CARACAS METROPOLITAN POLICE COMMUNICATIONS SURVEY REPORT

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CARACAS
METROPOLITAN POLICE
COMMUNICATIONS SURVEY
REPORT

SEPTEMBER 1972

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OFFICE OF PUBLIC SAFETY

AGENCY FOR INTERNATIONAL DEVELOPMENT

DEPARTMENT OF STATE

WASHINGTON, D.C.

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FOREWORD

In response to a request from the Metropolitan Police Force, Caracas, Venezuela, and at Government of Venezuela (GOV) expense, a communications survey was conducted from May 10 to May 17, 1972, by Mr. Paul Katz, Chief of the Telecommunications Branch, Office of Public Safety, Agency for International Development, Washington, D. C. Local arrangements for the survey were completed through the U. S. Embassy and the Office of A.I.D. Affairs in Caracas.

The information contained herein was obtained as a result of field observations and discussions with concerned officials. In addition, basic requirements deemed necessary by the Caracas Metropolitan Police Force to update their communications capabilities were provided the writer prior to the survey and these requirements are addressed in the report.

The Chief of the Metropolitan Police Force, Colonel Luis Enrique Sue and Deputy Chief Colonel Jaime Sayago Garcia, gave freely of their time and made the necessary arrangements to allow a comprehensive on-site evaluation. The frank definition of communications problems on the part of these officials formed the basis upon which the survey was conducted.

The excellent cooperation received from all ranks of the Metropolitan Police Force greatly facilitated the completion of the survey in the time allocated.

In addition to the above, meetings took place with officials of the Technical Judicial Police (PTJ). Discussions were held regarding current PTJ planning for utilization of computerized banks of information. Possible PTJ computer interface with the Metropolitan Police Headquarters Communications Center was explored to provide access to information regarding stolen vehicles, registered owner/vehicle descriptions, wanted persons and stolen articles.

GENERAL INFORMATION

The Metropolitan Police, a uniformed police force with personnel totaling approximately 8,600, has the primary responsibility for police patrol throughout Caracas. In addition, they are responsible for the control of civil disturbances in the metropolitan area.

The metropolitan area includes approximately 75% of the capital city of Caracas and the district of Sucre, in the adjoining state of Miranda. The metropolitan area covers about 923 square miles and has a population which is estimated between 1.5 and 2 million people.

In terms of police operations, it is divided into seven zones. Five of these zones are located in Caracas (Libertador Department) an area of about 167 square miles with a population of approximately 1,116,000 people. Another zone covers the Vargas Department having the largest area of 578 square miles and includes the town of La Guaira, the seaport for Caracas and one of the main ports of Venezuela. The last zone covers the district of Sucre, an area of about 178 square miles, with a population of approximately 243,000 people.

Caracas presents unique radio patrol car communications coverage problems; the city is located in a valley surrounded by mountains and is over 3,000 feet above sea level. Metropolitan Caracas extends throughout the valley and is expanding up the mountain slopes. It is an ultra-modern urban community with most of the city covered by multi-storied apartment houses and office buildings. Additional police patrol problems are encountered with the limited access to the numerous shacks and shanties which fill many of the canyons and hillsides in Caracas.

SUMMARY

The communications system has not kept pace with the Metropolitan Police responsibilities and, consequently, has restricted their effectiveness in protecting the public. The communications system is not fully capable of handling the communications needs of an emergency situation as well as the normal daily activities of the Metropolitan Police.

Metropolitan Police officials are cognizant of the problems and are exerting a considerable effort to rectify this situation. They are requesting sufficient funds to modernize and expand their communications system, and replace all old and obsolete radio equipment.

Several million dollars would be required to replace current equipment, modernize and expand the Metropolitan Police communications system. A large portion of these funds would be required to provide a better means of communications between the public and the police. Therefore, prior to any monetary investment by the Metropolitan Police to update or modernize their radio communications system, agreements should be reached with the telephone company (CANTV) to provide for an improved telephone capability such as that recommended in this report.

No matter what new or sophisticated radio equipment is purchased by the Metropolitan Police, or what operational dispatching concept they employ at the Command Center, the overall effectiveness of their communications system would still be hindered, at this time, in its ability to respond quickly and efficiently to telephone calls from citizens requesting emergency assistance. Since such calls are usually received through the (CANTV) telephone system, the first priority should be to establish a satisfactory telephone capability wherein telephone calls requesting emergency assistance can be effectively placed, received, routed and terminated.

The facilities that CANTV can provide will, to a large extent, dictate the type of command center installation and operational procedures which should be employed to effectively dispatch radio patrol cars.

Immediate coordination with high level CANTV officials is required to determine what telephone facilities they can furnish and the costs involved to do so. The Metropolitan Police would be required to absorb an initial installation charge and monthly user cost. These costs will be high and must be taken into consideration for present and future budget requests.

To effect a complete change in radio systems and equipment, at this time, is not recommended. This recommendation is based on several factors, the major one being the lack of trained manpower within the Metropolitan Police organization. Police personnel lack the in-depth knowledge and experience to implement an effective operational communications system in support of police activities. Another is the existence of some 700 VHF transceivers in the Metropolitan Police inventory which can be effectively employed for several more years.

It is believed that the best course of action for the Metropolitan Police to take to improve their communications capabilities would be to (1) gradually and systematically replace their old and antiquated equipment, (2) implement the several technical changes recommended in this report so that existing communications equipment can be better utilized; (3) undertake an intensive training program for police personnel in concert with the communications system modernization plans; and (4) request that the existing U. S. Government advisory effort include technical assistance in communications.

I. OBSERVATIONS AND CONCLUSIONS

A. General:

1. The Metropolitan Police existing VHF/FM communications system reflects considerable effort and ingenuity on the part of the officials concerned to provide essential communications in support of their overall police mission.

2. The present Metropolitan Police communications system is limited in its usage and unable to perform certain functions. It has not kept pace with the police operational needs and has affected their capabilities to properly supervise and direct their vehicle and foot patrols throughout the metropolitan area. There are certain technological developments which are being actively developed or produced by manufacturers which perform additional functions that the existing communications system does not.

3. The Metropolitan Police has made efforts to modernize their radio communications systems to support their current police operations and responsibilities. However, the majority of the radio equipment and systems configuration was originally installed to satisfy a requirement for a Unified Police Command in Caracas to combat urban terrorism. With the formation of the Metropolitan Police Force in December 1969, the communications priorities and requirements changed considerably.

4. In the actual network design planning, the Metropolitan Police existing system was studied and its merits and weaknesses identified. A review of the Metropolitan Police proposed modernization plan (see Annex I) was performed with consideration to compatibility with the existing system and organization. In designing and selecting the most appropriate communications system configuration, projections

of future technical innovations that will be in common use in the near future were considered as well as details regarding the radio traffic involved. Radio traffic statistics (see Annex II) dealing with criminal offenses, non-criminal offenses, complaints, services, moving traffic violations, accidents, etc., were not the sole determining factor for evaluating the Metropolitan Police role of protecting life and property and promoting the general safety and welfare of the public.

B. Organization:

1. The Metropolitan Police Communications Department (see Figure 1) is established as a staff function under the Operations Division. Senior police officers assigned to the Communications Department barely acquire the necessary expertise before they are reassigned to other police duties.

2. A lack of qualified radio technicians and the difficulty of retaining this type of personnel with current low police salaries have induced the Metropolitan Police to acquire the contract services of a private company to maintain their radio equipment numbering over 1,000 units. In light of this course of action, one of the most critical shortages which the Metropolitan Police is currently facing is the lack of a well-qualified technical police officer to coordinate, plan and/or intelligently discuss communications systems improvements with the private contractor.

3. Although seven police officers have received training in the United States during 1964 and 1965 in communications management, none of these individuals are currently utilized in this capacity.

C. Radio Patrol Car System:

1. Within the metropolitan area, the police operate a radio patrol car system of about 600 motor vehicles with approximately 140

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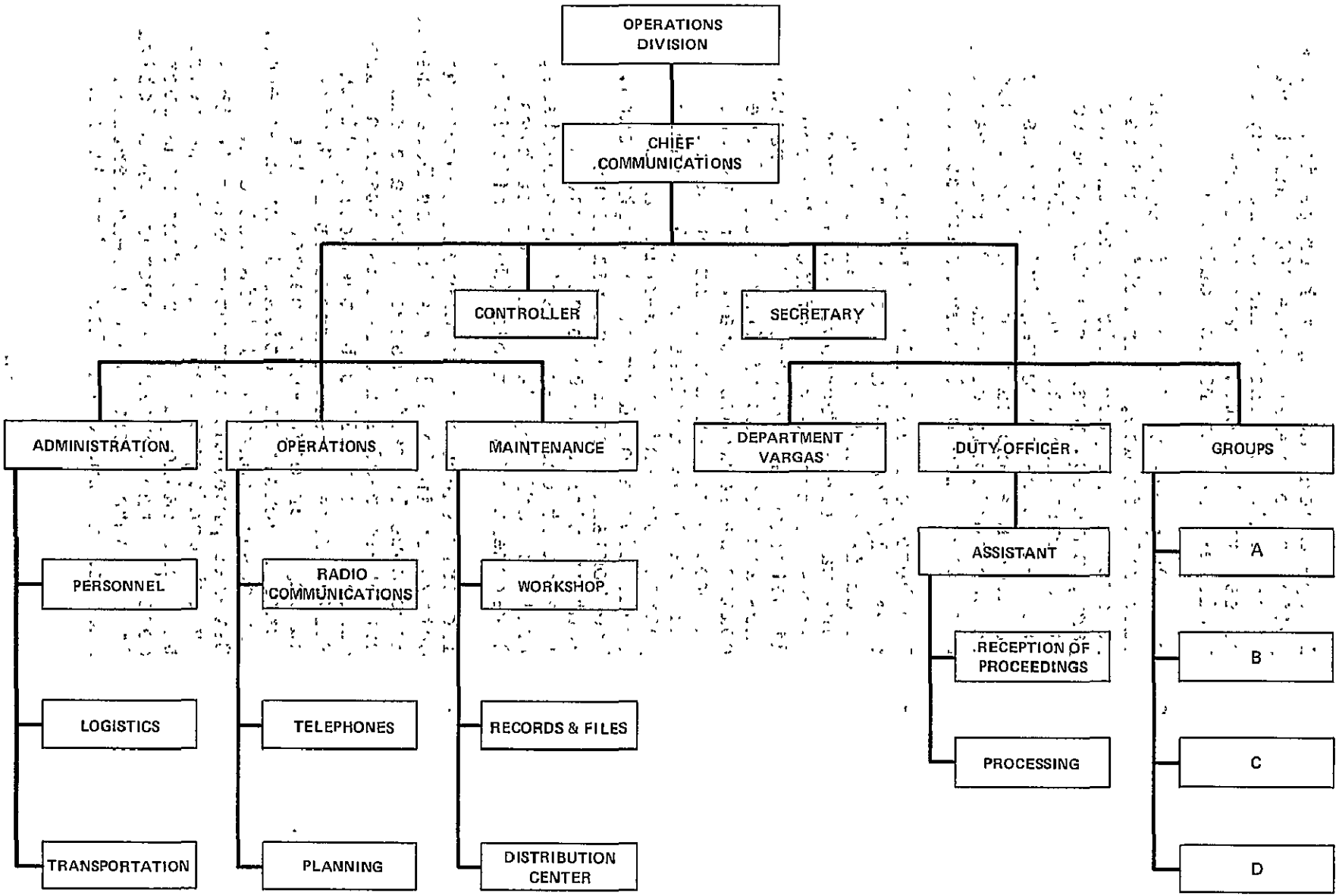


Figure 1

in operation each eight hour period. The police also operate some 400 additional motor vehicles consisting of motorcycles, buses, trucks, etc. Many of these vehicles are not radio equipped.

2. Over 30 percent of the radio equipment currently in use, both mobile and base, is over eight years old. For the most part, this equipment has far exceeded its operational life and is subject to frequent breakdowns requiring excessive maintenance and parts replacement. Due to the antiquity of some of these radios, some parts are no longer manufactured.

3. The Metropolitan Police Command Center, presently located at Cotiza, will be moved in the not too distant future to make way for a freeway. Cotiza now serves as the central office for the dispatching and control of radio patrol cars and foot patrol from each of the police detachments located throughout the metropolitan area. At present, this facility handles about 120 radio patrol cars and 56 hand-held radio transceivers on duty every eight hours. The Command Center also maintains contact with some 66 base stations located at each detachment headquarters, Prefects office, jails and other high Government of Venezuela (GOV) officials.

4. The only exception to central control at Cotiza is in Zone 1, the Vargas Department. Here some 16 radio patrol cars and six hand-held radios and 14 base stations are directly controlled by the Metropolitan Police Zone 1 Headquarters at La Guaira during each eight-hour period. The control center at Cotiza, in an emergency, can assume control of this network. Several problems currently exist in this system configuration, the major one being that all radio patrol car functions must cease in the Vargas Department when Cotiza is in contact with Zone 1 Headquarters. Another is where the lack of monitoring

Zone 1 operations at Cotiza requires the police officials at Zone 1 to telephone (long-distance) Cotiza before two-way radio communications can be established.

5. Because of the large area of police responsibility, some 923 square miles, and the difficult topographical features such as hills and mountains, the practice of using repeaters at several strategic locations is employed. While the repeaters provide fairly reliable communications coverage from the Command Center to the radio patrol cars, there are, reportedly, numerous locations in the immediate metropolitan area where reception at the Command Center is marginal or non-existent. These locations, commonly referred to as "dead spots", are listed in Annex III.

6. The Command Center at Cotiza is presently located in a sufficiently large room to allow orderly operations. Unfortunately, much of the room has been paneled for cosmetic purposes rather than for acoustics. As a result, the noise level is much higher than that desired. A lack of strict discipline on the part of the radio dispatchers and telephone operators combined with the volume of traffic being handled increases the noise level substantially.

7. The Metropolitan Police Command Center emergency reporting telephone number (111) has been widely publicized for general public use in requesting police assistance. Incoming telephone calls on this number average over 5,000 calls per day. Many of these telephone calls are caused by misdialing or requests for information not related to police emergency reporting. This has, on occasion, resulted in the ten incoming police emergency telephone lines being tied up and, consequently, slowed down police response. Police response is further deteriorated by the time element involved in relaying information received

over the (111) telephone lines by the telephone operators (women) to the police radio dispatchers.

8. Radio message forms, developed in 1963 and still in use, are not fully compatible with modern police operations. Although the current complaint cards can be utilized to develop factual information on the time, place, and type of crimes, they are not readily adaptable to electronic data processing equipment presently available to the Metropolitan Police.

9. Multi-channel tape recorders specifically designed to automatically record all incoming and outgoing radio traffic as well as incoming telephone calls on the police emergency telephone line (111) are not presently being used. The Metropolitan Police are utilizing several single channel home type Phillips tape recorders electrically controlled by the Duty Officer at the control console. The tape recorders are activated by the Command Center supervisor only during emergency situations. The superior practice of sound recording all radio transmissions makes unnecessary the burden of maintaining a radio log.

10. The Metropolitan Police current electronic visual displays are not wholly satisfactory for radio patrol car operations in a large city. Through the use of slide projectors, they have fabricated visual displays at several console positions whereby the radio dispatcher can select several maps depicting certain portions of the zone for which he is responsible. The master control map designed to control radio patrol cars throughout the city for all practical purposes is not usable. It does not display the areas of individual patrol responsibility nor does it permit each radio dispatcher to record the in-service, out-of-service status of each car.

D. Priority Control System:

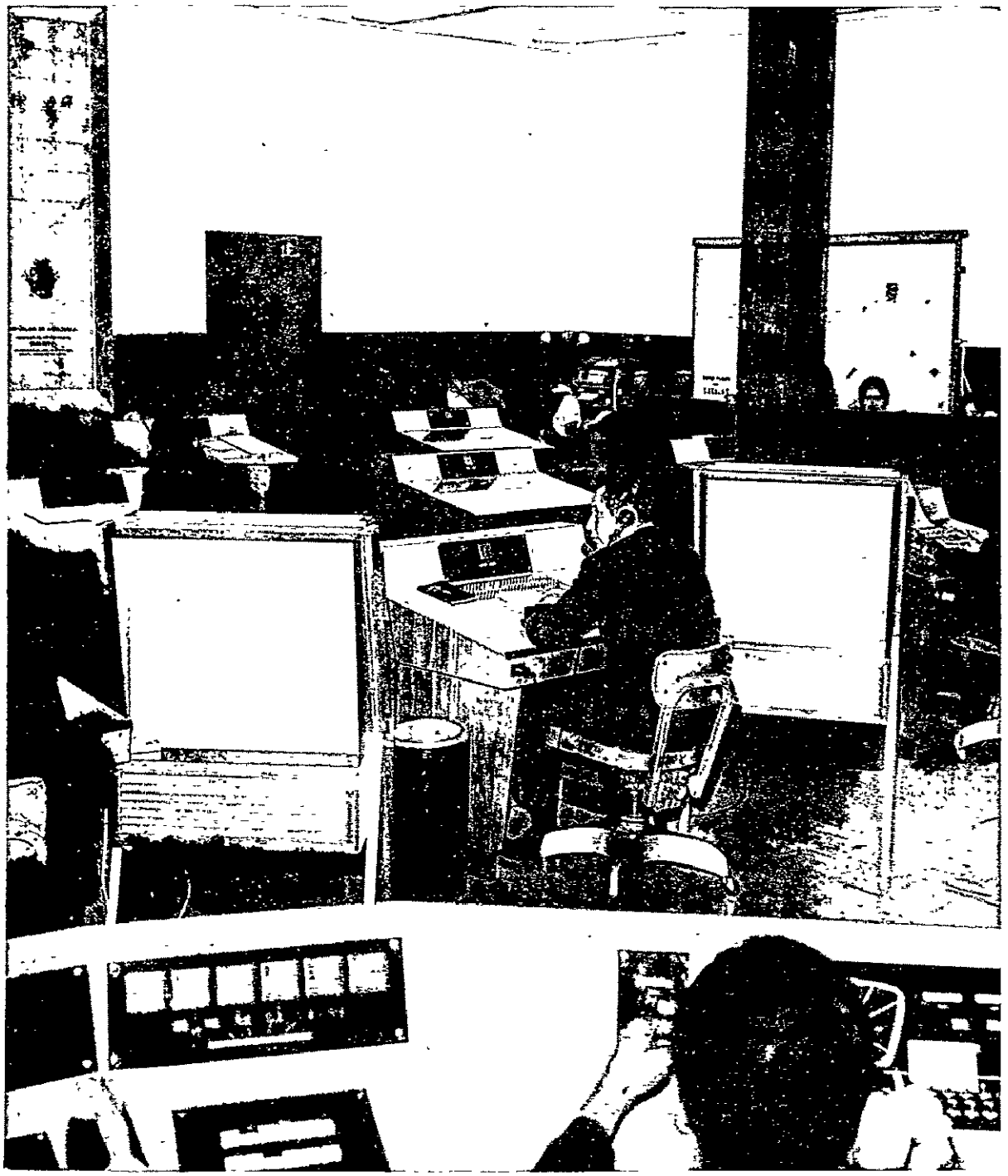
The Metropolitan Police employ a priority control system where high level Metropolitan Police officials are provided vehicle radios which can selectively interconnect with any of their base station/repeaters. This system requires that the police officials dial several digits for each station selected. Tones are then transmitted to the repeater site at El Tanque, decoded and, in turn, connect the vehicle radio with the proper base station/repeater. The use of the terminology "priority control system" is believed misleading since the ability of the officials vehicle radio to take positive control is not possible and depends on whether the circuit is in use. Further, the Command Center, through its direct UHF multiplex control link, could override the priority control system.

E. Police Call-Box Telephone System:

The Metropolitan Police currently employ some 40 call-box telephones strategically located in the Caracas metropolitan area. Of this number, 33 are operational and connected to the Command Center at Cotiza through CANTV Telephone Company leased lines. Given the rapid population growth and the lack of sufficient telephones (approximately 300,000) to service the public, requirements to expand the present call-box telephone system are believed valid.

F. Interservice Coordination:

1. Although coordination with the Technical Judicial Police (PTJ) and other police and security agencies are still carried out, the communications equipment which provided for the transmission and reception on each of the police and security agencies frequencies are no longer used. In fact, some of this equipment located at Cotiza and the repeater site at Bello Monte is inoperative.



COMMAND CONTROL CENTER AT COTIZA

2. The PTJ operate a base station in a small room adjacent to the Command Center at Cotiza which is linked to their radio network. This base station, operated by PTJ personnel, provides the Metropolitan Police with the necessary coordination channel. Approximately 500 radio messages a day are passed over this station. In addition to radio communications, the Metropolitan Police have a teletype link over leased lines to PTJ Headquarters where information regarding stolen vehicles, wanted persons and stolen articles are sent to the Command Center.

G. VHF versus UHF and Radio Interference:

The Metropolitan Police were directed to change frequency bands and have been assigned new frequencies in the Ultra High Frequency (UHF) band. No time limit has been imposed to effect this change. The Metropolitan Police desire to rapidly change frequency bands, for the most part, is based on the congestion of the Very High Frequency (VHF) band and the resulting co-channel interference which they are presently experiencing. Another contributing factor observed was the tendency of operators to "tighten" their standard squelch system in an effort to block out some of the weaker unwanted signals. This tightening of the squelch, while relieving to some extent the noise problem, contributes to the deterioration of the VHF system by reducing the mobile talk-back range of the base station. This action may, in part, be responsible for the numerous dead spots reported in Annex III. The interference problem is compounded by the existing system dependency on repeaters, located at high locations, where they intercept and relay signals both wanted and unwanted to the mobile and base units.

In changing the existing VHF High Band system (144-174 MHz) to a UHF system (450-470 MHz), several factors should be considered. These are:

1. Favorable Factors:

a. UHF frequencies offer greater penetration into buildings and through

man-made objects than VHF and is, therefore, considered ideal for dense municipal areas.

b. UHF frequencies are less susceptible to high noise levels (man-made and atmosphere).

c. The UHF antennas are smaller and, therefore, can be economically "stacked" (more than one) for base station operation resulting in increased range.

2. Unfavorable Factors:

a. Mobile and portable operation is seriously limited since the distance of communications in this mode is less than that obtained through VHF. (This would be partially offset through the use of repeaters and/or base stations which are elevated well above the average ground level).

b. The large amount of funds required to scrap the present VHF system (some of which is only a few years old) and replace it with new equipment.

One method to reduce the existing interference to a minimum and increase the mobile talk-back range would be to employ tone squelch. The addition of a tone squelch system could transform the slowly degrading existing VHF system into a more modern and effective mode of communications and thus negate the requirement to replace the entire system at this time. It is believed that, unless a tone or digital squelch system is included in the UHF system configuration, a similar interference problem could develop.

H. Emergency Communications:

1. Radio Channels:

Due to the advent of civil unrest in recent years, an emergency communications

capability is of increasing importance to police forces. With the present lack of sufficient radio channels, the Metropolitan Police communications capability would be far less than that required to effectively respond to emergency situations such as civil disturbances and natural disasters. A radio channel used for normal police operations cannot be used to saturation and still have reserve capacity to handle emergencies. At present, the Metropolitan Police are unable to respond to emergency situations without impairing its regular service. The accepted rule is to reserve exclusively for emergency use one radio channel for every 300,000 people. The metropolitan area, having a population which is estimated between 1.5 and 2 million people, would, therefore, require a minimum of five (5) emergency channels.

2. Mobile Communications Center:

In emergency situations resulting from large fires, floods, severe storms, civil disturbances and transportation accidents, it is sometimes necessary to establish a temporary communications center close to the scene of disaster. The Metropolitan Police do not currently possess a vehicle outfitted for this purpose. The ready availability of a communications van would provide the Metropolitan Police immediate access to the latest information in situations where rapid change is commonplace. It would serve as a hub from which the various activities necessary to control an emergency situation could be directed and coordinated.

I. Maintenance:

1. Methods of Maintenance Service:

a. Several methods of maintaining police communications equipment are used. One method is for the police to operate its own maintenance service facilities. Another method is to call upon one or

more technical service companies to maintain the equipment. In some cases, a combination of police operated and contracted maintenance service is employed.

b. The Metropolitan Police require that its communications system operate 24-hours a day. Consequently, a requirement exists for around-the-clock maintenance coverage. The method employed to obtain the required maintenance services is based on several factors. The primary one is the availability of qualified personnel. Additional factors to be considered are the cost of the maintenance equipment shop space and spare parts stock. The quality, convenience, speed and reliability of maintenance service are important factors to be considered regardless of which method is employed.

2. Contract Maintenance:

The Metropolitan Police are utilizing a private contractor (Telser de Venezuela Company) to maintain their police communications equipment. The ingenuity, technical competence and dedication displayed by the private contractor in maintaining over 1,000 police radio transceivers, many of which are antiquated (see Annex IV) and their efforts to modify portions of the communications system to satisfy expanded police operational needs is noteworthy. The private contractor's apparent satisfactory performance has relieved the Metropolitan Police from the necessity of acquiring a technical communications capability. It is believed that retaining highly skilled radio technicians under existing Metropolitan Police salary levels would be difficult.

3. Police Technicians:

a. Two Metropolitan Police personnel were trained in the United States in 1964

in radio maintenance, however, these personnel were commissioned officers and were transferred to other duties.

b. Several other enlisted police personnel have been partially trained as radio technicians and are currently performing limited maintenance on the equipment at the Metropolitan Police Headquarters. They have not been provided proper test equipment or spare parts and are required to notify the contractor in the event of equipment failure.

c. The use of technicians other than police personnel with access to critical areas such as the Command Center and repeater sites presents security problems such as continual updating of contract technicians security clearances.

J. Training:

1. Management Training:

Few members of the Metropolitan Police have been exposed to formal training in management and administration of a City Police Radio System. Seven police officers were given 26 weeks training in the United States during 1964 and 1965, however, they have been assigned other duties and refresher training would be required. Further formal training in management and administration of a City Police Communications System is needed. With the proposed modernization of the existing system, this type of training becomes of major importance to the successful implementation of an effective police communications capability.

2. Communications Training for Working Police Officers:

a. Two way radio is one of the most powerful tools in the hands of law enforcement officers today. There is, however, an

apparent inability of many experienced police officers to properly forward information to the Command Center on such things as civil disturbances and criminal activities. This failure to forward complete information, in logical sequence, results in time consuming transmission and ties up unnecessarily the police communications system. At times, experienced police officers bring their cars to the radio service shop complaining of a dead receiver when the only thing wrong is that the volume control has been turned down. Others may complain of a noisy receiver when a slight adjustment of the manual squelch will remove the noise. Reasons for these, and many more discrepancies may be many and varied.

b. The principal reason for the above problem is failure to give proper education in the use of two-way radio which is used every working day by the police officer. Practical experience alone is not enough. Continued practice of bad habits only serves to make them more firmly entrenched. It seems that this vital phase of police training in the Metropolitan Police Department has been, to some extent, neglected. Operating as most police organizations do, with a perennial manpower shortage, it is often difficult to conduct in-service training and refresher classes. There is, however, one group available which can be trained properly - this is the new recruit, the man who has not yet taken his place as a regular officer. The training of these men in police communications is just as important to effective police operations as training in firearms, law, etc.

3. Technician Training:

The Metropolitan Police technicians need advanced training to properly service radio

equipment in critical areas such as the Command Center. Several good technical schools are available for local training. One of them is the National Institute for Cooperative Education (INCE). Necessary on-the-job training can be obtained through the private contractor currently maintaining the Metropolitan Police radio equipment.

K. Technical Assistance:

The art of radio communications in the police field has risen to the point where it is practically impossible for any Chief, and usually even learned and dedicated police communications officers, to be completely familiar with all forms of communications in use today. Currently, Metropolitan Police personnel lack the in-depth knowledge and experience to develop and implement an effective operational and administrative telecommunications system in support of police activities. Given the Metropolitan Police proposed procurement of a modern telecommunications system and during the period that the police personnel are developing the necessary management and technical expertise assistance will be required. It is believed necessary for the Metropolitan Police to obtain technical assistance from a source that is void of conflict of interests. In addition, management advice including operational techniques peculiar to police communications will be required.

II. REVIEW OF METROPOLITAN POLICE COMMUNICATIONS SYSTEM REQUIREMENTS

A. General:

Basic requirements deemed necessary by the Metropolitan Police Force to modernize their facilities are contained in Annex I. Several of these requirements are believed to be in excess of present Metropolitan Police needs and are not compatible with the existing communications system or organization.

B. Multi-Channel UHF Links:

As shown in Figures 2 and 3, 900 MHz UHF radio links are currently employed to permit the Command Center at Cotiza to control the repeater sites at El Tanque, Alto Hatillo and Pipe. Even though the 900 MHz equipment (Buedlman) has been in use for three to ten years, it still appears to be in good condition. Given the expansion and modernization of the existing system, the channel capacity of the present 900 MHz equipment would not be sufficient. This is especially the case should a receiver voting system and/or several emergency channels be employed. Modern 900 MHz or 2000 MHz terminals having a capacity of 60 and 120 channels are available and could satisfy any new systems configuration. The existing 900 MHz low capacity equipment could be utilized to interconnect the PABX at Zone 1 Headquarters with that at Cotiza. This would permit internal police telephone service without reliance on commercial telephone lines. Other available voice channels could be utilized to extend communications coverage for portable and mobile units.

C. Channel Requirements:

Rapid population growth and related police problems have increased the requirements for additional radio channels. In fact, projected population by 1990 would be approximately ten million people. Presently, 14 channels utilizing 30 VHF frequencies are employed by the Metropolitan Police to support their

METROPOLITAN POLICE
RADIO COVERAGE IN THE VARGAS AND LIBERTADOR DEPARTMENTS

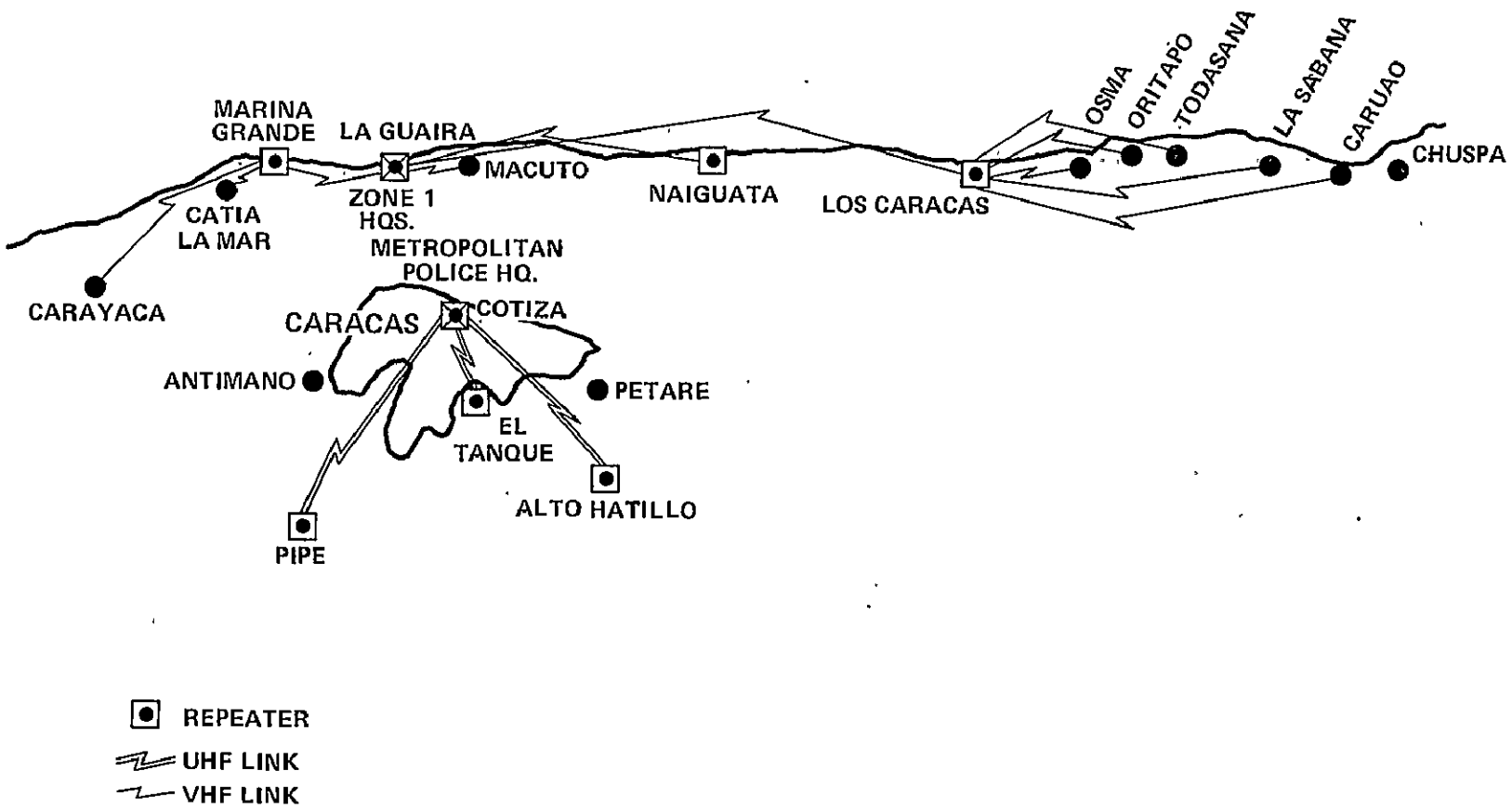


Figure 2
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METROPOLITAN POLICE RADIO COMMUNICATIONS SYSTEM

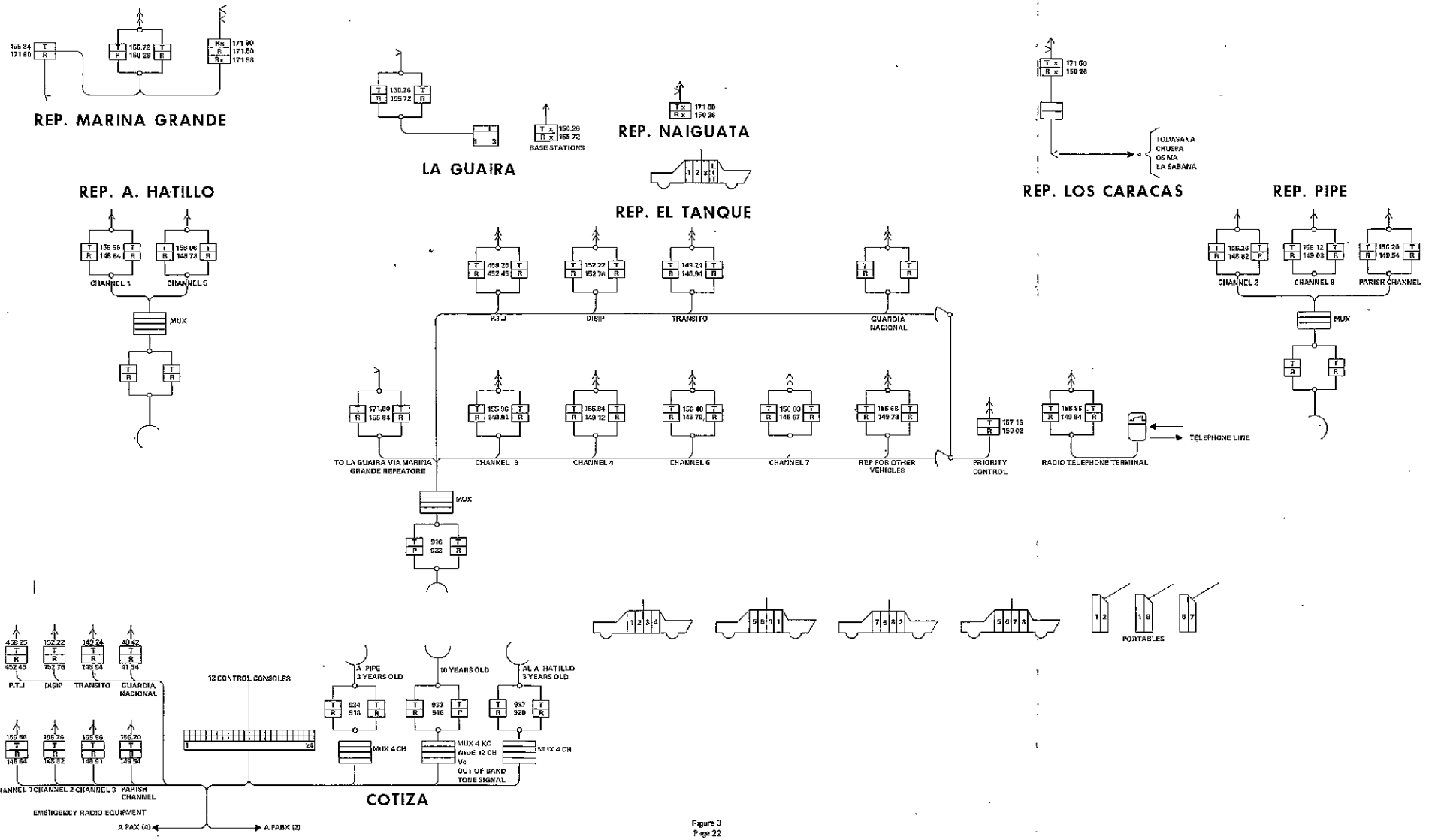

Figure 3
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operations (See Annex V). In addition, three UHF channels utilizing six UHF frequencies are employed to control three separate repeater locations. If the Metropolitan Police should retain the entire VHF system, then an additional six VHF channels (14 frequencies) and two UHF channels (4 frequencies) would be required. Should the entire system be converted to UHF, 25 UHF channels would be required. The following is believed to represent the minimum number of channels which would provide the Metropolitan Police the flexibility necessary to fulfill their responsibilities:

1. A separate patrol channel for each zone for better control of existing and future police patrol operations. (7 channels)

2. A metropolitan area wide channel.(1 channel)

3. Special Brigade for Civil Disturbance Control. (1 channel)

4. Traffic Detachment. (1 channel)

5. Parish networks for Libertador and Vargas Departments and Sucre District. (3 channels)

6. A dial radio-telephone system (IMTS) for high level GOV officials. (2 channels)

7. Emergency channels based on one channel for every 300,000 people. (5 channels) These channels would be available to support police operations during critical periods, such as earthquakes, floods, civil disturbances, etc.

8. UHF channels to control repeater sites from Cotiza. (3 channels)

9. UHF channels to provide for interdepartmental telephone communications between Zone 1 Headquarters at La Guaira and Cotiza. (2 channels)

D. Channel Congestion Using Voice Communications:

As described above, the increased number of radio transceivers which will be required to effectively deal with police problems due to the rapid population growth will create serious channel congestion. Relief from this problem using normal system configuration would require additional channels and the purchase of new radios. The volume of information being passed (see Annex II) and the lack of knowledge regarding vehicle status and location results in a deterioration of command and control. Although voice communications is indispensable for patrol operations, it imposes a number of limitations, as enumerated below:

1. The requirement for an excessive amount of frequencies in an already overcrowded spectrum.

2. The lack of protection against unauthorized interception of police traffic unless expensive voice scramblers are employed.

3. The time lag in which police personnel must wait their turn to communicate with the dispatcher.

E. Digital Communications:

It is believed that augmentation of the voice mode to permit transmission of digital data on a time shared basis would resolve many of the problems outlined above. It would substantially reduce requirements for new channels outlined in paragraph 3. The use of modern digital techniques would provide reliable and versatile communications to and from the patrol vehicles. It would discourage unauthorized transmissions by police personnel by providing vehicle identification whether transmissions are by voice or data. It would also increase existing channel capacity by relieving the police operator from having to identify the vehicle since the vehicle status and identification would be automatically transmitted each time the push-to-talk switch on the mobile microphone is depressed. Acknowledgment that the message was received by the

Command Center would be automatically relayed, illuminating an acknowledgment light in the vehicle so that the operator is aware that his message was received. The availability of approximately 100 prearranged digital messages related to the police "10 Code" (see Annex VI), further reduces air time and offers security of police transmissions. Digital techniques would further provide the Command Center with the capability of obtaining timely information regarding the status of each vehicle. It would permit the Command Center to interrogate the patrol vehicle even if it was unattended. Additional capabilities could be incorporated to permit the Command Center to selectively call an individual vehicle or group of vehicles and/or actuate the horn and/or headlights of a selected unattended vehicle to signal the operator he is wanted.

F. Transmission of Text Messages to Vehicles:

Several units are available for each vehicle installation which provides for text messages to be displayed on a video terminal (cathode ray tube) or be received in hard copy off a teleprinter. As with any kind of equipment, the utilization and effectiveness of these units would be directly proportioned to the radio patrol car personnel's ability to use it. Consequently, it is believed that this capability to utilize text messages in the patrol vehicles is far in excess of the existing and near future requirements of the Metropolitan Police. Should there be a drastic change in operational requirements in future years and printed text messages be deemed necessary for patrol vehicles, the digital data system would be compatible and provide the necessary interface.

G. Facsimile:

Facsimile is a method of transmitting written and pictorial information to a remote point by electronic means. It is a valuable tool to police agencies in their effort to combat crime, however, there are numerous other basic

Metropolitan Police requirements which must be satisfied prior to the consideration of facsimiles. It appears that the most immediate need of the Metropolitan Police is that of obtaining a more modern and reliable patrol and administrative communications system. At this time, it is believed that there are two circuits which might justify the use of facsimile; that to PTJ which could utilize leased (CANTV) telephone lines; and, the proposed 900 MHz wideband link connecting Cotiza with Zone 1 headquarters at La Guaira.

H. Repeater Coverage:

At present, three repeater sites are utilized to cover the metropolitan Caracas area. It is difficult to ascertain the extent of the reported radio dead spots listed in Annex III, since controlled technical tests were not conducted. Should the dead spots be verified, new repeater locations may be required. In revamping the existing communications system, another method to eliminate dead spots can be considered - that of utilizing satellite receivers at strategic locations throughout the metropolitan area.

I. Portable/Mobile Transceivers:

The commercial availability of portable radios which also function as mobile radios appears to be ideally suited to the requirements outlined in Annex I for the Metropolitan Police. In considering this configuration, the advantages and disadvantages should be evaluated in terms of police needs.

1. The advantages are:

   a. Greater utilization of equipment inventory, police officers can be in constant communications with the headquarters should they be required to leave the patrol car;

   b. Maintenance would be simplified reducing patrol vehicles out-of-service time in most cases defective

radios could be removed and sent to the radio repair shop and replacement units installed by non-technical police personnel.

2. The disadvantages are:

   a. Portable units circuitry requires a great deal more miniaturization than mobile units, have a higher failure rate and are more difficult to repair;

   b. The proposed or future use of digital signaling to and from mobile units would present operational limitations inasmuch as no digital information would be available to the Command Center should the portable unit be removed from the vehicle.

J. Portable Transceivers:

For purposes of standardization, where UHF and/or VHF portable (hand-held) transceivers are used in the mobile configuration described above, a minimum capacity of four channels would be required. Where portable radios are to be used solely to support foot patrol and/or special brigade requirements, two channel capacity is believed sufficient If more than two channel portable radios are employed for this purpose, problems relating to control and operational procedures may be experienced dependent upon the police officers training and discipline.

K. Batteries:

Portable transceivers employing nickel cadmium rechargeable batteries normally provide eight (8) hours of operation calculated on the Electronic Industry Association (EIA) duty cycle. The EIA duty cycle is based on portable operation time as follows:

10% Receive; 10% Transmit; and
80% in Standby.

An increase in the Receive or Transmit time cycle would result in less than eight hours of operation.

To satisfy emergency operations, the duty cycle time could be extended to approximately 40 hours through the use of non-rechargeable mercury batteries.

L. Police Call-Box Telephone System:

1. The Metropolitan Police should consider the employment of a modern police call-box telephone system in the metropolitan area. Call-boxes, if strategically located in Caracas, would compensate for the small number of existing public pay (coin) telephones.

2. The Metropolitan Police should consider the following features in the procurement of any call-box system:

   a. The call-box telephone should be contained in a locked, weatherproof metal box to offer maximum security against vandalism and theft. Police personnel should be able to open the door of the call-box by means of a key.

   b. The public should be able to use the box to summon police assistance without unlocking the box. This would require the installation of an enclosed intercom speaker with an externally mounted push-button or lever.

   c. Call-box should provide for routine reporting by foot patrolmen through a call-box switchboard located at the Metropolitan Police Headquarters.

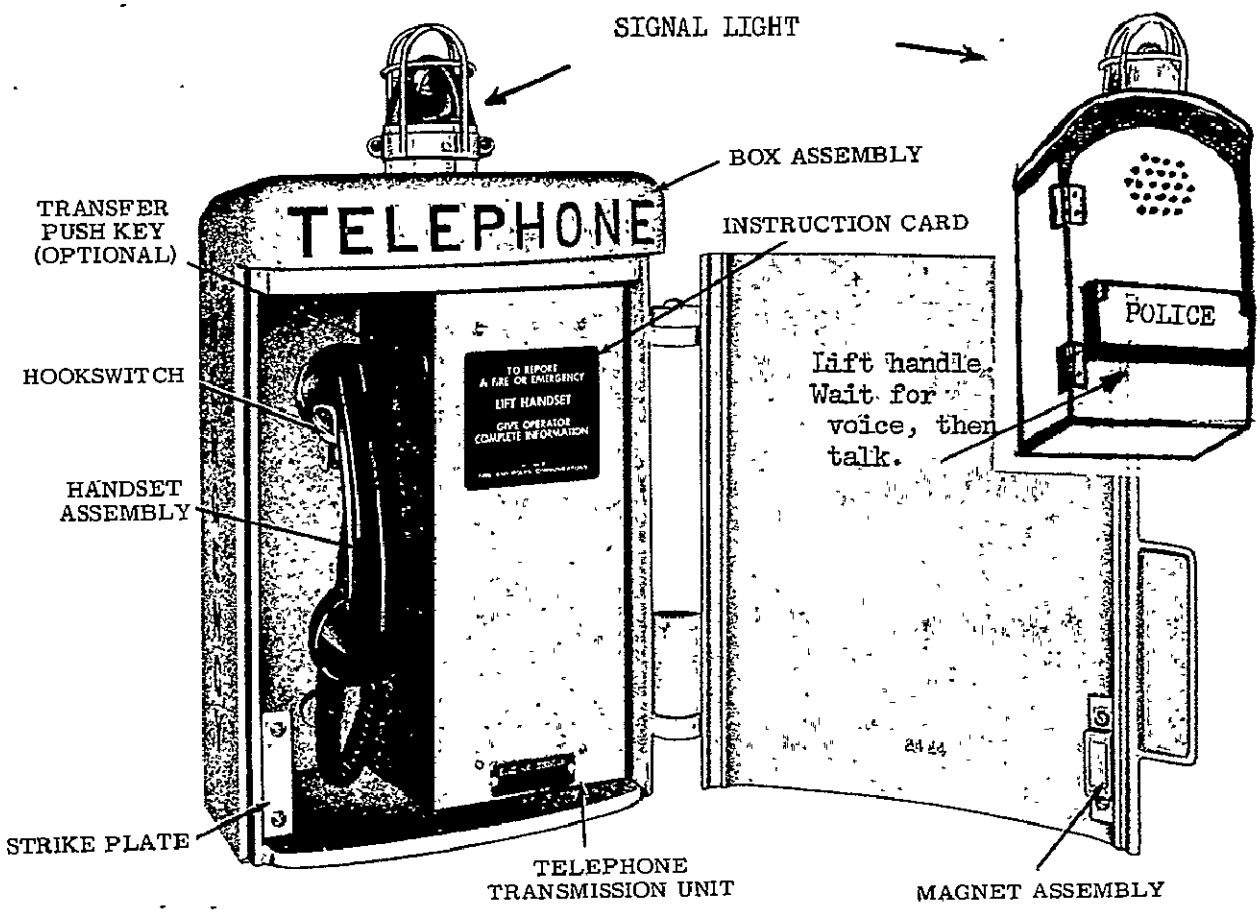
   d. A provision should be incorporated to permit the police call-box console operator at the Metropolitan Police Headquarters to contact the foot patrolmen in the call-box area by visual (flashing light), and audible signaling. System should have a

provision for the console operator to test each call-box without blocking system operation.

e. The call-box system should contain its own central power in case of commercial electrical power failure.

f. Instantaneous call-box identification should be available in a numerical lighted display at the console when a call-box is actuated.

EMERGENCY REPORTING TELEPHONE



M. Tape Recorders:

Multi-channel voice logging recorders to maintain a recorded log of the Metropolitan Police activities is required. In addition to recording internal police radio communications, sufficient channels should be available to record telephone complaints received over the (111) emergency reporting telephone system. It is believed that logging recorders should possess a capability of recording simultaneously a minimum of 20 channels to satisfy Metropolitan Police requirements. To provide a 100% backup, two recorder transports would be required. Each transport should have a capability of operating for a 24-hour period. A built-in time clock to automatically start the backup transport after 24-hours and a digital time system to record and display the time of day along with each message is necessary. A capability to retrieve recorded information through a high speed automatic search system is desirable.

N. VIP Communications:

The Government of Venezuela (GOV) has established a requirement for the Metropolitan Police to provide communications support to some 15 high level government officials who must be alerted in time of emergency or otherwise contacted. This requirement is currently being met through the use of standard mobile radio transceivers operating on police operational frequencies. Government officials have been provided a capability of initiating telephone calls by contacting the Command Center and requesting a telephone patch. In addition, these officials are able to monitor patrol operations.

Given the proposed implementation of a digital data communications system, little benefit would be derived for Government officials to monitor patrol operations or utilize police operational frequencies.

Some alternate methods of communications to satisfy the above requirements are:

1. Improved Mobile Telephone System (IMTS)

The use of IMTS to satisfy the above requirements is believed valid, however, the utilization of direct dial radio telephone equipment permanently installed in vehicles would not fulfill the requirement to maintain a 24-hour a day communications capability with Government officials. A more satisfactory approach would be to use an IMTS terminal, several remote receivers and portable direct-dial telephones. A portable direct-dial telephone, compatible with the IMTS is available in an attache case configuration. This unit is powered by rechargeable nickel cadmium batteries and offers an RF power output of 25 watts which compares favorably with the 20 watt mobile (IMTS) transceivers. The use of portable units by Government officials would provide the necessary 24-hour a day coverage since they could be operated in the vehicle, office, or private residence. The system would provide portable-to-portable and portable-to-telephone direct-dial capability as well as telephone-to portable direct-dial capability. This system would be full duplex allowing simultaneous transmission and reception. The use of two IMTS channels would service as many as 60 subscribers and permit two subscribers to communicate simultaneously. Sufficient channels are available on the portable telephone unit so that it could also function as a standard two-way radio on other frequencies.

2. Hand-Held Portables:

The use of hand-held portable units incorporating a selective call capability could provide the necessary communications for high level Government officials on a 24-hour basis. This type of system would be substantially lower in cost than that described above. Telephone calls could be placed in a similar manner to that currently employed (telephone patch at

Metropolitan Police Headquarters). The use of remote receivers could extend the range of hand-held units to that required. The Command Center could contact any individual hand-held unit without disturbing other subscribers. Two-way communications between hand-held units would first require contacting the Command Center. The drawback to employing this method of communications is that it imposes an additional workload on the Command Center.

O. Automatic Vehicle Monitoring (AVM):

1. General Requirements:

In the United States and other developed countries, police officials in large cities have an urgent need to know the location and status of their vehicles on a continuing basis. This need becomes of greater importance to foreign countries where these forces are operating with an insufficient number of vehicles and/or less disciplined police personnel. An AVM system provides the facility for a greater degree of control over operations and the rapid dispatching of patrol vehicles. It also provides police officials with a capability to assure that patrol vehicles are on assigned duties. In the event that the police officer is attacked, injured or killed and cannot respond to a radio call, AVM will assist in locating the vehicle with minimum delay.

2. Metropolitan Police Requirements:

The requirements for an AVM system for the Metropolitan Police must be weighed carefully since the funds necessary to establish such a system are sizable. There are numerous problem areas relating to speeding up the Metropolitan Police response to reported incidents which should be addressed prior to the consideration of an AVM system. Unless drastic changes are implemented to more effectively handle calls for assistance

over the "111" telephone reporting system, the increased response time achieved through AVM would be of little value. The use of AVM to primarily provide a supervisory tool is not believed warranted. This problem area could be resolved to some extent at a fraction of the AVM cost by the employment of supervisory police personnel in unmarked police vehicles.

3. Technical Discussion:

In considering an AVM system, there are several different types which may be utilized. The most common ones are Trilateration and Triangulation (pulse ranging and phase ranging), Signpost, and Dead-Reckoning. The use of these systems would depend on the area of coverage, topography, distance accuracies required, and the number of vehicles to be employed. The use of any type AVM system would require that it be custom designed and would, therefore, necessitate an extensive survey of the city of Caracas. Although numerous tests have been conducted on both triangulation, trilateration and signpost methods, a complete operational AVM system to support police operations has not been utilized to date. Signpost systems (whereby location of a vehicle is identified by its proximity to one of a multitude of transmitters which are permanently installed at key intersections throughout a city) have been utilized to satisfy fixed route requirements, such as that for buses. There is every reason to believe that this type system could be expanded to satisfy a city-wide police operational requirement. The trilateration technique has been successfully tested in a large metropolitan city and does offer good location accuracy (average about 150 feet). The use of a trilateration AVM system provides continuous tracking of a vehicle along a completely random route. It further would

relieve the problems of installing and maintaining several thousand signpost transmitters required to cover large metropolitan areas.

P. Command Center:

1. Noise Level:

a. The Metropolitan Police requirement to place dispatchers in semi-soundproof cabins outlined in Annex I is not believed valid. Although this approach has been utilized in a few major city police organizations, the resulting operational efficiency was found to be less than that achieved by organizations where dispatchers are not isolated. The basic problems facing proper Metropolitan Police Command Center operations is believed to be two-fold. One is that the existing Command Center was designed more for cosmetic purposes rather than acoustics. The other is the lack of sufficient discipline on the part of the telephone operators and dispatchers. It was also observed that teletype machines are installed in close proximity to the radio dispatchers and telephone operators and lend to the high noise level.

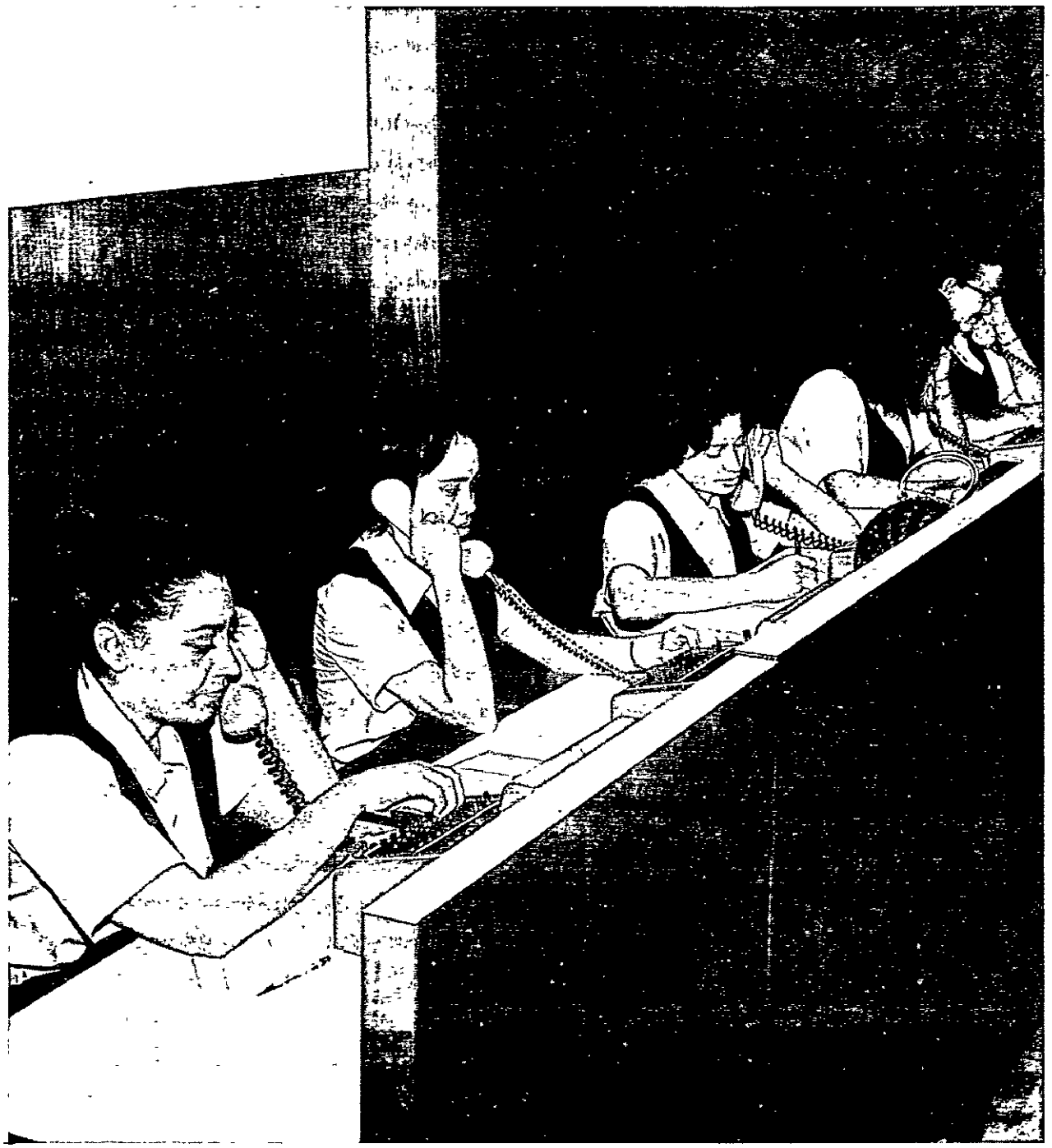
b. The use of ordinary telephone handsets by the telephone complaint operators is not believed compatible with modern command center techniques. The use of headsets in place of hand-held telephone instruments would be more satisfactory and convenient thereby freeing the operators hands for other purposes. Should the dispatcher and telephone complaint operators duties be combined, the telephone headset could then be shared with the radio system. The radio push-to-talk switch would automatically select the telephone or radio mode.

2. Physical Layout:

In considering current radio and telephone traffic as well as future expansion requirements, a total

COMMAND CENTER

TELEPHONE COMPLAINT OPERATORS



of 10 dispatch consoles, one supervisory console, one call-box console and four telephone override positions are believed to be suitable for operational needs. One method would be to arrange the 16 positions of the Command Center into 8 sections of 2 positions each. (See Figure 6) A document conveyor could be placed between two positions and run longitudinally beyond the length of the 8 sections to include service to the supervisor's position.

3. Emergency Reporting Telephone System:

a. One of the major problems with the Metropolitan Police emergency reporting telephone system is the use of telephone number 111. The mere jiggling of the telephone plunger (a hookswitch which connects and disconnects the telephone line) results in telephone calls being inadvertently placed over 111 without the individual being aware that they have done so. The use of the 111 telephone number was discarded by the telephone company in the United States, in part, for this reason. Changing the methods and facilities currently employed by the Metropolitan Police to respond to telephone calls for assistance from the public would be of marginal value unless prior action is taken by CANTV Telephone Company to correct the above problem. The telephone number 911 now used extensively throughout the United States could be considered for use in Caracas. The use of telephone number 911 or other suitable numbers would resolve the problem outlined above by reducing the number of erroneous telephone calls received by the Metropolitan Police Command Center.

b. The present emergency telephone reporting system does not provide for direct access to fire or ambulance assistance to citizens using the 111 emergency telephone

number. Presently, the public must dial one of several numbers to request assistance from police, fire, PTJ or ambulance organizations. Each of these organizations must then coordinate with each other, normally by radio, to assure proper coverage in the event of a fire or serious accident. There is a need for an Automatic Call Distributor (ACD) type system whereby all such telephone calls are received by the police and routed directly to the agency providing the services requested by the depressing of a button on the telephone complaint operator or dispatcher console.

c. The current Metropolitan Police method of responding to emergency telephone calls is for the telephone complaint operator to record the complaint information and send this to the dispatcher by messenger. One disadvantage of this arrangement is the time lapse between the recording the complaint and its receipt by the dispatcher. Additionally, since the information was relayed, there is also possibility for error. Many of the calls received by the telephone complaint operator do not require the dispatch of a patrol car. The choice of having telephone calls answered by the telephone complaint operator or the dispatcher depends to some extent upon the volume of radio messages, the population in the area serviced, and the nature of the demands made on the police by the community. The population in Caracas must be considered in concert with the number of telephones available. Although the population of Caracas is sizable, the number of available telephones is only about 300,000. Several police forces in comparable cities in the United States have experienced greater efficiency by designing their communications control center whereby the dispatcher also functions as the

telephone complaint operator. One such city has a population of over 800,000 and some 800,000 private and public telephones installed. The police department in this city responds to over 7,500 telephone calls requesting police assistance and dispatches some 10,000 radio messages in a 24-hour period. When compared to Metropolitan Police traffic contained in Annex II, it appears that this method of using one person to handle telephone complaint calls and dispatch radio patrol cars is applicable to Metropolitan Police operations in Caracas.

4. Vehicle Status Display Systems:

a. Automatic Systems:

Vehicle status display panels are available which indicate the status of the vehicle by changing incandescent lamp colors automatically upon receipt of digital information from the Master Decoder terminal. These panels could be wall-mounted on either side of a city-wide map and provide continuous timely vehicle status information to all personnel in the Command Center. The addition of a visible method of determining vehicle status at the Command Center, although high in cost, is believed worthwhile. The actual requirement to purchase the equipment would depend upon the type of dispatcher operational concept the Metropolitan Police decide to utilize. Should they select the method where each dispatched position has the capability to control all radio patrol cars city-wide, then a central wall-mounted automatic vehicle status display would be invaluable.

b. Manual Systems:

If the Metropolitan Police decide to limit each dispatch position to a certain area of responsibility, the use of a manual vehicle status display system is believed more

applicable. Each dispatcher position could control a select number of vehicles and indicate their status by the insertion or removal of an IBM complaint card such as that described in Annex VII. Vehicle status display could be made available at the dispatcher position and/or a central wall-mounted unit. This system would not be fully compatible since each dispatcher position could not control the status of all radio patrol cars. The installation of several hundred IBM status slots at each dispatcher position would be impractical.

5. Teletype Network:

At present, all messages to the zone headquarters from the Command Center are sent by either radio communications or hand-carried. A teletype network to interchange written orders, directives, and other documentary type of traffic between the Command Center and each zone headquarters is lacking. Stolen vehicle want lists received daily from the PTJ are currently broadcast over the Metropolitan Police communications system to each zone headquarters. This action results in channel congestion and a waste of air time. Teletype service over leased CANTV telephone lines would satisfy present requirements. The utilization of leased teletype machines would also negate the requirement for trained police teletype equipment mechanics.

III. RECOMMENDATIONS:

In consideration of the large monetary investment required to modernize the Metropolitan Police Communications System and the necessity to develop improved police managerial, operational, and technical capabilities, recommendations are proposed in several phases. The planning and subsequent implementation efforts proposed in this report could represent a substantial improvement in the Metropolitan Police communications capabilities.

A. Prerequisites to Develop an Effective Communications Capability:

1. Organization:

a. The Metropolitan Police organization structure is not believed, at this time, to be fully compatible with proposed communications systems improvements. Consideration should be given to orienting the Metropolitan Police communications organization along the lines shown in Figure 4.

b. Reorganization of the Communications Division should place non-communications functions into other appropriate departments. Examples are: Transportation operations should be the responsibility of a common motor pool; full scale personnel functions should be carried out by a central Manpower Resources Department. Various responsibilities of other presently existing sub-divisions should be reapportioned. Routine logistics support should be a function of the Maintenance Branch. Planning should be an effort of all branches, coordinated through the chief of each branch with the Communications Division Chief. In the recommended organization, Duty Officers

GENERAL ORGANIZATIONAL STRUCTURE

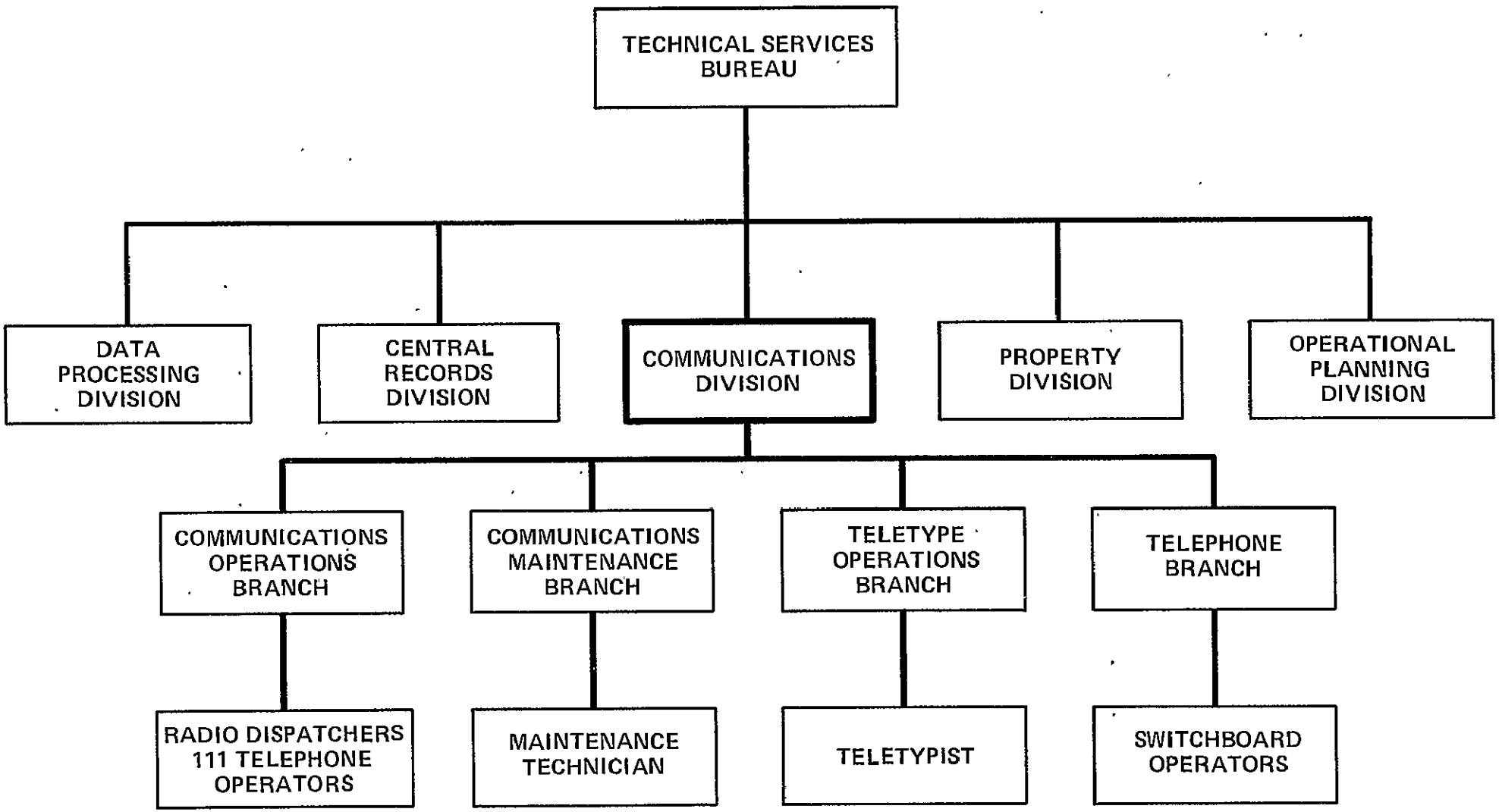


Figure 4
Page 41

(commissioned officers) should be assigned on a daily basis to conduct around-the-clock affairs of their respective branches of assignment.

c. It is recommended that senior police personnel assigned to the Communications Division remain on the job for extended periods of time so that the expertise they develop is not lost. Rotating senior police officers, through the Communications Division, should primarily serve as a screening device to select officers for regular assignment who have demonstrated their potential in this capacity.

2. Training:

a. As the selection and training of police communications personnel directly affects the performance of the communications system, consideration for these elements should receive as much care as the purchase and maintenance of the equipment. In this regard, the several police officers who received training in the United States in communications management and maintenance should be reassigned to these duties.

b. It is recommended that two senior police officers receive U. S. institutional training in communications management and observe how operational elements of large city police organizations utilize radio communications facilities in carrying out police tasks. This training should be initiated prior to the proposed modernization of the Metropolitan Police communications system. On returning, these police officers should be responsible for participating in the formulation of operational plans and for establishing a formal program of training.

c. It is recommended that a minimum technical capability be developed by the Metropolitan Police. In this regard, several police personnel having some radio technical background should be provided advanced

technician training in modern communications maintenance techniques. An advanced Police Radio Communications Course such as that required is contracted for periodically by the International Police Academy, Office of Public Safety. This course, although given in the United States is, on occasion, conducted in the Spanish language for students from South and Central America.

d. A requirement to train selected Metropolitan Police personnel in the installation, maintenance and operation of Command Center equipment should be included in any future contract awarded for communications systems modernization.

e. In order to retain trained radio technicians, the Metropolitan Police should consider entering into a written agreement with individual police personnel selected for this type of training wherein the individuals receiving this free training would be committed to remain in the police service for three to five years or reimburse the Metropolitan Police for the funds expended on their training.

f. The Metropolitan Police personnel resources for the Command Center should be utilized more efficiently. Command Center personnel should be required to develop a range of skills rather than a single narrow speciality. Personnel should be trained in the duties of others and on a scheduled basis be given the experience in the different tasks. Dispatchers, switchboard operators, telephone complaint clerks and teletypewriter operators should learn each others jobs. The results of this kind of a training approach should enable the Metropolitan Police to operate their Command Center more effectively when heavy demands are placed on its personnel during emergencies.

3. Technical Assistance:

It is recommended that the Metropolitan Police obtain U. S. Government technical assistance to assure the successful planning and implementation of an improved communications capability. Technical assistance, which must be void of a conflict of interest, should be provided at this time to assist in the proposed system modernization planning and in developing the necessary police management and technical expertise.

B. Phase I - Recommendations:

1. VHF versus UHF:

A complete change from VHF operation to UHF operation is not recommended at this time. This recommendation is based on the large amount of new radio equipment in the Metropolitan Police inventory (see Annex IV). There are 418 operational VHF mobile transceivers that are less than seven years old and 296 VHF portable transceivers that are less than three years old. It is believed that several manufacturers may offer to purchase some of the 700 transceivers (whose acquisition cost was over a half million dollars) in order to sell new equipment to the Metropolitan Police. This course of action, however, would not be in the best interests of the Metropolitan Police since the VHF communications equipment can provide many additional years of satisfactory service. The only exception to this would be the 310 Dumont mobile transceivers which are over 10 years old, in poor condition, and should be replaced. The VHF base station equipment, because of age, warrants replacement; however, this equipment has had few outages, has been well-maintained, is installed in air-conditioned facilities, and should provide satisfactory service for several more years. The availability of standby VHF base station equipment further reduces the necessity to immediately replace these units for reliability purposes.

2. VHF System Improvement:

a. General:

The newer VHF mobile transceivers should be retained and redistributed to selected police zones. Zone 1 along the coast and other suburban areas are believed ideal for this purpose. Base station equipment should be redistributed accordingly.

b. Technical Modification:

Tone squelch repeaters should be employed in the VHF system to transform it into a more effective mode of communications. To convert the existing VHF system to tone squelch operation, the replacement of existing VHF repeater receivers would be required. (The installation of tone squelch circuitry on most existing VHF receivers is somewhat impractical since it would require major circuit design changes.) Mobile transceivers should be equipped with a sub-audible tone oscillator which operates continuously during the transmit mode.

c. Cost Estimate:

The cost to convert 10 repeaters at three locations would be approximately $600 each, the total amounting to $6,000. The cost to convert some 400 mobile transceivers at approximately $75 each would require an additional $30,000. The total cost for the overall conversion would be approximately $36,000.

3. Repeater Coverage:

a. Tests:

Tests should be conducted immediately under adequate technical supervision to ascertain the extent of the reported dead spots listed in Annex III. Tests should relate to both mobile and personal portable coverage.

Tests should pinpoint shadow regions where received signal strengths are extremely weak. In such cases, rather than attempting to improve signal strength by increasing the power radiated by the repeater and mobiles, it is recommended that other repeater site locations be identified which could extend the coverage into the shadow regions.

Tests should also identify areas where satellite receivers could be employed to extend the talk-back range of portable transceivers.

b. Methods:

Several methods should be considered to extend repeater coverage. The method selected should be based on the findings of the tests recommended above. Some of the methods which can be employed are:

(1) Receiver Voting System:

(a) A Receiver Voting System, wherein satellite receivers are installed at strategic locations throughout the Federal District and connected to the Command Center through telephone or radio circuits. (See Figure 5) This feature should provide increased portable/mobile talk-back range to the Command Center.

(b) A Receiver Voting System with an additional feature incorporated to actuate a selected transmitter at the location where the best signal was received. This feature should extend the range of two-way communications between the portable, mobile and the Command Center.

(2) High Stability Oscillators:

The use of high stability oscillators could allow repeaters to operate on the same frequency at more than one location without repeater interaction problems. Repeaters installed at all or several of the following sites: Alto Hatillo, El Tanque, Pipe, Los Caracas, Naiquata, Marina Grande and El Avila should extend

RECEIVER VOTING SYSTEM

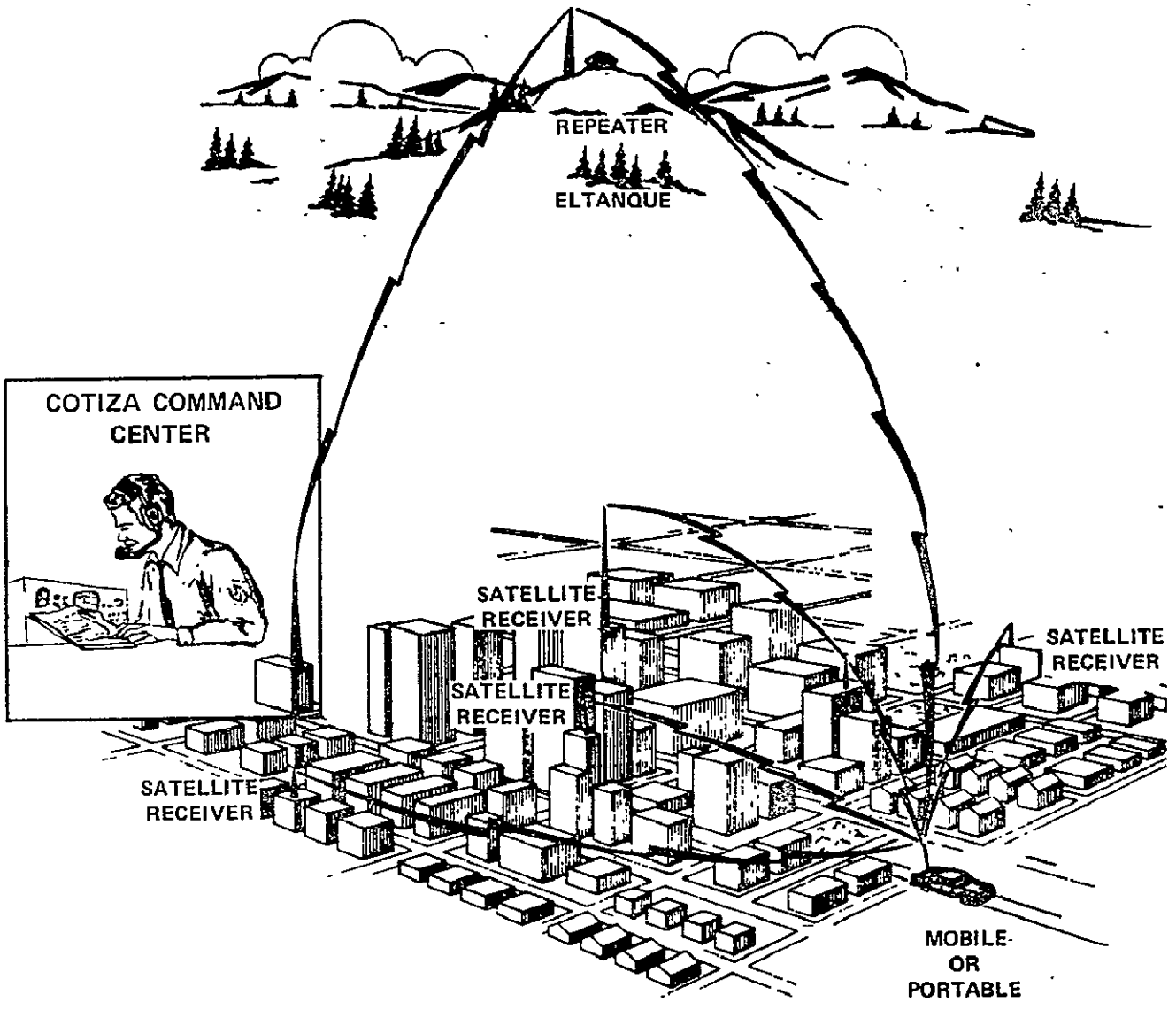


Figure 5

the range of two-way communications between portable, mobile and the Command Center. The installation of high stability oscillators in existing VHF repeater transmitters would be somewhat impractical as it would require major circuit changes. In addition, the cost of replacing the repeater transmitter with those containing high stability oscillators would be high.

c. Cost Estimate:

(1) The cost for a Receiver Voting System is approximately $1,700 for the comparator and $1,000 for each satellite receiver. Up to four satellite receivers can be accommodated by the comparator in this configuration. Total cost for comparator and four satellite receivers is approximately $5,700.

(2) An additional cost of approximately $1,300 is estimated to include in the system above a capability to actuate selected transmitters where the best signal was received. Total cost for a Receiver Voting System in this case would be approximately $7,000.

(3) High stability oscillators incorporated in solid state VHF transmitter exciters would cost approximately $1,700 each. These units, however, would require that power supplies and RF power amplifiers be compatible.

4. Tactical VHF Communications:

a. General:

The newer VHF personal portables should be retained and utilized for communications in support of tactical police operations.

Given the improved repeater coverage recommended above, the personal portable transceivers should also be utilized for foot patrol.

b. Technical Modification:

To assure full compatibility with the proposed tone squelch operated repeaters, personal portable transceivers should be modified to include a sub-audible tone oscillator. A tone squelch capability should also be included in the personal portable to improve reception in low signal areas. Modification of some 50 RCA units should be relatively simple and achieved through replacement plug-in modules. Modification for the 246 Motorola units would require a somewhat greater effort in that the cases and covers must be replaced as well as the installation of additonal modules. The necessary modification parts should be obtained from the manufacturer in kit form for installation in country.

c. Cost Estimate:

The cost to convert the RCA personal portable would be approximately $100 each, a total of $5,000 for 50 units. The cost to convert the Motorola personal portable would be approximately $200 each, a total of $49,200 for 246 units. The total cost to provide the newer VHF personal portables with a tone squelch and tone transmission capability would be approximately $54,200.

5. UHF System:

a. General:

The Metropolitan Police should procure sufficient UHF mobile and repeater stations to service one or two police zones. Zones should be selected in the built-up areas of

Caracas where the advantages of UHF equipment (greater penetration into buildings and through man-made objects) can best be employed. As previously stated, 310 Dumont VHF mobile transceivers require replacement. Given the procurement of a like number of UHF mobile transceivers and the introduction of new repeater concepts, area coverage could be extended substantially. Methods outlined in paragraph 3 above to obtain improved VHF repeater coverage are applicable to the proposed UHF system as well. A capability to extend radio coverage over the entire metropolitan area on one or two selected frequencies should be provided.

b. Technical Discussion:

(1) Tone Squelch:

To prevent the possible development of problems outlined in Part I, paragraph F, future procurement action relating to UHF two-way communications equipment should contain the following requirements:

That all UHF units purchased be provided with tone squelch and sub-audible tone oscillators.

(2) Mobile UHF Transceivers:

Mobile UHF transceivers should be solid state, trunk-mounted, have a minimum RF power output of 30 watts, 4 channel capability with simultaneous monitoring (scanning) of all 4 channels with priority override selection of any of the 4 channels. The cost of each transceiver would be approximately $1,600. Total cost for 310 units would be approximately $496,000.

(3) Portable/Mobile UHF Transceivers:

As discussed in Part II, paragraph I, the concept of utilizing the portable/mobile configuration presents several problems where the systems design is to include a digital signaling capability. Therefore, standard trunk-mounted UHF mobile transceivers are recommended in paragraph (2) above.

(4) Personal Portable UHF Transceivers:

Approximately 100 VHF portable transceivers are over 15 years old, in poor condition, and should be replaced. In purchasing new UHF portable transceivers the following should be included:

(a) A minimum RF power output of 4 watts should be specified to obtain maximum talk-back range.

(b) As described in paragraph (1) above, tone squelch and sub-audible tone oscillator should be incorporated.

(c) It is believed that 2 channel transceivers would satisfy present and future police operational requirements. Although 4 channel equipment is available and offers greater versatility for police operations, 2 channel equipment reduces the possibility of less disciplined police personnel transmitting or monitoring the wrong channel. In addition, the cost of each portable unit would be reduced by over $200. The cost of each 2 channel UHF portable transceiver would be approximately $1,100. The total cost for 100 units would be approximately $110,000.

(5) UHF Repeater/Base Station:

Future requirements will entail the use of UHF personal portable equipment.

Planning at this time must provide sufficient repeater coverage to satisfy this requirement. It is, therefore, recommended that UHF repeaters installed at El Tanque and/or El Avila possess a minimum RF power output of 250 watts. It is believed that a minimum RF power output of 60 watts should suffice for the other repeater site requirements. Facilities should be provided in the equipment to permit the Command Center, through its microwave system, to remotely select the mode of operation desired (repeater or base station). Given this capability, a time-out timer is not believed necessary. The cost of each 250 watt repeater in the desired configuration would be approximately $5,500. The cost of each 60 watt repeater would be approximately $3,500.

(6) UHF/VHF Repeater/Base Station:

Given Metropolitan Police action to retain and utilize VHF mobile and portable transceivers as recommended in paragraph (2)(a) and (4)(a) above, a cross-band repeater to assure capability between the UHF and VHF system should be purchased. This repeater should provide, through selected UHF and VHF channels, the capability for VHF portable or mobile units to establish two-way communications with UHF equipment users. The repeater installed at either El Tanque or El Avila should possess a minimum RF power output of 60 watts and be remotely controlled by the Command Center where it can be placed into operation as required. The cost of one cross-band repeater in the desired configuration would be approximately $7,000.

(7) Receiver Voting System:

Tests should be conducted to ascertain the extent of UHF mobile and portable talk-back capabilities within the built-up areas of Caracas. Satellite receivers could be installed to cover any problem areas discovered. The requirement to conduct an in-country UHF propagation test should be included in the procurement action. Sufficient funds should be provided in the event that a Receiver Voting System is required. Funds should also be allocated to cover the cost of leasing CANTV telephone lines connecting the satellite receivers to the Command Center. Cost for a UHF Receiver Voting System would be slightly higher than that given for VHF in paragraph (3)(c) above.

6. Digital Communications:

a. General:

(1) A basic digital communications capability for radio patrol cars is recommended. Digital terminals purchased should provide a capability to send both data and voice on a time-shared basis. Police officers should be able to send any one of 100 pre-established digital messages by merely pushing a button. More sophisticated digital terminals offering teletype keyboard and CRT displays for vehicles are not recommended, as these type of units are not believed compatible with Metropolitan Police radio patrol car personnel capabilities.

(2) The number of digital terminals procured would depend upon the funds available. Therefore, as a first priority, the proposed UHF mobile transceivers should be purchased with digital terminals. If sufficient funds are available, consideration should be given to purchasing digital terminals for the VHF mobile transceivers which are retained. These

digital terminals could be utilized at a later date on subsequent replacement UHF mobile transceivers.

b. Technical Discussion:

Some digital terminals currently available for mobile transceivers provide eight decimal digits for data messages. This includes mobile identification, status, and "10" code data. Digital terminals having this number of digits would not be compatible with all types of AVM systems. Since future requirements may include the implementation of an AVM system, it is recommended that digital terminals purchased have the capability of interrogating vehicles for location information. The vehicle digital terminal should report back its identification, status, and provide closure for external vehicle location information.

c. Cost Estimate:

The cost for a digital terminal having the capabilities outlined above and that discussed in Part II, paragraph E, would be approximately $900 each. Should 310 UHF transceivers be purchased, the digital terminal cost for these transceivers would be approximately $279,000.

7. Command Center:

a. Master Decoder Terminal:

(1) General:

Terminals should be employed at each dispatcher position to decode the data transmissions, display and provide a hard copy print-out of the information received. A method should be provided whereby the dispatcher, on depressing several buttons, can query a selected vehicle.

Information received from the vehicle queried should be displayed at the terminal in large illuminated numerical indicators and an acknowledgment sent to the vehicle. In addition, data messages and the exact time they are received should be available on a hard copy print-out. Terminals shall contain the capability to be directly connected to a computer and video terminal. This capability should be in concert with Electronic Industries Association (EIA) standards.

(2) Cost Estimate:

The cost of each Master Decoder Terminal is estimated at $8,000 each. Assuming that 10 dispatch consoles and one supervisory position would satisfy Metropolitan Police requirements, the total cost would be approximately $88,000.

b. Video Terminals:

(1) General:

The use of video terminals (CRT displays) in addition to the Master Decoder Terminal is recommended. The use of video terminals is believed to be compatible with modernization and expansion plans of Metropolitan Police Command Center facilities. In contrast to the single queried vehicle status display provided by the Master Decoder Terminal, the video terminal should display the status of more than 48 vehicles simultaneously. The video terminal should operate in the scrawl mode, allowing vehicle status changes to appear on the video terminal and the earlier status reports dropped off. Consideration should be given to purchasing video terminals having an integral keyboard. Utilization of

this type of terminals would provide the compatibility for future computer interface. This is especially the case where future utilization of an AVM system requiring a mini-computer is under consideration.

(2) Cost Estimate:

The cost of the video terminal, including keyboard, would be approximately $3,000 each. Eleven (11) video terminals would cost approximately $33,000.

c. Vehicle Status Display:

(1) Central Vehicle Status Display:

A large vehicle status display system, visible to all police personnel in the Command Center, should be considered. It should display vehicle status through the use of colored lamps and be visible for a minimum of 30 feet away. The large city-wide map currently installed in the Command Center could be retained and vehicle status display panels mounted on either side. The cost for the vehicle status lamp panels is estimated at approximately $18,000.

(2) Automatic Vehicle Status Display:

The type of dispatcher operations employed (see Part II, paragraph R) should be the determining factor in purchasing a high cost automatic vehicle status display system. The cost of an automatic status display system is estimated at approximately $150,000. This cost would include necessary interface electronics with the Master Decoder Terminals, a capability of monitoring eight radio channels simultaneously, and the automatic switching of 600 vehicle status lamp panels.

(3) Manual Vehicle Status Display:

A manual method of vehicle status display should also be considered. The use of IBM complaint cards (see Annex VII) to actuate the vehicle status lamp panels should also be considered. Inserting or removing an IBM card from the vehicle status slot panel at the dispatcher console would change the lamp panel color indicating vehicle status. The cost of each IBM status slot panel capable of handling 24 vehicles is approximately $500. This method, although usable with a central display, is more suited to zone type operation where one dispatcher is responsible for a selected number of vehicles. In zone type operation, vehicle status display can also be incorporated in the map. Assuming a capability to control 72 vehicles from each dispatch console, the cost would be approximately $6,500 for each dispatcher position. This cost includes a map with 72 vehicle status lights and would be correspondingly reduced if one map display was used for each two dispatch positions.

d. Telephone Systems:

(1) Emergency Reporting Telephone System:

It is recommended that representation be made at the highest levels of government to have CANTV Telephone Company change the emergency reporting telephone number 111 to a number where inadvertent calls (outlined in Part II, paragraph P) would be less likely to occur.

(2) Required Telephone Trunk Lines:

The CANTV Telephone Company should provide a minimum of 30 trunk lines for emergency telephone service direct from their central

office to allow for overflow conditions and load control during extreme emergencies such as natural disasters and civil disorders. A minimum of five direct trunk lines to the fire department, five direct trunk lines to the PTJ, three direct trunk lines to the ambulance control center, and two direct trunk lines to the Office of the Governor of the Federal District should be provided.

(3) Automatic Call Distribution:

The CANTV Telephone Company should provide, on lease, an Automatic Call Distribution (ACD) system to satisfy the operational needs of the Metropolitan Police. Calls received requesting fire or ambulance assistance on the emergency reporting telephone system should be routed through the ACD and dedicated telephone trunks to the agency providing the service requested. CANTV Telephone Company should also provide Director type telephone consoles at the ten dispatcher positions, four telephone override positions and the supervisory console. The Director telephone consoles should be a part of the ACD system and have call-waiting lamps, buzzers, and functional push button switches. The Director consoles should have a capability of terminating a minimum of 12 ACD and 24 administrative trunks. This will also allow sufficient capacity to handle administrative trunks. The ACD system should provide a feature where it immediately selects the first non-busy dispatcher position designated to answer incoming emergency telephone calls. If the dispatcher does not answer the call within 30 seconds, the supervisor should be automatically notified by call-waiting lamps which

indicate the position that has not responded to the telephone call. The ACD system should be arranged so that when all dispatcher positions are busy the telephone calls will select the first non-busy telephone operator override position. In the event that the ACD system cannot be provided by the CANTV Telephone Company, the equipment could be purchased from commercial sources. The cost of such a system is difficult to estimate since much of it would require custom design and installation.

(4) Telephone Exchange Boundaries:

Given an agreement with CANTV to provide dedicated emergency telephone (111) trunk lines (number of trunk lines would depend on the number of subscribers) to the Command Center from each of their telephone exchanges, the Metropolitan Police should then consider changing their zone of operations to be in concert with the CANTV telephone exchange boundaries. (Each telephone exchange services a particular area within the city of Caracas.) This action would allow the Command Center to adopt the method of zone dispatching. Each zone dispatcher position would only receive emergency telephone calls from a telephone exchange which handles the telephones in his particular zone. As an example: Should five telephone exchanges cover the city of Caracas, two dispatch positions could be assigned to each zone. The number of dispatch positions assigned to any one zone would depend on the total number of telephone exchanges used in the city of Caracas and the number of subscribers in a particular zone. Where numerous telephone subscribers are concentrated in one particular zone, additional dispatch positions could be assigned.

e. Control Consoles:

(1) General:

Sixteen Control Consoles are recommended for the Command Center. They should be arranged as shown in Figure 6. Each of the four telephone override consoles should be constructed to accommodate two telephone operators. This is required in the event of a disaster, major accident, or civil disturbance where flexibility in Command Center operations must take into consideration the possibility of excessive telephone calls from the public conflicting with the dispatchers duties of directing police personnel in the field.

(2) Technical Discussion:

(a) It is recommended that the ten dispatchers and one supervisory position have a minimum of the following basic furniture and accessories:

(i) Swivel chair with arms.

(ii) 60 inch pedestal desk

(iii) 60 inch turret with three 19 inch equipment mounting racks. Turret to have removable hinged rear door.

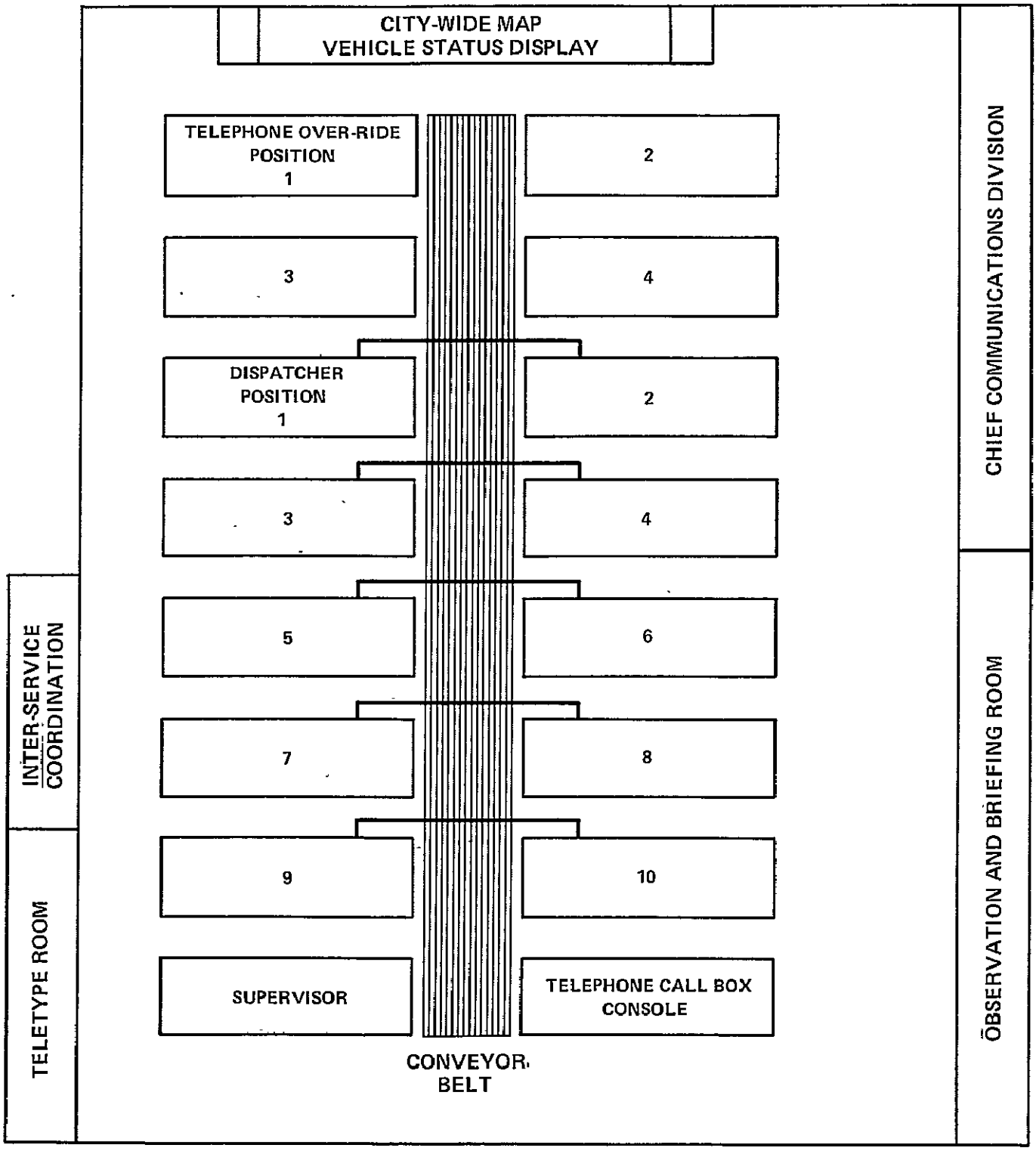
(iv) 21 inch extension cabinet to accept IBM status slot panels (see paragraph 7.c(3)).

(v) Time clock digital readout

(vi) IBM card storage rack

(vii) Female telephone jack to accept telephone type headset.

PROPOSED COMMAND CENTER LAY OUT



(b) Each of the ten dispatchers and one supervisory position should have the following technical features:

(i) VU Meter - to provide a relative indication of audio level transmitted or received on the control lines. VU Meter should be illuminated when a transmitter is activated.

(ii) Volume Control - two concentric control sections to adjust audio level received from selected station and the unselected stations monitored.

(iii) A provision for speakers is only to be provided on the supervisory console. All dispatch consoles shall have audio terminated at a telephone type headset jack.

(iv) Transmit Bar Switch and/or Foot Switch should permit push-to-talk operation of selected stations.

(v) Monitor Bar Switch should disable the tone coded squelch of a selected channel for monitoring purposes.

(vi) Channel Select Switches - one switch for each channel to be controlled. 20 such switches are recommended. Switch should be a momentary action, push-button type, with built-in indicator lamp. The face of the switch, when depressed, should illuminate indicating channel selection. Depressing another channel select switch should automatically cancel previous selection.

(vii) Simultaneous Channel Select Switch should disable reset function of channel selection switch above so that two or more channels can be selected.

(viii) Busy/Mute Switch should indicate when a call is received by an on and off flashing of the Busy lamp portion of the switch. Should another console be transmitting on this channel, the Busy portion of the switch should be illuminated steadily until such transmission is terminated. The dispatcher should be able to Mute the received audio of this channel lighting the Mute lamp portion of the switch. Twenty such switches are recommended.

(ix) Supervisory Control Switch - this switch should permit supervisory control over other consoles using the same control line. It should allow the supervisors console to disable the transmitter control circuit of dispatcher consoles.

(3) Cost Estimate:

The cost for each console containing the features described above would be approximately $5,200. Ten dispatcher and one supervisory console would cost approximately $57,200. The cost for each telephone override console would be approximately $1,200 each. A total cost for four telephone override consoles would be $4,800.

f. Document Conveyor System:

(1) A Document Conveyor System in the Command Center to pass documents between telephone operators, radio dispatchers, and the supervisor, is recommended. The conveyor system shown in Figure 6 is one of several configurations which may be employed.

(2) The Document Conveyor System should be designed to carry standard IBM type complaint cards (See Annex VII). It should have a minimum of 13 lanes with 12 of these lanes traveling the full distance from the Telephone Override Consoles to the Supervisor's Console. The 13th lane should travel in the opposite direction from the Supervisor's Console to the Telephone Override Consoles where documents could be forwarded to any console as desired. All consoles should be serviced by rubber stops which can be removed or inserted, when necessary, to satisfy changing police operational needs. The Supervisor's Console should have a drop box (receiving box) where completed IBM complaint cards should be examined for accuracy, filed or follow-up action initiated.

(3) The full length of the Document Conveyor System shown in Figure 6 would be approximately 50 feet. It should be constructed on stanchions (platform) to elevate the conveyor system so that it will be compatible in height with the consoles.

(4) The cost of a Document Conveyor System such as that described above would be approximately $5,000.

g. Tape Recorders:

(1) The Metropolitan Police should utilize multi-channel tape recorders to effect an electronic logging capability. Statistics regarding police activities should be extracted from these tapes on a periodical basis and provided senior Metropolitan Police officials.

(2) It is recommended that a 20 channel logging tape recorder system be purchased to monitor all incoming emergency telephone lines and each radio patrol car channel. System should include two identical 20 channel tape transport mechanisms, each with a 24-hour recording capability. System should be easily expandable to 40 channels when so desired. A method should be provided to record the time of day (digital) along with each message and a capability to reproduce and retrieve automatically at a high speed any message based on the time received. The cost of a 20 channel logging tape recorder system with the features described above is estimated at approximately $20,000.

h. Teletype Network:

(1) It is recommended that the Metropolitan Police utilize direct teletype circuits connecting their Command Center with each of their subordinate zone headquarters. The teletype machine at the Command Center should have a capability of sending individual or group messages and have a tape perforator capable of producing printed "Chadless" tapes in addition to standard page copy. Keyboard should be equipped for Spanish language characters. Units should be geared for a minimum of 100 words per minute operation.

(2) The teletype circuits and equipment should be leased from CANTV Telephone Company. In the event that CANTV cannot provide the teletypewriter machines, they should be purchased from commercial sources. The cost of each machine would be approximately $3,500.

(3) Teletypewriter machines should be installed where the noise of the machines cannot interfere with radio dispatcher operations. There is a room connected to the Command Center which should be utilized for this purpose. This room, currently used to respond to telephone calls from police officers, would not be required if recommendations regarding Command Center operations are followed.

8. Mobile Command Center:

It is recommended that a mobile trailer or van be converted to a mobile communications center. The vehicles should have provisions for a command center type of arrangement employing several dispatchers. Several VHF and UHF transceivers for operation on the emergency frequencies should be installed as well as a terminal to enter the police IMTS system. Consideration should be given to equipping this vehicle with a repeater to pick up the transmissions of mobile and portable units and retransmit them to Cotiza at higher power levels. This would be especially useful in the outskirts of the city. To ensure reliability in case the normal power supply should fail, a back-up power system should be incorporated. Since the mobile communications center may become a target during civil disorders, the vehicle should be reinforced accordingly. The cost to establish a mobile communications center will vary depending on the equipment installed and the size of the vehicle employed. It would cost between $15,000 and $50,000.

9. Priority Control System:

The Metropolitan Police should not employ a dial tone system to provide their senior police officials with the ability to selectively seize any one of the base/repeater stations through their vehicle transceivers. This method is not believed in concert with the proposed modernization plan especially should digital techniques be introduced. Should senior police officials desire a capability to override Command Center

transmissions to the patrol vehicles at any given time, the following method should be employed. Transmitters in the senior police officials vehicles could emit a sub-audible tone when the push-to-talk switch was depressed which would capture a standby repeater and relay signals on an emergency frequency. This emergency frequency should be the priority channel continually scanned by the new UHF receivers (see Part III, paragraph 5.b.(2).).

10. Police Call-Box Telephone System:

a. Immediate planning and coordination with the telephone company (CANTV) regarding installation, cable requirements, and call-box locations should be initiated. Planning should include requirements for a loop-type system with spare wire pairs to each location and the necessity to provide direct connection to the Command Center at Cotiza (not through the telephone exchanges). Call-box telephones should contain the features described in Part II, paragraph L. To avert possibility of personal calls being placed from the call-boxes, they should not be connected to the public telephone system.

b. Because of the number of call-boxes required to adequately cover the city of Caracas and the cost of such a program (approximately $800 for each call-box, it should be phased over a period of several years. Before a call-box system is procured, sufficient budget must be allocated for the recurring expense related to leasing of dedicated telephone lines from CANTV Telephone Company.

11. UHF/Microwave System:

a. UHF Multi-Channel Equipment:

(1) The existing 900 MHz UHF and multiplex equipment which links the headquarters at Cotiza with the transmitting and receiving facilities at El Tanque should be replaced. This equipment, though

operational, does not provide the capacity needed to implement the recommended change. This equipment, though old and possibly less reliable, can contribute many more years of service and should be employed in an administrative circuit where possible outages would not disrupt police operations. It is, therefore, recommended that this equipment be used to satisfy the administrative communications requirements between Cotiza and Zone I Headquarters at La Guaira.

(2) Should direct point-to-point communications between the repeater site at El Tanque (or other site selected as a result of test recommended in paragraph 3.a) and La Guaira not be possible, it may be necessary to establish a 900 MHz back-to-back repeater terminal at Marina Grande. The cost of such a terminal would be approximately $12,000.

(3) Several channels in the multiplex equipment should be terminated at the administrative PABX in Cotiza to provide the police at Cotiza and La Guaira a direct dialing capability through their own internal telephone system. Other available multiplex channels should be considered for terminating satellite receivers, facsimile and teletype.

b. <u>UHF/Microwave Circuit:</u>

(1) The selection of 900 MHz or 2000 MHz equipment to provide the link between Cotiza and the main repeater site at El Tanque would be dependent upon the availability of frequencies in these bands. The Metropolitan Police should proceed to immediately request frequencies in these bands so that the expansion and modernization plans can can be finalized.

(2) It is believed that units should be equipped with 36 channels to control the VHF and UHF base/repeater stations, the IMTS system, satellite receivers, and the administrative internal telephone system as well as provide a sufficient back-up capability. It is recommended that the multiplex equipment purchased be solid-state, include an economical modulation plan and provide the capability whereby the system could be easily expanded to 60 channels at a later date. Multiplex system should include in-band signaling and four wire terminating capability. In addition, several tone channels superimposed on one voice channel should be provided for teletypewriter operations. To reduce cost, multiplex terminals should be purchased on a non-Consultative Committee for International Telephone and Telegraph (CCITT) modulation plan. The cost of each multiplex terminal is estimated at approximately $25,000.

(3) The cost of each UHF wideband terminal to provide the link between Cotiza and El Tanque is estimated at approximately $15,000 each. This cost is based on 900 MHz equipment with a minimum RF power output of 5 watts and 2000 MHz equipment with a minimum RF power output of 2 watts. The cost includes a standby transmitter and receiver, automatic transfer panel to switch units in the event of failure, antenna and transmission line.

(4) The total cost for a UHF/microwave link would be $80,000.

12. Physical Security:

a. Communications Personnel:

There are a number of steps which should be taken by the Metropolitan Police to improve the physical security of communications personnel.

(1) All communications personnel should be screened to eliminate the possibility of sabotage from within the department. This would especially apply to contract maintenance type personnel.

(2) Access to the Command Center and remote repeater sites should be restricted so that only persons with proper authorization can enter these facilities. Should public viewing of the proposed Command Center operations be permitted, some method of detecting weapons should be employed.

b. Equipment:

(1) Telephone and power cables should not be easily accessible. Greater protection from damage by storms or sabotage should be effected by buried cables rather than those located above ground. Telephone and power lines to repeater sites should run underneath rather than above ground.

(2) The structure, which includes the antenna, supporting mast, tower, and/or guy wires, should be strong enough to withstand high velocity winds. Access to the antenna systems should be restricted with fences, locked doors or gates to prevent possible sabotage. Another factor to be considered is lightning. The antenna support structure should be grounded by means of a number four or larger diameter wire connected to a grounding stake by the shortest possible path. The wire should be insulated from the roof by standoff supports.

13. PHASE I - COST ESTIMATE

	Cost	
Repeater and Mobile Transceiver Modification	$ 36,000	
VHF Portable Modification	54,200	
VHF Receiver Voting System	7,000	
Total Cost for Existing VHF System Improvement		$ 97,200
310 UHF Mobile Transceivers	496,000	
100 Portable UHF Transceivers	110,000	
20 UHF Repeater/Base Stations	86,000	
1 Cross Band Repeater	7,000	
UHF Receiver Voting System	7,000	
Total Cost for UHF System		706,000
310 Digital Terminals	279,000	
11 Master Decoder Terminals	88,000	
11 Video Terminals	33,000	
1 Automatic Vehicle Status Display	150,000	
* Alternative ten individual manual status display ($65,000)		
Total Cost for Digital System with Automatic Vehicle Status Display		550,000
Total Cost for Tape Recorders		20,000
Total Cost for Mobile Command Center		50,000
Total Cost for UHF Multi-Channel Equipment		80,000
Total Cost for Control Consoles		70,000
Total Cost for Document Conveyor System		5,000
Total Cost for 200 Police Call-Box Telephones and Consoles		175,000
Phase I Equipment Cost Estimate		$1,753,200
Initial Installation 10%		175,320
1 year Maintenance 10%		175,320
2 year U. S. Technical Assistance		80,000
Phase I - Total Cost Estimate		$2,183,840

C. Phase II - Recommendations:

1. Improved Mobile Telephone System (IMTS):

a. IMTS Terminal:

It is recommended that IMTS terminal service be obtained through CANTV Telephone Company to provide telephone communications support to high level government officials. Should this be possible, vehicle and/or portable terminals could be purchased by the Metropolitan Police from commercial sources. In the event that CANTV cannot provide the IMTS service, then the Metropolitan Police should purchase an IMTS control terminal, UHF base station, several satellite receivers and appropriate number of IMTS vehicle/portable units. The IMTS terminal should provide full duplex operation, a two-channel capability, and a capacity to service as many as 60 subscribers. The IMTS terminal shall provide full ring-down, unattended dial telephone operation between public telephones and vehicle/portable telephone units or from one vehicle/portable telephone unit to another. The telephone exchange control group should be located at the Metropolitan Police Headquarters in Cotiza and connected to the IMTS base station at El Tanque. Satellite receivers at other locations such as Alto Hatillo, Pipe, and El Avila should be considered to expand the vehicle/portable coverage.

b. IMTS Portable Transceiver:

Portable transceivers with an IMTS direct dial telephone capability contained in an attache case are recommended to satisfy VIP requirements. This recommendation is based on the requirement to provide VIP's with a 24-hour-a-day coverage in their vehicle, office or private residence. Additional channels which are available with this portable transceiver should be placed on an emergency frequency (not that employed for police operations). This would permit standard two-way portable communications with the Command Center when required.

c. Cost Estimate:

The cost for a two-channel IMTS Control Terminal capable of handling as many as 60 subscribers would be approximately $18,500. The IMTS UHF base station to operate two channels simultaneously would cost approximately $12,000. Total cost for the IMTS terminal station would be approximately $30,000. The cost for each IMTS UHF portable transceiver would be approximately $2,700. Assuming 15 subscribers at this time, the cost would be approximately $40,500.

2. Computer Operation:

a. A mini-computer should be employed in connection with equipment and systems recommended for Phase I. It should be utilized as a storage and retrieval device. It should serve as an exchange center between video terminals at the Command Center. Through proper programming, it could periodically query each vehicle, store and display on the video terminals and vehicle status display board the status of each patrol car. When used in conjunction with an AVM system, it should also display on the video terminals the location of each patrol vehicle.

b. Given the installation of a mini-computer, four additional video terminals should be installed at the telephone override consoles where information received from the public can be immediately transferred to the computer and would appear at the appropriate dispatch console positions.

c. With the future computerization of PTJ files on stolen vehicles, wanted persons, etc., the mini-computer could be interfaced with the PTJ computer to retrieve this type of information. In the interim, daily stolen vehicles and wanted persons reports currently sent by teletype to the Command Center by PTJ could be stored in the mini-computer (data file) and retrieved in seconds by the dispatcher when required.

d. The cost for a mini-computer with sufficient capacity to handle the above data storage and retrieval information would be approximately $40,000. A mini-computer having the above capabilities was included in the cost estimate for an AVM system.

e. Video Terminals:

In concert with the purchase of a mini-computer, video terminals should be installed at each telephone override console. The cost of four such video terminals would be $12,000.

3. UHF System:

a. Base Station:

Converting the remainder of the VHF base station equipment should be undertaken in Phase II on a selective basis. Many of the existing VHF base stations were originally procured to satisfy a requirement for a unified command which is no longer applicable. The exact number of base station replacements will, therefore, depend, to a great extent, on present and future police operational needs. For budgetary purposes, 50 UHF base stations (which includes standby units) were selected as the number which would satisfy present and future requirements. The cost of each UHF base station having a minimum RF power output of 90 watts is estimated at $2,700. This cost should include a capability for the equipment to operate on any one of four channels, tone squelch, antenna array and transmission line. Total cost for 50 UHF base stations is estimated at $135,000.

b. Mobile Transceivers:

The replacement of the remaining VHF mobile transceivers should be undertaken in Phase II on a selective basis. Phase I

included a provision for the purchase of 310 UHF mobile transceivers, leaving 418 VHF mobile transceivers which would require replacement. The cost of UHF mobile transceivers, in accordance with specifications contained in Phase I Recommendations, paragraph B.5.b(2), would be approximately $1,600 each. The total cost to replace the remaining VHF mobile transceivers would be $668,000.

c. Portable Transceivers:

The replacement of some 296 VHF portable transceivers should be performed in Phase II on a selected basis. The cost for each UHF portable transceiver described in Phase I Recommendations, Paragraph B.5.b.(4), would be approximately $1,100. The total cost to replace the remaining VHF portable transceivers would be approximately $325,000.

4. Digital Communications:

With the procurement in Phase II of 418 UHF mobile transceivers, compatible digital terminals for vehicle installation should be purchased. These units, described in Phase I Recommendations, Paragraph B.6 and Part II, Paragraph E, would cost approximately $900 each. The total cost for the required number of digital terminals would be approximately $376,200.

5. Automatic Vehicle Monitoring System (AVM):

a. The Metropolitan Police should consider the employment of an Automatic Vehicle Monitoring System (AVM) at such time as the basic requirements outlined in Phase I Recommendations are satisfied. It can be seen from the discussion in Part II, Paragraph O that there are many approaches to an AVM system with each method having advantages and disadvantages. Consequently, manufacturers claims regarding

their particular AVM package to satisfy Metropolitan Police requirements should not be considered as the ultimate. The most appropriate system for the metropolitan area of Caracas must be determined by actual testing and demonstration.

b. Some manufacturers claim that a more sophisticated method of trilateration with pulse transmission would also provide a capability to send digital data from the car thus cancelling the requirements for digital communications outlined in Phase I Recommendations, Paragraph 6 and 7. Under these conditions, approximately $400,000 could be subtracted from systems cost in Phase I. However, the requirements in trilateration pulse transmission necessitate that an additional transmitter be installed in each vehicle possibly increasing the cost of the overall AVM system by an equivalent amount.

c. Care should be taken that an AVM system with higher location accuracy than that necessary to meet police operational needs is not specified, since system costs rise rapidly with accuracy. The cost to implement one of the numerous types of AVM systems would be difficult to estimate since each system must be designed particularly for the area in which it is to be used. An in-country systems survey should form the basis for any AVM procurement.

d. To assist the Metropolitan Police in arriving at a budgetary figure, the following assumptions were made:

(1) A fleet of 1,000 vehicles with approximately 600 in service at any time.

(2) A coverage of 167 square miles (Libertador Department) with a location accuracy of approximately 500 feet.

Under these assumptions, the total cost for an AVM system is estimated at approximately 1.7 million dollars. This cost

would not include the normal police mobile transceivers used for voice communications. It would include systems engineering, installation, a mini-computer with additional storage capabilities, and interface with video terminals for display purposes at the Command Center.

6. Facsimile:

a. Requirements:

(1) As stated in Part II, paragraph G, facsimile systems should be implemented in Phase II. The present time consuming method of sending photographic and/or graphic material by mail or courier to and from the distant Metropolitan Police sub-headquarters at La Guaira should be changed through the implementation of a facsimile capability. Wanted persons circulars and photographs should be sent to the Command Center by the PTJ for Metropolitan Police information and/or action.

(2) Requirements to transmit fingerprints through a facsimile system should be carefully evaluated since this type of material requires a higher density in lines per inch transmitted than that required for the transmission of normal photographic, written or typewritten material. The existing means of transmitting fingerprints by mail and courier combined with a facsimile system to transmit other photographic or graphic material requiring less detail should be considered.

(3) Simultaneous transmission and reception of photographic and graphic material at each of the above locations should be evaluated. The requirements of having duplex operation, individual transmitters and receivers opposed to a simplex operation; single transceiver should be evaluated.

b. Resolution:

(1) Facsimile equipment purchased by the Metropolitan Police should have capabilities which are in concert with their present and future operational needs and the type of material which will be transmitted. To assure that equipment and transmission link costs are not excessive, equipment capabilities should not exceed that required to obtain faithful reproduction.

(2) The detail necessary in the transmitted copy will determine the density in lines per inch needed. Should the police decide they require a capability to send fingerprints through facsimile then they should be aware that this would require facsimile equipment with density of approximately 200 lines per inch. This would entail a longer transmission time and require a higher grade transmission link than other facsimile systems using lower quality resolution.

(3) Low cost facsimile equipment should be considered for the link between Cotiza and La Guaira. This type equipment has a resolution of approximately 90 lines per inch and is believed satisfactory for the transmission and reproduction of normal graphic and photographic material. The transmission link in this case could utilize the existing 900 MHz equipment as proposed in Figure 7.

c. Cost Estimate:

(1) For the Cotiza/PTJ circuit over leased telephone lines, facsimile equipment having an electrolytic type print out, separate transmitter and recorder for duplex operation (simultaneous reception and transmission) a capability to reproduce fingerprints as well as other

PROPOSED UHF WIDE BAND MULTIPLEX RADIO CIRCUIT

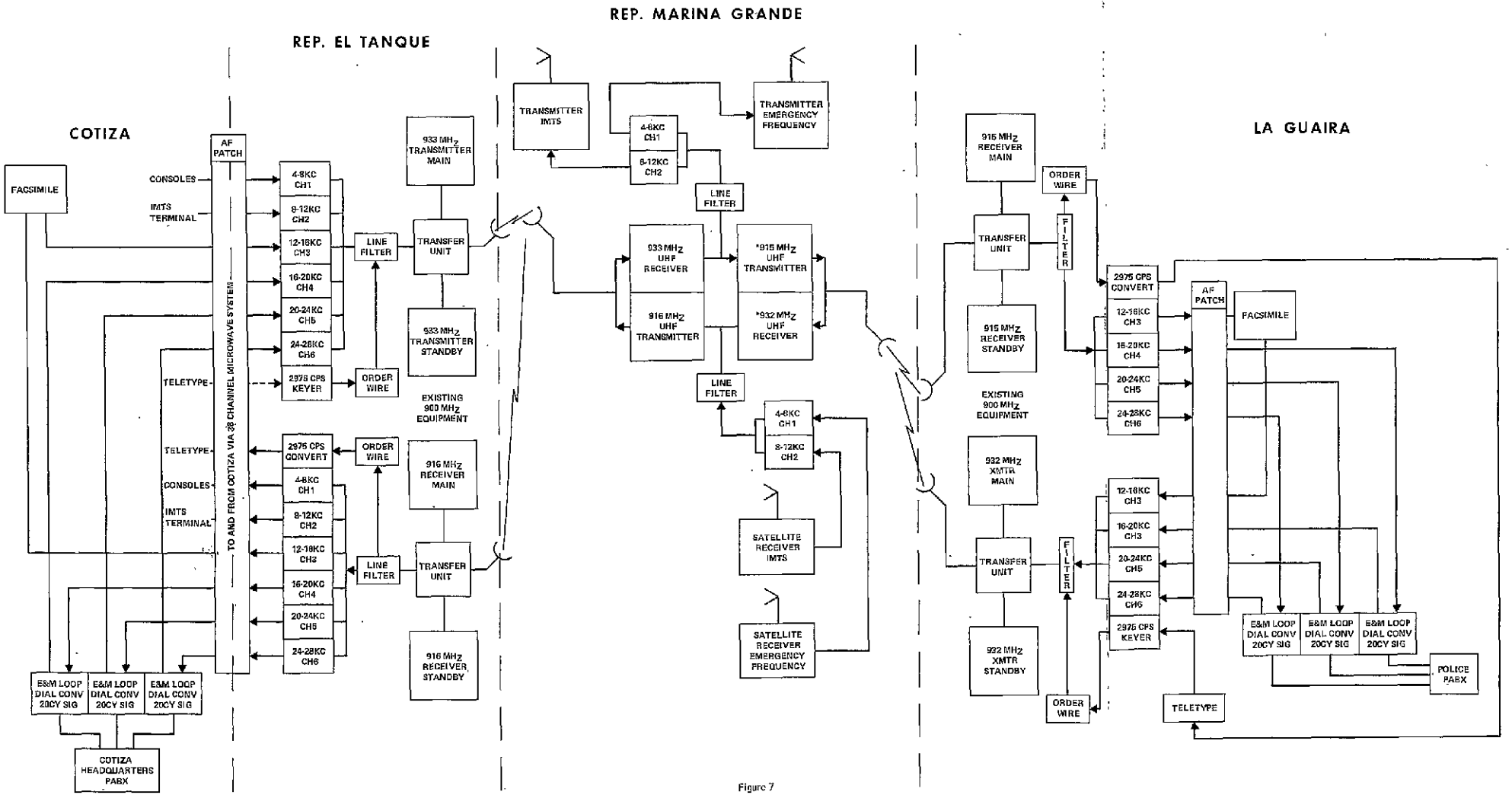


Figure 7
Page 80

photographic and graphic material would cost approximately $14,000 each. Two transmitters and two receivers would be required for this system resulting in a total cost of approximately $28,000.

(2) For the La Guaira circuit, less sophisticated facsimile units which operate in a simplex mode should be considered. They should possess a capability to reproduce normal photographic and graphic material. These units would cost approximately $2,000 each. The system would require two such units for a total cost of approximately $4,000.

7. PHASE II COST ESTIMATE

1 IMTS Terminal	$30,000	
15 IMTS Portable Units	42,000	
Total Cost IMTS System		$ 72,000
50 UHF Base Stations	135,000	
418 UHF Mobile Transceivers	668,000	
296 UHF Portable Transceivers	325,000	
Total Cost UHF System		1,128,000
* 1 Mini-computer	40,000	
4 Video Terminals	12,000	
Total Cost Computer Operation		52,000
Digital Terminals		376,000
Automatic Vehicle Monitoring System		1,700,000
* Mini-computer is included in AVM system		
Facsimile		32,000
Phase II Equipment Cost Estimate		$3,360,000
Initial Installation 10%		336,000
One year Maintenance 10%		336,000
Phase II Total Cost Estimate		$4,032,000

ANNEX I

BASIC REQUIREMENTS FOR THE COMMUNICATIONS SYSTEM OF THE CARACAS METROPOLITAN POLICE

1. Multiple-channel microwave system with capacity for 24 channels and the possibility of expanding to 36.

2. The radio communications system should have independent channels for the following:

   2.1 A channel for each one of the police zones for the control and direction of the patrol services. For the time being, it is considered that there will be seven (7) zones of which five (5) are located in the Libertador Department (433.5 Kms^2 and 1,115,844 population); one (1) in the Vargas Department (1,496.5 Kms^2 and 141,671 population); and one (1) in the Sucre District (488 Kms^2 and 243,630 population). The following are presently in operation:

   Zone 1 in the Vargas Department;
   Zones 2, 5 and 6 of Libertador Department; and
   Zone 7 in Sucre District.

   This means that we need to activate five (5) channels to cover patrol services.

   2.2 A channel for the Special Brigade (Riot Control Division).

   2.3 A channel for the Traffic Detachment.

   2.4 A channel for the parish network of Libertador Department for liaison between the Prefect's Office, the Wards, Jails, and Police Headquarters.

   2.5 A channel for the parish network of the Vargas Department for liaison between the Prefect's Office, the Wards, Jails, and the Police Headquarters.

2.6 A channel for the Municipal network of Sucre District for liaison between the Prefect's Office, Mayor's Office, Jails, Zone 7 Headquarters, Metropolitan Police Headquarters, and the Miranda State Governor's Office.

2.7 An emergency channel.

2.8 A direct dial channel for telephone communications with police authorities that will have the capacity for the following users:

- Governor of the Federal District.
- Governor of Miranda State.
- Prefect of Libertador Department.
- Prefect of Vargas Department.
- Prefect of Sucre District.
- Commander of the Metropolitan Police
- Chief of the Operations Division.
- Director of the Technical Judicial Police.
- Director of the Directorate of the Intelligence and Prevention Services.
- Chief of the Land Traffic Corps (or National Traffic Police).
- Director of the Armed Forces Information Service.
- Minister of Interior Relations.
- Three (3) other users, who will be determined later.

3. All the networks or radio circuits that are established should control mobile and portable base stations on the same frequency

4. There will be two (2) networks control stations, distributed in the following manner:

4.1 At the Metropolitan Police Headquarters, a network Control Station will operate for the following networks or channels:

- Patrol channel for the zones of the Libertador Department and Sucre District of Miranda State, the latter with connection to the Governor's Office of Miranda State in Los Teques.

- Special Brigade channel.

- Traffic Detachment channel.

- Parish channel for the Libertador Department.

- Municipal channel for the Sucre District.

- Emergency channel.

4.2 In the Zone 1 Headquarters on the coast, the network control station will operate the following networks or channels:

- Patrol channel for Zone 1 with connection to the Metropolitan Police Headquarters.

- Parish channel for the Vargas Department with connection to the Metropolitan Police Headquarters.

5. The system should assure a method of transmitting graphs and/or written matter by radio using the same frequencies and circuits to connect with this transmission, the base stations of the Zones and Detachments, with the possibility of extending it to the Jails managed by the Metropolitan Police.

6. The system should have more than one repeater so that it covers all the territorial area of the Metropolitan Police without dead areas.

7. The principal transmitters and the repeater stations which are installed should have standby equipment with an automatic change over capability which will permit uninterrupted operations in case of failure.

8. In the repeater stations, beside the necessary equipment for the zones which they serve, there should be installed channels for the Special Brigade, the Traffic Detachment, and the emergency channel with future possibility of duplicating all patrol channels.

9. It is our desire that the mobile equipment for patrol vehicles will be comprised of four channels which will operate in patrol cars as well as on AC current and rechargeable batteries.

10. The portable equipment should have four (4) channels with rechargeable batteries with the capacity of no less than 24 hours and with the possibility of being recharged in half that time.

11. The system should incorporate the most modern communications equipment for the base mobile radio and have the following additional characteristics:

11.1 Voice communication and prearranged electronic codes of the digital or similar system.

11.2 System identifying units transmitting which allows the Master Control to recognize them.

11.3 Capacity to transmit in writing all communications established between the central and mobile units and bases (teleprinter).

11.4 Capacity to operate by remote control certain components of the patrol vehicles such as emergency lights and/or the siren when the operator is out of his unit.

11.5 Capacity that allows the occupants to use portable radios on the same frequency as the radio of the patrol unit and puts them in contact with the central control.

12. The system should be designed to permit three-way communications; Central to Unit; Unit to Central; and Unit to Unit. However, additional equipment

should be installed that will permit use of only two-way communications, Central to Unit and vice versa. This equipment should be operated from Central Control, independent of each channel or network, and with the facility to be disconnected as desired.

13. If possible, the proposed system should utilize all the parts and components of the old system.

14. It should incorporate a simulated system of communications with closed circuits that can be used in the training of police personnel.

15. The system should include the necessary equipment to tape simultaneously voice communications in all the patrol channels, emergency channels, traffic detachment channel, and the Special Brigade channel, at each one of the stations of Network Control.

16. Design an internal telecommunications system independent of the public telephone system.

Design a telephone complaint receiving system which is more reliable than the present emergency system.

The Master Control operator must be able to monitor and operate all networks simultaneously, if so desired. He must also be able to operate the tape recording system and supervise the complaint receiving operations; and be able to effect a telephone patch.

Design 12 independent semi-enclosed, semi-soundproof cabins for the dispatchers operating the different nets or channels. Each cabin should have an enlarged electric map of the district or area of responsibility for each respective dispatcher.

There should be built within the system a means of transporting complaint cards from the complaint desk to the different dispatcher cabins in order to eliminate the present messenger-type service.

The system should be designed so that either the chief or deputy chief may monitor any and all radio communications in their respective offices.

Expand the present call-box telephone system and provide it with two-way communications and some type of audible or visual alarm system to alert the foot patrolmen that they must call headquarters for an assignment.

ANNEX II

TRAFFIC COUNT

AT COTIZA

A. Average of radio calls per channel during 24-hour period on weekday:

Channel	Number of Calls
No 1	1,200
No 2	1,400
No 3	600
No 4	900
No 5	1,200
No 7	700
Traffic Police	300
PTJ	400
DISIP	150
Total Radio Calls	6,850
Total Telephone (111) Calls	5,000

B. Average of radio calls per channel during 24-hour period on weekend:

Channel	Number of Calls
No 1	1,600
No 2	2,800
No 3	800
No 4	1,200
No 5	1,800
No 7	1,200
Traffic Police	500
PTJ	500
DISIP	200
Total Radio Calls	10,600
Total Telephone (111) Calls	7,200

C. Average of radio calls per channel during 24-hour period on weekday with major incidents such as disturbance, parade, strike, etc.

Channel	Number of Calls
No 1	2,800
No 2	2,200
No 3	800
No 4	1,600
No 5	2,000
No 7	1,400
Traffic Police	400
PTJ	500
DISIP	600
Total Radio Calls	12,300
Total Telephone (111) Calls	6,500

ANNEX III

Reported dead spots in the Federal District where radio patrol cars and hand-held units are not copied at the Command Control Center.

1. Kennedy urban section (subdivision)
2. Village El Junquito
3. Las Adjuntas Ward
4. Macarao Urban Section and Ward
5. Old highway of Los Teques - Rio Crystal heights
6. Ward Mamera
7. Urban Section Ruiz Pineda
8. Urban Section Caricuao
9. La Guaira Old Highway at the Pedro Garcia heights
10. Highway El Junquito betweel El Junco and Cafetal Ward
11. Lower section of the town of Antimano
12. Kilometer 2 on the El Junquito Highway
13. Area of the Ward Isaias Medina Angarita
14. Lower Section of Ward Gramoven
15. Ward Carapita
16. La Yaguara Section
17. Urban area Pedro Elias Gutierrez (Casalta)
18. Ward Plan of Manzano
19. Ward Gramoven
20. La Guaira Old Highway between kilometers 4 and 5
21. End of Italia Street in Alta Vista
22. Espana Avenue between Panamerican and 2nd Avenue, Catia
23. Colombia Street between Panamerican and 2nd Avenue, Catia
24. Ward Montalban
25. Central of La Vega Ward
26. Los Cangilones Ward, La Vega
27. Los Paraparos Ward, La Vega
28. Country House Aereas, El Paraiso
29. Corner of Los Higuitos Street and Zaraza, Los Flores, Catia
30. Sucre Avenue, corner of El Yunque Street, Catia
31. Sucre Avenue, corner Los Robles elevation, Catia
32. Fields of La Cota # 905
33. Brisas del Paraiso Ward

34. Area of the urban section
    El Paraiso
35. Section La Mariposa, El Valle
36. El Helcoide Ward
37. Center of the Police Building,
    Gran Colombia, Los Rosales
38. Fields of La Bandera,
    New Granada Avenue
39. Valle Abajo Urban Section
40. Los Canguaramos Urban Section
41. Cumbres de Curumo Urban Section
42. El Sebucan Urban Section,
    Sucre Avenue
43. San Blas Ward (La Casona Section)
44. Los Ruices Hills
45. El Cafetal Urban Section
46. El Hatillo Section
47. Cuatrocentenario Ward, Petare
48. El Carmen Ward, Petare
49. Miranda Urban Section, Petare
50. Hills of Turumo Urban Section
51. Kilometer 17 (Caucaguita)
    Highway of Guarenas
52. Kilometer 10, Highway
    of Santa Lucia

ANNEX IV

INVENTORY OF METROPOLITAN POLICE

COMMUNICATIONS EQUIPMENT

Manufacturer	Model	Type	Quantity	Approximate Year
Dumont	MCA-301-G	Base	14	1962
Dumont	MCA-375-B	Base	60	1962
Dumont	MCA-361-E	Base	6	1962
Dumont	MCA-356-C	Base	5	1962
Dumont	MCA-460-E	Base	1	1962
Dumont	MCA-161-E	Base	2	1962
Dumont	MCA-354-E	Base(Repeaters)	40 *	1962
RCA	CSK7LJH	Base	14	1967
Budelman (Cardion)	930 MHz	Terminal	12 **	(See Figure 3)
		TOTAL FIXED STATION	154 ***	
Dumont	MCA-301-G	Mobile	24	1962
Dumont	MCA-326-B	Mobile	166	1962
Dumont	T-301-RTAH	Mobile	120	1962
GE	MT76TF555	Mobile	200	1965
Motorola	U73MHT1170A	Mobile	18	1968
RCA	CMCF7MNK	Mobile	200	1969
		TOTAL MOBILES	728	
Dumont	Fairchild	Portable	50	1963
Dumont	8TN2H22	Portable	50	1963
Motorola	H23DEH1130AW	Portable	246	1970
RCA	CPCJ1PNH	Portable	50	1969
		TOTAL PORTABLES	396	

* Includes 18 standby units
** Includes 6 standby units
*** Includes 24 standby units

ANNEX V

METROPOLITAN POLICE COMMUNICATIONS SYSTEM

Current Channel Allocation

Channel 1	Traffic Police, Special Brigade Detachments 71 and 75
Channel 2	Headquarters of Zone 2 Detachments 21, 23 and 37
Channel 3	Headquarters of Zone 6 Detachment 62
Channel 4	Detachments 42 and 54
Channel 5	Headquarters of Zone 7 Detachments 71 and 75
Channel 6	Detachments 25, 59 and 46
Channel 7	Detachment 51
Channel 8	Detachments 21, 23 and 37
Channel 9	Parish
Channel 10	Vehicles other than patrol
Channel 11	Mobile Radio Telephone for VIP
Channel 12	Connects Marina Grande Repeater with Cotiza via El Tanque
Channel 13	Patrol and Parish Channel for the Vargas Department (Zone 1)
Channel 14	Priority Control for Chief and Deputy Chief police vehicles

VHF FREQUENCY ALLOCATIONS

148.64	155.96
148.67	156.03
148.73	156.06
148.79	156.12
148.82	156.20
148.91	156.26
149.03	156.40
149.12	156.56
149.54	156.68
149.78	156.86
149.84	156.96
150.02	157.16
150.26	171.50
155.72	171.80
155.84	171.98

UHF FREQUENCY ALLOCATIONS

916	933
918	934
920	937

ANNEX VI

"10 CODE"

10-1	Unable to copy - change location
10-2	Signals good
10-3	Stop transmitting
10-4	Acknowledgment
10-5	Relay
10-6	Busy - Stand by unless urgent
10-7	Out of service (give location and/or telephone number)
10-8	In service
10-9	Repeat
10-10	Fight in progress
10-11	Dog case
10-12	Stand by (stop)
10-13	Weather and road report
10-14	Report of prowler
10-15	Civil Disturbance
10-16	Domestic trouble
10-17	Meet complainant
10-18	Complete assignment quickly
10-19	Return to
10-20	Location
10-21	Call by telephone
10-22	Disregard
10-23	Arrived at scene
10-24	Assignment completed
10-25	Report in person to (meet)
10-26	Detaining subject, expedite
10-27	Drivers license information
10-28	Vehicle registration information
10-29	Check records for wanted
10-30	Illegal use of radio
10-31	Crime progress
10-32	Man with gun
10-33	EMERGENCY
10-34	Riot
10-35	Major crime alert
10-36	Correct time
10-37	Investigate suspicious vehicle
10-38	Stopping suspicious vehicle (Give station complete description before stopping)

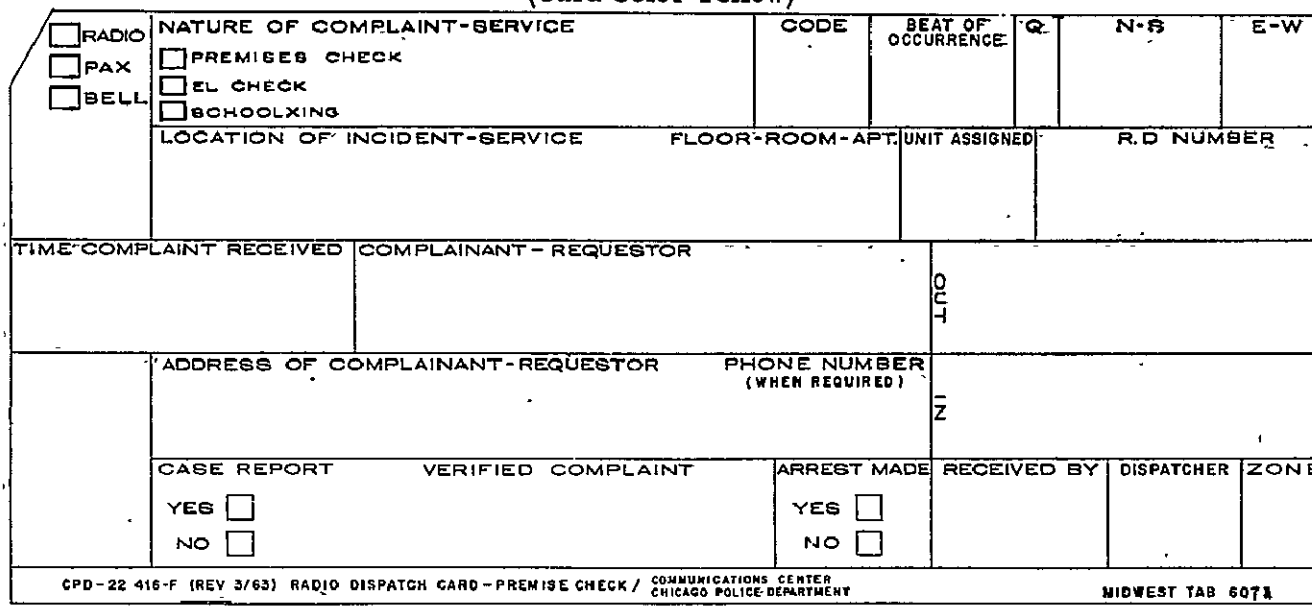
10-39 Urgent - Use light and siren
10-40 Silent run - No light or siren
10-41 Beginning tour of duty
10-42 Ending tour of duty
10-43 Information
10-44 Request permission to leave patrol for
10-45 Animal carcass in lane at
10-46 Assist motorist
10-47 Emergency road repairs needed
10-48 Traffic standard needs repairs
10-49 Traffic light out
10-50 Accident - F,PI,PD
10-51 Wrecker needed
10-52 Ambulance needed
10-53 Road blocked
10-54 Livestock highway
10-55 Intoxicated driver
10-56 Intoxicated pedestrian
10-57 Hit and run - F,PI,PD
10-58 Direct traffic
10-59 Convoy or escort
10-60 Squad in vicinity
10-61 Personnel in area
10-62 Reply to message
10-63 Prepare to make written copy
10-64 Message for local delivery
10-65 Net message assignment
10-66 Message cancellation
10-67 Clear to read net message
10-68 Dispatch information
10-69 Message received
10-70 Fire alarm
10-71 Advise nature of fire (size, type, and content of building)
10-72 Report progress of fire
10-73 Smoke report
10-74 Negative
10-75 In contact with
10-76 En route
10-77 ETA (Estimated Time of Arrival)
10-78 Need Assistance
10-79 Notify Coroner
10-80 Kidnapping
10-81 Stolen vehicle
10-82 Reserve Lodging
10-83 Found vehicle

10-84	If meeting advise ETA
10-85	Will be late
10-86	Missing person
10-87	Pick up checks for distribution
10-88	Advise present telephone number of
10-89	Found person
10-90	Bank alarm
10-91	Unnecessary use of radio
10-92	Wanted person
10-93	Blockade
10-94	Drag racing
10-95	Stolen cattles
10-96	Mental subject
10-97	
10-98	Prison or jail break
10-99	Records indicated wanted or stolen

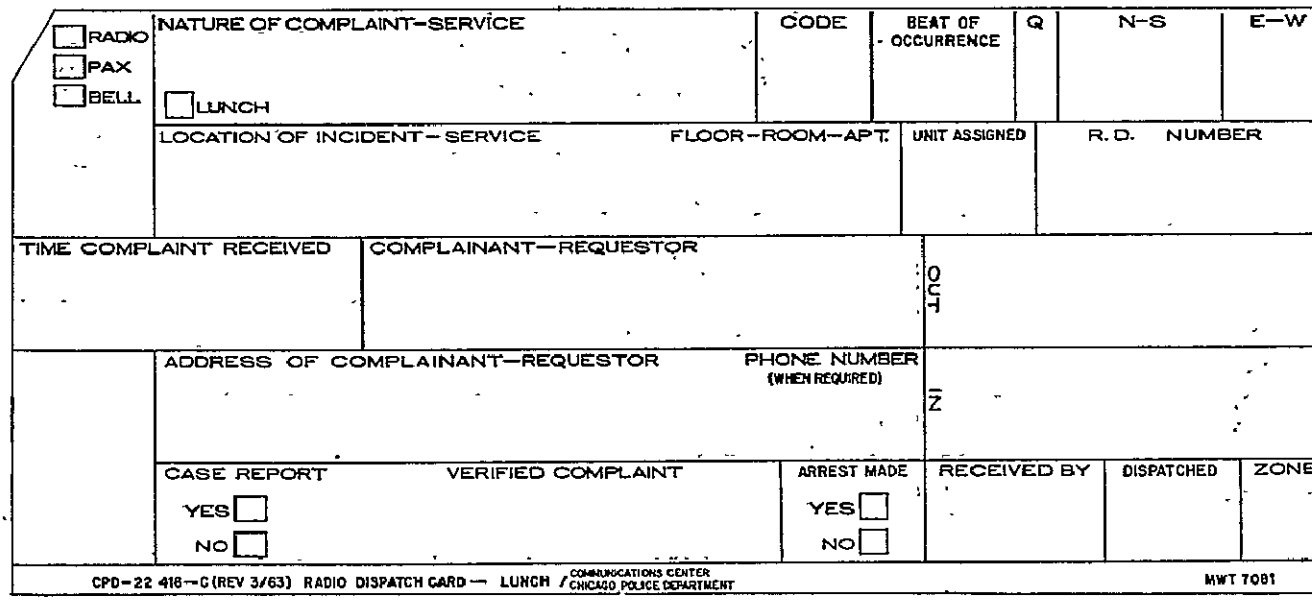
ANNEX VII

IBM COMPLAINT CARDS

(Card Color Yellow)

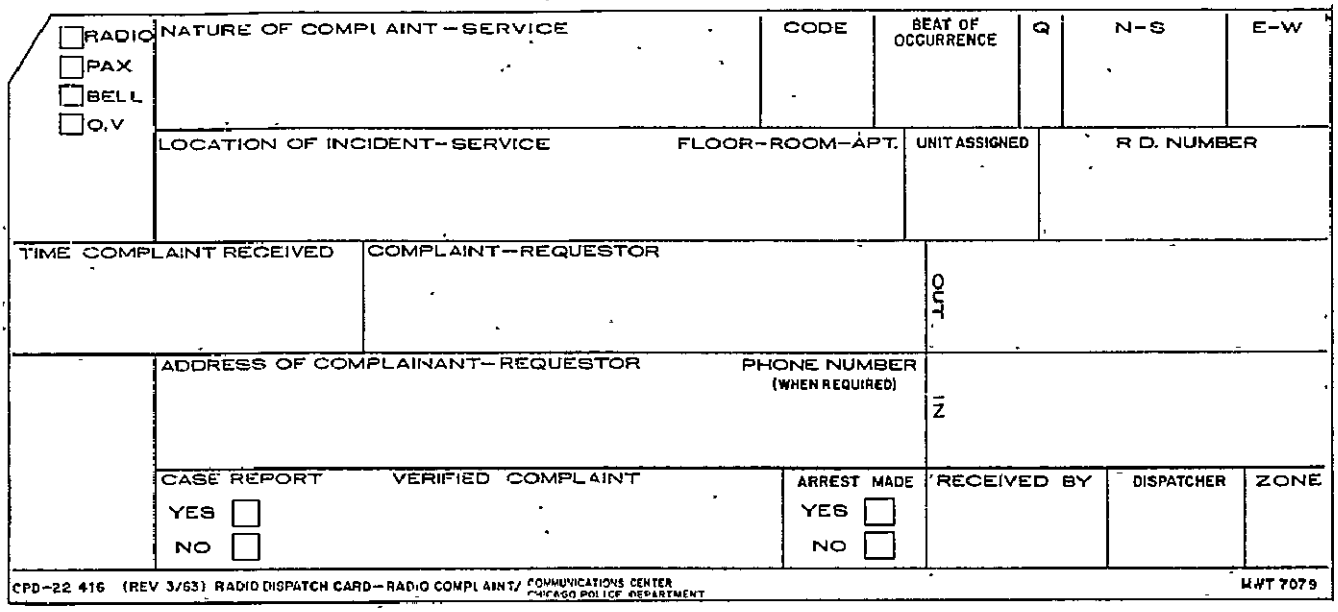


(Card Color Blue)

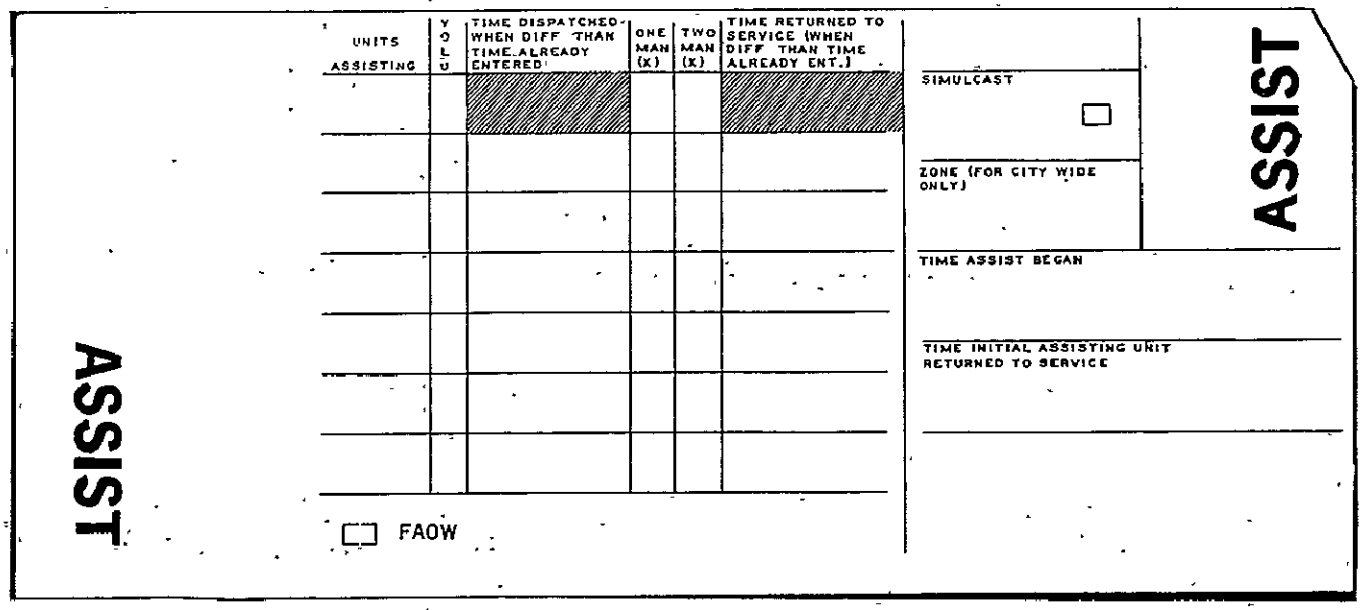


Printing on face of Radio Complaint Card

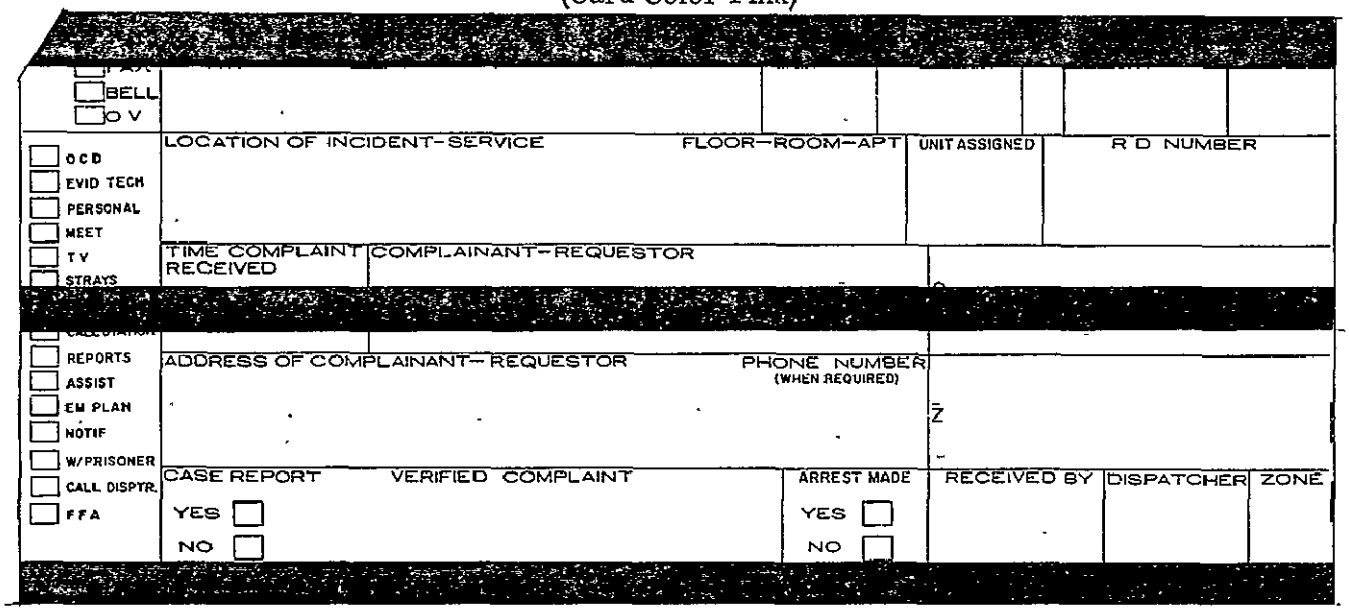
(Card Color White)



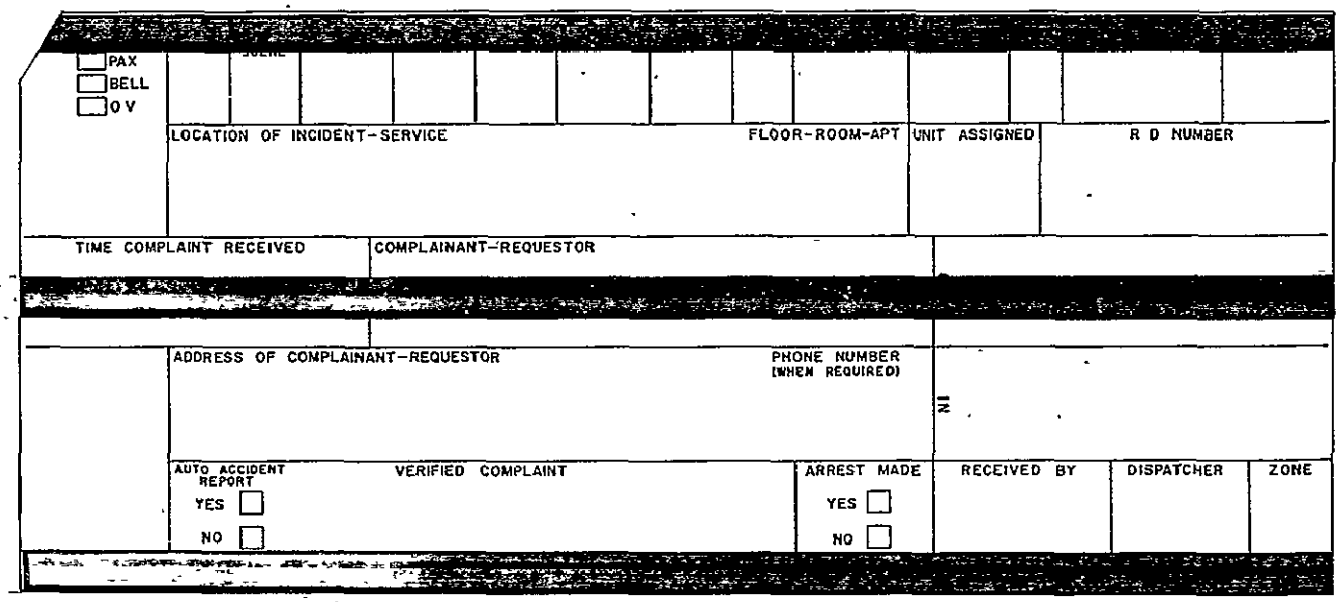
Printing on back of Radio Complaint Card



(Card Color Pink)



(Card Color Gray)



ANNEX VIII

GLOSSARY

Adjacent Channel Interference

A condition when an adjacent channel signal is so strong that it is not rejected by the receiver selectivity.

Channel

A certain single portion of the radio spectrum assigned to a user of two-way communications.

Circuit

A means of both-way communication between two points comprising associated "go" and "return" channels.

Command Center

The complex of equipment and personnel from which all communication activity in a particular system is controlled.

Comparator

A device located at the Command Center that continuously compares received signals in a Receiver Voting System and selects the best signal from one or more satellite receivers.

Control Console

A desk-mounted enclosed panel which contains a number of controls used to operate a radio station.

Cross-band Repeater

A method whereby VHF and UHF repeaters are electrically connected to provide two-way communications between UHF and VHF equipment.

Digital Communications

A system whereby virtually all routine intelligence to be transmitted can be accomplished by pressing a message

button at the control center or in a mobile station rather than using voice communications.

Duplex Operation

A type of operation in which simultaneous two-way conversations, messages, or information may be passed between any two or more given points.

Extension Line

A line from the PABX which terminates at a telephone.

Facsimile

A system that systematically converts a picture or other fixed graphic copy into electrical signals which are transmitted by wire or radio to a receiving point where they are converted back into a replica of the original.

Frequency Modulation (FM)

A method of modulating a carrier-frequency signal by causing the frequency to vary above and below the unmodulated value in accordance with the intelligence signal to be transmitted. The amount of deviation in frequency above and below the resting frequency is at each instant proportional to the amplitude of the intelligence signal being transmitted. The number of complete deviations per second above and below the resting frequency corresponds at each instant to the frequency of the intelligence signal being transmitted.

Hard Copy Print Out

A system whereby information (digital data messages) is received at the Command Center from the vehicle (electronically decoded) and printed out on paper in plain language or numbers.

Intermodulation

The combination of two signals at closely spaced frequencies to yield a signal at a new frequency which is close to the first two frequencies.

Link

A transmitter-receiver system and transmission medium forming a two-way path for transmission of information.

Mobile(Vehicle) Transceiver

A two-way radio station in the mobile service intended to be used while in motion or during halts at unspecified points.

Multiplex

A multiplex system combining a number of voice channels for instantaneous transmission over a wide-band system.

Patch

Electrically connecting two or more circuits together.

Private Automatic Branch Exchange (PABX)

Telephone switchboard requiring no operator. Provides automatic dial service for incoming and outgoing telephone calls.

Personal Portable

A small portable transceiver intended to be carried by hand or on the person of the user.

Portable Transceiver

A completely self-contained battery-operated radio which may be moved from one position to another.

Radio Network

A number of radio stations fixed and mobile in a given geographical area which communicate with each other by sharing the same radio channels.

Radio Receiver

An instrument which amplifies radio frequency (RF) signals, separates the intelligence signal from the RF carrier, amplifies the intelligence signal additionally,in most cases, then converts the intelligence signal back into its original form.

Radio Transmitter

A radio frequency power source which generates radio waves for transmission through space.

Repeater

Used to increase mobile-to-mobile and mobile-to-base communications range and extend the range of a VHF or UHF radio system over greater distances and obstructions such as mountains, buildings, etc. Back-to-back two-way repeater can be used to link two different communications systems.

Scrambler

A device that connects to a telephone or two-way radio and converts the sound of a human voice into unintelligible sound.

Signal

The form or variation of a wave with time, serving to convey the information, message, effect, or other desired intelligence in communications.

Signpost

A system of Automatic Vehicle Monitoring consisting of a group of transmitters which emits location codes that are received and stored by the vehicle as it passes by any one of the transmitters.

Simplex

That type of operation which permits the transmission of signals in either direction alternately.

Speech - Plus

A method of operation in which speech and digital data are transmitted simultaneously over the same radio channel.

Squelch Control

A manual control in a receiver that can be adjusted to render the receiver inoperative when no signal is present.

Teletype

A system of communication in which the Teletype - a trademark applied to a kind of teletypewriter - is used.

Teletypewriter

An electromechanical device, similar to a typewriter, wherein messages typed on the keyboard of the transmitter unit are converted into electrical signals. These signals are then conveyed to a receiver unit where they are transferred to print out on paper.

Transceiver

A transmitter and receiver with common circuits constructed in such a manner as to form one complete mobile, portable or base station.

Triangulation

A system of Automatic Vehicle Monitoring that uses the intersection of two lines at angles measured from a third line which connects two reference points as the means of location.

Trilateration

A system of Automatic Vehicle Monitoring whereby the vehicle's position is determined by the signal's time of arrival at two pairs of stations.

Trunk Line

A line that connects the telephone company central exchange with the police switchboard or PABX.

Ultra High Frequency (UHF)

Frequencies from 300 to 3000 Megahertz, used for line-of-sight communications.

Very High Frequency (VHF)

Frequencies from 30 to 300 Megahertz, used for line-of-sight communications.

Wide-band System

A system with a multi-channel bandwidth of 20 Kilohertz or more.