreed to a monitoring study by FCC's Field Operations Bureau to measure usage of the Sheriff's frequencies. The purpose of the study was to establish the existing level of traffic on the Sheriff's communication system.
- Jan. 20, 1984 Comments to the supplement were filed. Public safety organizations supported the supplement and reiterated the communications difficulties that pervade the public safety sector. Broadcasters, on the other hand, strongly objected to any approach that would give additional UHF frequencies to public safety services. The broadcasters suggested other alternatives for meeting public safety needs.
- Feb. 6, 1984 The Chief Scientist granted a motion of the Sheriff's counsel that the date for filing reply comments be extended from February 6 to February 16, 1984.
- February 1984 OST established an objective to have its recommended decision on the petition, as supplemented, before the Commission during the fourth quarter (the summer) of fiscal year 1984. A Commission decision will likely require an additional round of comments and reply comments and further evaluation by FCC staff. A final Commission order may not be adopted for another 6 months.
- Mar. 13, 1984 FCC released the results of its 7-week monitoring study of the utilization of the Sheriff's frequencies. The study concluded that the frequencies are not as heavily utilized as the Sheriff stated in the petition and supplement.
- Mar. 7, 1984 FCC released a Notice of Inquiry soliciting public comment on the present and future communication requirements of public safety agencies. (See above entries dated Nov. 15, 1983, and Dec. 8, 1983.)

Source: GAO prepared this chronology based on FCC records and discussions with FCC staff.

TECHNICAL CONSIDERATIONS IN THE MANAGEMENT
OF THE RADIO FREQUENCY SPECTRUM

The radio frequency spectrum is the medium which makes possible wireless communications of all sorts, such as land mobile radio, shortwave and commercial radio, television, microwave telephone relays, radar, radio navigation, radio astronomy, and various satellite transmission activities. As a natural resource, the radio frequency spectrum is like a river used for transportation--it cannot be used up, but it can suffer from congestion if too many people operate on it in an uncoordinated way. Therefore, the spectrum must be carefully managed, both on a national and international level, in order to best meet the needs of a constantly increasing number and variety of users.

To a large degree, spectrum management policies flow from a technical consideration of how radio waves behave. Because of this, familiarity with a few characteristics of radio waves is needed to appreciate some of the reasoning behind spectrum management.

CHARACTERISTICS OF THE
RADIO FREQUENCY SPECTRUM

Radio waves are produced by the oscillation of electricity within a conductor, such as an antenna. The number of times per second that a radio wave undergoes a complete cycle of oscillation is called its frequency, which is measured in units called hertz. Modern equipment can produce oscillations ranging from several thousand hertz (cycles per second) to several billion hertz. The terms kilohertz (thousands of hertz), megahertz (millions of hertz), and gigahertz (billions of hertz) are used in referring to the higher frequencies. By international agreement, the radio frequency spectrum has been defined as the range of frequencies extending from 10 kilohertz to 300 gigahertz. For convenience, the radio spectrum below 30 kilohertz is known as the VLF (Very Low Frequency) range; from 30 to 300 kilohertz, LF (Low Frequency); from 300 kilohertz to 3 megahertz, MF (Medium Frequency); 3 to 30 megahertz, HF (High Frequency); 30 to 300 megahertz, VHF (Very High Frequency); 300 to 3,000 megahertz, UHF (Ultra High Frequency); 3 to 30 gigahertz, SHF (Super High Frequency); and 30 to 300 gigahertz, EHF (Extremely High Frequency). Most of the world's wireless communication takes place on frequencies under 40 gigahertz; frequencies above this are used mainly for experimental and developmental work.

One of the most important features of the radio spectrum is that some frequencies are better suited for certain communications tasks than other frequencies. This is because radio waves of different frequencies behave differently, particularly in the way they are affected by terrain and atmosphere. For example, lower frequencies are able to propagate (travel) around obstructions, such as hills and buildings. This characteristic makes them

suitable for long range radar, AM radio, and land mobile communications. Higher frequencies, however, have different characteristics that make them better for other important uses, such as high resolution radar and microwave telephone relays. Frequencies can also differ in the ways in which they are affected by weather conditions.

As a result of the non-uniform nature of the radio spectrum, some parts of it can be in heavy demand when a variety of users flock to a particular frequency range because it best suits their needs. For instance, the VHF and UHF frequencies are sought after because they are suitable for several activities such as land mobile communications, commercial radio and television, weather satellites, and amateur radio.

A basic means of fitting users onto the spectrum involves the geographic separation of broadcast areas. If transmission signals of the same frequency and strength have broadcast areas that overlap, the resulting **radio interference** will disrupt the reception of messages. This interference can be mutual, as in the case of two television stations whose signals interfere equally with each other, but it can also be one-sided. A land mobile radio, for example, may interfere with television reception, while the television station's signals may not affect the mobile radio. Depending on the variables involved, including the relative strength of the signals, the reverse may also be true. That is, a television signal may interfere with mobile radio use, while mobile radio use may not affect television reception. Fortunately, the same frequencies can be used by more than one party if their broadcast areas are geographically distinct. This allows the spectrum to be used more than once on a nationwide basis. On the local level, though, geographic separation is more difficult to achieve. Congestion and interference problems can quickly become serious, especially in large, heavily populated urban areas.

Competition over a particular frequency range can be intensified by another technical characteristic of wireless communications: some types of transmission require much more room--called bandwidth--on the spectrum than others. Simply stated, bandwidth is the amount of spectrum space needed to transmit information at the rate and with the quality required of the system used. For example, a land mobile radio channel may require a bandwidth of 25 kilohertz, while an AM radio channel uses only 10 kilohertz. In comparison, a television channel uses 6 megahertz--240 times as much as a land mobile channel and 600 times as much as an AM radio channel.

Over the years, technological improvements to transmitters and receivers have narrowed the bandwidths needed in some non-broadcast areas of communication, such as telephone microwave links and land mobile radio, and these improvements have helped to

fit more users onto the spectrum.¹ Television, however, continues to use a relatively wide bandwidth. Some broadcasting groups maintain that switching to a more efficient television transmission signal would require the American public to replace their current television receivers with new ones. Television broadcasters can point to innovations being made in the use of the broadcast spectrum, such as stereo sound transmission. But still, as competition for frequencies increases, television broadcasting is coming under criticism from land mobile users and others on the grounds that television's inefficient technology is outmoded and squanders a large amount of valuable spectrum, part of which could be used by other communications services.

SPECTRUM MANAGEMENT

The procedure known as **spectrum allocation** has been adopted, both nationally and internationally, as a means of controlling radio interference and apportioning appropriate types and amounts of frequencies among the various kinds of wireless communications services needing them. This procedure involves segmenting the spectrum into bands of frequencies which are set aside and reserved (allocated) for the use of a particular type of wireless communications service. For instance, FM radio has been allocated the band of frequencies from 88 to 108 megahertz. Other services may not enter this range--and FM radio may not leave it--without the FCC's permission. This procedure of allocating distinct bands to the various wireless communications services assures that each of them will have some degree of access to the radio spectrum. It also minimizes the chance of interference between different types of communications service. When interference does occur, it tends to be confined within one class of service, making it easier to coordinate ways of resolving the problem.

Spectrum allocation has been taking place for most of this century as higher frequency ranges gradually came into use and more types of wireless communication were invented. At present, the spectrum is segmented into several hundred frequency bands of various sizes which are allocated to over 60 types of wireless communication service. Many services, over the years, have received additional bands to meet their growing needs. Public safety agencies, for example, use frequencies within the following bands allocated to land mobile communications: 25 to 50 megahertz; 150 to 174 megahertz; 450 to 470 megahertz; 470 to 512 megahertz (shared with UHF television in 13 locations); and the 806 to 947 megahertz bands. The fact that additional bands are not always contiguous with each other, as in the case above, can sometimes be troublesome. Due to equipment limitations, the users of one band usually are not able to communicate directly with colleagues whose radios operate on a different band. This can lead to communications **fragmentation** between services that may

¹See appendix III of this report for views on the use of new radio technology by public safety agencies.

have closely related missions--such as police and fire departments--but which use frequencies in different bands of the spectrum.

The allocation procedure has helped maintain a degree of order and efficiency in the use of the spectrum. But even with allocation, not all services can be accommodated in the manner that their users would prefer. It is possible that technical advances may open up more spectrum in the higher frequencies. (Before World War II, the highest usable frequencies were at 300 megahertz; post-war electronic developments extended the useful limit to 40 gigahertz.) Also, more ways may be found to use the available spectrum more efficiently. But at the same time, the demand for use of the spectrum continues to grow rapidly. At present, nearly all of the usable spectrum has been allocated. Allocation efforts today mainly deal with reallocating spectrum--that is, taking some previously allocated spectrum away from one type of wireless communications service and giving it to another. This reallocation procedure, which can be heavily charged with social, economic and political issues, is one of the FCC's most important and difficult tasks.²

²See appendix VI of this report for FCC's role in spectrum allocation.

THE ROLE OF THE FCC AND ITS ADMINISTRATIVE
PROCESS IN SPECTRUM ALLOCATION

Pursuant to its basic legislative authority contained in the Communications Act of 1934 (47 U.S.C. 151 et seq.), FCC is responsible for allocating the radio frequency spectrum used by the private sector and by state and local governments.¹ These allocations are made within a general framework of international agreements on spectrum use and take into consideration national policy issues as well as technical aspects of wireless communication. The allocation process can be complex, particularly since developments in telecommunications technology are creating ever-increasing--and often competing--demands on the FCC for radio frequencies. Although the FCC attempts to manage the spectrum so as to derive maximum usefulness from it, the resource is a limited one and not all requests for radio frequencies can be accommodated. The Commission has, therefore, established rulemaking procedures for deciding which communications activities will be permitted to use the spectrum and how much spectrum will be allocated to them.

FCC CONSIDERS SIX FACTORS
IN ALLOCATING SPECTRUM

Although the FCC has not issued a formal policy statement on spectrum allocation, over the years it has consistently considered six general principles which form, in effect, the basis for its spectrum allocation decisions.

First, the FCC determines whether the communication service in question really requires the use of the radio spectrum or if there are practical substitutes, such as the use of cables. Included in this determination are economic and social factors as well as the national policy implications of the services.

Second, the FCC determines whether the services are necessary for safety of life and property (such as police and fire departments). As such, they deserve more consideration than convenience or luxury services. This is a subjective judgment; there is no formula for determining the extent of consideration to be given to public safety.

Third, the FCC considers how many people would benefit from the service. Where other factors are equal, the FCC decides in favor of the service proposing to serve more people.

Fourth, FCC determines if the service meets a substantial public need and whether it is likely that the service can be

¹Spectrum allocation for federal government uses is done by the National Telecommunications and Information Administration in the Department of Commerce.

established. Given the limited availability of spectrum, the Commission wants to be sure that the service will be publicly accepted and used.

Fifth, the Commission is concerned with placing the service in the portion of the spectrum which allows it to render its best service.

Finally, the Commission considers the financial costs and time involved in requiring a service to relocate to another part of the spectrum in order to make room for a new service.

Spectrum management decisions
are shifting from allocations
to reallocations

Spectrum allocation emphasis has changed over the years. In the past, allocation decisions have been concerned with allocating unoccupied spectrum as it became usable due to advances in telecommunications technology. At present, however, the heavy demand for spectrum has resulted in the allocation of virtually all of the usable radio frequencies. As a result, FCC proceedings must increasingly deal with the issue of reallocating (redistributing) spectrum that has already been allocated.

Because of their adversary nature, reallocation proceedings are more difficult and politically complex than initial allocations. In reallocations, some service or services must relinquish privileges in which they have vested interests. For example, the Los Angeles County Sheriff's petition requests that some frequencies previously allocated to television be taken away from broadcasting and reallocated to land mobile public safety. Reallocation decisions can sometimes result in appeals and court tests.

THE RULEMAKING PROCESS

FCC regulations governing the allocation of the spectrum and its use by individual licensees are designed to promote technically efficient spectrum use and to control interference between users. The process of establishing and changing the regulations is carried out by formal rulemaking, using a notice and public comment procedure required by the Administrative Procedure Act. This process allows all interested parties to be heard and their views to be considered. The rulemaking process involves the following steps:

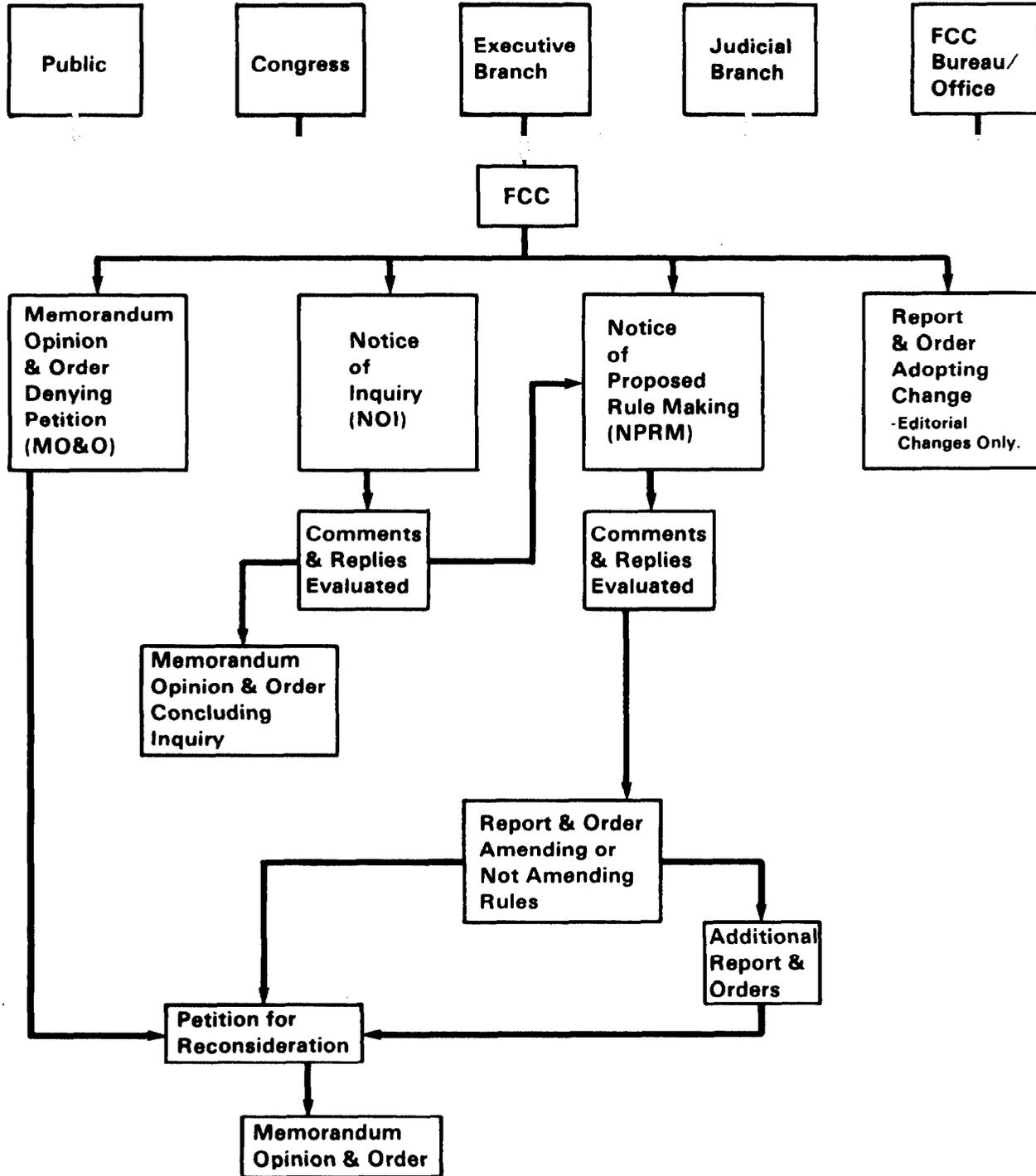
- Petition for a rulemaking can be filed by any interested person from outside the FCC.
- The petition for rulemaking is sent to the appropriate FCC bureau and/or office for evaluation. A petition which is moot, premature, repetitive, frivolous, or which plainly does not warrant FCC consideration may be dismissed or

denied. Otherwise, the petition is assigned a file number and the public is given 30 days to comment, plus 15 days to reply to these comments.

- After considering the public comments and the recommendations of its staff, the Commission acts on a petition for rulemaking either by denying it or by instituting a rulemaking proceeding and assigning a docket number.
- The FCC may present the issues raised by the petition as either a Notice of Inquiry (NOI) or Notice of Proposed Rulemaking (NPRM). An NOI is issued when the FCC simply wants information on a subject or is trying to generate ideas. An NPRM, on the other hand, is issued when a specific change to the rules is proposed. The FCC may also begin an inquiry or a rulemaking proceeding on its own motion.
- When an NOI or NPRM is issued, the public is given a reasonable amount of time to file comments and reply comments. Interested parties can file requests to extend the comment period, which the FCC must also evaluate and rule on.
- The FCC staff evaluates the comments and reply comments. There is no established time limit for this evaluation process. The amount of time this process takes depends on the amount of comments and the complexity of the issues, as well as staff resources and work priorities.
- After comments and reply comments to an NOI have been evaluated, the FCC can either issue a Memorandum, Opinion and Order (MO&O) terminating the inquiry or an NPRM furthering the case. If it does the latter, the public comments and reply comments cycle is repeated.
- When the comments on the NPRM have been evaluated, FCC issues a Report and Order amending or not amending the rules and explaining its reasons for the action taken.
- Following the Report and Order, interested parties may appeal by filing Petitions for Reconsideration to the FCC, which are evaluated by the appropriate FCC bureau/office and/or the Commission itself. As a result of this review, the Commission may issue an MO&O modifying its initial decision or denying the Petition for Reconsideration.

These rulemaking procedures are laid out in the following flow-chart:

How FCC Rules Are Made



This brief account of how Rules are made at the FCC merely highlights the major components of the process. Reprinted from the FCC Communicator September, 1975.

Depending on the issue at stake, the whole rulemaking process can take months or years to complete.



SHERMAN BLOCK, SHERIFF

County of Los Angeles

Office of the Sheriff

Hall of Justice

Los Angeles, California 90012



July 11, 1984

Mr. Lou Schuster, Assignment Manager
 U. S. General Accounting Office
 Brown Building, Room 473
 1200 19th Street, N.W.
 Washington, D.C. 20554

Dear Mr. Schuster:

We have reviewed the draft of your report on the Los Angeles County Sheriff's request for radio frequencies. There are several issues which concern us, and we believe they should be corrected to reflect an accurate and useful informational document. Some of these issues are listed below:

- Both the executive summary and the letter to Senator Wilson should clearly state that the Department is requesting additional TV/land mobile sharing of the UHF-TV band with land mobile using unused television spectrum. Specifically, in Los Angeles County, the Department is requesting licenses within UHF channel 19, a channel that is not and cannot be used by the television service.

[GAO COMMENT: Our letter did state that channel 19 was not presently being used for television broadcasting. The Engineering Assistant to the Chief of FCC's Mass Media Bureau confirmed in a discussion with us that channel 19 cannot be used for either full power or low power television broadcasting in Los Angeles because of potential interference with channel 18 transmitting from San Bernardino. He also said that land mobile use, if properly designed, may be possible without causing such interference. In our letter's reference to channel 19 we have added a statement that it cannot be used for television service.]

[GAO NOTE: Some page references have been changed to agree with the final report.]

- The Department's response to the FCC Monitoring Study clearly demonstrates our channel saturation problem, explains the operational and utilization characteristics of various types of police frequencies (i.e. dispatch, tactical, surveillance, command post, etc.), and positively refutes the FCC conclusion that, "The Sheriff's channels are less occupied than is indicated in his petition."

[GAO COMMENT: In our report we have included a discussion of the FCC monitoring study and the Department's response. We have not evaluated either one. The FCC study was not released until after we had completed our field work, and the Department's response was not released until June 25, 1984. We believe further effort on our part to evaluate the Sheriff's saturation problem would not be productive given FCC's ongoing work in this area. The Department has emphasized that frequency saturation is only one of six major radio spectrum problems now facing it. Also, since FCC is still evaluating the Department's petition, new data and analyses may be submitted by other parties, including the broadcasters. For example, a representative of the attorneys for the Association of Maximum Service Telecasters, Inc., told us that they are having their experts conduct an in-depth study of segments of the Department's response and that they may file their own response with FCC.]

We believe that the differing conclusions reached in FCC's monitoring study and the Department's response support our view that evaluating the Sheriff's problems is difficult, especially with the absence of generally accepted standards on what constitutes adequate emergency communications.]

- (Appendix II, Page 13, Paragraph 2) The reports from which the Department used data to perform statistical analyses are not the same reports referred to in your study.

[GAO COMMENT: We have revised our report to clearly distinguish between the two communications reports that automatically generate data on the use of the Department's radio system.]

- (Appendix II, Page 16, Paragraph 2) This paragraph supports the Department's position that dispatch channels are saturated during peak periods. This paragraph should be included in the executive summary and letter to Senator Wilson.

[GAO COMMENT: We have added information from this paragraph to our letter. However, we have also added other information indicating that there are periods when the dispatch channels are relatively quiet.]

- (Appendix II, Page 17, Paragraph 1) In the examples where deputies had to communicate with other police agencies, the "problem" is that interagency communications did not and could not occur under existing conditions.

[GAO COMMENT: The Department only provided us with one example that clearly showed that interagency communications did not occur. This example is included in our report. Other examples, along with discussions with Department officials, showed that interagency communication does occur, but only by using a roundabout method which the Department believes is extremely cumbersome. We believe our discussion in appendixes I and II adequately reflects the Department's fragmentation problem based on the information and examples provided to us.]

- Based upon the information provided by the Department and a reasonable evaluation by GAO staff, we believe the report should reach conclusions as to the need for both a hand-held radio system for patrol officers and for tactical mutual aid communications capability.

[GAO COMMENT: Based on our review, we agree that hand-held radios and mutual aid communications capability are legitimate needs of large urban law enforcement agencies. No one we talked with said these were not important or would not be useful. We have included this observation in our report. However, we also found strong disagreement over the best way to meet these needs and improve the Department's communication system.]

We are confident that our meeting will resolve these concerns.

Sincerely,

SHERMAN BLOCK, SHERIFF


K. M. CABLE, CHIEF
TECHNICAL SERVICES DIVISION

(062312)





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