SURVEY

TELECOMMUNICATIONS

PERUVIAN INVESTIGATION POLICE (PIP)

PERU

July-August 1972

OFFICE OF PUBLIC SAFETY
AGENCY FOR INTERNATIONAL DEVELOPMENT
DEPARTMENT OF STATE
WASHINGTON, D.C.

PERUVIAN INVESTIGATIVE POLICE

(PIP)

TELECOMMUNICATIONS SURVEY

PERU

July 29 - August 14, 1972

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AID/OPS

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CHAPTER I

INTRODUCTION

In response to a request from the Government of Peru (GOP), and as recommended by the American Embassy in Lima, a Telecommunications Survey of the Peruvian Investigative Police (PIP) was conducted by Mr. Lucien V. Gormont, representing the Office of Public Safety (OPS), Agency for International Development, Washington, D.C., from July 29 to August 14, 1972.

The primary purpose of the survey was to determine communications improvements required to substantially increase the efficiency of the PIP Narcotics Control Section.

Frank discussions with U.S. and GOP officials revealed that a special network and/or special communications equipment would not provide satisfactory solutions to the problems on hand. Indeed, a practical answer must consider improvements of the overall PIP Communications System, not only in those areas and functions supporting a narcotics control operation.

Consequently, the survey was conducted under the following terms of reference:

1. To examine and determine the existing communications capability of the PIP organization.

2. To evaluate the ability and performance of the PIP communications management and technical personnel.

3. To recommend communications system improvements and the related equipment which would be required to improve the PIP communications capability to support narcotics control operations.

The writer travelled extensively to visit PIP facilities at Cuzco, Piura, Trujillo, Chiclayo and Puente Piedras, in order to examine significant problems and to observe special and standard operating aspects of the PIP communications system.

CHAPTER II

GENERAL INFORMATION

Peru is approximately 1,200 miles long (north-south) and 600 miles wide (east-west) in its largest dimensions and offers the particularity of having three radically different topographical zones. To the west, the Pacific Coastal Zone, rarely wider than a few dozen miles, contains most of the larger cities and the larger population percentage. It also contains most of the roads.

Then, parallel to it, are the Andes, a wide barrier made up of towering mountains, high plateaus and deep valleys. To the east of the Andes, we find dense tropical jungles, cross-crossed by the rivers of the upper Amazon basin. Large population centers are scarce, as are roads.

Law enforcement in Peru is the responsibility of three organizations:

1. The Republican Guard (Guardia Republicana), assigned to Border Patrol, prison control and national monument protection.

2. The Peruvian Investigative Police (Policia de Investigaciones del Peru), a non-uniformed police organization of approximately 5,000 men, responsible for all investigative work. Narcotics control is one of the PIP responsibilities, and some 75 agents are assigned to this function.

3. The Civil Guard (Guardia Civil), a uniformed police, approximately 40,000 men strong, and responsible for all other law enforcement duties.

It is reported that, traditionally and culturally, these three organizations operate independently from each other. Moreover, there is rivalry and professional jealousy between the Civil Guard and the PIP. These feelings surface quite readily in criminal cases where both organizations are involved or in areas where responsibilities are not well defined. There is little common working ground between the PIP and the Civil Guard, and this attitude extends to communications networks and facilities as well.

The Office of Public Safety provided police communications assistance in Peru from 1962 to 1970. This program was primarily directed to the main law enforcement agency, the Civil Guard. The PIP received some AID police communications assistance in 1964, when 18 radio transceivers were provided by USAID.

The PIP communications system, up to 1967, consisted of ten HF/AM radio transceivers used on the national network and of 10 VHF/FM radio transceivers used in the Lima Metropolitan Network. All equipment was of European manufacture.

In 1967, the PIP undertook to expand and modernize its communications facilities. The obsolete equipment then on hand was discarded and replaced by U.S. made equipment, purchased with local funds at a cost of approximately $120,000. The resulting networks are still in operation, and are the targets of this survey.

CHAPTER III

SUMMARY

A. Situation

The present PIP Communications System is principally made up of four networks:

1. The National Network, connecting Lima to 22 stations in the interior (HF/SSB).

2. The Metropolitan Network, providing mobile service to the capital city, Lima (VHF/FM).

3. The Urban Network, connecting Lima to four suburban communities (VHF/AM and VHF/FM).

4. The INTERPOL Network, connecting Lima with Buenos Aires.

The operation and maintenance of these networks reflect considerable effort on the part of the officials concerned to provide essential communications support to their overall police mission. Unfortunately, the efficiency of all these networks is limited. The National Network is of particular concern, as it provides neither the coverage nor the message transferral speed, and privacy needed for an efficient narcotics control operation. In fact, it has been reported that in number of narcotics investigations, interceptions and raids have failed because of inadequate communications.

The limitations affecting the Metropolitan and Urban Networks are not as restrictive to the PIP Narcotics Section as those affecting the National Network. It is, however, important to note that the Metropolitan Network does not provide the flexibility or the area coverage needed, and that the Urban Network works with a very poor quality signal over only four stations using obsolete equipment.

B. Areas Requiring Improvements

Some of the above problems are rooted in inadequacies of management, operating and maintenance personnel, which must reorient and modernize their practices. Maintenance must be converted into a preventive effort, to include field inspections, records analysis, and more complete repair and test practices. Operating techniques must be developed to handle much heavier traffic, and to insure message security.

The greatest failure lies in the misconception that communications equipment can be bought in a department store and put to use without sound planning and engineering. This was done with the PIP, ignoring fundamental transmission laws, misassigning frequencies, promoting interferences and completely disregarding possible future needs.

C. Recommendations

The effectiveness of PIP communications can be dramatically improved through the incorporation of several operational and technical changes, and through the acquisition of appropriate equipment. Any program considered should be divided into three phases:

1. Phase I - The National Network. All efforts should be directed to make it operational as close to 24 hours per day as the state of the art permits. Greater coverage will be achieved by adding 26 fixed stations and five mobile units, by increasing the number of operating channels, and by eliminating interaction between the three Lima control transceivers.

   Installation and related efforts will require approximately one year to complete, and the equipment cost will be $138,000 (estimated).

2. Phase II - The Lima Metropolitan Network. After Phase I is completed and, if sufficient funds are available, Phase II would continue the improvement process. Some nine months will be needed to modify all transceivers to expand the control console and to install the three recommended repeaters.

   The estimated cost of this equipment is $35,000.

3. Phase III - The Urban Network also requires a repeater which can be installed concurrently with Phase II. The cost of the equipment is approximately $14,000.

   The existing Lima maintenance and operating facilities are overcrowded and must be substantially enlarged to cope with the proposed equipment additions. This step must be completed before delivery of equipment is made. Proper planning could effectively combine these requirements with the housing facilities for the repeaters recommended.

Finally, a U.S. communications advisor should be assigned for a two-year tour to insure not only effective installation and training of technicians, but also to promote the implementation of the management and maintenance practices indicated above. His contribution in these fundamental areas is essential, as the concepts involved are still new in the PIP.

CHAPTER IV

OBSERVATIONS AND CONCLUSIONS

A. General

The four networks listed in the Summary - National, Metropolitan, Urban and INTERPOL - are supplemented by three small VHF networks, providing mobile service to the PIP precincts in Tumbes, Piura, and Trujillo. These are of little consequence to the narcoticsoperation, and will be discussed no further.

All of the networks essentially fulfill their basic intended purposes, but with extreme limitations. From the point of view of narcotics control, they do not permit the expeditious flow of information needed to apprehend narcotics dealers and their products. The writer has been advised that many arrests and confiscations were lost because of insufficient communications capability.

B. National Network

The National Network (see figures 1 and 2) is an HF/SSB network connecting Lima to 22 (out of a total of 23) departmental capitals. It is divided, for operational purposes, into three sub-networks - South, Central and North. All are controlled from Lima. The following observations were made regarding these sub-networks.

1. The actual time during which messages can be exchanged is, on the average, less than 15 hours per day. During those 15 hours, the received signals are rarely of good quality, and much time must be spent by the operator repeating and/or relaying messages through another station. This poor network performance is the direct result of the next two observations.

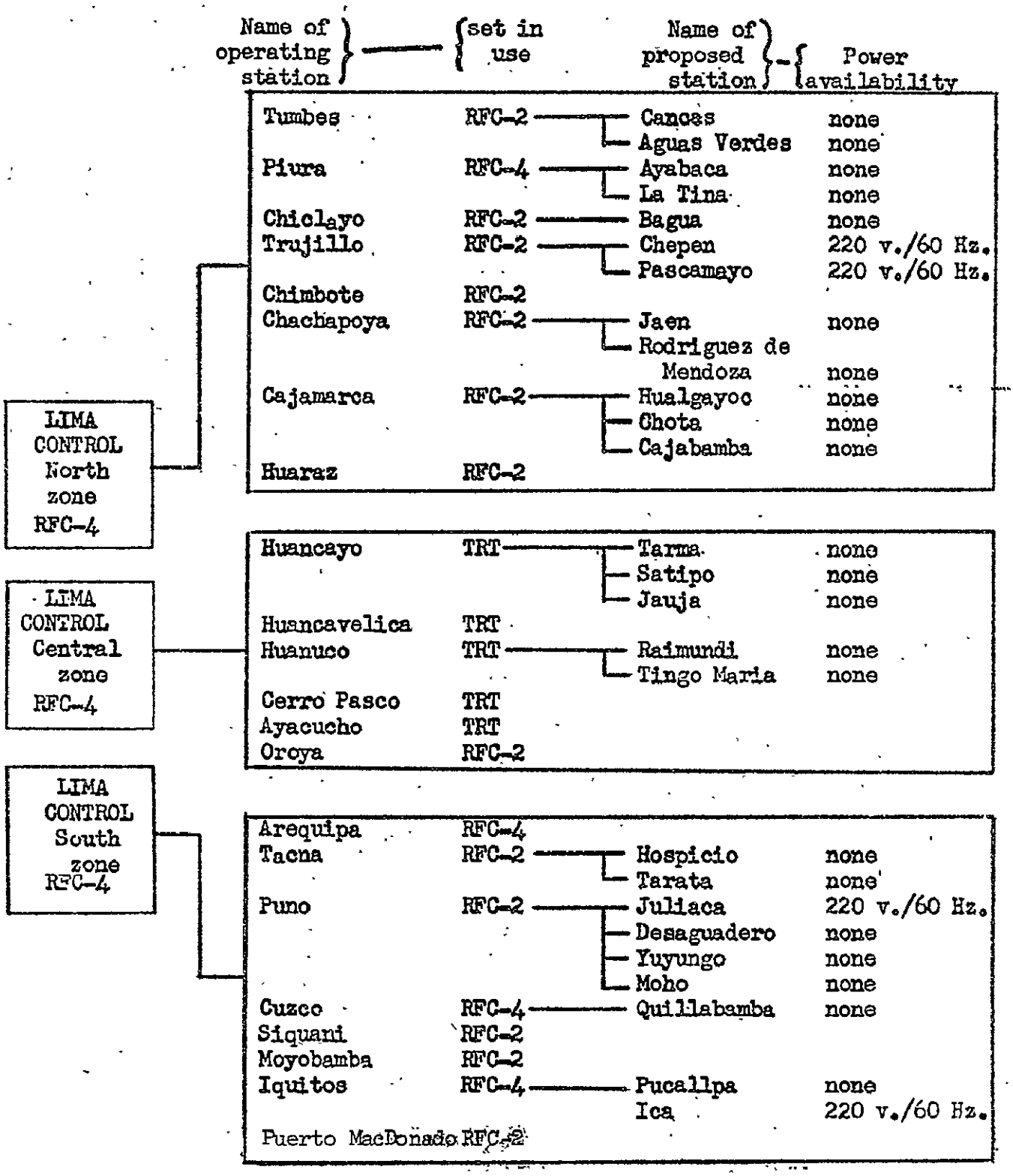
2. One frequency only is assigned to each sub-network. Since one HF frequency is rarely suitable for both day and night operation, the network suffers consequently.

3. All three sub-network control stations are located in the same room, and the corresponding antennas are installed within a few feet from each other. As a result, two of the sub-networks interfere heavily with each other and noticeably affect the third. The consequence is a further reduction of the effective transmission time, as all three sub-networks cannot operate simultaneously.


ECUADOR
COLOMBIA
BRASIL
BOLIVIA
CHILE
TUMBES
Cancas
Aguas Verdes
IQUITOS
Ayabaca
La Tina
PIURA
Chota
Jaen
Chachapoyas
Bagua
Huallaguayoc
Mendoza
MOYOBAMBA
CHICLAYO
CAJAMARCA
Chepen
Pascomayo
Cajabamba
TRUJILLO
Pucallpa
HUARAZ
Timbo Mario
Raimondi
Casma
HUANUCO
CERRO PASCO
Torma
Satipo
Jauja
HUANCAYO
LIMA
(Three Control Centers)
Quillabamba
PUERTO MALDONADO
HUANCA-VELICA
AYACUCHO
Cuzco
ICA
Desaguadero
Julica
Moho
LAKE Titi caca
PUNO
AREQUIPA
Yunguyo
Tarata
TACNA
Hospicio
P.I.P.
Communications
NATIONAL NETWORK
△ Existing Stations.
⊙ Proposed Stations.

Figure 1

P.I.P. COMMUNICATIONS: NATIONAL NETWORK. EQUIPMENT AND STATION DISTRIBUTION.



RFC-2 : R. F. Communications, Inc. transceiver, mofel "Compact" equipped with two operating channels.

RFC-4 : Same transceiver, but equipped with four operating channels.

TRT : Transceiver of french manufacture, equipped with four operating channels. (Model FBU-340M).

Figure 2

4. The message tranferral rate is low, averaging approximately 32 messages per week per station (see Appendix 1, Section 1). Furthermore, a message is frequently delayed for up to ten hours before being transmitted, and occasionally must wait until the following day.

5. The three Lima control stations are on the air only nine times per day, at designated times, and remain so for whatever time is required to exchange the messages accumulated, but no longer. The control stations are then turned off.

6. Only voice communications are used; none of the operators is capable of utilizing Morse Code (CW). Consequently, the network cannot be used when the received signal is too weak to allow voice transmission, but would still be strong enough to permit intelligible CW messages. Furthermore, voice communications make encoding impractical and security is jeopardized.

7. There are no means for an individual investigator operating in remote locations to communicate with a PIP office. Commercial telephone, if available, may require several hours to provide a circuit, and furthermore, its security reliability would be questioned in areas where drug traffic and production is prevelent.

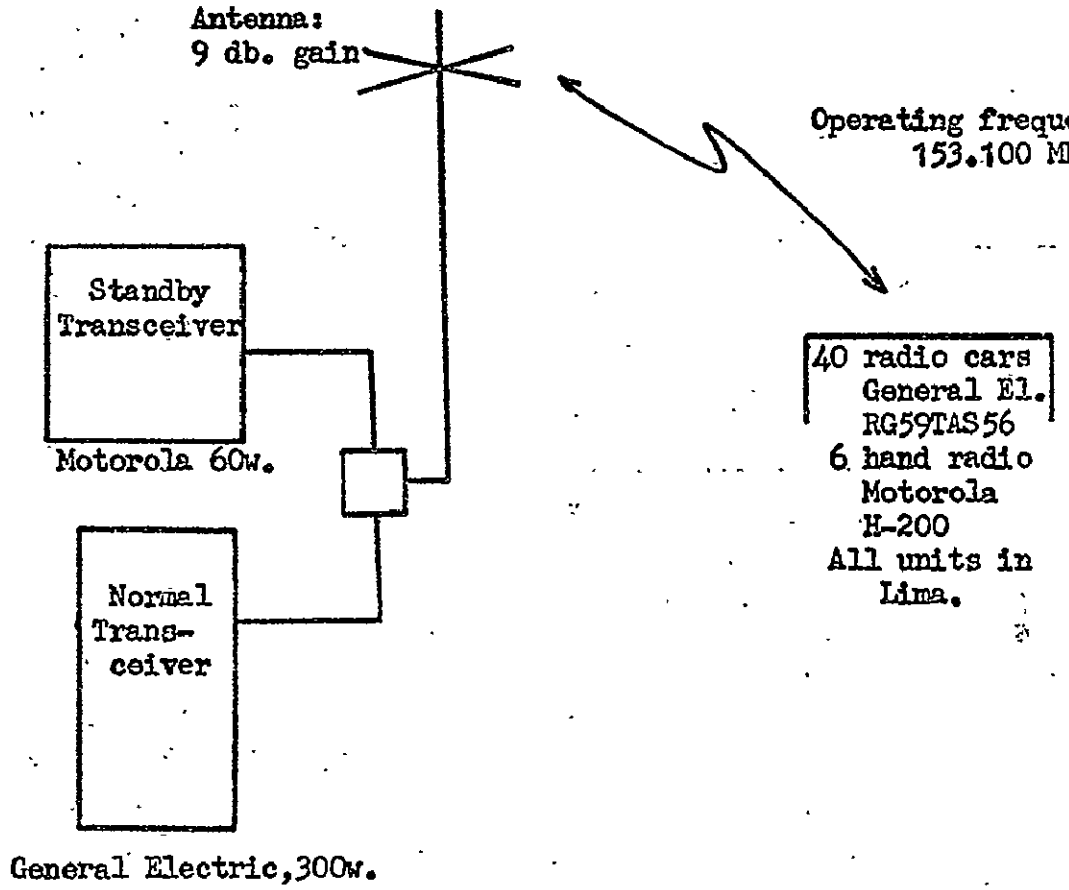
In view of the above, we must conclude that the National Network is not capable of supporting even a routine narcotics operation; the narcotics investigator has insufficient communications in the field. Many PIP detachments in areas where narcotics are produced, traded or smuggled, have no communications facilities at all. The area has, in fact, been selected by the narcotics trafficker for this specific reason.

Whenever PIP communications facilities are available, they are rarely able to respond quickly; the word "emergency" has little meaning when related to the Naional Network.

C. Lima Metropolitan Network

The Metropolitan VHF/FM Network (see Figure 3) provides mobile coverage to 40 car radios and six hand held units. The operation of this network could be satisfactory, were it not for two limiting factors:

1. One channel is used throughout the entire network. This is sufficient for the control and dispatching of a few mobile units, but one large scale operation involving many vehicles could congest the network making it unavailable to another unit involved in another operation.



P. I. P. COMMUNICATIONS

Metropolitan VHF Network

Figure 3

2. The control station operates from PIP headquarters, located in the flat portion of the city. Coverage for Lima in the 1960's was adequate. However, important new housing developments and a commercial satellite receiving station have sprouted around and behind (radio wise) the hills which dominate the city. Few of these new areas are presently reached by the PIP Headquarters transceiver.

These two limitations reduce the effectiveness of communications to the narcotics squad, since its agents are not able to contact headquarters at all times, from anywhere in the city.

D. Urban Network

The Urban Network (see Figure 4) provides communications to four Lima suburban communities. Three of the towns - Puente Piedras, Comas and San Juan - are connected to Lima via VHF/AM equipment. The fourth location, the port of Callao, is connected by VHF/AM equipment.

Communications to Callao are excellent, but those to the other three points are not satisfactory. Circuits are noisy and occasionally interrupted by atmospheric conditions. This is because:

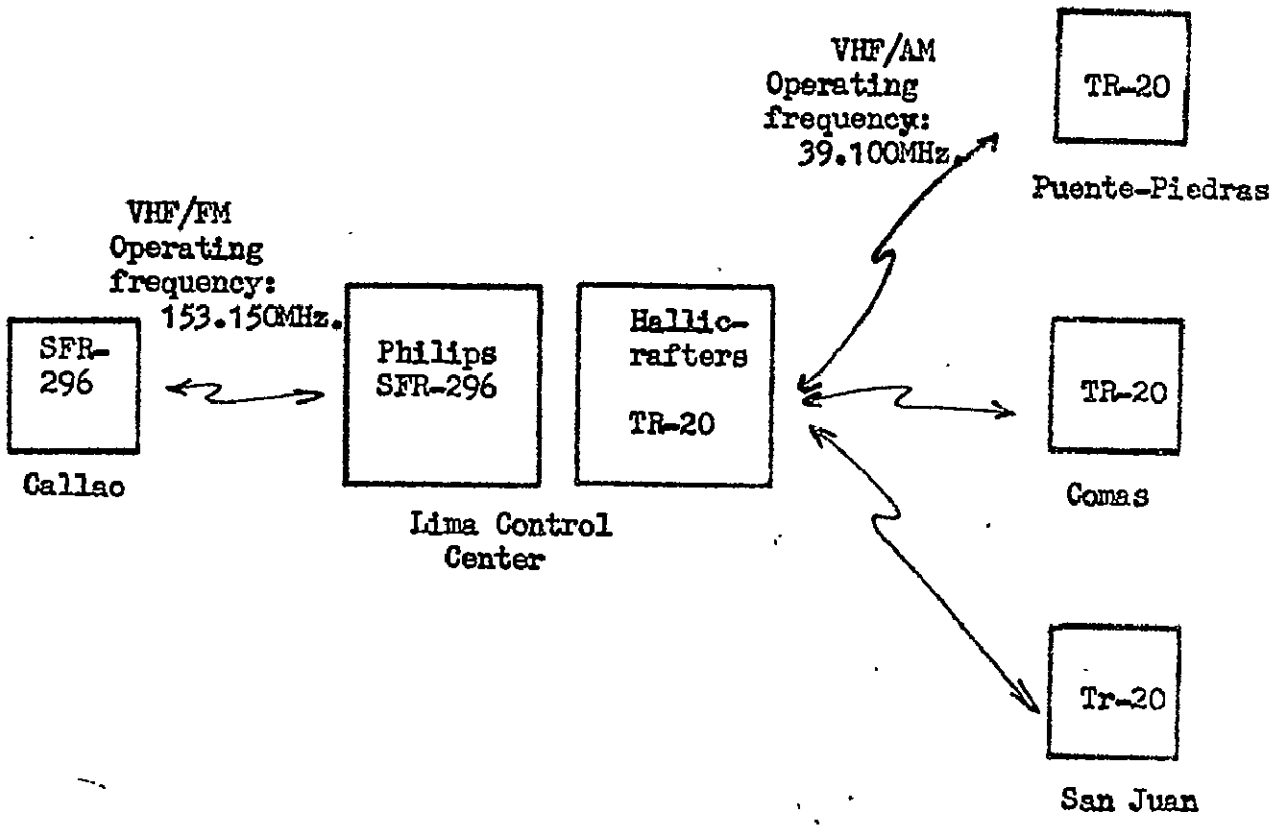
1. There is no line-of-sight between the stations and PIP Headquarters.

2. The equipment - Hallicrafters TR-5, TR-20, and HT-1 - is obsolete. Spare parts are unavailable, and equipment expected life has been exceeded. Consequently, the transmitters are operating at less than half power and receiver sensitivity is questionable. At this time, ten of the original 18 units are operable.

Yet, in spite of its operational deficiencies, this point-to-point system is the principal communications means of the urban PIP offices, since commercial facilities are completely inadequate. While visiting one of the stations, it became necessary to telephone PIP Headquarters 15 miles away. It took 35 minutes to complete the call.

E. INTERPOL Network

The Lima INTERPOL station (see Figure 5) works with Buenos Aires, the South American Net Control Center. Its 300-watt transmitter is equipped with three channels and additional equipment to operate on six channels has been ordered. The equipment configuration of this network is satisfactory and requires no further input.



P. I. P. COMMUNICATIONS

Peripheral Network.-

Figure 4

However, there is insufficient personnel to properly man the station; at this time, only one operator is competent to work Buenos Aires on International Morse Code (CW). A second operator is in training and will not be ready for another few months.

It should be noted that four operators would be needed to man the station on a 24-hour basis.

F. Personnel

The total strength of the PIP Communications Division (Figure 6) is approximately 65 men, plus an undetermined number employed in the "electronic department," in charge of surveillance equipment maintenance.

Inspector Superior Octavio Sarango Ojeda is the Director of Information and Communications and also supervises the Narcotics Section.

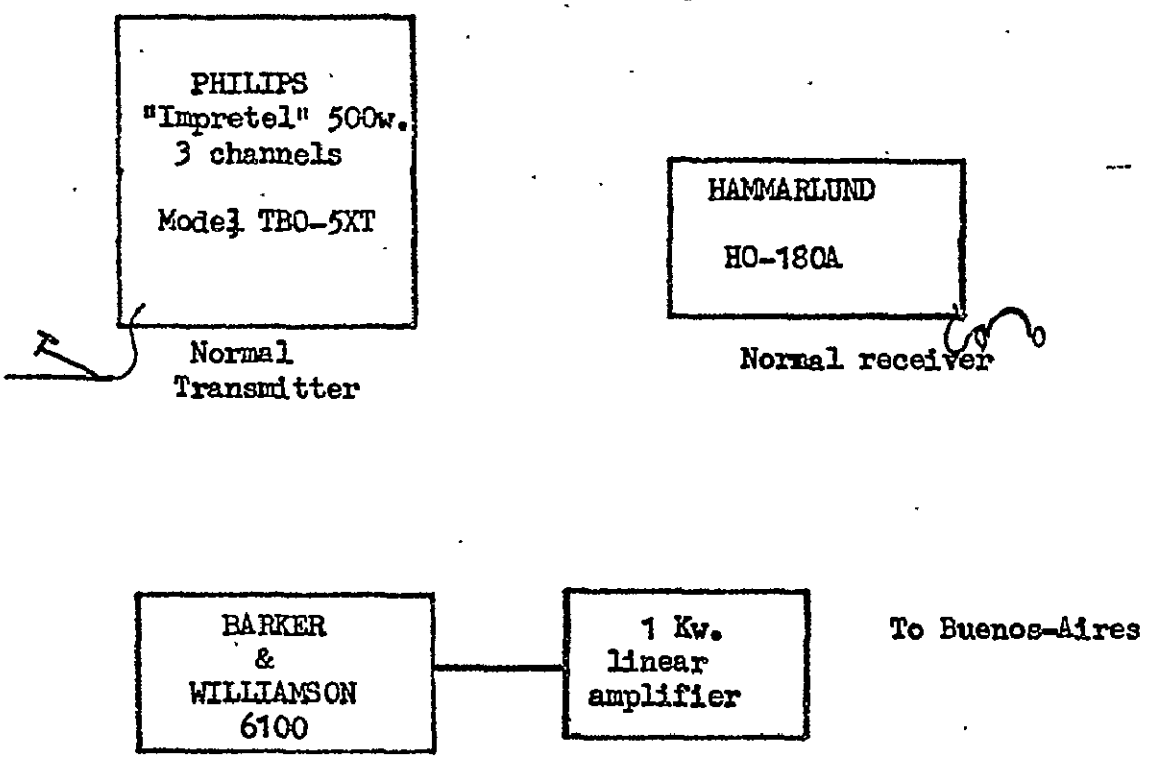
The Communications Division Chief, Comisario Superior Douglas Lezameta, appears to be a competent administrator, but lacks the managerial and technical knowledge necessary to run an efficient communications organization.

The maintenance personnel consists of 13 men; 12 police technicians, of whom four are in training, and one civilian expert, the technical mainspring of the unit. This sub-unit is run by a Maintenance Chief, a competent administrator, but with limited technical experience.

All police maintenance personnel have undergone a two-year training course in the Peruvian Armed Forces (Navy or Air Force). In their own words, the subjects taught were too theoretical, and far exceed the needs of most technicians. Their repair ability is limited to the equipment they are familiar with, and new models require further familiarization training. Nonetheless, the PIP technicians are capable and adaptable; little time will be needed to sufficiently complement their knowledge.

The civilian technician is very competent, capable not only of repairing almost any type of communications equipment, but also of designing and building fairly complex electronic gear.

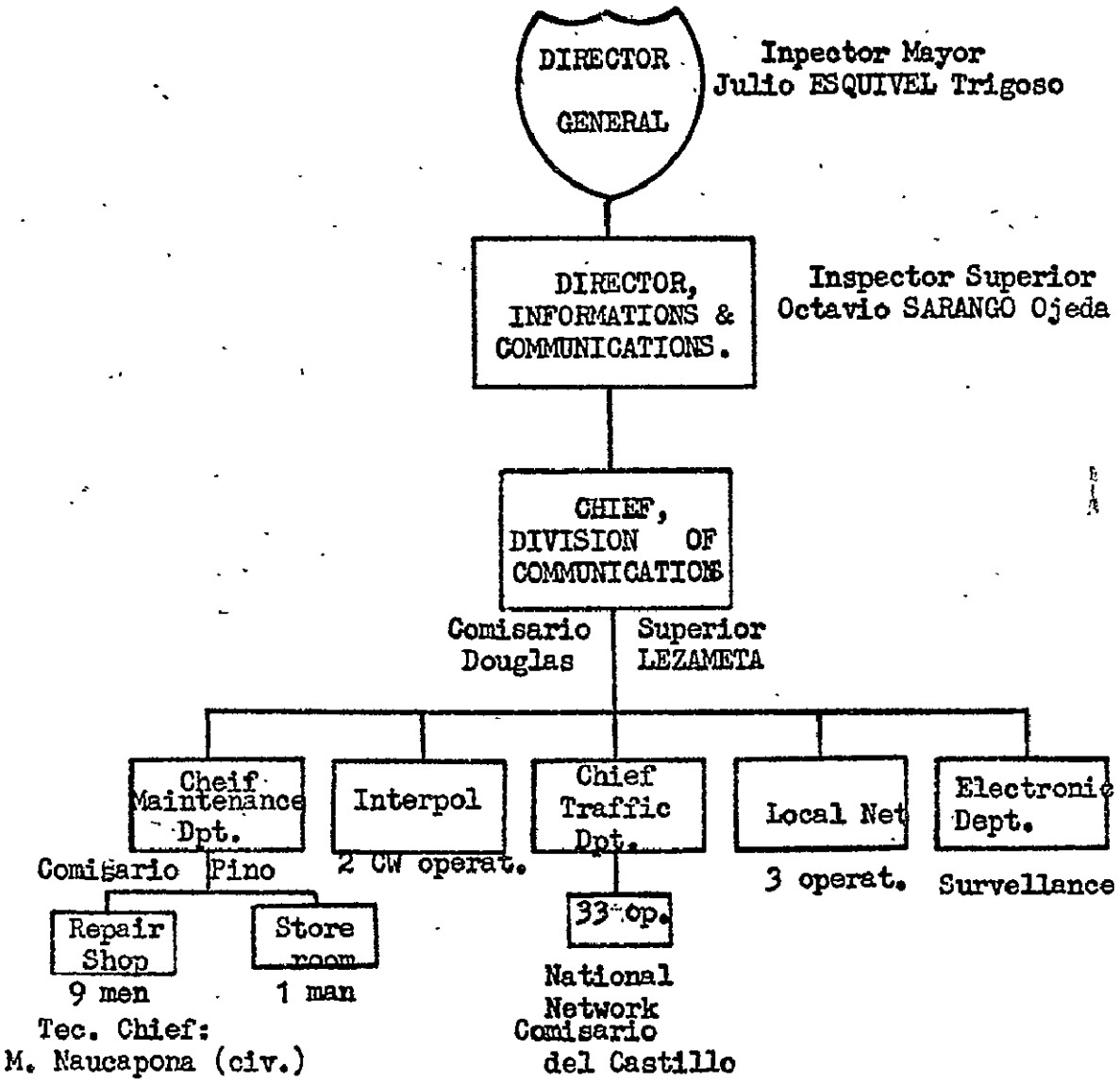
Unlike maintenance tehcnicians, operators are not professionally oriented. They are assigned to the job for two to three years, and then are transferred. Also, radio operators frequently handle an additional assignment, such as secretarial or license issuance duties. No operator (INTERPOL excepted) is capable of using the International Morse Code, nor has he been given any sort of basic radio training.



P. I. P. COMMUNICATIONS

Interpol Station

Figure 5



P. I. P. COMMUNICATIONS

Organization Diagram and Personnel Distribution

Figure 6

Salaries, although not high, appear sufficient for a technican to live in relative comfort. The average take home pay received by the police repair technician was $225.

It should be noted that the local private sector offers from 1.5 to 2.5 times this amount for well trained technicians. An exodus of PIP technicians is not a necessary consequence; however, present technicians have a long time investment in the PIP and fairly strong loyalties have been developed.

G. Headquarters Facilities

The entire Lima communications operation is contained in seven small rooms located on top of one of the PIP Headquarters buildings. This includes all management and planning functions, all networks control stations and consoles, the repair shop, and the telephone switchboard. These facilities are obviously congested and are incapable of coping with the considered communications expansion.

The PIP communications management seems to believe that all communications functions must be kept under one roof. From the point of view of efficiency, such a requirement is not necessary. Certain functions such as maintenance, planning, telephone switchboard, can easily be separated from the centers where messages are received and distributed.

H. Maintenance

The PIP does not apply routine preventive maintenance procedures, nor does it conduct technical field inspections. Once a transceiver has failed, the affected station will ship it to the Lima repair center for repair and return. Back-up units are not available in Lima to expedite the restoral process. PIP records show that a transceiver is repaired within two to four days from being received. Shipping time, back and forth, averages one week to ten days. Thus, a station could be off the air for as long as two weeks, or more, if not too unusual delays occur.

Except at installation, a station in the interior is never visited by a technician. Thus, several problems affecting the system have never been identified or corrected - local interference, frequency drift, improper antennas, incorrect use of radio equipment.

The "send for repair and return" type of maintenance requires a very thorough repair technique, in order to avoid frequent returns to the repair shop. Unfortunately, several key measurements, such as sensitivity, selectivity, modulation and frequency, are not made because neither the expertise nor the test equipment is available.

NATIONAL NETWORK: FAILURE TABULATION

Station	1969	1970	1971	1972
Central Norte (Control)	6	3	1	1
Tumbes	2	2	2	1
Piura	2	3	4	1
Trujillo	2		1	4
Huaraz	1	2	1	1
Chiclayo		3		
Chimbote	1	5	3	
Cajamarca		1	2	
Chachapoyas			1	
Central Sur (Control)	1	2	1	4
Arequipa	2		1	1
Tacna	1			1
Sicuani	1		1	
Moyobamba	1			
Iquitos	1	1	2	
Pto-Maldonado	1		1	1
Puno				1
Cusco				1
Central Centro (Control)	3	4	2	1
Huancavelica	2	1		
Huan co	3	1	1	3
Cerro Pasco	2	3		2
Ayacucho	1	1		1
Huancayo		2		1
Oroya			1	
	33	34	25	25

FIGURE 7

In spite of this, and much to the credit of the maintenance personnel, relatively few failures have been recorded. The records show that from 1968 to date the 25 operating HF transceivers sustained the following failures:

33 failures in 1969 or 1.3 failures per set per year
34 failures in 1970 or 1.3 failures per set per year
25 failures in 1971 or 1.0 failures per set per year
25 failures to July 31, 1972 or 1.0 failures per set for the first seven months of the year (see Figure 7 for details).

The above figures represent a fairly good performance, considering the means on hand. However, a closer look at the records indicates that the same set returns to Lima several times, often for a few minor adjustments. The survey revealed that the problem was not in the set, but in inadequacies of the station itself. The real cause of failure was therefore the lack of inspection reported previously. We can only conclude that once better maintenance practices are implemented, the failure rate will be reduced and the net operating time will be increased.

I. Spare Parts

The PIP Communications Division suffers from a chronic shortage of spare parts. At the time of our visit, the entire stock for all PIP networks was stored in six standard-size filing drawers, which also contained tools and other implements.

Part of the difficulty is the eight to ten months needed to process an order and receive U.S. spare parts. This could be corrected by better planning and proper evaluation of parts usage records. Unfortunately, such records, although partially kept, are not utilized for this purpose.

J. PIP Communications Budget

Many of the problems reported are related to insufficient communications budgets. The sums allocated for this purpose were not only too small, but the Communications Division did not have full control of the money assigned to it. This situation is being corrected, as the following figures tend to show: (Data supplied was converted at the 1972 exchange rate of 50 soles = $1.)

Budget Year 1970 (Communications Division only, salaries excepted)

Approved account 2.5.14 "Others"	$1,040
Approved account 2.7.4 "Maintenance and replacement parts for other equipment"	9,278
Approved Total for 1970	$10,318
Actually allowed to spend (9% of approved budget)	$ 980

Budget Years 1971-1972 (current administrative procedures call for two-year budget)

Account	Purpose	Initial Approval	Reduced to	Spent to Date
2.16	Spare Parts	$12,000	$ 6,214	$2,290
3.09	Maintenance	$16,400	$ 3,000	$ 65
8.13	Others		$27,152	$4,879
			$36,466	$7,234

As of July 31, 1972, 20.4% of assigned budgets have been spent. In the remainder of the current fiscal period, another $12,000 for new equipment is being processed for expenditure, and will probably be approved.

The trend is definitely upward and more money is being made available for communications maintenance, operation and spare parts acquisition.

K. Records

Records covering repairs, spare parts usage and cash flow are kept and are generally very detailed.

When a radio set is sent for repairs, an actual invoice is prepared, eventually including all the details of the repair (faults, dates , spare parts used, receipts, etc.). However, none of this information is tabulated or used to show trends, repair rates, workshop and technician efficiency, spare parts stock levels and minimum quantities, dead ended transceiver numbers and other statistics needed to qualify and manage a telecommunications unit.

CHAPTER V

RECOMMENDATIONS

A. Management

PIP Communications Management must be concerned with more than just insuring an expeditious flow of messages. Performance goals must be established and measurement techniques must be devised to compare actual performance to these goals, in order to monitor and verify the satisfactory operation of all communications networks.

Specific data must be gathered to measure:

1. Overall System Performance

    a. "Off time" due to equipment or operator failure
    b. Time elapsed between message delivery to operator and its receipt by the addressee.

2. Operations

    a. Quantity, length and type of message.
    b. Accuracy of message transmission
    c. Network discipline

3. Maintenance

    a. Repair flow - failure rate trends, repeated return trends, dead-ended equipment trend, time equipment is in shop.
    b. Spare parts flow - total usage, consumption per man, per unit of equipment repaired, per part stocked.

Properly utilized, these measurements can pinpoint system, network and prsonnel problems, and allow management to take suitable corrective action.

B. Maintenance

The PIP maintenance concept must be changed from "operate until failure" to a preventive maintenance routine; this new approach entails field technical inspections, more complete test procedures including sensitivity, modulation and frequency measurements. Results must be recorded and used to determine trends and routine cycles.

Maintenance personnel should be trained in these new techniques. Maintenance facilities must be enlarged and rationally laid out to cope with the incrased demands created by additional equipment, test positions and enhanced accuracy.

C. National Network

Deficiencies in the National Network are the most important communications problems affecting the operation of the PIP Narcotics Section. The equipment listed in Appendix 2, costing approximately $138,000, will correct these problems. Specifically, it will:

1. Promote an effective communications capability. This will be done by converting the entire network from a one-frequency operation to a six-frequency operation. In this manner, a good quality signal will be normally available at least 20 hours per day at all stations.

The division into three operating zones will be maintained, each zone operating on two frequencies. Two more frequencies will be available for emergency and lateral communications.

2. Enable three Lima control stations to operate continuously and simultaneously. Mutual interferences can be practically and economically eliminated by physically separating the transmitting and receiving station antennas by a minimum of one mile.

The receiver site will be maintained at the PIP Headquarters. The transmitter site will be established at a convenient location as determined by the PIP. The transmitter site will consit of six transceivers, one for each of the frequencies used. Control from PIP Headquarters will be achieved through six telephone pairs, connected as shown on Figure 8, and through proper matching and amplifying equipment.

The existing control transceivers will remain at PIP Headquarters and will be used on the receiver mode only. The idled transmitters will be reactivated in emergency or stand-by situations only.

3. Provide new stations. The PIP requested that 26 new stations (see Figure 2) be added to the network. It is recommended that this request be granted in order to provide suitable radio coverage to the Narcotics Section. Most of the locations considered do not have electric power available, and 2 KW gasoline-driven generating plants, equipped with rectifier and battery, should be provided where needed.

4. Supply back-up provision. Three AC and three DC transceivers should be acquired in addition to those needed to open new stations,

to be used as maintenance replacements for failed sets. In this manner, "off the air" time for a station could be reduced from the normal two weeks to an average of three days.

5. Provide portable radios. Five portable HF/SSB transceivers should be acquired to allow narcotics investigators in the field to communicate directly and rapidly with fixed PIP facilities. This equipment must be capable of operating from vehicles, back packs or from hotels and insure contact with Lima or any other station listening on a pre-arranged frequency.

6. Supply test equipment. The test equipment recommended will complement that already in country and will enable PIP maintenance personnel to perform the recommended series of adjustments.

7. Allow CW operation. The National Network must be operated on CW for greatest efficiency, and the conversion must be made as rapidly as practical. All operators must be taught to use Morse Code or replaced. Personnel procedures and incentives must consequently be modified to insure that operators remain on the job for more than one or two years, as is the current practice.

D. Lima Metropolitan Network

The problems affecting the Metropolitan Network seriously limit the effectiveness of the Narcotics Control Operation in Lima. However, these limitations are not as restrictive as those of the National Network, and constitute therefore a second priority.

The equipment listed in Appendix 3, and costing approximately $35,000, will habilitate the following corrective measures:

1. Three-channel operation.

    a. The Command Channel, to be used by the Director and all Division Chiefs requiring communications.

    b. The General Operating Channel, assigned to all units involved in normal operational activities.

    c. The Special Channel, assigned to the Narcotics Section and/or any other unit requiring sporadic, but exclusive and extensive, radio coverage.

All current radio transceivers should be converted to a two-channel operation, with the special channel being available on all units.

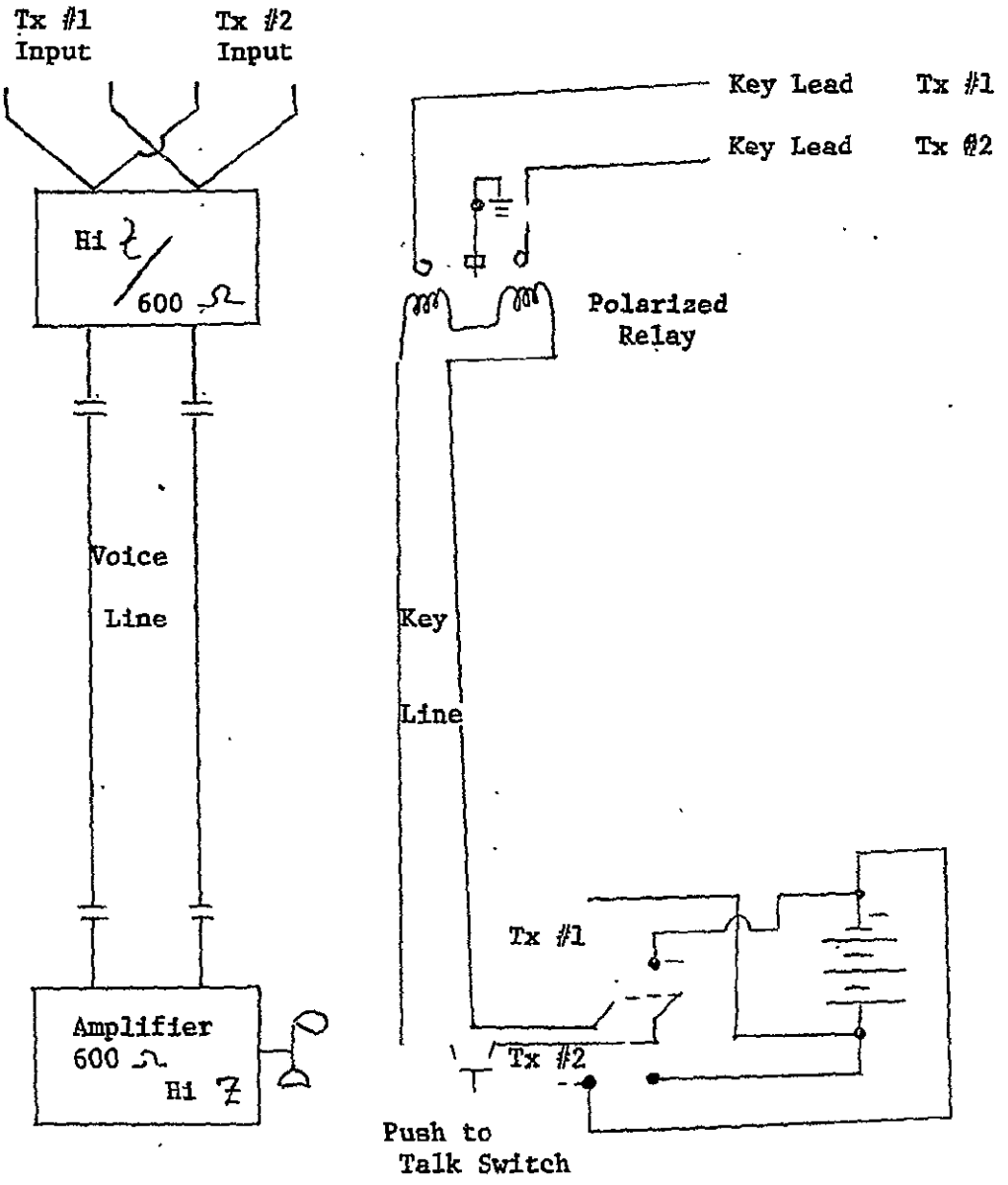


FIGURE 8

Connections Required to Control Two Transmitters With Two Telephone Pairs

The units assigned normally to the special channel will also be able to operate on the general operating channel.

2. Three Repeaters - As established previously, important new population centers are beyond the reach of the current headquarters VHF antenna. A repeater station, installed on one of the hills surrounding the city and handling all three recommended channels, will provide sufficient radio coverage. The construction, rental, or leasing of the building housing this facility should be the responsibility of the PIP, and the delivery of this equipment must be conditioned to suitable assurances that such a building will be available on time.

3. Narrow band conversion - All current VHF/FM equipment of the Metropolitan Network has wide band characteristics. In view of the increasing reluctance, by American manufacturers, to supply this now non-standard type of equipment, modification kits should be provided to modify all VHF/FM radio units to narrow band operation. Whenever this conversion is not possible, the units will operate with reduced deviation and gain.

4. Test equipment - The test equipment recommended will enable the maintenance unit to measure sensitivity, modulation and frequency. These key measurements are not performed at the time of this writing.

E. Urban Network

The problems affecting the Urban Network are related to obsolescence and improper antenna location. The equipment listed in Appendix 4 and costing approximately $14,000 would replace all existing equipment with modern, low power VHF/FM transceivers. A repeater will also be provided for installation at the same station as that used for the Metropolitan Network, unless better arrangements can be made.

F. U.S. Communications Advisor

It is recommended that a U.S. Communications Advisor be assigned to the PIP for two years, to insure the proper implementation of the important management and equipment changes recommended.

The advisor would have to apply himself to:

1. Management - introduce systematic performance evaluation, analysis, and improvement.

2. Maintenance - introduce routine preventive maintenance.

3. Installation - planning and supervision.

4. Training - maintenance, operating and management personnel.

5. Procedures - determine changes needed and recommend same to PIP.

6. Records - institute record system suitable to effective management support.

APPENDIX 1

NATIONAL NETWORK: MISCELLANEOUS INFORMATION

A. Traffic Flow

Calendar Year 1970-dispatched 37,978 messages containing 990,120 words or 31.6 messages per week per station.

Calendar Year 1971-dispatched 41,362 messages containing 1,042,967 words or 32.6 messages per week per station.

Calendar Year 1972 (January to June)-dispatched 18,287 messages or 30.5 messages per week per station.

B. Frequencies

National Network Frequencies (HF/SSB)

Currently used on loan:	North Zone	9.210 MHz
	South Zone	8.212 MHz
	Central Zone	4.438 MHz
Authorized and under test:	4.450 MHz	8.130 MHz
	4.610 MHz	9.210 MHz
	5.930 MHz	10.235 MHz
	7.575 MHz	10.370 MHz
	7.660 MHz	

Metropolitan Network (Lima - VHF/FM) 153.100 MHz

Urban Network VHF/AM 39.100 MHz
VHF/FM 153.150 MHz (to Callao)

Provincial Independent Network VHF/FM 169.400 MHz

APPENDIX 2

NATIONAL NETWORK: EQUIPMENT LIST AND ESTIMATED COST

Item	Quantity	Unit Cost	Total Cost	Description
1.	13	$ 50	$ 650	Modification kit to convert RF Communications Transceiver model SSB Compact to four-channel operation (currently equipped for 2)
2.	76	25	1,900	Sets of crystals to change all operating frequencies to newly assigned frequencies (see Note 1).
3.	25	1,400	35,000	SSB transceiver, 125-watt pep, fully transistorized except for final amplifier, 2 - 18 MHz, upper side band only, CW option, four channels, 12 volts DC input, four separate inputs required, and other standard options. Set will be RF Communications model RF2200-dc-4 or equivalent (see Note 2).
4.	13	1,200	15,600	SSB transceiver, same specifications as Item 3, except power input, which is now 220 v, AC, 60 Hz. Set will be RF Communications model RF2200-ac-4 or equivalent (see Note 3).
5.	5	2,000	10,000	SSB transceiver, portable, 20-watt output; 6 channels, no CW option but antenna coupler to be automatically (or very easily) tunable. The set will be able to operate from batteries 220 v AC supply (accessory acceptable for this purpose), and a cable for operation from car battery will be supplied. All other specifications similar to those of Item 3. Set will be RF Communications RF1400-A or equivalent.
6.	1 lot	12,000	12,000	Spare parts for items 3, 4, and 5, not to exceed 20% of total equipment value.

Item	Quantity	Unit Cost	Total Cost	Description
7.	6	400	2,400	Antenna coupler, 150-watt, 6-channel, 52 ohms input, for use in Lima, equipped with doublet antenna, antenna lead, insulators, and other necessary installation items.
8.	60	150	9,000	Antenna kits containing the necessary equipment to install a complete doublet antenna.
9.	5,000	150/1,000	750	RG-8u coaxial cable
10.	100	0.50	50	PL-250 coaxial fittings
11.	26	500	13,000	Primary power plant, consisting of 1 motor generator, 220 v AC. 60 Hz, 1,500-watt, hand-started. 1 rectifier, full-wave, 12 v, 70 v. amp capacity. 200' of twin conductor, 20-amp, weather proof wire, breaker switch. (see Note 4)
12.	1 lot	2,000	2,000	Spare parts for motor generator, not to exceed 20% of cost of motor generator.
13.	1	1,600	1,600	HF signal generator, with built-in VTVM, for measurements of 1 micro-volt or better. Hewlett Packard 606B or equivalent.
14.	1	600	600	Frequency counter, DC to 15 MHz, 5-digit display, Hz and KHz resolution. El Dorado model 225 or equivalent.
15.	100	10	1,000	CW transmitter keys
16.	3	500	1,500	Audio amplifier and remote control equipment unit for Item 4 (transmitter at remote control site) (see Note 5)
			$107,050	
			8,564	8% GSA surcharge
			$115,614	
			22,386	20% transportation
			$138,000	GRAND TOTAL

Note 1: The PIP currently uses three frequencies, one for each of the sub-networks: 9,100 KHz, 8,214 KHZ, and 4,438 KHZ. However, these frequencies have been "loaned" to the PIP and must be vacated shortly. Nine new frequencies have been assigned recently and the verification of their suitability for our application has been started during the survey. One frequency has already proved unusable due to heavy interference (8,130 KHz). It is therefore impossible to distribute frequencies at this time. All frequencies are listed in Appendix 1, Section 2.

Note 2: The 25 D.C. transceivers will be distributed as follows:

22 to locations where no primary power is available.

3 for back-up maintenance, to be stored in Lima warehouse.

Note 3: The 13 A.C. transceivers will be distributed as follows:

6 for the remote control site in Lima.

4 for the interior stations where A.C. power is available.

3 for back-up maintenance, to be stored in the Lima warehouse.

Note 4: 22 sets will be distributed to the stations where AC power is not available. The generator is to be used to change the battery on predetermined schedules. The station must be on a listening condition at least 16 hours per day, and 24 when necessary.

3 sets are to be kept in the Lima warehouse for back-up and stand-by purpose.

APPENDIX 3

METROPOLITAN NETWORK: EQUIPMENT LIST AND ESTIMATED COST

Item	Quantity	Unit Cost	Total Cost	Description
1.	3	$4,500	$13,500	Repeater, 70-watt, one-frequency receive, one-frequency transmit, standard squelch, usual standard options. Wire line control of any nature is not required. Time out timer not needed. Narrow band duplexer to be provided.
2.	3	200	600	Antenna, omnidirectional gain in 136 to 174 MHz band, 4.5 to 5.5 db or better (Colinear array), with mounting clamps.
3.	200		50	RG-8/U coaxial cable and fittings
4.	1	500	500	Tower 30' disassembled, painted and supplied with lighting equipment. Suitable for Zone A (per EIA RS-22-A) usage.
5.	40	50	2,000	Modification kits for General Electric transceiver model RG59TAS56 to accomplish the following: Add second operating frequency (frequency to be determined on request); Convert each unit from wide band to narrow band operation.
6.	1	300	300	Modification kit for General Electric Co. transceiver model RG59TFS66 (300-watt) to: Equip two other channels for operation at two additional frequencies to be determined upon request; Convert to narrow band operation. (Note: This unit will double as standby for the other two control transceivers, if and when needed;)
7.	1		200	Modification kit for Motorola 60-watt base transceiver to change two frequencies and to convert to narrow band operation.

Item	Quantity	Unit Cost	Total Cost	Description
8.	1	2,100	2,100	Base station radio, 60-watt max., 30-watt min., 1-frequency receive, 1-frequency transmit, extended local control (100' cable kit to be included for this purpose).
9.	2	300	600	Antenna, broadband directional or omnidirectional. 6 db gain (decibel product #224 or equivalent).
10.	2	100	100	Duplexer
11.	1		3,000	Spare parts kit for Items 1, 8 not to exceed 20% of the total equipment cost.
12.	3	400	1,200	Resonant cavities, 2 db insertion loss for base receivers.
13.	1	3,000	3,000	Multi-function test set (frequency counter-deviation meter-signal counter and level meter). Cushman CM-3 or equivalent.
			$27,100	Equipment Total
			2,170	8% GSA surcharge
			29,270	
			5,730	20% shipping costs
			$35,000	

Note 1: This selection of equipment will provide the control center with three transceivers, two of which are already in operation.

A. The General Electric 300 w. transceiver will be equipped for three-frequency operation and will serve as stand-by, if and when needed.

C. The new unit provided will serve as the third main channel base.

Note 2: The current frequency of operation is 153.100 MHz. The point-to-point net to Callao is operated on 153.150 MHz; this frequency will be made available for this proposal should another one not be available.

Note 3: The frequency assignments should be made on the basis of two distinct frequencies for transmitting and receiving with a translation at the repeater.

Note 4: All installation and modification labor to be provided by the PIP as will be the housing facilities for the repeater station.

APPENDIX 4

URBAN NETWORK: EQUIPMENT LIST AND ESTIMATED COSTS

Item	Quantity	Unit Cost	Total Cost	Description
1.	1	$1,500	$1,500	Portable repeater, fully transistorized, 10-watt, 1-frequency transmitter, 1-frequency receiver, standard squelch, narrow band. Motorola model N1106 or equivalent.
2.	1 lot	400	400	Accessories for Item 1, to include: 220-volt power supply, microphone, high sensitivity option, external battery cable.
3.	1	400	400	Antenna, omnidirectional, 6 db gain or more.
4.	7	1,000	7,000	Consolette base station, solid state 30-watt, 1-frequency transmitter, 1-frequency receiver standard squelch, 220-volt AC input, desk microphone and high sensitivity option. Similar to Motorola L33BBB110030M.
5.	7	200	1,400	Antenna, folded cardioid, 3 db gain
6.	500		100	RG-8/U coaxial cable and fittings
			$10,800	Equipment Total
			864	8% GSA surcharge
			11,664	
			2,336	20% transportation
			$14,000	Grand Total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