Law Enforcement Communications Study

for the

State of WYOMING

Presented By _____

PREFACE

This report represents a condensed version of the recently completed "Law Enforcement Communications Study for the State of Wyoming" conducted on behalf of the Governor's Planning Committee on Criminal Administration by the Motorola Communications and Electronics Company, Inc. This survey was funded with monies available to the State of Wyoming under the Omnibus Crime Control and Safe Streets Act of 1968 through the Law Enforcement Assistance Administration of the United States Department of Justice.

In executing the contract for this survey, the Governor's Planning Committee on Criminal Administration requested the consultant to review and make recommendations concerning three aspects of the law enforcement communications system in the State of Wyoming. These included: (1) management of the system, (2) operational requirements of the system and (3) equipment needs for meeting operational objectives. The consultant conducted this study in three phases including: (1) a data gathering phase, (2) a system analysis and design phase and (3) an equipment specification phase. This report represents substantially all of the material presented to the Committee in Phase Two together with a brief summary of the information developed during Phase One.

The major recommendations of the "Law Enforcement Communications Study" can be summarized as follows:

1. Recommendation for the development of a "backbone" communications linkage which would tie together all law enforcement agencies throughout the state.

   The Motorola recommendation for this "backbone" was the development of a statewide microwave system.

2. Recommendation for channel or frequency separation by function.

   This recommendation was designed to deal with the problem of channel congestion in the current Wyoming system and also to facilitate the development of a common statewide emergency channel. The Motorola survey recommends four law enforcement channels including Wyoming Highway Patrol, county sheriffs, city police and statewide emergency.

3. Recommendation for the development of a statewide emergency channel.

   This recommendation was designed to address the need for coordinated communications coverage between cooperating law enforcement agencies and to allow for law enforcement access to communication facilities at any location in the state.

4. Recommendation for combined regional communications dispatch centers.

   This recommendation was designed to reduce the degree of duplication of effort and resulting waste of resources which currently exists in the Wyoming law enforcement communications system. The Motorola survey recommends eleven regional dispatch centers operating from strategic locations throughout the state.

5. Recommendation for independent, state-level law enforcement communication system management.

   This recommendation was based upon the need for continuing, professional management of the system in an agency which would be free of individual user pressures and capable of coordinating the entire system. The Motorola survey recommends a State Division of Communications, probably to be located in the State Department of Administration and Fiscal Control, which would be assisted by a User Advisory Committee consisting of a cross section of user representatives.

While there may be agreement as to the need for eventual adoption of all or some of these general recommendations of the Motorola survey, alternatives for the specific implementation of these recommen-

dations must be explored prior to any decision to recommend significant changes in the existing system. It is the hope of the Governor's Planning Committee on Criminal Administration that - as these alternatives are identified and evaluated - a coordinated plan for the improvement of the law enforcement communication system of the State of Wyoming which will be agreeable to all parties concerned can progressively evolve.

It should also be noted that each phase of this survey was presented to, and reviewed by, an interagency committee composed of representatives of the major users of the present Wyoming law enforcement communication system. This committee included representation from the Wyoming Highway Department, Wyoming Highway Patrol, Adjutant General's Office, Game and Fish Commission, Bureau of Identification, Civil Defense Agency, Governor's Traffic Safety Coordinator, Revenue Department, Department of Health and Social Services, Department of Administration and Fiscal Control, United States Army Strategic Communications Command, National Park Service, the Albany County Sheriff's Office and the Green River Police Department.

Also participating in the review sessions were representatives of the University of Wyoming Electrical Engineering Department, Bell Telephone Company and General Electric Communications, plus several guests from other interested agencies. Each phase of the report was

also subject to the review and comment of the Subcommittee on Communications and Information Systems of the full Governor's Planning Committee on Criminal Administration. Comments by these representatives at meetings of the coordinating committee were taken into consideration by the consultants in drafting final copies of the report.

The Governor's Planning Committee on Criminal Administration would appreciate any comments or suggestions readers of this report might care to make.

Cheyenne, Wyoming
December 4, 1972

John B. Rogers
Administrator
Governor's Planning Committee
on
Criminal Administration

The Governor's Planning Committee on Criminal Administration of the State of Wyoming authorized Motorola Communications and Electronics to conduct a law enforcement study for the entire state. It immediately became obvious that a study restricted to law enforcement communications was impossible. Instead, a comprehensive survey of all state-wide communications users was needed, because all agencies need to intercommunicate with one another in order to be effective.

During the Phase I of this study, these problem areas were defined:

- Channel Congestion
- Skip Interference
- No Dedicated Statewide Emergency Communications Channel
- Multiple Dispatch Centers in the same area
- Inadequate Interagency Communications
- Inefficient Teletype System
- Radio Coverage

These problem areas are discussed briefly in the following paragraphs:

CHANNEL CONGESTION

Most Statewide communications users utilize the Wyoming Highway Patrol (WHP) low band channel. Some of these users are listed below:

- Wyoming Highway Patrol
- Sheriff's Departments
- Police Departments
- Game and Fish Department

- Port of Entry Personnel
- Brand Inspectors
- FBI Agents
- Ambulances

There are approximately 450 mobile units now on this channel and the number is growing. It is inevitable that this large number of units on a single channel must intere with each other.

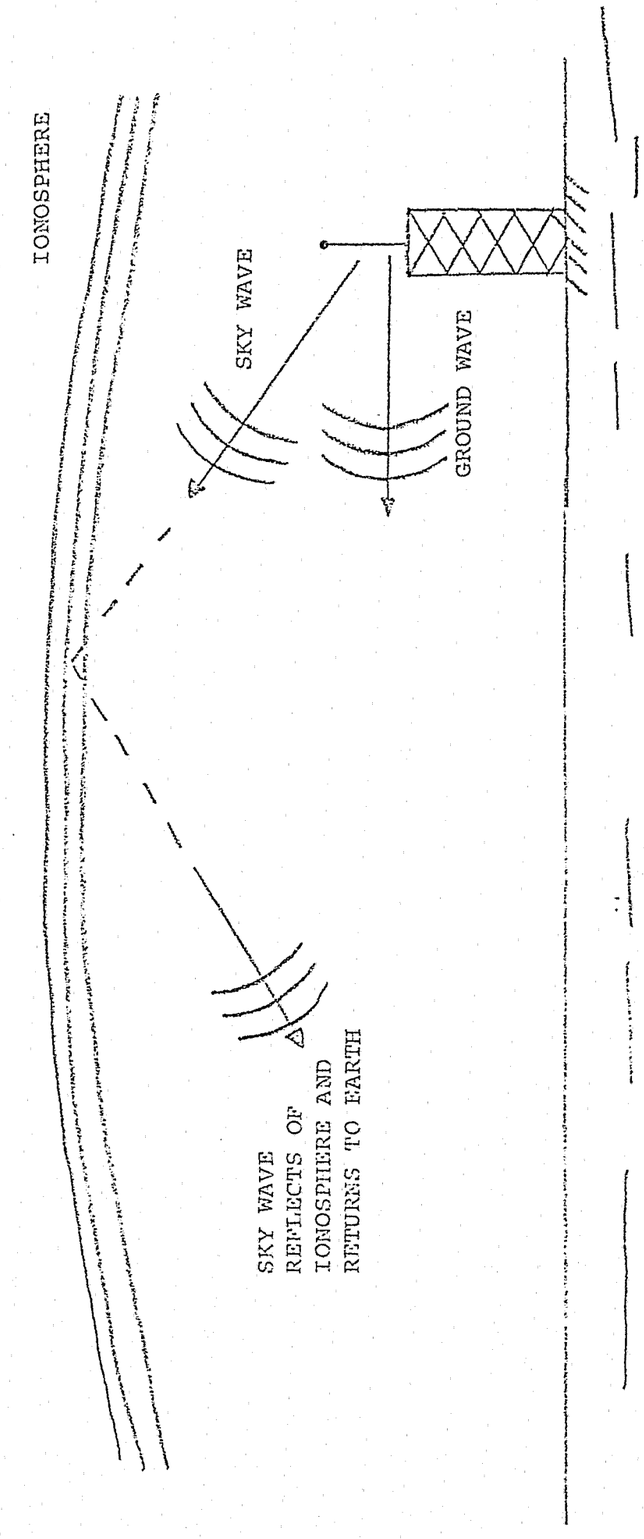
SKIP INTERFERENCE

Frequencies in the 25-54 MHz band, commonly called low-band, are susceptible to skip interference.

The Minnesota Highway Patrol, Illinois State Police and California Highway Patrol are all on the same channel with the Wyoming Highway Patrol. During the summer months, these agencies cause drastic interference on the channel, sometimes rendering the channel useless. This phenomenon is illustrated in Figure 1.

STATEWIDE EMERGENCY COMMUNICATION CHANNEL

A major deficiency in the present law enforcement radio system is the lack of an interagency emergency communication channel. As indicated in Figure 2, the WHP, Albany County Sheriff and Laramie Police Department all operate on different channels and consequently cannot immediately intercommunicate with each other via radio. This means that these agencies cannot properly coordinate the activities of law enforcement efforts during a mutual aid situation. There is, then, a very real need for an emergency communications channel available to all



SKIP INTERFERENCE
25-50 MHz

FIGURE # 1

City	Dispatch	County Sheriff	Dispatch
Gillette PD	24 hour	Campbell	8 hour
Sheridan PD	24 hour	Sheridan	8 hour
Buffalo PD	24 hour	Johnson	8 hour
Thermopolis PD	24 hour	Hot Springs	8 hour
Lander PD	24 hour	Fremont	8 hour
Rawlins PD	24 hour	Carbon	8 hour
Douglas PD	24 hour	Converse	8 hour
Torrington PD	24 hour	Goshen	8 hour
Worland PD	24 hour	Washakie	8 hour

FIGURE # 3

MULTIPLE DISPATCH CENTERS IN SAME CITIES

availability of only one party line circuit. The system is functionally diagramed in Figure 4.

All 31 users share a single party line circuit. Any station may send a message to any other station; a group of stations, or all stations. System usage is limited by the fact that there is only one party line circuit which permits only one station to send a message at a time.

A switching center at Cheyenne accepts messages to be routed into the Law Enforcement Teletype System (LETS) or into the NCIC check on a stolen vehicle, they offline type the message using a special format. That is, they make a punched tape of the message, then transmit it to Cheyenne. At Cheyenne, the message is received in two forms; printed copy and a paper tape. Since the Wyoming system uses a five level tape, the operator at Cheyenne must retype the inquiry before he can send it to NCIC. The "level" of a teletype system refers to the number of holes which span the punched tape. A 5-level system has 5 holes and is not directly compatible with an 8-level system. The return message from NCIC must likewise be retyped before it can be forwarded to the requesting agency.

INADEQUATE RADIO COVERAGE

There are numerous dead spots in several areas in the state. The area around Kaycee is essentially dead. Also the area east of Sundance in the mountainous terrain is dead along Route 285. The Western region of the State from Sage to Jackson along Route 89 and Route 189 has several dead areas. Also the area east of Dubois is dead along Route 26.

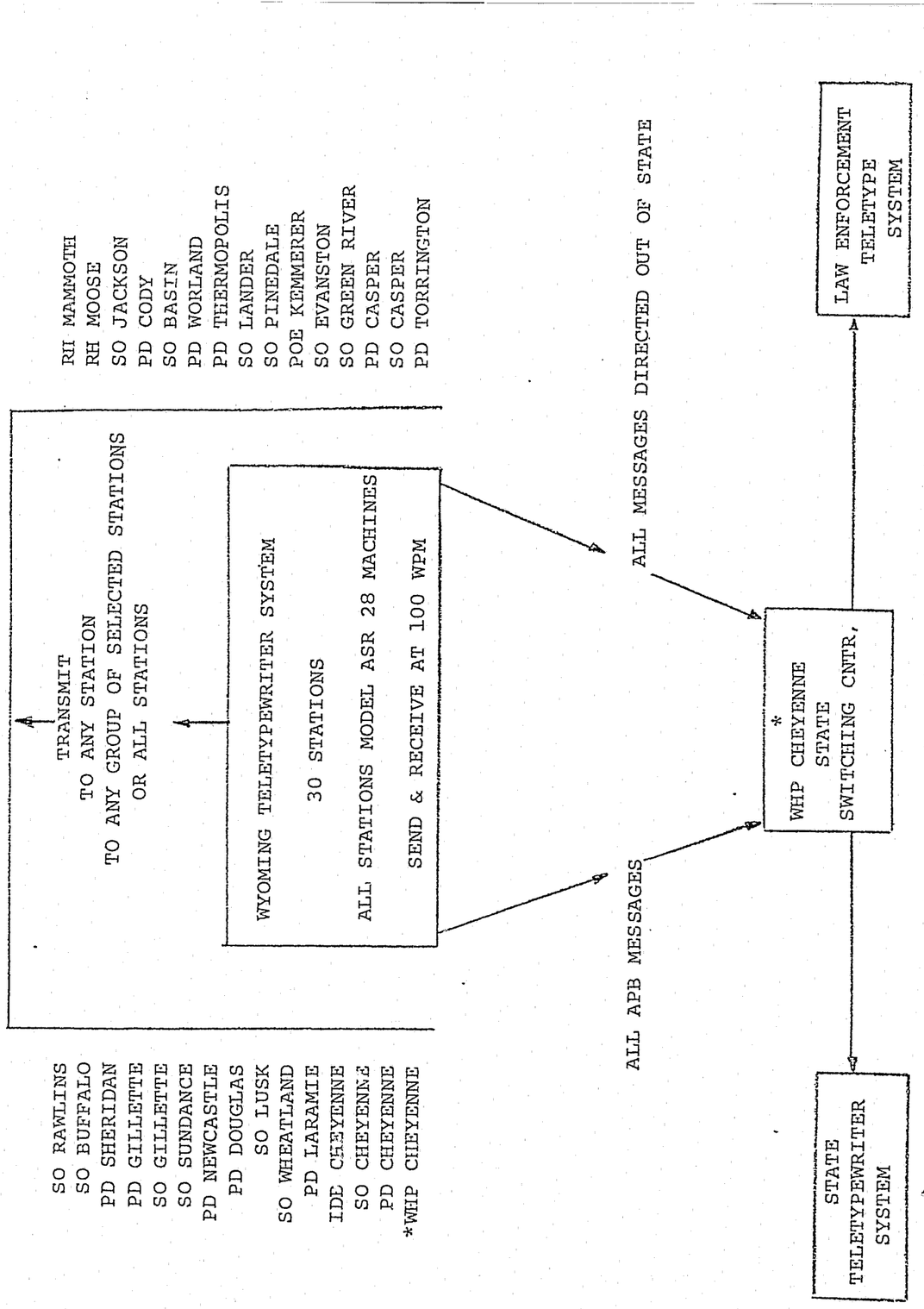


FIGURE # 4 WYOMING TELETYPE SYSTEM

These areas are just a few of the dead spots adversely affecting state-wide communications systems.

An analysis of the stated problems results in the following suggestions for a more effective state-wide communications complex:

1) State-wide Microwave Backbone System
2) Regional Communications Centers
3) New, Solid State Equipment
4) Expansion of existing Systems
5) Installation of New Systems
6) Centralized Management of a State-wide Communications System

These recommendations will be discussed further in the following paragraphs:

STATE-WIDE SYSTEM RECOMMENDATIONS

In order for any type of State-wide Communications System to be effective, it must be capable of talking into all areas of the State, mountainous as well as flat, rural as well as metropolitan. This system must have the capability of linking all agencies together as required ie; (police with sheriff, road department with highway patrol, etc.). Further. the system must be designed to accomodate all state agencies to include such users as the Internal Revenue Service, Forestry, Fish and Game, as well as all Law Enforcement Agencies. The more agencies involved, the more effective the system and the less cost to each user.

A Microwave Backbone System is mandatory for an effective state-wide

communications system.

MICROWAVE BACKBONE SYSTEM

The Microwave Backbone System is the nucleus of the entire coordinated communications system for the State of Wyoming. It is absolutely essential to any serious approach to a state-wide communication system. The microwave backbone provides the essential tool for implementing a truly intergrated inter-agency communication system which will link together all state agencies scattered throughout the state.

A microwave system is a radio system which is capable of carrying a large number - typically 300 - of telephone type circuits. A microwave system consists of radio frequency (rf) and multiplex equipment. The rf equipment is analogous to the conduit in an electrical wiring system. Depending on the radio frequency of operation, the rf equipment is capable of handling a certain number of channels, just as a conduit can hold a fixed number of electrical wires, or circuits. The multiplex equipment compares to the wires in the conduit; just as the wires in the conduit can be connected to power outlets, lights, or doorbells, the multiplex equipment can be connected to base station on mountain tops, telephones, or computers and data terminals. Once the rf equipment is installed, additional multiplex channels may be added at a modest cost.

This Microwave Backbone System will be able to "tie in" circuits from

any one location within the state to any other location within the state.

Each microwave link will hook up to another link without the use of unreliable telephone lines. In this way, the various cities and communities are connected together via the microwave backbone system. This configuration provides teletype circuits, telephone circuits, computer circuits, telemetry circuits and many other functions required between these locations on a daily basis. Note that at this point no radio systems have been connected to the backbone system.

The backbone system will accommodate any type radio system, regardless of frequency band, power, age, or useage. Therefore, it would not be necessary to immediately replace or even upgrade existing radio systems in order to utilize the advantages afforded by the backbone system. Existing radio systems could be immediately connected to the backbone system and upgraded or replaced as funds became available at a later date. Figure 5 shows how each dispatch center can be tied into the microwave system.

As an example, the existing Highway Maintenance radio system could be connected to the backbone system when it is first installed. The existing base stations are already occupying space on the same mountain tops that the microwave backbone equipment will occupy. Thus, the base stations and their antenna systems could be adjusted so as to provide coverage of the immediate area around the mountain tops. With the backbone system installed it would no longer be necessary for the radio

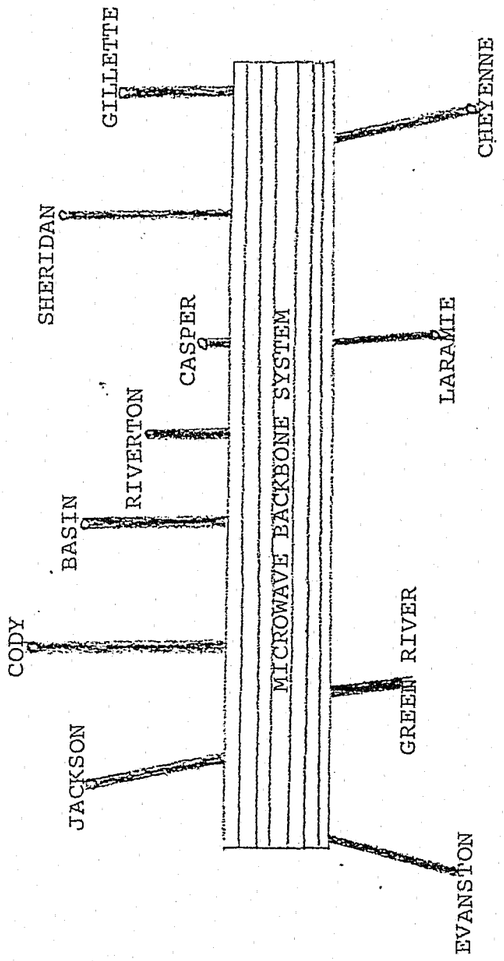


ILLUSTRATION OF MICROWAVE BACKBONE SYSTEM TYING
CENTRALIZED COMMUNICATIONS CENTERS TOGETHER STATEWIDE

FIGURE # 5

stations to talk mountaintop to mountaintop in order to relay base to base information. Reduction in coverage from each mountaintop would eliminate or greatly reduce the unnecessary interference experienced on the system as it is now configured. This advantage is illustrated in Figures 6 and 7.

In Figure 5, the overlap of coverage provides base to base communications, allowing manual relay of messages from one base to another. This configuration has the disadvantage of each base station interfering with the other each time they communicate with their respective mobiles. When Mountaintop #1 transmits to mobiles in that area, the transmissions are also heard by the mobiles operating in the vicinity of Mountaintop #2.

By reducing the radio coverage from each mountaintop, the interference is eliminated. Base to base communications would then be accomplished via the backbone system as illustrated in Figure 7. By proper utilization of the backbone system, a Dispatcher in Cheyenne or any other dispatch center could transmit and receive, selectively, over any mountaintop base station within the state. Also, a dispatcher in Rock Springs would have "intercom" communications with any other dispatch center in the state. Note that all these advantages accrue to the Highway Maintenance System without replacing any of the existing radio equipment, base or mobile. All other existing systems could be connected to the backbone system and enjoy the same type advantages.

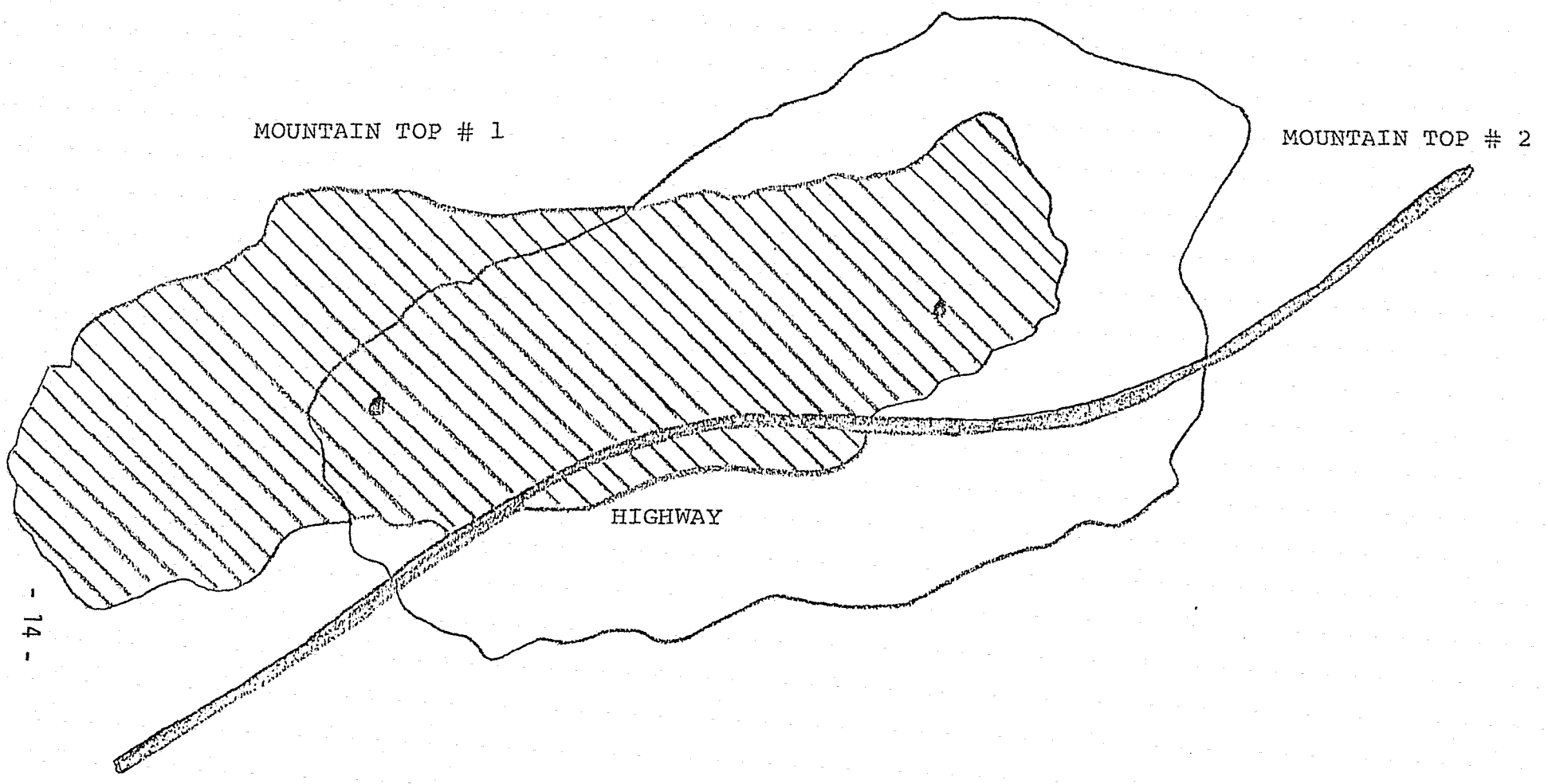


FIGURE # 6

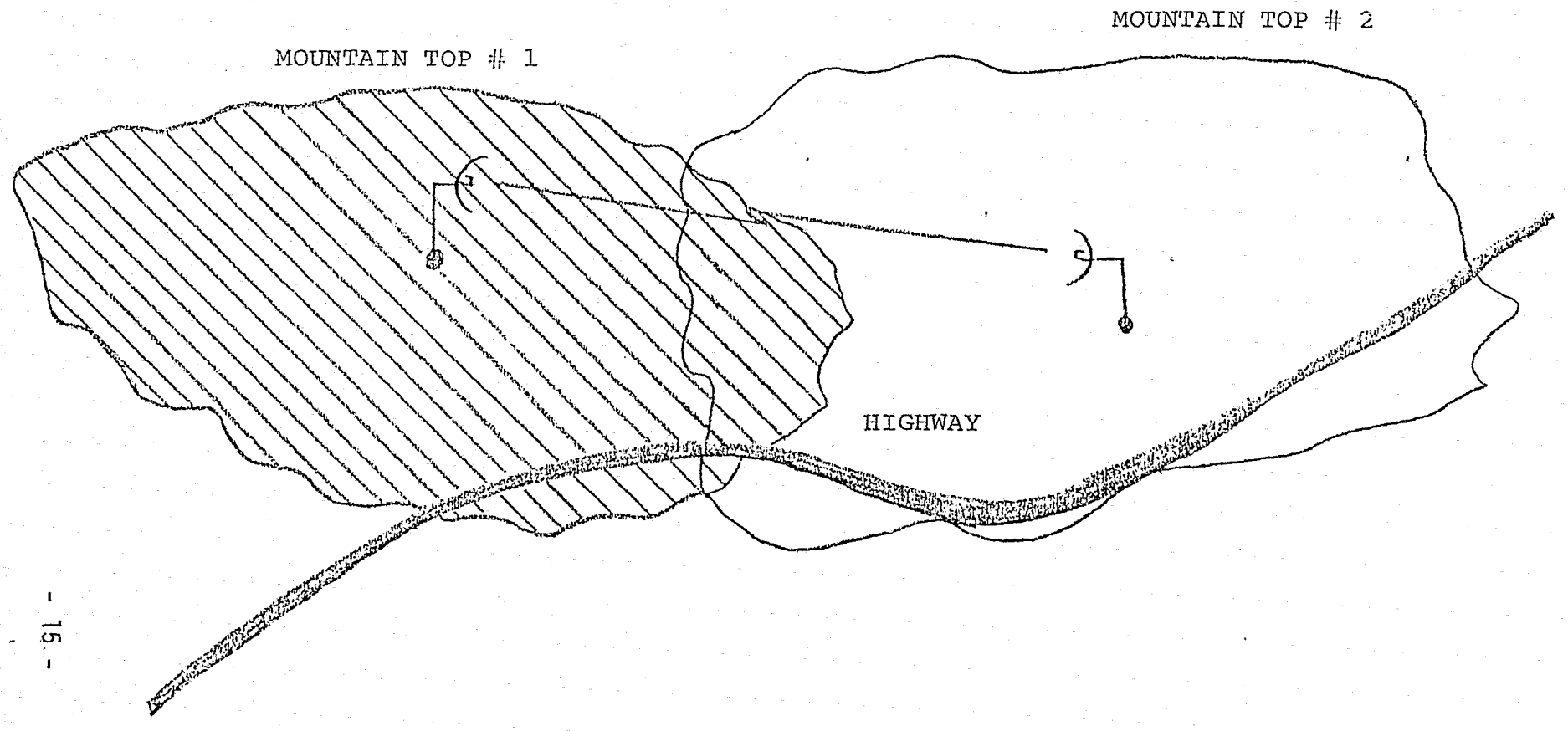


FIGURE # 7

REGIONAL COMMUNICATIONS CENTERS

The purpose of a Regional Communications Center is to consolidate all dispatching facilities under a single roof. This has the effect of vastly increasing dispatching effectiveness and, at the same time, drastically reducing dispatching costs.

Initially, 11 Regional Communications Centers (RCCs) would be required. These RCC locations are indicated in Figure 8. Nine of these RCCs would be equipped with a single two position console, backed up and supervised by a single one position console. Because of the heavier traffic handling requirements of Cheyenne and Casper areas, these two RCCs would be equipped with three two position consoles, backed up and supervised by a single one position console. All consoles would have control facilities for all circuits handled by that RCC. The positions would be designated and manned in accordance with traffic handling requirements. As an example, during heavy traffic shifts, one position would handle all public safety traffic while the other position would handle all other traffic. During emergencies or other peak traffic periods, the supervisory position would handle the overflow traffic. During low traffic shifts the RCC would be manned by one operator dispatching all traffic from one position. Overflow traffic would be handled by the shift supervisor.

In addition to controlling the radio system, each console position will have a multiline telephone instrument. The dispatcher will act as a complaint taker and dispatcher. The complaint will be entered on color

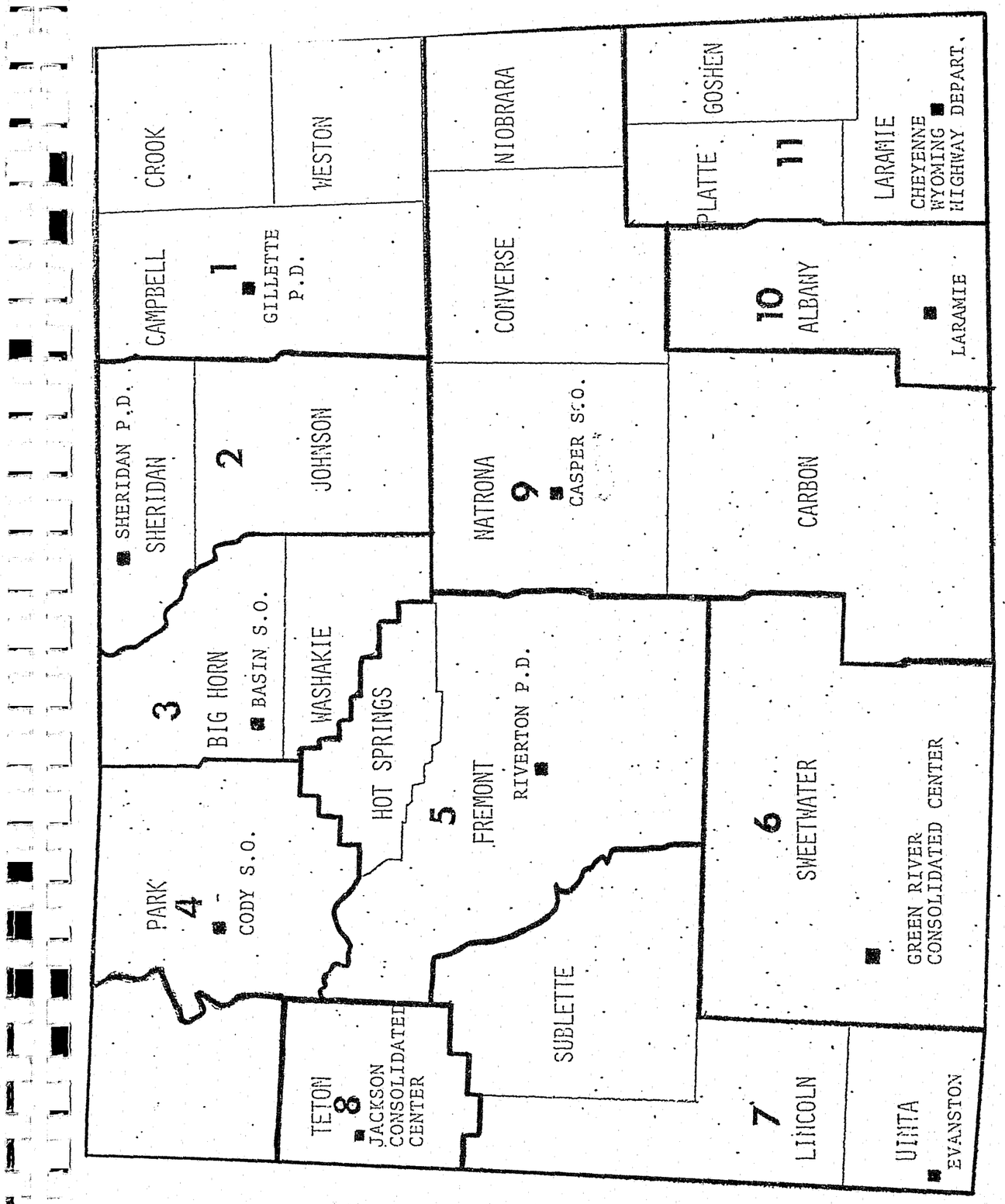


FIGURE # 8

coded IBM type computer cards which will later be used for computer record keeping.

Each center will be equipped with a Random Access Viewing Device referred to as a microfliche. A microfliche provides status storage of records. The operator keys in 3 digits on the front panel of the microfliche unit and the record appears on the screen. Microfliches typically can store 700,000 8½ x 11 views or records. Records that should be stored are:

1. Detail Map Area, Jurisdiction of Boundaries
2. Name, Address, Phone Number of All Law Enforcement Personnel
3. Auxiliary Unit Call Up Schedule
4. Location of Fire Hydrants on Maps
5. Building Layouts - Safe Locations, Escape Routes, Location of Hazardous Material Storage
6. Standard Operating Procedures
7. Emergency Operating Procedure (Civil Defense)
8. Doctors Names and Phone Numbers
9. Highway Maintenance Station Locations and Telephone Numbers
10. Telephone Numbers and Locations of Supervisor Personnel of Various State Agencies
11. Any Training and/or Operation of Equipment within the Communications Center, i.e., How to Change Tape on Logging Recorder.

It is important to note that the cost of installing, operating and maintaining a backbone system and control center complex is essentially the same whether there are two or 20 radio systems connected. It follows, then, that the more systems connected to the backbone, the less cost distributed to each individual user. As quickly as is feasibly possible, all statewide systems, as well as all law enforcement systems, should be connected to the backbone system.

Once the backbone system is installed, the state could add a state owned telephone system which would be far superior to the WATS system now leased from the telephone company. The state would own all telephone instruments and circuits. This system will provide toll free service throughout the state, providing enough circuits to eliminate long waits for telephone circuit access. In addition to normal dial telephone service, "hot line" and other special telephone and teletype circuits would be installed as required.

The backbone system would also provide data transmission capability throughout the state. Data terminals installed in outlying areas would have access to computers located in Cheyenne and other major cities in the state.

Each center will be equipped with a 24-hour logging recorder. This recorder will provide a tape of all incoming telephone calls and radio transmissions. The logging records will be equipped with a time generator and reader which will provide easy access to any recording during the 24-hour period. The logging recorder will have dual transports for simultaneous recording and playback features.

Each center will have a teleprinter for access to the LETS and NCIC data banks. When the computer facility is complete in Cheyenne, access will be provided to this data bank for inquiry of state records.

The advantage of consolidation of dispatch is reflected in the necessity for only one records system at the Regional Communication Center. Each dispatcher must have access to a Regional Master Name File for wanted persons. Therefore this file must be maintained on the regional basis. Checking intra-regional files will be accomplished via telephone on the microwave backbone. Some other types of records that must be maintained at the dispatch center are:

- Arrest Records by all Law Enforcement Agencies
- Stolen Property files
  - Vehicles
  - Guns
  - Personal Effects
- Juvenile File
- Wanted Persons
- Car Registration within the Region
- Traffic Citations Files

By entering the Master Names file, the dispatcher or records clerk can cross reference to any of the other files.

Each dispatcher must have at his finger tip the status of all units, i.e., when an officer comes on duty, he must check in with the dispatch, giving his name and patrol area. The dispatcher must know the status of all ambulances within the region to include location, phone number of drivers and equipment availability. The dispatcher must also have a list of all Wrecker Agencies within the region.

NEW SOLID STATE EQUIPMENT

Although it is not necessary to immediately replace the existing equipment in the various state agencies, i.e., Highway Maintenance, Forest Service, etc., the law enforcement agencies should be provided with new equipment at the earliest possible date. All law enforcement agencies, i.e., State Patrol, Sheriff's Department, and Police Departments, will require new equipment to facilitate interagency communications as well as to provide for a statewide emergency communication channel. These extra channels will naturally require multichannel mobile and portable equipment.

Four channel VHF equipment is recommended. Radio propogation studies of the Wyoming terrain indicate that best communications coverage can be expected on VHF. Also, if action is begun immediately to obtain the necessary channel authorization from the FCC, it is reasonable to assume that enough VHF channels are still available to implement a statewide system such as is proposed herein. Four channel equipment is recommended

because the four channels will provide the versatility required for a statewide system, and because four channel equipment is available, standard, from a number of major communications equipment manufacturers

Each law enforcement agency would be assigned several frequencies which would be common within each individual agency. That is to say that a Highway Patrol vehicle would be able to talk to other patrol vehicles and to patrol base stations on the patrol channels -- but -- Sheriff's Departments and Police Departments would not be on the patrol channel. The Sheriff's Departments and Police Departments would have their own individual channels to be used for communications within their own departments.

Because of the four channel capability of all mobile and portable equipment, each agency would have their own agency channel on Channel I of their radio unit. They would have the option of carrying additional agency channels on Channels 2 and 3 of their radio unit. For instance, a Highway Patrol vehicle operating in a given area might have the patrol channel on Channel I, the local Sheriff's Department channel on Channel 2, and the Fish and Game channel on Channel 3. Thus, the Highway Patrolman could talk to the patrol on Channel I, and, at his option, to the sheriff on Channel 2, and to Fish and Game on Channel 3.

As mentioned earlier, one of the most pressing needs of law enforcement communications in Wyoming is the ability of all law enforcement agencies to talk to each other on a common channel. This capability would be provided on Channel 4 on all law enforcement mobile and portable units.

Thus, Channel 4 becomes the statewide, emergency communications channel. This would be a single frequency channel monitored by all law enforcement base stations, all Regional Communications Centers, and by all law enforcement mobile units. Any officer (from any agency) requiring immediate assistance would call for help on Channel 4, having full confidence that his call for help would be heard by all other law enforcement stations within his area.

Channel 4 would also be used by law enforcement officers traveling to other parts of the state. An Albany County Sheriff's vehicle traveling to Green River would not have the Sweetwater County Sheriff's channel on his radio unit. He would, therefore, switch to Channel 4 and communicate with the Sweetwater Sheriff's Department on that channel for as long as he operated in that area.

To insure that all law enforcement vehicles monitored Channel 4 at all times, it would be necessary to equip each mobile unit with special circuitry to automatically switch the mobile receiver to Channel 4 any time a call came in on that channel.

Typical law enforcement mobile unit channelization is illustrated in Figure 9. Note that the Highway Patrolman has the option of communicating with any patrol unit; Albany County Sheriff, or Laramie City Police, or with everyone monitoring the emergency channel. The Laramie City Policeman would have the option of communicating with his own units, Albany County Sheriff, the city local government channel, i.e., Fire, Water Department, Street Maintenance, etc., or with everyone monitoring the

	CHANNEL # 1	CHANNEL # 2	CHANNEL # 3	CHANNEL # 4
HIGHWAY PATROL	HIGHWAY PATROL	ALBANY COUNTY SHERIFF	LARAMIE CITY POLICE	EMERGENCY
SHERIFF'S DEPARTMENT	ALBANY COUNTY SHERIFF	LARAMIE CITY POLICE	HIGHWAY PATROL	EMERGENCY
POLICE DEPARTMENT	LARAMIE CITY POLICE	ALBANY COUNTY SHERIFF	LARAMIE CITY LOCAL GOVERNMENT	EMERGENCY
FORESTRY DEPARTMENT	FORESTRY	HIGHWAY PATROL	ALBANY COUNTY SHERIFF	BLANK

TYPICAL MOBILE CHANNELIZATION

FIGURE # 9

emergency channel.

This channelization scheme permits each agency to carry on its day to day communications on its own channel without suffering interference generated by other agencies on the channel. Yet, by selecting another channel or by selecting Channel 4, interagency communications is available when necessary.

Non-law enforcement communications users, i.e., Forestry Service, Fish and Game, Fire Departments, Ambulances, County Road Maintenance, City Street Maintenance, etc., would be equipped with the exact same type multichannel mobile and portable equipment. Although most of these agencies would not usually have the requirement for more than one or two channels, there are several reasons for them to be equipped with the multichannel units. All communications equipment would be purchased by the state. This large purchasing power would allow purchase of multichannel equipment at a much lower price per unit than could be expected when each individual agency purchases a few units at a time. Buying all one type of equipment greatly reduces logistics problems. Only one type of parts stockage is required thus effecting significant savings in parts inventories. Technical manuals and technical training exercises would be reduced to one type of equipment and the technicians would obtain greater proficiency in less time. Thus, the equipment would work better and would require less down time for repairs.

Solid state equipment is today's state-of-the-art. All equipment in the recommended statewide system should be 100% solid state. This includes the microwave backbone equipment, repeaters, base stations, and, of

course, all mobiles and portables. Because it generates much less heat, it can be enclosed in smaller housings and can, therefore, be constructed so as to render a much more rugged, more durable unit. Reliability is enhanced by about 10 times that expected of tube type equipment. Solid state equipment requires much lower power levels than does tube type equipment. This feature makes it ideally suited for remote mountaintop locations where power limitation is a serious restraint to communications. Solid state equipment can be expected to work better for longer periods of time, and with less maintenance.

EXPANSION OF EXISTING SYSTEMS

Existing statewide systems are restricted to local radio coverage, i.e., the dispatcher can talk only as far as his base station will talk from a tower or mountaintop. He may be able to relay a message to another dispatcher by talking from mountaintop base station to mountaintop base station, but this manual relay of information is slow, subject to mistakes in translation, and a gross waste of usable channel time. These problems will be eliminated for all law enforcement agencies when the micrwoave backbone system and Regional Communications Center (RCC) complex is installed (see Figure 5). All other statewide systems should immediately make use of the backbone/RCC complex to eliminate their communications limitations.

Existing statewide systems (non-law enforcement) could benefit from all the advantages of the backbone/RCC complex without purchasing new equipment. Existing base stations, mobiles, and portables could be used

used just as they exist today only they would provide much more effective communications because of the connection to the backbone/RCC complex.

Using the State Highway Maintenance System and the State Forestry Service System as examples, intergration of existing systems into the backbone/RCC complex will be explained.

Reference Figure 10 , the numbered circles represent mountain tops selected to carry the microwave backbone system and to provide radio communications coverage for the area around the mountain. The wider paths from one to two to six represent the "trunk" portion of the backbone and the more narrow paths from three to four and five to four represent "links" necessary to tie remote areas into the backbone. The "drops" to the Regional Communications Centers (RCC) are represented by single lines. The arrows indicate that the backbone trunk extends into other parts of the state.

Assuming that mountain top one is near Cheyenne and the RCC connecting thereto is in Cheyenne, the State Highway Maintenance System (SHM) and the State Forest Service System (SFS) would normally be dispatched from the Cheyenne RCC. Both systems would also have control points located in their respective headquarters.

The mobile and portables operating within these systems would transmit/receive through the base stations located on the mountain top. These

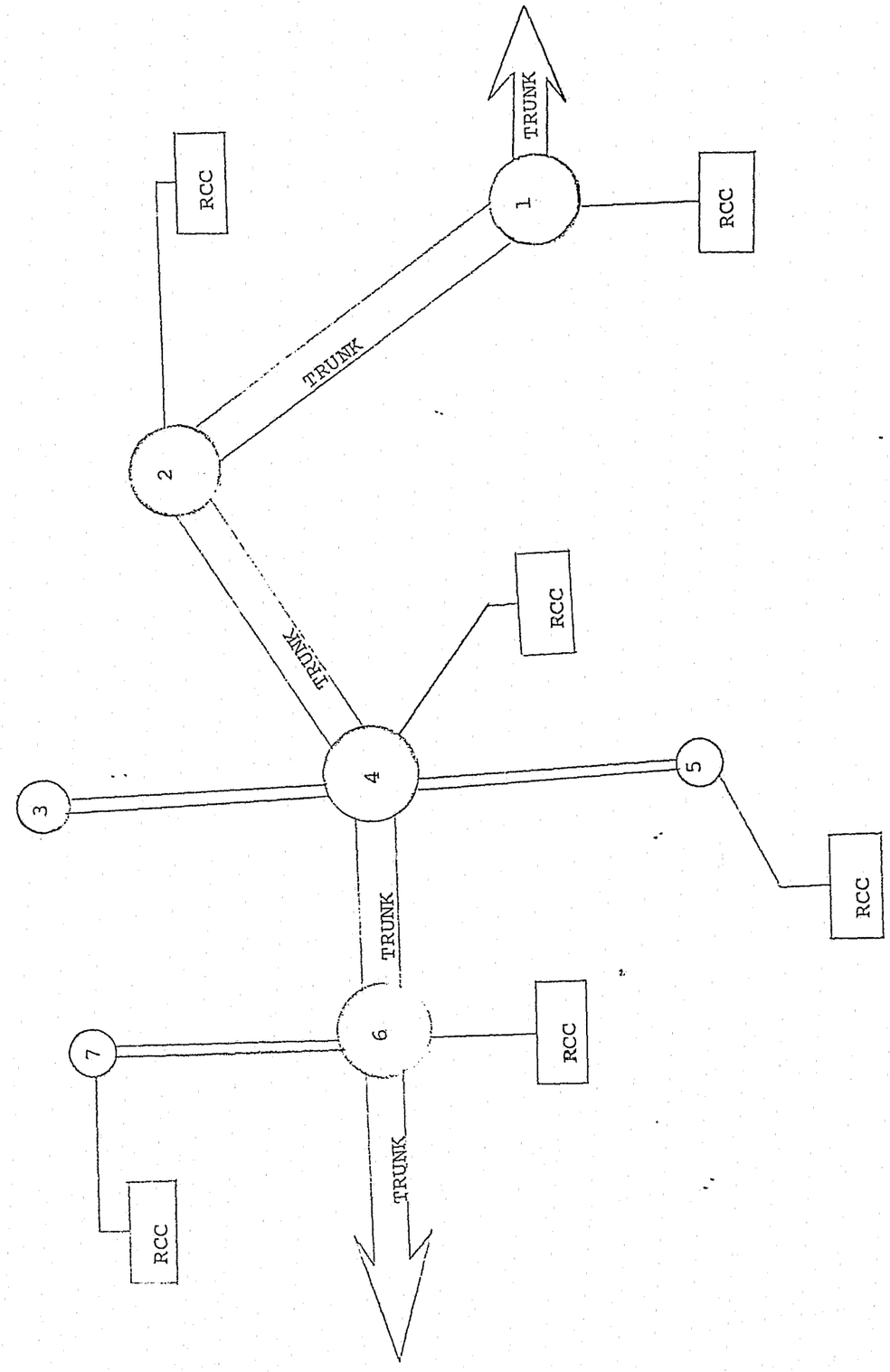


FIGURE 10 ILLUSTRATION OF MOUNTAIN TOP/BACK BONE/RCC RELATIONSHIP

conversations would travel through the microwave drop to/from the dispatcher in the Cheyenne RCC. If necessary, direct communications with their respective headquarters could be accomplished via the phone lines between the RCC and the headquarters buildings.

The Cheyenne dispatcher would have communications with the mobiles/portables operating within radio communications range of mountain top number 1. The Cheyenne dispatcher would also have communications with mobiles/portables operating within range of other mountain tops throughout the state. This configuration is diagramed in Figure 11.

A Highway Maintenance dispatcher in Cheyenne wishing to talk to a mobile in the Sheridan area would select the mountain top #3 base station and call the mobile. His call would travel thru the microwave drop from the Cheyenne RCC to mountain top #1, thence via microwave trunk from mountain top #1 to mountain tops #2 and #4 and via microwave link to mountain top #3. The Highway Maintenance base station on mountain top #3 (near Sheridan) would then be under the control of the Cheyenne RCC dispatcher. After the Cheyenne dispatcher had completed his conversation with the Sheridan mobile, he would release control of the mountain top #3 base station.

Using the same path on the backbone, the Cheyenne dispatcher would have "intercom" contact with the Sheridan dispatcher through the Sheridan RCC microwave drop. In fact, any dispatcher in any RCC would have "intercom" contact with any other dispatcher in any other RCC in the

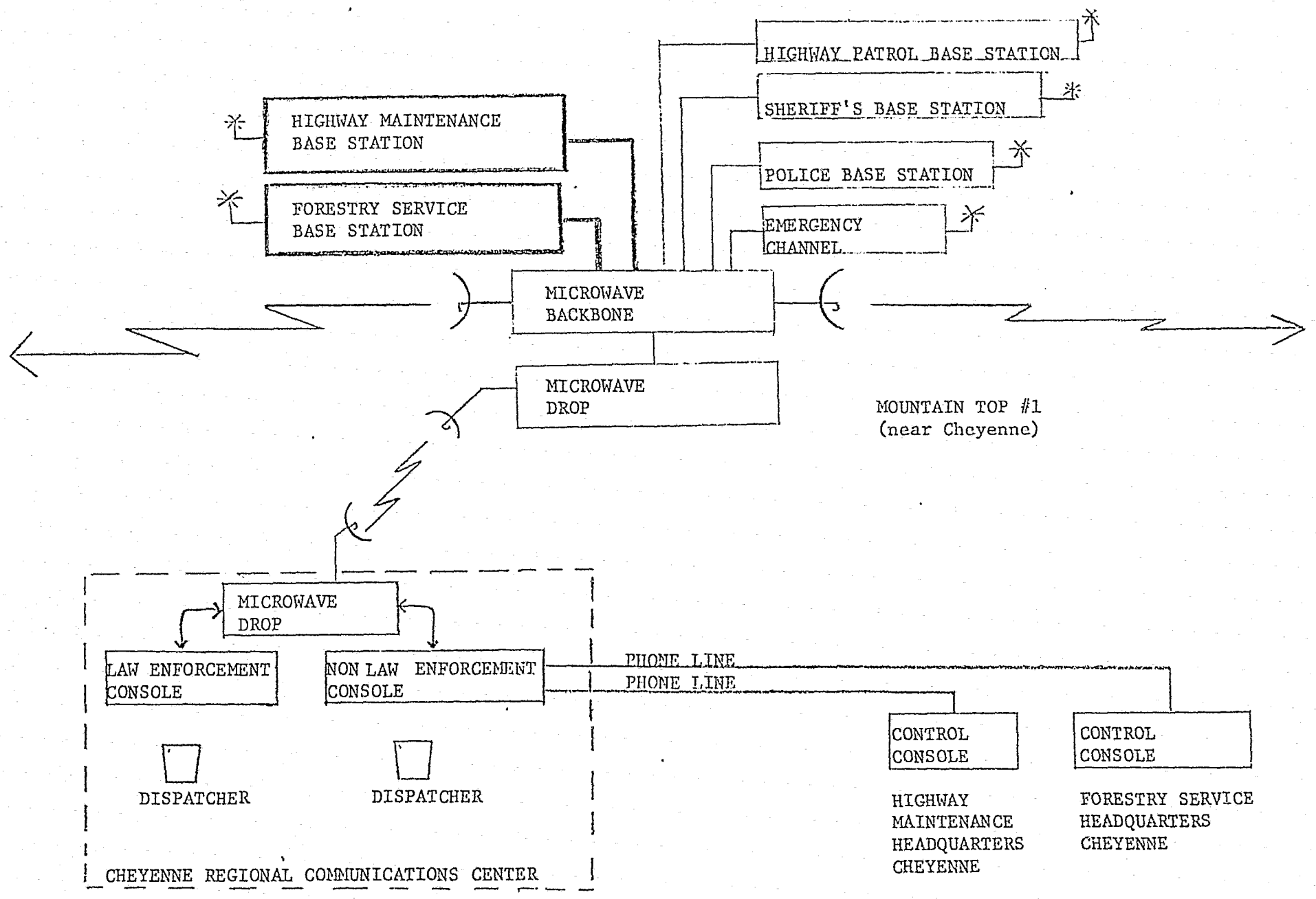


FIGURE #11 ADDING NON-LAW ENFORCEMENT SYSTEMS TO THE BACKBONE/RCC COMPLEX

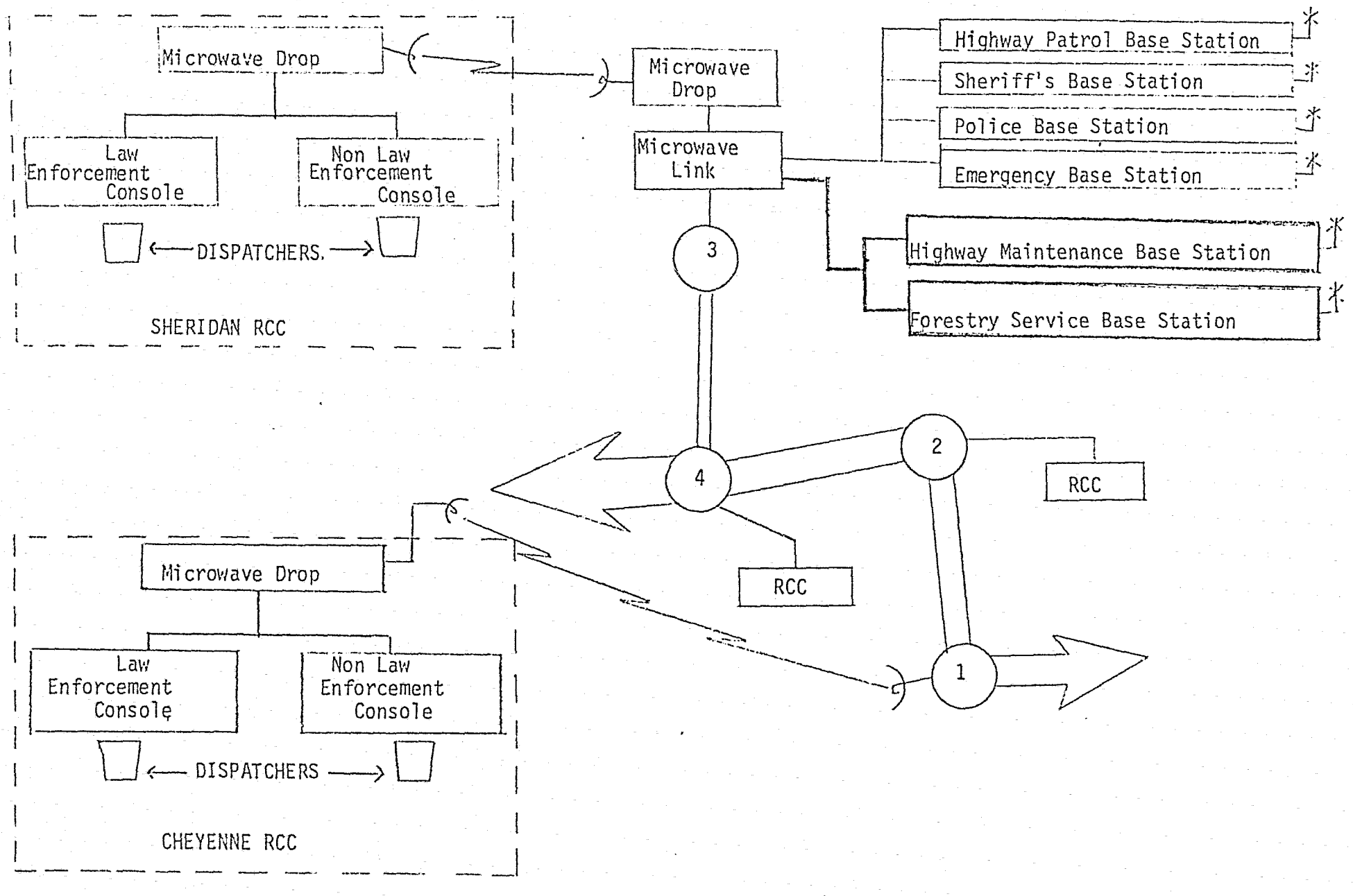


FIGURE # 12 UTILIZATION OF BACKBONE SYSTEM BY NON-LAW ENFORCEMENT AGENCIES

in the state. Also, any dispatcher in any RCC would communicate with mobiles/portables from base stations located on any of the mountain tops where the microwave backbone system is installed. Reference Figure 13, a Forestry Service Dispatcher in Laramie RCC could talk to a mobile in the vicinity of the Jackson RCC or he could have "intercom" communications with the dispatcher in Gillette. He could, in fact, have radio contact from any of the mountain tops and "intercom" communications with any of the RCC's.

This expanded communications capability is available to any statewide system simply by connecting existing system base stations/repeaters to the backbone system. The more statewide systems taking advantage of this system expansion capability, the less the system will cost each individual user. The backbone system must be installed to support one communications system. Adding additional systems costs very little and helps share the cost of the backbone system installation, maintenance and administration.

Connecting existing systems to the new backbone/RCC complex would allow each user to continue using existing equipment until it is beyond economical repair--and still make use of the expanded capability of the statewide system. As the existing equipment became obsolete, and as funds became available, new, high band equipment conforming to statewide standards could be purchased and installed. This "phase-in" approach eliminates the requirement for large investments from each user in order to take advantage of statewide system.

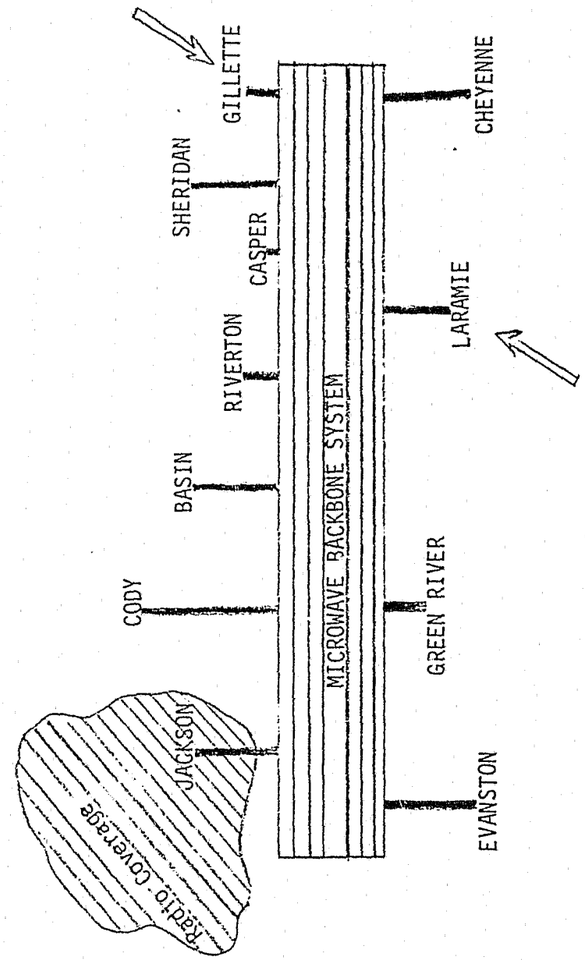


FIGURE # 13

FORESTRY SERVICE DISPATCHER IN LARAMIE HAS RADIO AND INTERCOM COMMUNICATIONS STATEWIDE

The statewide system would provide (as required) all agencies with:

1. "Ring down" or "hot" telephone circuits
2. Intercom circuits
3. Teletype circuits
4. Computer terminals for data transmission to/from centralized computers
5. Telemetry circuits
6. Base Station/Repeater Control
7. 24 hour Dispatch Service

Perhaps the Dispatch Service requires clarification. The Regional Communications Centers (RCC) would be operated by the state on a 24-hour, seven day per week basis. These RCC dispatchers would have all the necessary data at hand to handle 90% of all communications with the operating units (mobiles/portables) of all using agencies. Certain agencies may need to talk directly with their operating units, either occasionally or extensively. In these instances, a secondary control console can be connected between the local RCC and the agency headquarters. Then either the RCC dispatcher or the agency dispatcher could operate the mountain top base station.

INSTALLATION OF NEW SYSTEMS

Because of the limited statewide communications capability available in Wyoming today, the State is either doing without essential services or paying great sums to the telephone company for these services. The installation of a backbone/RCC complex will provide these services and the funds now being paid to the telephone company will make substantial contributions toward paying for the state-owned system.

One of the most important services needed by the State is a statewide Port-of-Entry Communications System.

The State Internal Revenue Service now has the problem of not having enough Port-of-Entry points to properly supervise truck traffic over the Wyoming highways. As a result, it is suspected that large amounts of revenue are lost because truckers neglect to declare their actual travel and tonnage when operating on the Wyoming Highway System. To overcome this problem, Port-of-Entry points could be established on both sides of the highway at all major highways entering and leaving the state. Such a system is illustrated in Figure 14. These points would not be manned but would have voice and teletype access to the IRS center in Cheyenne. The truck driver would stop at the remote Point-of-Entry House and call the Cheyenne IRS Center, using the telephone instrument provided. He would give the IRS operator the required data, i.e., weight, destination, cargo, name of trucking company, billing information, etc., and wait for instructions. When the driver picked up the telephone instrument an automatic identification signal was transmitted to the IRS operator telling him the location of the caller and which side of the highway he

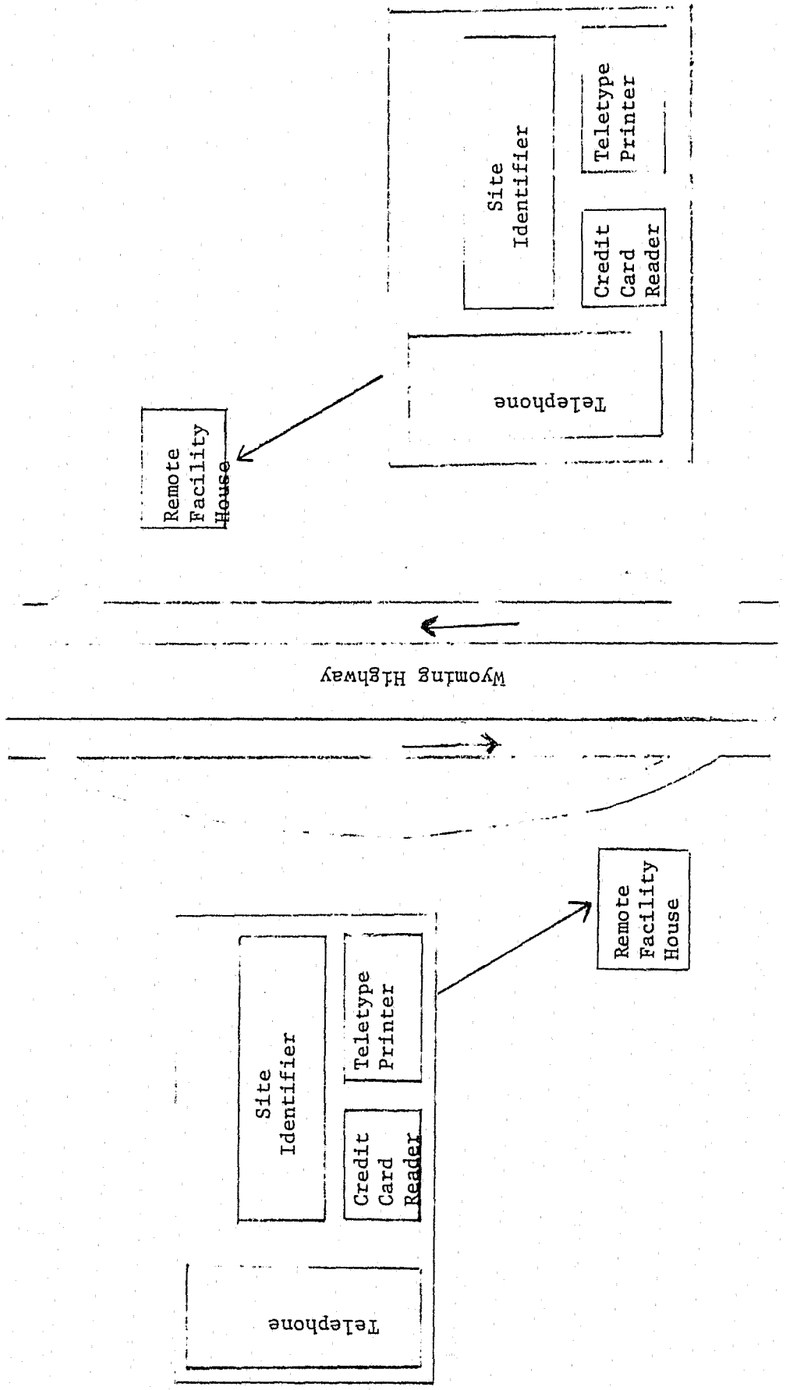


FIGURE # 14 PORT OF ENTRY REMOTE FACILITY

is on.

The Cheyenne IRS operator would verify the received information, make the necessary entries into his log and/or computer, and send the driver the requested travel authorization. This travel authorization would be in the form of a teletype message printed at the Remote Facility House on the printer provided. This teletype message would contain an authorization code (this code system would be known only to the IRS operator and the IRS patrolmen) and authorization to proceed to a given point with the cargo mentioned in the request. If the driver is later checked by an IRS patrolman, he would be required to have a teletype message containing the correct IRS code for the day and the message description must correspond to the cargo on the truck.

Wyoming based companies or companies regularly using the Wyoming Highway System would be issued plastic credit cards which would be used with the Credit Card Reader to facilitate identification and billing information.

The Remote Facility Houses located on either side of the highway would be connected together via phone lines and then connected into the statewide backbone system via radio or microwave drops to the nearest mountaintop. The entire statewide system could be handled by one centralized Port-of-Entry Center located in Cheyenne.

The installation of this system using leased telephone lines would be prohibitive. The electronic equipment required for each Remote Facility House would be approximately $6000.00. These remote facilities could be installed one at a time, placing the first units where they are needed the most. The rest of the system could be phased in as the

need became more pressing and as funds became available.

Another vital service required by the State of Wyoming is an Emergency Medical Services Communications System (EMSCC). Currently, many independent ambulance services are operating on many different communications systems and some are operating with no radio communications at all. With very few exceptions, the ambulances do not have communications with the emergency room of the hospital to which they are delivering a patient. Communications between a medical doctor in the hospital and the ambulance attendant is a rare occurrence.

The Federal Communications Commission has set aside the frequency 155.340 MHz as a channel dedicated to medical services. This channel is to be used for ambulance-hospital traffic as well as for hospital administrative traffic.

A base station on each mountaintop connected to the backbone system would provide a statewide emergency medical communications system. This EMSCC would provide direct communications between ambulances and emergency rooms and would provide hospitals with an administrative channel. An ambulance could travel any part of the state and maintain almost constant communications with the EMSCC. Because the ambulance mobiles would be high band (155.340 MHz) equipment, they would be compatible with the multi-channel mobile plan to be used by all other state communication users.

The backbone system would also provide voice circuits between hospitals throughout the state. These voice circuits could be in the form of special telephone or "intercom" channels or data transmission, i.e.,

computer data storage, etc., or telemetry such ECG information. All these circuits could be used for training and coordination of medical services.

Victims suffering from a heart attack or from a serious accident could often be assisted and saved in the ambulance en route to the hospital -- if -- the ambulance attendant had communication with the emergency room and -- if -- the doctor in the emergency room had ECG information pertaining to the patient.

Recognizing the need for ECG data, the Federal Communications Commission has set aside five UHF channels to be used for transmitting ECG information continuously from the ambulance to the emergency room. This would be accomplished by installing UHF receivers on the statewide system mountaintops and sending the ECG information over the backbone system to the emergency room that would be receiving the patient.

These systems are diagramed in Figure 15. Note that the ambulance carries two mobile radio units. One VHF two-way unit (155.340 MHz) is used for two-way communications between the ambulance attendant and the doctor in the emergency room. The other unit is UHF and is transmitting ECG telemetry continuously to the doctor in the emergency room. The signals travel to the mountaintop where they travel over the backbone system to a mountaintop close to the hospital. There the signals enter the microwave drop to the nearest Regional Communications Center (RCC) and from there to the hospital emergency room via telephone lines.

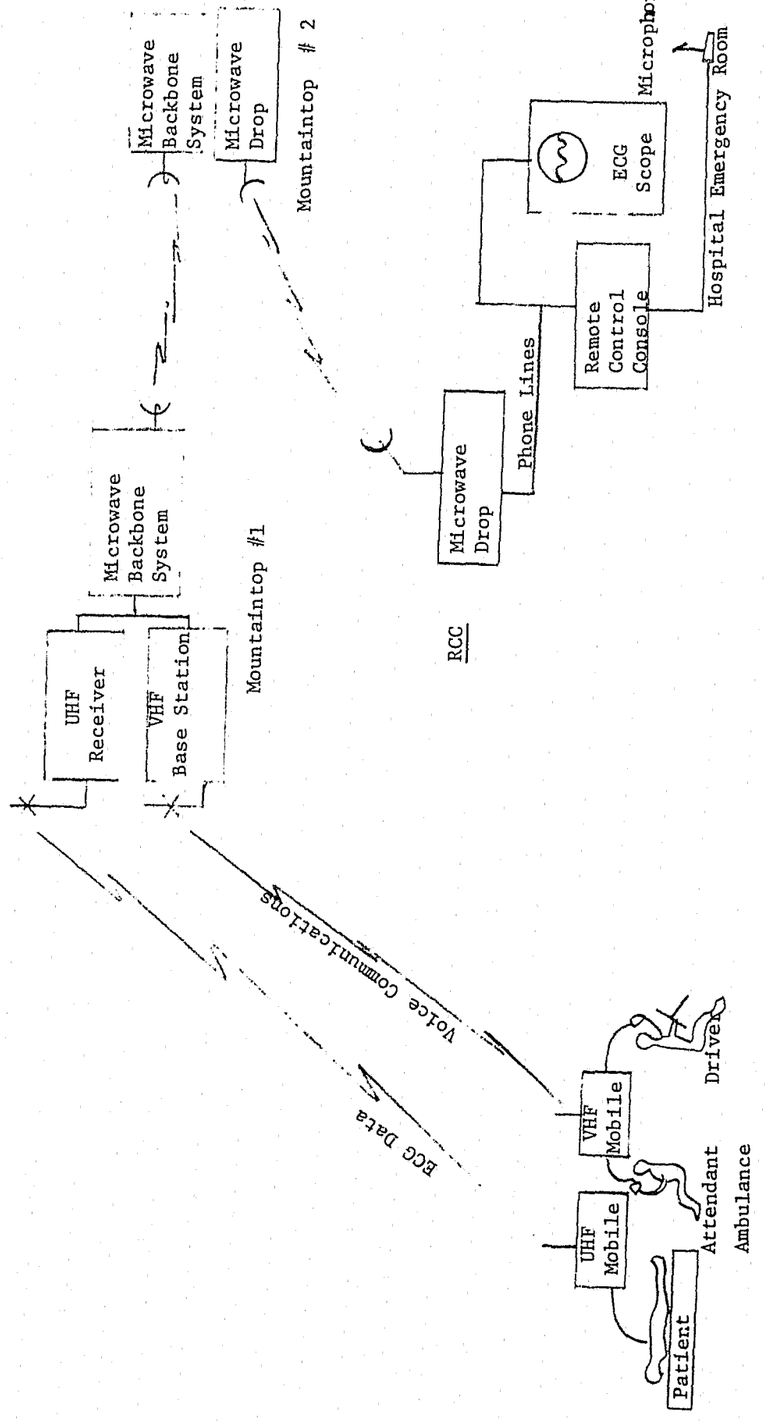


FIGURE # 15 EMERGENCY MEDICAL SERVICES COMMUNICATIONS SYSTEMS

The ECG can be monitored visually and audibly on a continuous basis while maintaining voice communications between the emergency room and the ambulance. The doctor can monitor the patient's ECG data and advise the ambulance attendant to take whatever action necessary.

Several stretches of Wyoming highways become extremely hazardous during the winter months. A motorist becoming stranded in one of these areas may not receive assistance for extended periods of time because of the light travel on that particular section of highway. This problem is serious enough in some areas as to require some form of call box communications. Such a system would distribute call boxes on each side of the highway at half mile intervals. A stranded motorist would walk to a call box, pick up a telephone handset and talk directly to an operator located in one of the Regional Communications Centers. The operator would then dispatch whatever assistance required. This highway callbox system is diagramed in Figure 16. This system consists of telephone type handsets connected to a low power base station, all of which is housed in a rugged pedestal located on both sides of the highway at half mile intervals. These low power base stations "talk to" a high power base station located on a mountaintop. This high power base station is in turn connected to a microwave link which connects into the backbone system. The signal then enters a microwave drop to a Regional Communications Center. The distressed motorist at the highway callbox picks up the telephone type handset and speaks into the instrument just like he uses his telephone at home. When he comes "off hook" with the handset, the callbox transmitter automatically sends an identification signal

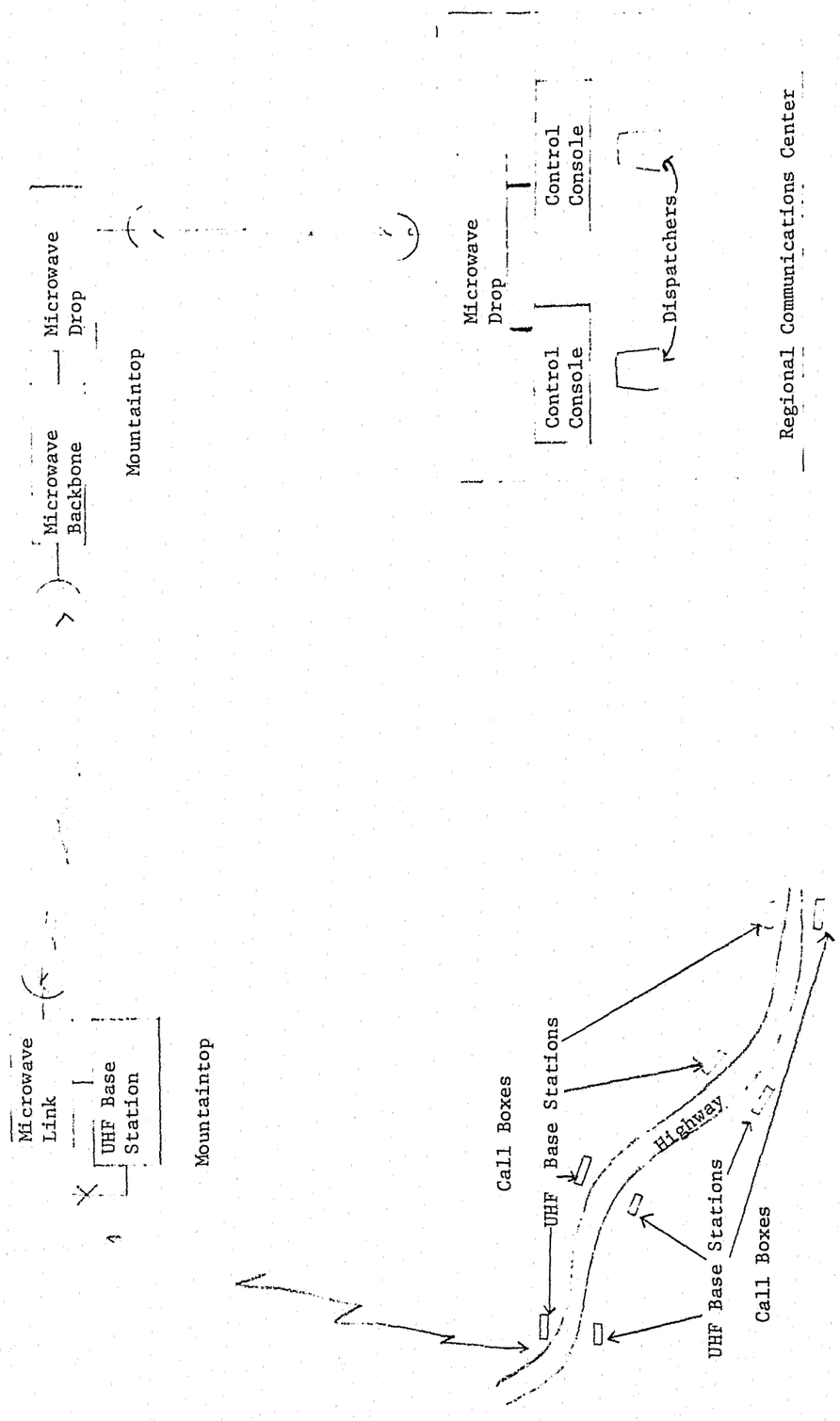


FIGURE # 16 HIGHWAY CALL BOX SYSTEM

to the dispatcher at the Regional Communication Center. The motorist tells the dispatcher the nature of his problem and requests assistance. The motorist does not have to know where he is -- the automatic identification signal provided the location information to the dispatcher. The dispatcher acknowledges the request and calls the required agency to send to the assistance of the motorist.

Note that this system works entirely by radio frequency circuits. They are powered by self-contained batteries which are kept charged by a self-contained solar cell system. Therefore, no power cables and no telephone cables are required for installation.

Many outlying state entities have need for frequent access to files and data maintained in the computer data banks in Cheyenne. They also have need of computer access for tabulation and computation of local data. These needs could easily be met by allocating data channels on the backbone system for Remote Computer Terminals. Such a system is illustrated in Figure 17. Any number of remote data terminals could be installed in cities throughout the state. These terminals could have access to the Cheyenne computers either on dedicated data channels or on regular use channels on a scheduled time basis.

All Civil Defense circuits are now carried on leased telephone lines with some backup realized via sparsely located radio channels. Disasters caused by Acts of God, or actions by subversives quite frequently disrupt telephone service because the telephone lines, either on poles or buried, are vulnerable to this type failures. The statewide microwave

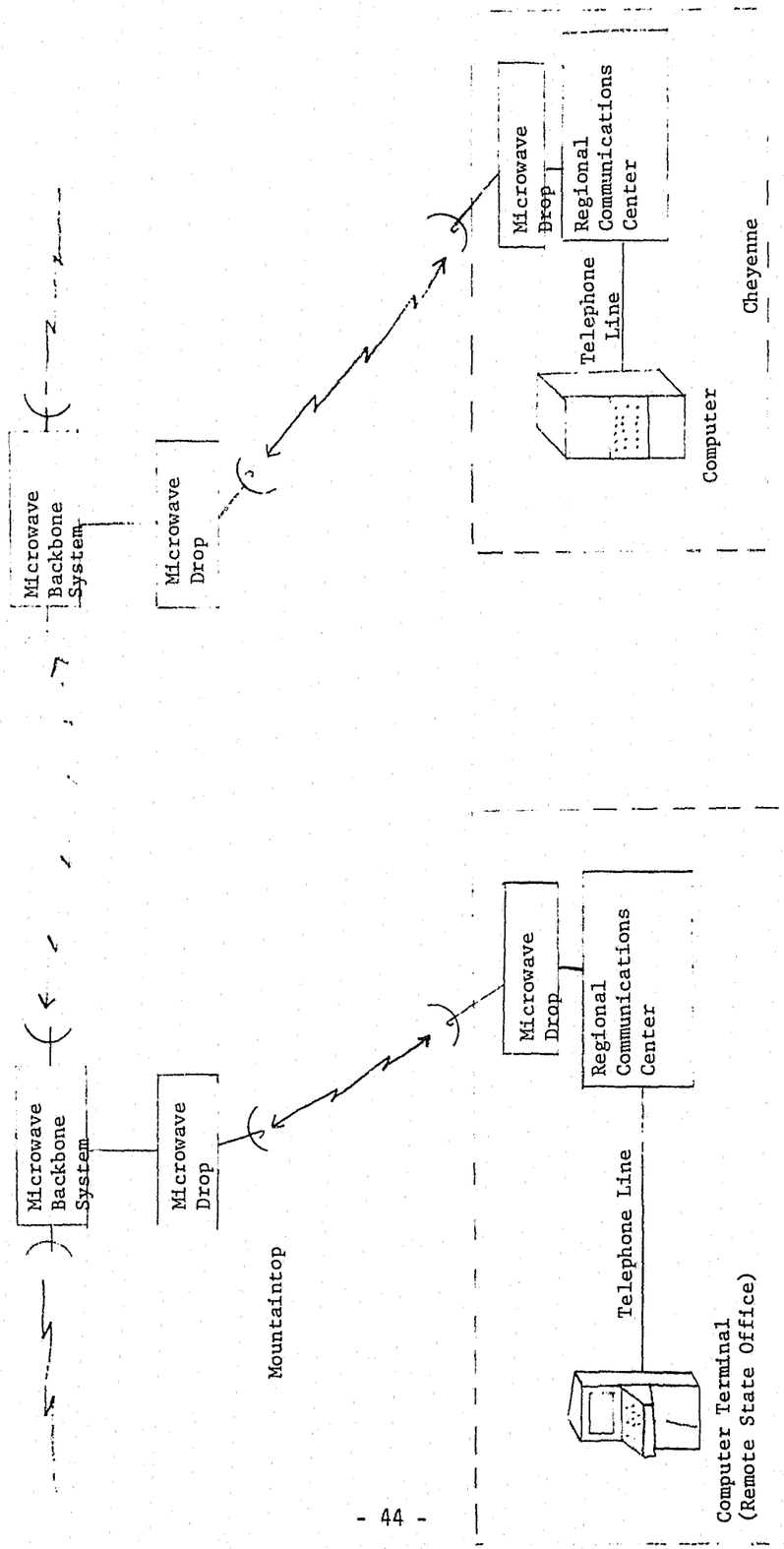


FIGURE # 17 REMOTE COMPUTER ACCESS SYSTEM

backbone system would provide excellent alternate routing facilities for the Civil Defense telephone circuits. It will also provide Civil Defense with circuits for operation of CD oriented radio base stations located on any or all of the mountaintops associated with the statewide system. The Regional Communications Centers would provide Civil Defense with the vehicle of total statewide communications control in the event of serious disaster.

The statewide communications system will provide the law enforcement entities with an effective means of communicating with each other within their own system and between systems, statewide. This capability will greatly improve the safety of those officers in the field operating alone in areas where help would be available only if called for via radio. The system provides efficient interagency communications which will facilitate better coordination during chases and other actions where close coordination between agencies is required. Another major factor is the ability to call in for a license check, driver or vehicle, and receive an answer within seconds. All Regional Communications Centers will have data terminals connected, via the backbone system, to the driver/vehicle registration files maintained on the computer in Cheyenne. An officer need only call the nearest RCC to request a registration check. The RCC dispatcher would query the computer in Cheyenne and immediately relay the received information back to the requesting officer.

MANAGEMENT/ADMINISTRATION

There are many possible schemes of managing and administering a large

communications system as is described herein. One paramount consideration of any such scheme must be the continued support of the backbone and dispatch subsystems. The key to the overall effectiveness of the statewide system is the effective and continuous operation of these two subsystems. Almost equally important is the requirement for some form of control over the user systems and the operational procedures used throughout the system. An obvious example of this requirement is the operation of the Emergency channel used by the law enforcement agencies. Unless all law enforcement mobile units are required to have the emergency channel on their mobile units and unless they are required to monitor the emergency channel at all times they are in the vehicle, then the emergency channel cannot be effective and serve the need it was designed to fulfill. Individual law enforcement entities cannot be allowed to join or withdraw from the services of the statewide system at will. They must all belong -- all the time.

These considerations point up the requirement for a state level organization to manage and administer the statewide communications system. The following paragraphs will describe a state level organization which meets the requirements as stated.

Figure 18 is a functional diagram of the Management/Administration scheme. First, the department should be physically located as near to the Capitol Building as is possible. The Director of Communications should be high enough in the political chain to be free of pressures from other state level departments. He should, however, be responsive to the needs of all users on the system.

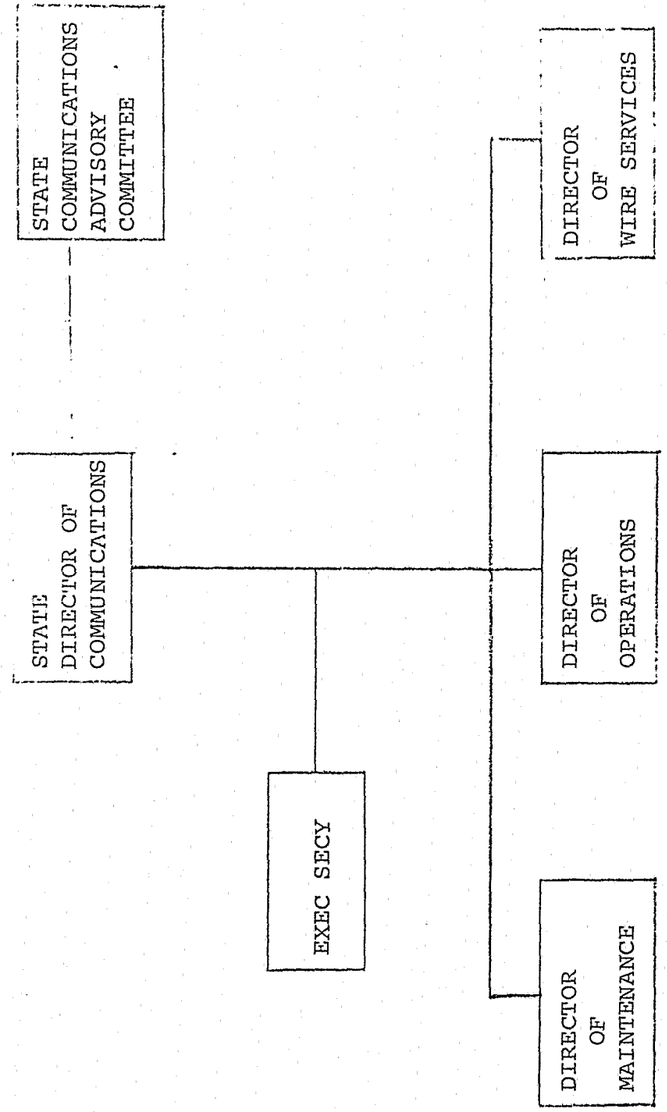


FIGURE # 18

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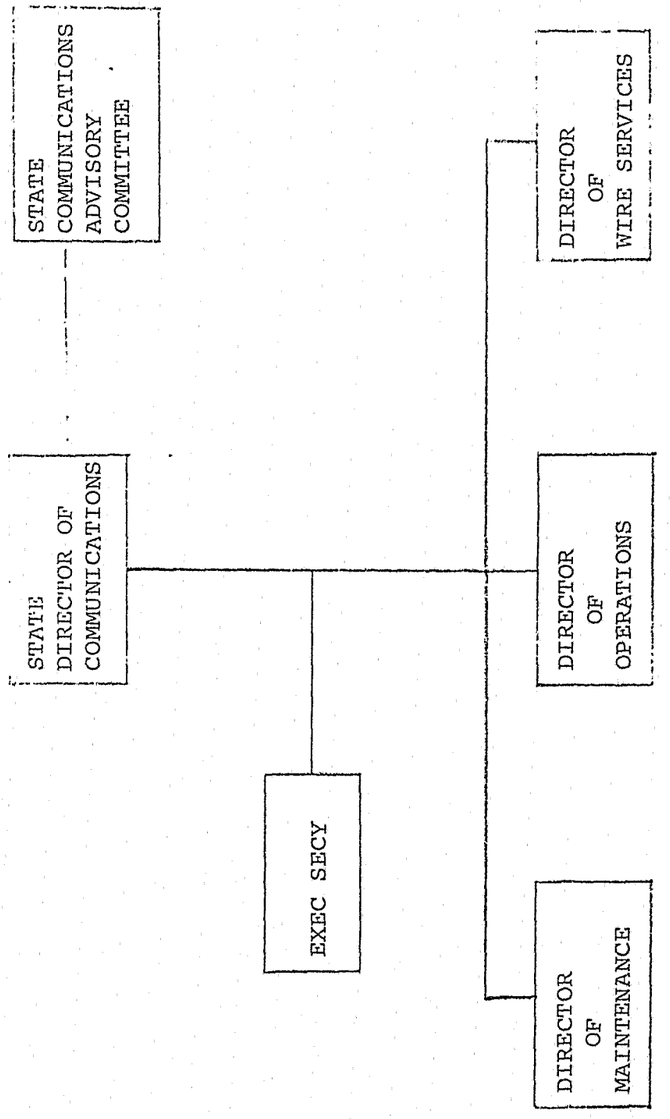

FIGURE # 18

The State Advisory Committee would consist of an uneven number (5 to 9) of user representatives. They would be selected to serve (1 to 2 years) by their user agencies because of their knowledge of communications and because of their knowledge of their respective agencies. The committee would be chaired by a member elected by the other members of the committee. This chairman and two other members, also elected, would serve as the executive board and would act as liaison between the committee and the State Director of Communications.

The State Director of Communications would be directly supported by three staff members, namely, Director of Maintenance, Director of Operations, and Director of Wire Services. An executive secretary would provide secretarial services to the four directors.

DIRECTOR OF COMMUNICATIONS

The State Director of Communications would be charged with the responsibility for overall administration of the Communications Department and would be responsible for the overall management of all statewide communications systems.

DIRECTOR OF MAINTENANCE

The Director of Maintenance would be directly responsible for the maintenance of all equipment in all systems within the statewide system. Figure 19 is an organizational diagram of his activity.

DIRECTOR OF OPERATIONS

The Director of Operations would be charged with the overall supervision of the 11 Regional Communications Centers. His organizational chart is

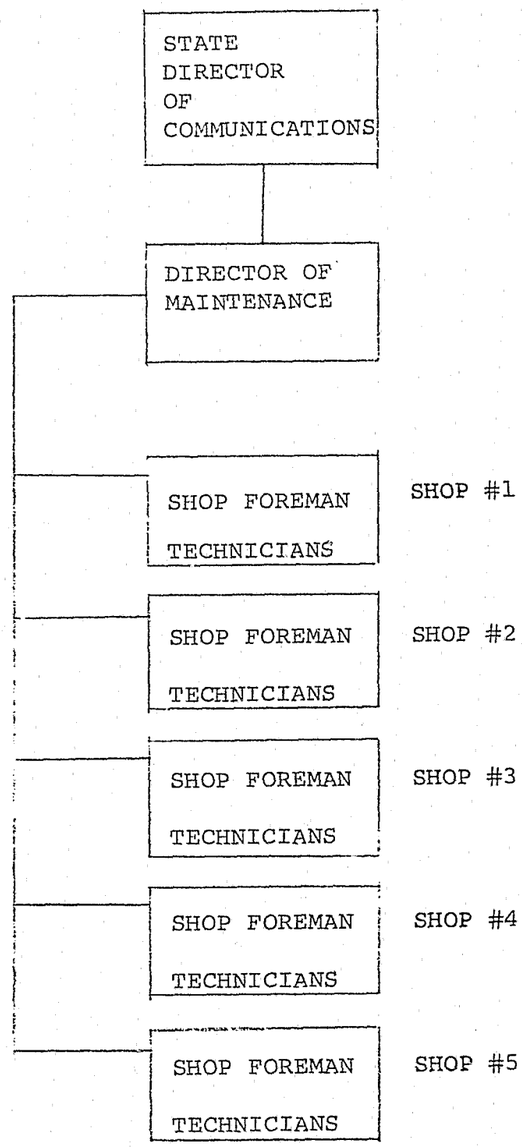

FIGURE # 19

diagramed in Figure 20.

DIRECTOR OF WIRE SERVICES

The Director of Wire Services is responsible for providing all wire services to the state and to all users of the statewide communications system. He will provide liaison between the state and all telephone and other wire services leased or purchased from outside vendors. He is responsible for writing and administering all contracts with all outside services. He makes recommendations for system changes as required. In all probability, this would be a one or two man operation.

SYSTEM COST CONSIDERATIONS

Because the communications study was primarily concerned with law enforcement systems, and because the law enforcement systems must have a backbone system to be effective, cost estimates quoted herein are restricted to the law enforcement portion of the proposed statewide communications system. The integration of other statewide communications systems will greatly reduce the cost to each user and will greatly enhance the total effectiveness of the overall statewide communications system.

Costs discussed herein are necessarily budgetary in nature and are not to be considered as quotations for actual implementation.

MICROWAVE BACKBONE SYSTEM INSTALLATION COSTS

The microwave backbone system will consist of some 30 units of terminal, relay, and drop microwave equipment. As quoted, the backbone system has enough channels installed to carry all the communications channels and control channels necessary to implement all of the law enforcement

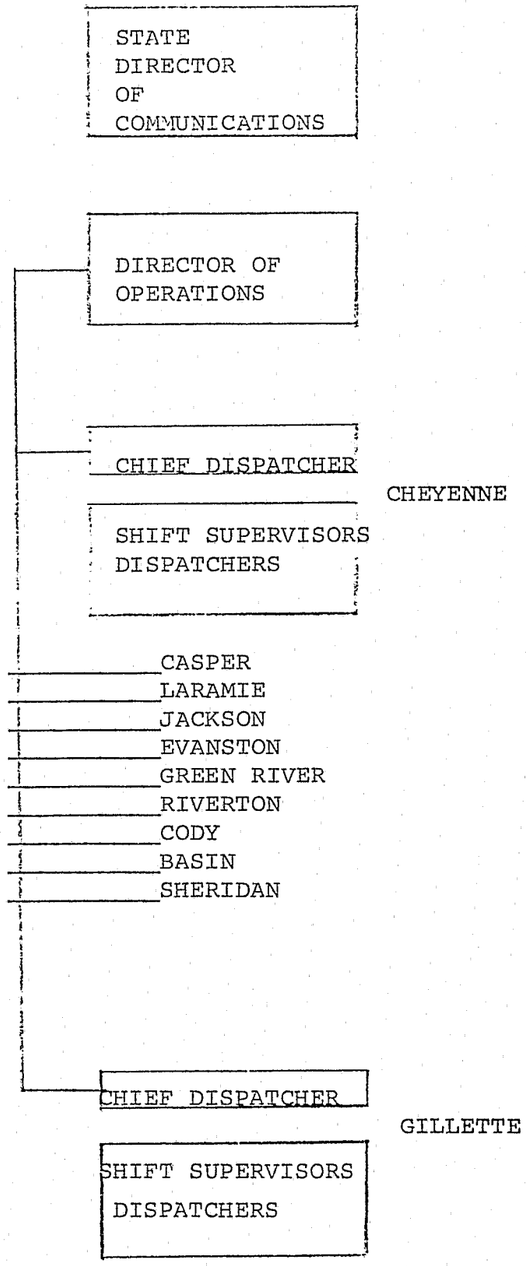

FIGURE # 20

entities, state and local, throughout the state. The backbone system is expandable to 300 channels between any two mountaintops and to 300 channels on the drops from the mountaintops to the Regional Communications Centers.

The Microwave Backbone System, installed, will cost $1,100,000.00

The above figure does not include "Hot Standby" equipment as it is felt that this capability will not be required initially. At some future date it may be necessary to install a few hot standby units on especially critical paths which have demonstrated a tendency to fail because of weather or other factors.

REGIONAL COMMUNICATIONS CENTER INSTALLATION COSTS

Eleven Regional communications Centers will be installed to coordinate the operations of the entire system, statewide. With the exception of Cheyenne and Casper, all centers will be equipped with a single two-position console, backed up and supervised by a single one-position supervisory console. One position of the two-position console will be used primarily to dispatch all public safety systems while the other position will be used to dispatch all other systems. All three console positions will have the same system control capabilities which will facilitate "split load" operations.

During heavy traffic periods, both of the two position consoles will be manned and the shift supervisor will handle spill-over traffic on his supervisory console when traffic is too heavy for the two positions to handle. The supervisor may also use his console to supervise and train

a new dispatcher operating one of the two-position consoles.

Cheyenne and Casper will both be equipped with a single three-position operational console backed by a single one-position supervisory console. Each of the three-position units will be equipped to handle traffic from all systems. The supervisory console will have capability of controlling all systems assigned to the center. This configuration allows for "split load" operations to permit minimum manning during light load conditions and maximum manning during maximum load conditions.

The 11 Regional Communications Centers, installed, will cost $300,000.00.

BASE STATION, REPEATERS, TOWERS, INSTALLATION

Initially, each of the 11 mountaintops located within the vicinity of the 11 Regional Communications Centers will be equipped with the following:

1 ea. Repeater . . . . . Highway Patrol
1 ea. Repeater . . . . . Sheriff's Departments
1 or more Base Stations . Local Police Departments
1 ea. Base Station . . . . Emergency Channel

Each mountaintop will require new, heavy duty tower facilities to accommodate the microwave dishes. All other systems antennas will be mounted on the new towers together with the microwave dishes.

44 Units of Base Station equipment, including 11 heavy duty towers, installed, will cost $300,000.00.

MOBILE EQUIPMENT

Because the initial installation phase is for law enforcement entities

only, just those mobiles are quoted herein. These units are quoted with a scanning capability in order to incorporate the "constant monitor" capability for the emergency channel necessary to the operation of all law enforcement mobiles.

Utilization of selected mountaintops throughout the state eliminates the requirement for high powered mobile equipment. The mobiles will always be in the vicinity of a mountaintop base station or repeater to communicate. There is some problem, however, on frequency selection for the system and the subsequent selection of mobile equipment to accommodate the frequencies to be used in the system.

If the system is implemented within the year of 1973, or even as late as 1974, and if action is taken to tie up the required frequencies now, it should be possible to use standard mobile units. If, however, the system implementation is delayed, then other entities in the bordering states will have assigned systems to many of the frequencies now available and it will become necessary to accept any unused frequency. In this event it will be necessary to purchase mobile equipment having wide-spaced receivers and wide-spaced transmitters. The cost of wide-spaced equipment is approximately twice the cost of standard mobile units.

Equipment quoted herein is standard.

225 Mobile Units, installed	$300,000.00

SYSTEM INSTALLATION SUMMARY

Microwave Backbone System	$1,100,000.00
11 Regional Communications Centers	300,000.00
44 Base Stations/Repeaters/Towers	300,000.00
225 Mobile Units w/Scanners	300,000.00
TOTAL SYSTEM COST, INSTALLED	$2,000,000.00

SYSTEM OPERATION COST

One of the largest operational costs of a statewide communications system is the salaries and fringe benefits paid to the dispatchers and shift supervisors. Manning the 11 Regional Communications Centers will be an expensive undertaking.

Two of the Centers, Cheyenne and Casper, will be four console position operations, while the other nine Centers will be three console position operations. All eleven centers will, of course, be manned 24 hours per day, 7 days per week.

The 11 Regional Communication Centers will operate with the following manpower.

	Day	Swing	Mid	Sub Total	Relief	Total
Cheyenne	4	4	3	11	2	13
Casper	4	4	3	11	2	13
Laramie	3	3	2	8	2	10
Jackson	3	3	2	8	2	10
Evanston	3	3	2	8	2	10
Green River	3	3	2	8	2	10
Riverton	3	3	2	8	2	10
Cody	3	3	2	8	2	10
Basin	3	3	2	8	2	10
Sheridan	3	3	2	8	2	10
Gillette	3	3	2	8	2	10
						116

Using a nominal salary of $7,200.00 plus approximately 25% for fringe benefits, each dispatcher will average $9,000.00 per year. This figure multiplied by 116 dispatchers results in an average annual cost of $1,044,000.00.

SYSTEM MAINTENANCE

Maintenance to the system would constitute the second largest annual cost. To adequately maintain a system of this magnitude, five electronic maintenance shops would be strategically located throughout the state. Each shop would operate two completely equipped service vehicles. In addition, two heavy duty snowmobiles would be available to the five shops as required.

Maintenance cost breakdown would be as follows:

Each Shop	Annual Cost
4 ea. Technicians @ $10,000 salary plus 25% fringe benefits	$ 50,000
Test equipment $15,000 amortized in 5 years	3,000
2 ea. Service Vehicles, complete with test equipment and spare parts @ $12,000 amortized in three years	8,000
	$ 61,000
	x 5 shops
	$305,000

Spare parts per year:	Microwave	2,000	
	Mobiles	2,500	
	Consoles	500	
	Base/ Repeaters	2,000	
			7,000
2 ea. Snowcat @ $10,000 amortized in 5 years			4,000
TOTAL SYSTEM MAINTENANCE COST PER YEAR			$316,000

MANAGEMENT COSTS

It is anticipated that the State of Wyoming will own and operate the entire communications system. Each user will lease equipment from the state at a rate which will pay for the equipment and for the cost of operating and maintaining the statewide system. Such an arrangement will require a management/administrative organization to manage the system.

Figure 21 outlines the type of team necessary to manage the system.

Costs involved in establishing such a management team are as follows:

	Annual Costs
Communications Director	$15,000
Director of Maintenance	12,000
Director of Operations	10,000
Director of Wire Services	10,000
Secretary, Executive	7,000
	54,000
Plus 25% fringe benefits	13,500
TOTAL COST OF SYSTEM MANAGEMENT	$67,500

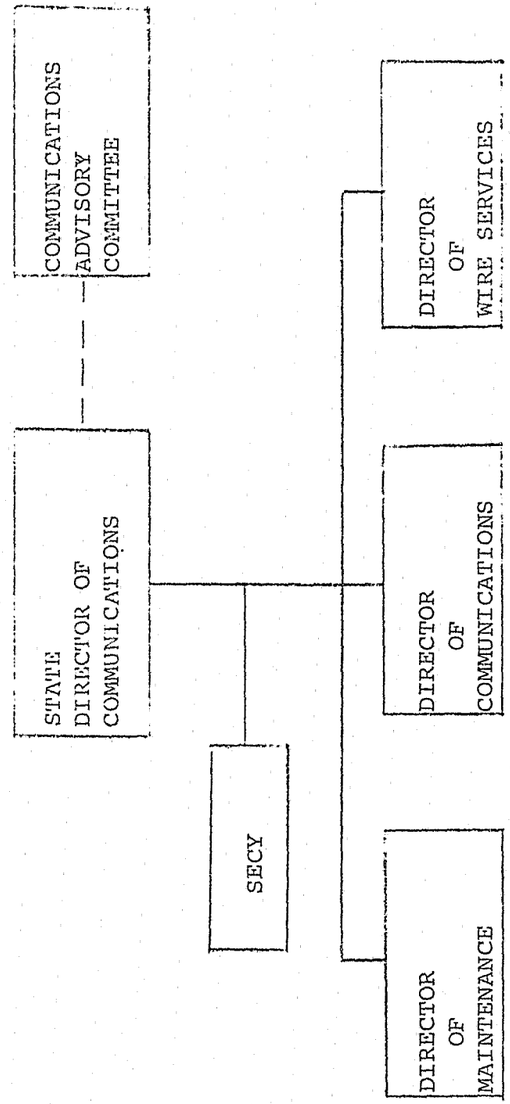

FIGURE # 21

Operations Cost Summary:

Cost of Manning Regional Communications Centers	$1,044,000
Cost of Maintaining System	316,000
Management of System	67,000
TOTAL ANNUAL OPERATIONAL COSTS OF SYSTEM	$1,427,000

AMORTIZATION COSTS

Once installed, all equipment immediately begins to deteriorate. Funds must, therefore, be set aside to replace system components as they become obsolete or when they have deteriorated to a point beyond economical repair. Different types of equipment become obsolete or otherwise require replacement over different time spans, i.e., a solid state microwave system will be in good operating condition after 20 years of service if properly maintained. By contrast, mobile equipment should be replaced every 10 years for best results. The amortization schedule below reflects these different amortization periods.

	Initial Cost	Annual Amortization
Microwave Backbone System amortized over 20 years	$1,100,000	$ 55,000
Regional Communications Centers amortized over 20 years	300,000	15,000
Base Stations/Repeaters/Towers amortized over 15 years	300,000	20,000
Mobile Units amortized over 10 years	300,000	30,000
Total System Cost	$2,000,000	
TOTAL ANNUAL AMORTIZATION COST		$120,000

TOTAL SYSTEM COST

The total annual system cost is computed as follows:

Annual System Operational Cost	$1,044,000
Annual System Maintenance Cost	316,000
Annual System Management Cost	67,000
Annual System Amortization Cost	120,000
TOTAL ANNUAL SYSTEM COST	$1,547,000

ADDITIONAL COST CONSIDERATIONS

An annual communications systems cost of $1,547,000 is, to be sure, a staggering figure. However, when this figure is considered in the light of the various services rendered, it will be accepted as being a reasonable, realistic cost for a statewide communications system. When the costs of existing systems are analyzed in the light of better communications to be provided by the proposed systems, the costs involved will be minimal for the services provided.

A typical example of costs vs. services rendered is the cost of each law enforcement agency operating its own communications system. Keep in mind that all of these individual systems are limited in range and versatility and that they have neither a statewide emergency channel nor the capability of talking to other agencies on the single radio unit.

Two examples of local system costs are presented. Example number one is for a Sheriff's Department with a five vehicle force operating a dispatch center on a 24-hour basis, 7 days per week. Example number two is for a Police Department with a 15 vehicle force operating a dispatch

center on a 24 hour basis, 7 days per week.

	Sheriff (5)	Police (15)
Dispatchers, 5 each, at cost of $9,000 per man	$45,000	$135,000
Mobile Units, at cost of $1,000 per unit, amortized over 10 years ($100)	500	1,500
Maintenance at $5 per mobile, per month	300	900
TOTAL ANNUAL COST FOR RADIO COMMUNICATIONS	$45,800	$137,400

Multiply these figures by the many law enforcement agencies who maintain their own systems and the figures become astronomical. Add to these figures the cost of maintaining other (non-law enforcement) systems, i.e., Highway Maintenance, and the proposed system costs become immediately realistic. Yet, adding non-law enforcement systems to the backbone-Regional Communications Center Complex would be very little more than operating the system with law enforcement agencies only.

The proposed system provides a stateowned, statewide telephone service connecting the principal cities to even the most remote hamlet in the state. As an example, a state official in Cheyenne wishing to speak to a person in Greybull would dial a level on his telephone instrument to gain access to the telephone circuits on the backbone microwave system from Cheyenne to the Regional Communications Center in Basin. The operator in Basin would patch into the Commercial Telephone Circuits from Basin to Greybull. The opposite is also true. The Sheriff in Lander wishing to talk to the Police Chief in Rock Springs would call to the Regional Communications Center in Riverton. His call would

travel the stateowned circuits from Basin to the Regional Communications Center in Green River and from Green River to Rock Springs on the commercial telephone circuits.

The number of stateowned telephone circuits is almost limitless. The system has the capability of 300 voice circuits. Assuming that 100 channels were used for control circuits, teletype, telemetry, etc., this leaves 200 telephone circuits available.

The stateowned microwave backbone system would provide the state with a stateowned telephone system far superior to that system now leased from commercial telephone services. Thus, the WATS costs and almost all other toll charges now paid to the telephone company could be applied to the cost of operating a stateowned, statewide communications system.

All law enforcement teletype circuits would be carried over the stateowned backbone system. Thus, the lease line costs now paid to the telephone company would accrue to the operational costs of the stateowned communications system. If the teletype circuits were stateowned, the system could be greatly expanded at nominal cost. These expansions would include tributary circuits from Regional Communications Centers to many of the outlying law enforcement entities to provide a more cohesive law enforcement system. They would also include dedicated circuits between heavy traffic points, i.e., there would be a dedicated teletype circuit between the Regional Communications Centers located in Cheyenne and Casper -- in addition to the regular teletype circuits already on the system.

Other state departments requiring hard copy data between cities could install teletype and/or data transmission links as required. Leasing telephone circuits for this purpose would be so expensive as to be prohibitive. A stateowned system, however, would render the costs nominal.

The State Internal Revenue Service now has the problem of not having enough Port of Entry points to properly supervise truck traffic over the Wyoming highways. As a result, it is suspected that large amounts of revenue are lost because truckers neglect to declare their actual travel and tonnage when operating on the Wyoming Highway System. To overcome this problem, Remote Port of Entry Houses could be established on both sides of the highway at <u>all</u> major highways entering and leaving the state.

These additional Ports of Entry, coupled with better control (i.e., teletype travel authorization), will increase the revenue collected. The installation of a statewide backbone system would bring the Remote Port of Entry System within economical reach.

<u>OTHER COMMENTS</u>

Almost all state level radio communications are conducted on the State Highway Patrol channel and the State Highway Maintenance channel. These are both low band channels which suffer traffic congestion, interference, and lack of statewide, direct communications with outlying areas. Both systems contain antiquated equipment, especially the base station

equipment. Because of the advanced age of these base stations, the systems suffer from frequent equipment failure and high maintenance costs. Both of these prime systems require immediate corrective action.

At this point in time, the state is faced with the choice of replacing the older equipment and continuing on with low band systems with all their inherent problems and limitations, or installing a new, statewide communications system which will better serve the needs of all state level communications users. High band frequencies necessary to implement the proposed system are being rapidly committed to other users. It is, therefore, imperative that action be begun immediately to tie up the required frequencies.

Because of the general inflation in all areas, the cost of installing the proposed system can be expected to increase by 5 to 10% per year. Even 5% of $2,000,000 is $100,000 per year.

Various federal funding sources are available to assist in the implementation of the proposed system. If federal funding is used to install the law enforcement portion of the statewide system, all other agencies can ride "piggyback" on the system thus making the system more effective, and less expensive.

The time for decision is now.

END