

State of Arizona
Office
of the
Auditor General

PERFORMANCE AUDIT

**ARIZONA
DEPARTMENT
OF PUBLIC SAFETY
TELECOMMUNICATIONS
BUREAU**

Report to the Arizona Legislature
By Debra K. Davenport
Auditor General
March 2001
Report No. 01-05

The Auditor General is appointed by the Joint Legislative Audit Committee, a bipartisan committee composed of five senators and five representatives. Her mission is to provide independent and impartial information and specific recommendations to improve the operations of state and local government entities. To this end, she provides financial audits and accounting services to the state and political subdivisions and performance audits of state agencies and the programs they administer.

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DEBRA K. DAVENPORT, CPA
AUDITOR GENERAL

STATE OF ARIZONA
OFFICE OF THE
AUDITOR GENERAL

WILLIAM THOMSON
DEPUTY AUDITOR GENERAL

March 15, 2001

Members of the Arizona Legislature

The Honorable Jane Dee Hull, Governor

Colonel Dennis Garrett, Director
Department of Public Safety

Transmitted herewith is a report of the Auditor General, A Performance Audit of the Arizona Department of Public Safety—Telecommunications Bureau. This report is in response to a June 16, 1999, resolution of the Joint Legislative Audit Committee. The performance audit was conducted as part of the Sunset review set forth in A.R.S. §41-2951 et seq. I am also transmitting with this report a copy of the Report Highlights for this audit to provide a quick summary for your convenience.

This is the fourth in a series of reports to be issued on the Department of Public Safety.

As outlined in its response, the Department agrees with all of the findings and recommendations.

My staff and I will be pleased to discuss or clarify items in the report.

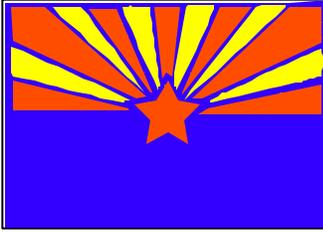
This report will be released to the public on March 16, 2001.

Sincerely,

A handwritten signature in black ink that reads "Debbie Davenport".

Debbie Davenport
Auditor General

Enclosure

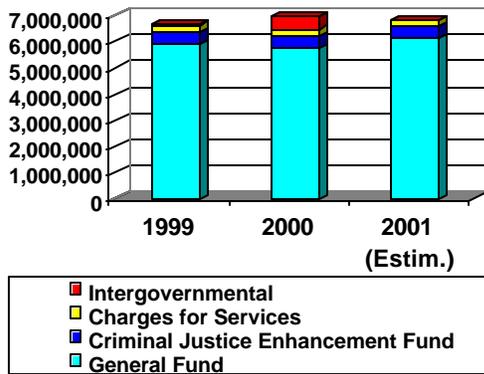


Program Fact Sheet

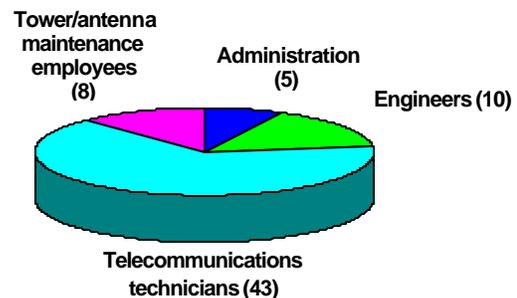
Department of Public Safety Telecommunications Bureau

Services: The Telecommunications Bureau maintains DPS' telecommunications system, which provides critical information to the law enforcement community through: 1) **the state-wide law enforcement radio network**, which enables DPS officers and other state agencies to communicate with dispatchers using mobile and hand-held radios; and 2) **ACJIS**, the Arizona Criminal Justice Information System, which contains the State's criminal justice information and is used by more than 200 government and law enforcement entities, such as county sheriffs' offices, DPS officers, city police departments, and county probation departments.

Program Revenue: \$7 million (fiscal year 2000)



Personnel: 66 full-time staff (fiscal year 2000)



Facilities:

The Telecommunications Bureau is located at three main facilities: Phoenix, Tucson, and Flagstaff. Outlying radio shops are also in Holbrook, Kingman, Prescott, Safford, Show Low, and Yuma.

Program Goals (fiscal years 2001-2003)

1. To improve department efficiency through automation, technology, and adequate staffing.
2. To maintain telecommunications equipment so that no more than 10 percent of the inventories exceed replacement age.
3. To modernize obsolete radio, voice, and data communications systems for the Department of Public Safety and other public safety agencies in Arizona.
4. To support the development of a state-wide interoperable public safety radio system.

Adequacy of Performance Measures:

Under the subprogram Communications, DPS has established four goals for the Telecommunications Bureau. Its goals include 15 performance measures. Auditors' review of these measures identified the following:

- Although the Bureau has an efficiency goal, it does not show any performance measures that identify efficiency. Therefore, productivity and the cost of providing services is not made clear.
- Some of the Bureau's measures are incorrectly categorized as outcome measures although they are actually output measures. Outcomes should show the effect on the program services and achievement of desired results.
- Although part of the Bureau's mission is to provide telecommunications services for statewide radio, voice, and data systems, they have no performance measures to address the quality of their services. However, the Bureau does have a measure to develop a customer survey.

Infrastructure Equipment: The Telecommunications Bureau maintains approximately \$27 million worth of major infrastructure equipment used to provide communications for DPS' Radio Network and the Arizona Criminal Justice Information System (ACJIS).



76 buildings that house microwave radios. They can cost up to \$100,000 each.



144 microwave radios used to carry communications from site to site at a cost of about \$7,500 each.



449 base station radios that carry communications from the site to local officers' mobile and portable radios. Each costs approximately \$9,100.



53 towers used to support the various radio antennas needed to provide communications in the area. Each costs approximately \$250,000.



44 emergency power generators used at critical sites to protect against commercial power failures at a cost of about \$9,000 each.



76 stationary batteries used at each site to ensure continued operation of the system at a cost of about \$6,000 each.

SUMMARY

The Office of the Auditor General has conducted a performance audit of the Department of Public Safety's Telecommunications Bureau as part of a Sunset review of the agency. This audit was conducted pursuant to a June 16, 1999, resolution of the Joint Legislative Audit Committee. This audit was conducted under the authority vested in the Auditor General by Arizona Revised Statutes (A.R.S.) §41-2951 et seq. This is the fourth in a series of audits of the Department of Public Safety.

In addition to DPS, ten other state agencies rely on the radio network.

The Department of Public Safety (DPS) Telecommunications Bureau is responsible for maintaining DPS' telecommunications system, which provides critical information to law enforcement entities through its radio network and the Arizona Criminal Justice Information System (ACJIS). Specifically, this system enables DPS officers to communicate with dispatchers and provides Arizona law enforcement agencies with criminal justice records, warrant information, and motor vehicle data needed to carry out their operations. In addition, ten other state agencies rely on the radio network for their communications needs including the Department of Corrections for prisoner transport and the Department of Transportation for its highway maintenance and construction workers (see Table 1, page 2, for a complete listing of user agencies).

DPS uses a microwave network to support its communications system. Microwaves extend the range of communications by providing access to remote sites for communications, and are often used as an affordable alternative to other wireless communication forms, such as satellite and fiber optics.

DPS' Communications System Relies on Obsolete Technology (See pages 9 through 17)

DPS' communications network is obsolete because it currently relies on analog technology that is no longer being manufactured

The question is no longer whether to convert from analog, but when.

and can no longer accommodate DPS' needs. Specifically, manufacturers in the United States began phasing out analog microwave radios in favor of digital technology in the early 1990s. As a result, analog users must depend upon spare parts from existing analog microwave radios to repair or replace broken equipment. Once the supply of spare parts is depleted, users will be unable to service their radios. As such, the issue for DPS is no longer whether to convert from analog technology, but when.

Although DPS is aware of the need to convert its system to digital technology, it has been slow to initiate the needed changes. While the existing system is not in any immediate danger, DPS should plan for a digital conversion as soon as possible because of the significant implementation time required to convert the system. In preparation for the conversion, DPS should complete a conversion plan of the entire communication system before it seeks funding from the Legislature. In addition, it should pursue grant funding to help defray some of the costs to the General Fund.

Staffing Problems Could Hinder DPS' Ability to Maintain System (See pages 19 through 23)

DPS' ability to convert to a digital system while maintaining its current system could be jeopardized because of numerous staff vacancies expected in the future. Specifically, DPS may lose almost one-quarter of its telecommunications technician staff in the next three to five years due to impending retirements. Further, DPS is already having difficulty filling existing technician vacancies.

Telecommunications technicians, among other things, ensure the continuous operation of the communications system so officers and dispatchers can speak to each other without interruption. In addition, they will play a pivotal role in the conversion process because contractors will need their assistance to customize the new system to meet DPS' needs. Although DPS is currently working on ways to enhance its recruitment efforts for technicians, it should consider additional recruitment and retention tools. For example, DPS should work with the Law Enforcement

Summary

System Council to assess the feasibility of offering hiring bonuses and counter-offers similar to a Department of Administration pilot project being tried at four other state agencies.

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INTRODUCTION AND BACKGROUND

The Office of the Auditor General has conducted a performance audit of the Department of Public Safety’s Telecommunications Bureau as a part of a Sunset review of the agency. This audit was conducted pursuant to a June 16, 1999, resolution of the Joint Legislative Audit Committee. This audit was conducted under the authority vested in the Auditor General by Arizona Revised Statutes (A.R.S.) §41-2951 et seq. This is the fourth in a series of audits of the Department of Public Safety.

DPS’ Telecommunications System Provides Critical Information to Law Enforcement Entities

The Department of Public Safety (DPS) Telecommunications Bureau (the Bureau) is part of the Criminal Justice Support Division that provides diverse scientific, technical, and other support services essential to the promotion of public safety in Arizona.¹ The Bureau is responsible for maintaining DPS’ telecommunications system, which provides critical voice and data information to the law enforcement community through the:

- **DPS Radio Network**—This voice network enables DPS officers to communicate with dispatchers using mobile and hand-held radios as needed to carry out their daily functions. This network is critical to providing DPS officers in the field with information on accidents, criminal history, arrest warrants, and requests for backup. In addition, ten other state agencies rely on the system for their communications needs. Table 1 (see page 2) shows the agencies that use the system and what they use the system for. These agencies are not charged a fee for their use of the microwave network.

¹ The Division also includes these Bureaus: Criminal Information Services; Fingerprint Identification; Information Technology; Licensing; Operational Communications; and Scientific Analysis.

- **Arizona Criminal Justice Information System (ACJIS)**—ACJIS is the State’s central repository for criminal history records and related criminal justice information. More than 200 governmental and law enforcement entities, such as city police departments, county sheriff offices, DPS officers, and county probation departments, rely on ACJIS to provide vital criminal justice information. This system contains information such as criminal history and background information, warrant information, and motor vehicle license and registration data.

Table 1

**Department of Public Safety
Telecommunications Bureau
Microwave Radio Network Users
Year Ended June 30, 2000**

Agency	Radio Communication between:
Department of Public Safety	DPS officers and dispatchers
Arizona National Guard	Duty men
Arizona State Parks	Rangers and local fire departments
Department of Agriculture	Field agents and dispatchers
Department of Corrections	Correctional officers when prison work gangs are in transit and during prisoner transport
Department of Health Services	Emergency medical services field personnel and hospital dispatchers
Department of Juvenile Corrections	Correctional officers when prisoners are in transit
Department of Liquor Licenses and Control	Field agents
Department of Transportation	Highway maintenance and construction workers
Game and Fish Department	Field officers
State Land Department	Rangers and local fire departments

Source: Auditor General staff analysis of the DPS Telecommunications Bureau’s Microwave and Radio Systems Brochure and interviews with Bureau staff.

**Microwave Network Used
to Carry DPS Communications**

DPS uses an analog microwave network to support its land mobile radio network and ACJIS as well as its own in-house telephone lines.¹ Microwave networks extend the range of communications by providing access to remote sites for communications

¹ Analog radio systems continuously transmit radio waves that are usually modulated by voice channels.

support and are the predominant infrastructure for large wide-area communications systems. State police departments around the country frequently use microwave communications systems as an affordable alternative to other wireless communication forms, such as satellite and fiber optics.

Seventy-six radio communications sites located throughout Arizona and its four border states comprise the microwave network. Most are remote sites located on mountaintops and consist of the following:

- **Buildings**—Each communications site contains at least one building to house the microwave radios that carry communications from site-to-site and the land-mobile radios that carry communications from the site to local officers' mobile and portable radios.



- **Towers**—Most communications sites have at least one tower to support the various radio antennas needed to provide communications in the area.



- **Batteries**—Should there be a commercial power outage, each site has a stationary battery to ensure the microwave system operates continuously.

- **Emergency generators**—All critical sites have added protection against commercial power failures with the use of an emergency power generator. In these cases, the emergency generator is the first level of backup protection. Should the emergency generator fail, the battery would then take over to ensure continued microwave network operation.



Organization, Staffing and Budget

For fiscal year 2000, the Bureau was authorized 66 full-time equivalent (FTE) positions. A manager assisted by 4 support staff administers the Bureau. The remaining staff are divided into three categories:

- **Engineers (10 FTEs)**—Engineering staff plan, design, and construct telecommunications systems, such as voice and data, and analyze system problems, such as interference, to determine the best way to improve communications. They also design radio communications sites including building, tower and antenna placement, and equipment requirements.
- **Telecommunications Technicians (43 FTEs)**—This staff is responsible for installing, repairing, and maintaining various forms of communications equipment including microwave, mobile and hand-held radios, data lines, and telephones for DPS buildings. Technicians deliver these services from various locations across the State at urban and remote mountaintop sites.
- **Tower/Antenna Maintenance Riggers (8 FTEs)**—These employees are responsible for installing and maintaining radio communications towers, buildings, and antenna systems at urban and remote mountaintop sites.

The Bureau received \$5.8 million in General Fund monies for fiscal year 2000 (see Table 2, page 5) and \$452,300 from the Criminal Justice Enhancement Fund to operate the Arizona Criminal Justice Information System. In addition, the Bureau bills for the radio maintenance services it provides to other state agencies.

Table 2

**Department of Public Safety
Telecommunications Bureau
Statement of Revenues, Expenditures, and Reversions¹
Years Ended or Ending June 30, 1999, 2000, and 2001
(Unaudited)**

	1999 (Actual)	2000 (Actual)	2001 (Estimated)
Revenues:			
Appropriations:			
State General Fund	\$5,940,362	\$5,785,954	\$6,154,200
Criminal Justice Enhancement Fund ²	452,300	452,300	452,300
Charges for services	235,362	242,254	235,500
Intergovernmental ³	196	500,000	
Total revenues	<u>\$6,628,220</u>	<u>\$6,980,508</u>	<u>\$6,842,000</u>
Expenditures:			
Personal services	\$2,899,300	\$2,838,300	\$3,040,100
Employee related	617,800	600,100	760,000
Professional and outside services	9,000	121,300	35,600
Travel, in-state	67,400	105,100	62,600
Travel, out-of-state	3,900	5,100	4,000
Other operating ⁴	1,572,686	1,504,573	1,450,300
Equipment ⁵	<u>1,191,972</u>	<u>1,533,781</u>	<u>1,253,900</u>
Total expenditures	6,362,058	6,708,254	6,606,500
Remittances to the State General Fund	235,362	242,254	235,500
Reversions to the State General Fund	24,500	27,700	
Reversions to the Criminal Justice Enhancement Fund ²	<u>6,300</u>	<u>2,300</u>	
Total expenditures and reversions and remittances	<u>\$6,628,220</u>	<u>\$6,980,508</u>	<u>\$6,842,000</u>

¹ The Bureau's revenues and expenditures include an allocation of revenues and expenditures recorded in the Department's Joint Account. The Joint Account contains State General Fund appropriations and other appropriated monies, such as amounts from the Criminal Justice Enhancement Fund.

² Consists of fines and forfeits deposited in the Criminal Justice Enhancement Fund (CJEF) and appropriated to the Department. Unexpended CJEF monies are presented as a reversion to CJEF since any unexpended monies at year-end are subject to legislative appropriation in future years.

³ In 2000, the Department received a grant from the Arizona Department of Health Services for the purchase and installation of communication equipment to enhance Emergency Medical Services Communications Network capabilities.

⁴ Nearly 70 percent of other operating expenditures were for maintaining the statewide radio, voice, and data telecommunications systems.

⁵ Most of the equipment purchased was computer and telecommunications items to replace and upgrade the statewide telecommunication system.

Source: Auditor General Staff analysis of financial information provided by the Department of Public Safety for the years ended or ending June 30, 1999, 2000, and 2001.

Audit Scope and Methodology

The audit focused on the adequacy of the current communications system and the need for DPS to take additional steps to recruit and retain its telecommunications technicians. The audit presents findings and recommendations in two areas:

- The need for DPS to take steps to prepare to convert its telecommunications system because the system relies on obsolete technology.
- The need for DPS to consider additional ways to hire and retain staff so that it has sufficient staff to maintain and convert the system.

Many methods were used to study the issues addressed in the audit including:

- Contacting three leading analog microwave radio manufacturers to obtain information on the expected time frame they will continue supporting analog microwave equipment, and researching the second-hand market to determine the availability of used analog microwave radios for spare parts;
- Contacting the ten other Western states (California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming) to obtain information about their statewide public safety telecommunications systems, specifically focusing on microwave system types (analog or digital), and their plan for or experience with digital conversion and its related cost, time frame, and method of conversion;¹
- Contacting a frequency coordinator who acts as an intermediary between DPS and the Federal Communications Commission (FCC) to determine the availability of additional frequencies;

¹ Western states were chosen because their public safety communications involve large expanses of land similar to Arizona.

Introduction and Background

- Attending four meetings of the Arizona Public Safety Communications Committee and reviewing budget documents to learn of the Department's past and current efforts to address the needs of its communications system;
- Reviewing personnel documents and interviewing staff to confirm expected retirements from DPS, the problems created by current telecommunications technician vacancies, and the efforts made to hire new staff.
- Contacting five other entities, such as Arizona Public Service and Salt River Project, that have similar telecommunications technician positions to determine the recruiting methods they use to attract applicants, their starting salaries, and their position qualifications and required certifications.¹

This audit was conducted in accordance with government auditing standards.

The Auditor General and staff express appreciation to the Department of Public Safety Director, the Assistant Director and Chief of Staff of the Criminal Justice Support Division, and the Telecommunications Bureau Manager and staff for their cooperation and assistance throughout the audit.

¹ Auditors contacted the Central Arizona Project, Western Area Power Authority, Salt River Project, Arizona Public Service, and the City of Phoenix.

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FINDING I

DPS' COMMUNICATIONS SYSTEM RELIES ON OBSOLETE TECHNOLOGY

DPS needs to prepare to convert its aging microwave network. The system currently relies on obsolete analog technology that is no longer being manufactured and can no longer accommodate DPS' needs. Although DPS is aware of the need to convert its system to digital technology, it has been slow to initiate the needed changes. While the existing system is not in any immediate danger, DPS should plan to convert as soon as possible because of the significant time required to implement a new system and the limited number of spare parts available to support the existing system. In preparation for the conversion, DPS should complete a conversion plan of the entire system before it seeks funding from the Legislature and it should pursue grant funding to help defray the cost to the General Fund.

Communications System Has Loop Configuration

DPS' statewide microwave communications system has a looped configuration to provide added protection against communication failure. Specifically, it comprises three continuous paths or loops, each with approximately 24 sites, that provide communication coverage to much of the State (see Figure 1, page 11). The loop configuration is advantageous because communication can travel in either direction on the loop providing continuous communication capability, even during an equipment failure.¹ This added protection means officers are less likely to encounter an interruption in communication.

As illustrated in Figure 1 (see page 11), the loops do not cover all areas of the State. Some areas, such as Flagstaff, are covered by peripheral paths or spurs that are offshoots of the loops. Because

¹ A looped configuration protects against equipment failure at one site. Equipment failure at a second site would cause an interruption in communication.

spurs are not within the main system, they are not protected against site failure. Therefore, if a site on a spur fails, all users dependent on that spur lose communication.

Analog System Obsolete and Unable to Accommodate DPS' Needs

DPS' telecommunications system is outdated and can no longer support all of its needs. The system relies on analog microwave radio equipment, equipment that is obsolete and no longer being manufactured. As a result, DPS can no longer expand certain parts of the system to meet its needs. Because analog technology is obsolete, most Western states have already converted their systems to digital technology.

System relies on outdated technology—DPS' microwave system consists of outdated analog radios that are no longer produced by manufacturers in the United States.¹ Manufacturers in the U.S. began phasing out analog microwave radios in favor of digital microwave technology in the early 1990s. They did so because digital technology has numerous advantages, as shown in Item 1. Manufacturers phased out their analog systems to the point that they no longer guarantee that repair parts will be available. As a result, the issue for DPS is no longer whether to convert from analog technology, but when.

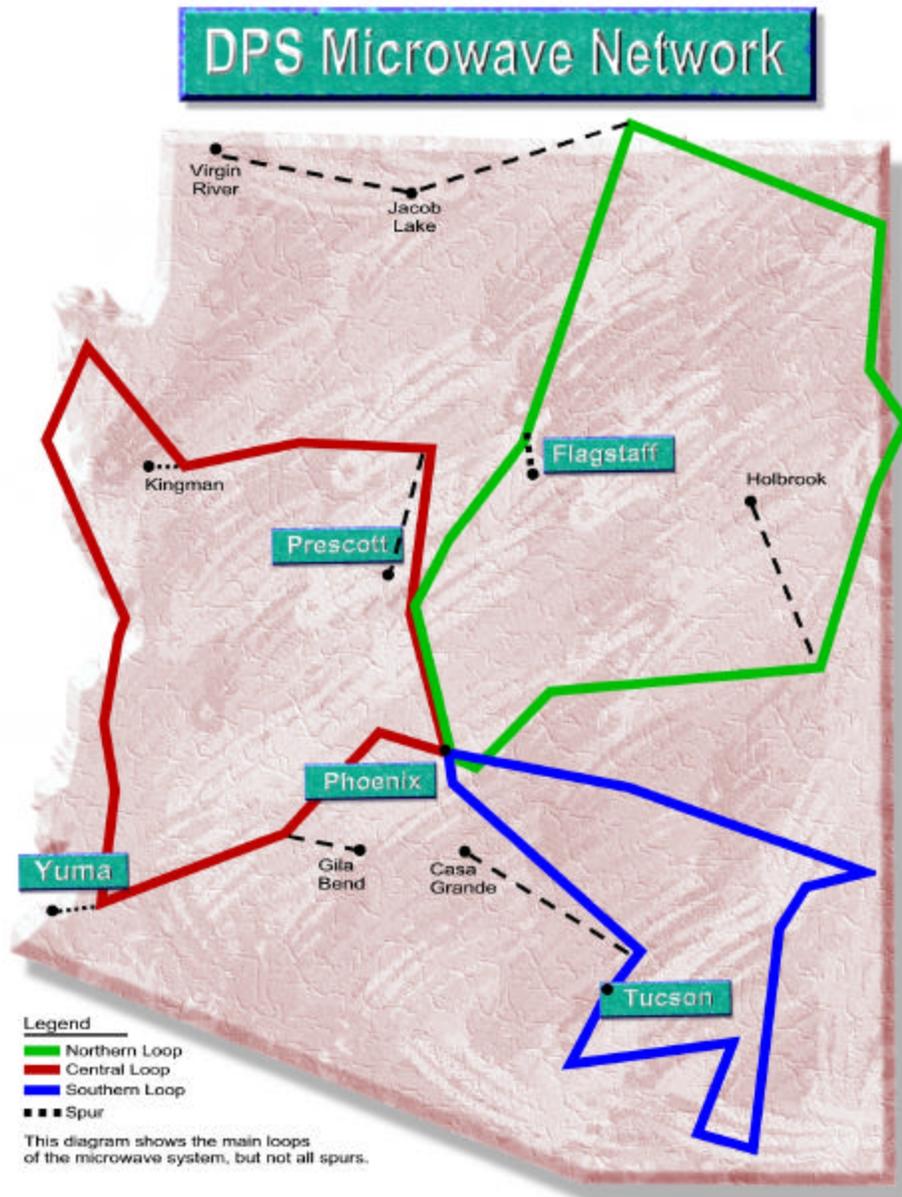
Manufacturers began phasing out analog radios in the early 1990s.

Item 1: Advantages of Digital Technology	
Analog microwave	Digital microwave
<ul style="list-style-type: none"> ➤ Reduced audio quality with increasing distance from broadcast site. ➤ Obsolete technology. ➤ Decreasing vendor support. ➤ Inefficient data transport. ➤ Increasing maintenance costs. ➤ Less efficient use of spectrum due to inflexible technology. 	<ul style="list-style-type: none"> ➤ Superior audio quality. ➤ The preferred technology by telecommunication companies. ➤ Increasing vendor support. ➤ Highly efficient data transport. ➤ Decreasing maintenance costs. ➤ Highly efficient use of spectrum accommodating more users with fewer resources.

¹ One low-range, low-capacity analog microwave radio is currently being built in the U.S. However, DPS indicates that it is insufficient to support the high-capacity microwave infrastructure it currently uses.

Figure 1

**Department of Public Safety
Telecommunications Bureau
Microwave Network
As of December 2000**



Source: Auditor General staff analysis of the Telecommunications Bureau's microwave map.

Because manufacturers in the U.S. no longer produce analog microwave radios, analog users and service vendors must depend upon spare parts from existing analog radios in order to repair or replace broken radio equipment. Once this supply of parts is depleted, users will be unable to service their radios or maintain their analog systems.

Currently, DPS has only enough spare parts to last 3 to 5 years.

DPS believes it has a supply of parts that will last several years, but whether the supply will last that long is not clear. To its credit, DPS began accumulating spare analog radios when manufacturers informed DPS that production was stopping. Based on historical repair rates, DPS estimates it has sufficient spare parts to maintain the system for another three to five years. However, DPS' repair rates may be higher in the future as its analog equipment ages and becomes more maintenance intensive.

System cannot accommodate future growth—As a result of its reliance upon analog microwave technology, it is becoming increasingly difficult for the existing system to meet DPS' needs. For example, expanding coverage to keep up with increasing population growth and added highway miles would mean trying to acquire additional equipment at a time when manufacturers are no longer producing or supporting it. The following examples illustrate this point:

- **Incorporation of Flagstaff into the Northern loop**—DPS would like to incorporate Flagstaff into the Northern loop rather than maintain it as a spur. Incorporating it into the looped system would provide protection against site failure. Currently, if Flagstaff's communications site fails, they must rely on a makeshift system involving the use of Phoenix dispatchers to cover some areas, cellular telephones for other areas, and losing all communication in remaining areas, putting officer safety at risk.
- **Reduction of "dead spots"**—The existing microwave system does not cover 5 to 10 percent of Arizona's state and federal highways. Officers cannot communicate with dispatchers or access criminal information within these "dead spots." Reducing "dead spots" requires additional communications sites as well as additional equipment such as towers and microwave radios.

Most Western states already converting—Because analog technology is obsolete and difficult to support, most Western states have already converted their analog systems. Specifically, of the nine other Western states (California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), eight have already converted or are in the process of converting to a digital system network.¹ Of those converting, most gave unavailable analog equipment as a reason for making the change.

DPS Slow to Address Outdated System

While DPS is aware of the need to convert its microwave system to digital technology, it has been slow to initiate the conversion process. One reason for the delay may be that DPS has historically linked digital conversion to interoperability, a larger, more expensive project.

DPS slow to address outdated system—Although DPS has acknowledged the need to convert to a digital system, it has been slow to initiate implementation. In 1994, DPS conducted an assessment to determine the need to convert to a digital communications system. The study recommended DPS consider an immediate conversion to digital technology should any one of six scenarios occur. To date, three of the six scenarios have occurred, including notice from vendors that they are no longer supporting their analog microwave radio product line. However, DPS has only recently begun addressing the conversion issue since its 1994 assessment. Specifically, DPS completed a preliminary internal study in September 2000 that estimates the operational requirements needed to convert to a digital network such as additional buildings and towers. DPS also intends to hire a consultant to provide a more detailed plan that will include specific information on how to convert the system and the cost of conversion.

Conversion historically linked to interoperability—DPS may be unnecessarily delaying digital conversion because it has historically linked conversion to its goal of implementing an interoper-

¹ Montana is excluded because it does not use a statewide microwave system to carry public safety communications.

able communication system. An interoperable system enhances the ability of various law enforcement agencies (i.e., local police, county sheriff, DPS, etc.) to coordinate their actions during large-scale emergencies. While an interoperable system would undoubtedly be helpful, it is not needed to begin a digital conversion. However, DPS continues to link the two issues together. For example, in a recent grant request to the National Institute of Justice for a consultant, DPS linked the analysis of the digital microwave conversion to an assessment of what would be required to implement an interoperable system. For these two combined components, DPS requested \$350,000, or about \$150,000 more than would be needed for just a digital conversion plan.

While converting to digital technology will not preclude an interoperable system from developing in the future, linking these two issues together could unnecessarily postpone digital conversion for several years. This delay is due to several reasons. First, the FCC is in the process of developing nationwide interoperability standards that will not be finalized until at least 2003. Second, before interoperability can be implemented in Arizona, many stakeholders must agree on its project design. These stakeholders meet monthly through the Arizona Public Safety Communications Committee and concede that implementation is a long way off. Third, obtaining funding for the project may be difficult, as the costs associated with interoperability are significantly greater than digital conversion alone. For example, based on DPS' preliminary internal study, the cost of digital conversion is approximately \$55,250,000.¹ In contrast, the Arizona Public Safety Communications Committee has indicated that an interoperable system could cost approximately \$200 million.

¹ The estimate includes the contractors' cost to erect or repair all towers and buildings, the placement of antennas, and the purchase and installation of radio equipment. Until the Bureau can hire a consultant to develop a more precise estimate, the cost estimate assumes the following:

- The system design's backbone requires a DS3 bandwidth;
- Radio equipment vendors will grant DPS a significant volume discount;
- The FCC will assign DPS secondary frequencies, allowing it to build and test the new system while the old one is fully functional; and
- DPS will receive funding for at least the total cost of one microwave loop at a time.

DPS Should Plan for Conversion as Soon as Possible

While the existing analog system is not in any immediate danger, DPS should plan for a conversion as soon as possible for two key reasons. First, the additional frequencies needed for a smoother conversion to a digital system are becoming increasingly difficult to obtain. Second, without adequate funding and external contractors, digital conversion could take as long as 15 years to implement and it is not clear how long spare analog parts will be available to continue to support the existing system.

Additional frequencies increasingly scarce—One reason DPS should begin planning for conversion as soon as possible is that it needs to obtain additional frequencies from the FCC that are becoming increasingly scarce. Additional frequencies are needed so that DPS can install and test the new system without interfering with communications carried on existing frequencies. A frequency coordinator used by DPS who functions as an intermediary between agencies and the FCC confirmed that additional frequencies are difficult to obtain because of the competition and the limited number of frequencies. Consequently, the coordinator suggested that DPS move as quickly as possible to obtain them while they are still available.

Digital system requires significant implementation time—In addition to limited frequencies, DPS has indicated that converting to a digital system will require significant implementation time due to the many steps required. Because of the size of the system, the cost, and manpower limitations, DPS has indicated that upgrading one loop at a time is a more realistic approach to conversion than addressing the entire system all at once. Under a loop-by-loop approach, DPS estimates implementation could take as long as 15 years to complete, or approximately 5 years per loop without adequate funding and external contractors. Before conversion can even occur, DPS indicates that it must upgrade the existing microwave infrastructure, such as towers and buildings, because it cannot fully support a digital network. Specifically, additional towers will be required because digital microwave systems require shorter path lengths. In addition, DPS reports that it will need to replace or improve 95 percent of the existing towers because they cannot fully support the new digital

equipment. Furthermore, DPS indicated it needs time to secure the land required to house the additional sites and time to complete the conversion once the infrastructure needs are addressed.

Although the loop-by-loop conversion method involves a longer time period, DPS indicates that it offers the following advantages:

- **Lessons learned**—Converting to digital one loop at a time allows DPS to build on lessons learned from one loop before converting the others.
- **Less initial investment**—The entire cost of the conversion would be spread out over a longer time period using this method, rather than funding the entire conversion up-front.
- **Extension of existing analog system**—Once a digital loop is up and running DPS could use the spare analog parts gained from the converted loop to extend the life of the remaining loops until the conversion is complete.

DPS Should Take Steps to Prepare for Conversion

DPS should take the necessary steps to prepare for conversion. First, it should complete a conversion plan for the entire system that outlines project costs and timelines of the project before seeking funding from the Legislature. Second, it should seek grant monies to help support the project's cost and minimize the impact to the General Fund.

DPS should complete a conversion plan—Because of the significant costs associated with conversion and the magnitude of the project, DPS should develop a complete conversion plan before it seeks funding from the Legislature. This plan should outline the operational requirements, such as the additional buildings and towers needed as well as the associated costs. In addition, the plan should include estimated time frames for completing each major phase of the conversion project. To ensure DPS stays within its budget and time frames, it should report to the Legislature periodically on its progress toward fulfilling its plan. Several of the Western states that have already converted or are in the process of converting to digital technology developed a plan

prior to starting their conversion. In fact, some states report that their plan was critical to garnering the support and funding needed from their legislatures.

DPS should seek grant monies—In addition to completing its conversion plan, DPS should aggressively pursue available grant funding to help pay for the high cost of conversion. The U.S. Department of Justice, Office of Justice Programs, provides numerous criminal justice grants. DPS may be eligible to receive grant money that could be used to help defray some of the costs of digital conversion because of its role as a law enforcement agency.

Once DPS has completed its plan and thoroughly pursued grant funding, it should seek funding from the Legislature for additional monies that may be needed to support the cost of upgrading the system.

Recommendations

1. DPS should develop a plan for converting, as soon as possible, its entire telecommunications system from an analog system to a digital system. This plan should include the operational requirements, such as the additional buildings and towers needed, as well as the associated costs. In addition, the plan should include estimated time frames for completing each major phase of the conversion project.
2. DPS should seek grants to help finance the cost of digital conversion, and the cost of preparing its digital conversion plan.
3. Once DPS has completed its plan and thoroughly pursued grant funding, DPS should seek additional monies needed from the Legislature so that it can begin converting to a digital communications network as soon as possible. In doing so, DPS should pursue digital conversion separately from its goal of an interoperable system.
4. DPS should report periodically to the Legislature on its progress toward fulfilling its plan.

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FINDING II

STAFFING PROBLEMS COULD HINDER DPS' ABILITY TO MAINTAIN SYSTEM

DPS' ability to convert to a digital system while maintaining its current system could be jeopardized because of numerous staff vacancies expected in the near future. Specifically, a loss of experienced telecommunications technician staff within the next three to five years due to retirements, combined with vacant positions that are hard to fill, could pose difficulties should the Department convert to a digital communications system. Although DPS is currently working on ways to enhance its recruitment efforts, it should take additional steps to ensure it can recruit and retain its technicians.

Future Technician Vacancies May Make Conversion More Difficult

Staffing problems may impact DPS' digital conversion plans and its ability to continue to operate and maintain the system. DPS could lose nearly one-quarter of its telecommunications technician staff within the next three to five years, if retirements occur as expected. This loss, particularly of the experienced technical staff, could make conversion to a digital communications system more difficult. Furthermore, DPS has had problems filling telecommunications technician positions in the past due to the high demand for these positions in similar industries.

The Bureau could soon lose one-fourth of its experienced technicians.

Numerous technician vacancies likely in the future—DPS may face a severe shortage of technical staff in the near future due to impending retirements. Specifically, persons filling 10 of the 43 technician positions are expected to retire in the next three to five years. DPS will lose much of its experience and institutional memory if the majority of these expected retirees, who have more than 14 years experience each with DPS, retire as scheduled.

Technicians' knowledge of the current system is vital to a smooth conversion to digital technology.

Loss of experienced staff poses problem—While a loss of experienced staff is difficult under most circumstances, it could pose particular difficulties should conversion to a digital system occur. Technicians will play a pivotal role in the transition to a digital system because a smooth conversion will require extensive knowledge of both the existing system, as well as the new digital system. Contractors that may be hired to assist in the conversion will not likely have knowledge of the existing analog system because DPS significantly modified it from the manufacturer's original configuration in order to meet its needs. As a result, contractors will need to work with the experienced in-house staff when customizing and testing the new system to ensure the actual transition involves minimal down-time. Furthermore, DPS will continue to need in-house technicians to maintain the existing system while the new one is being built. Experienced staff can usually identify and resolve system problems more quickly than less experienced staff, thereby reducing the amount of down-time officers and other users experience when there is a problem.

Vacancies a historical problem—Finding replacements for these positions may not be easy because, historically, DPS has had difficulty attracting new telecommunications technician applicants. For example, DPS currently has four vacant telecommunications technician positions, some of which have been open for up to two years. DPS indicates these positions are hard to fill because there are several highly technical industries competing for the same applicants. While the entry-level salaries for most entities with similar personnel needs, such as Salt River Project and Arizona Public Service, are not much higher than DPS, these entities offer hiring bonuses, which range from \$2,000 to \$10,000 for new employees.

In addition to the difficulty with attracting applicants, recent actions may have resulted in some staff considering retirement. Specifically, in April 1997, during a Classification/Compensation Maintenance Review (CCMR) process, senior telecommunications technician positions were changed to telecommunications technicians. This change resulted in the freezing of some salaries because they exceeded the maximum range. Nine of the technicians who will likely retire within the next three to five years were impacted by the CCMR salary cap and are currently at the maximum salary amount allowed by CCMR. In addition, at least

14 other technician positions are currently affected by this salary cap and may not receive a raise at least until the next CCMR process that will take place in fiscal year 2002.

DPS Should Take Additional Steps to Address Technician Staffing Problems

DPS can do more to help ensure staff vacancies and retirements do not jeopardize its operations. While DPS is taking action to improve its recruiting efforts, it could take additional steps to recruit and retain its telecommunication technicians, including considering hiring bonuses for new employees similar to a Department of Administration (DOA) pilot project.

DPS is working to improve recruiting efforts—DPS has recently developed an apprentice program to help address its staff vacancy problem. Specifically, DPS plans to hire part-time apprentices from trade and technical schools who have been enrolled for at least three months and who maintain passing grades. DPS would provide them with on-the-job training throughout their schooling and pay them up to \$15 per hour in the hope that, when they graduate, they would begin working at DPS as a trainee and progress into an entry-level technician position after 1 year. DPS began interviewing for the apprenticeship program in October 2000, but has not hired anyone yet.

In addition to the apprentice program, DPS is also proposing other ways to improve its ability to attract technical applicants. Currently, DPS requires technician applicants to have an FCC license or other technical certification at the time they are hired. DPS is proposing changing that policy and providing a grace period of up to six months from the date of hire to allow new employees time to study for and take the FCC exam. The grace period would also apply to trainees who would be allowed 12 months to obtain their FCC license or other certification. Lastly, the Telecommunications Bureau has proposed a review of DPS' civilian background requirements to ensure a broad applicant pool.

Additional steps are needed to retain and attract technicians—While DPS' current efforts are positive, it should pursue addi-

tional measures to ensure it can attract and retain technicians. First, as contacts are made at technical institutes during recruitment for the new apprentice program, DPS should also strive to promote its entry-level technician trainee positions to new graduates. Success in recruiting applicants could come about by working with the schools to give presentations on the advantages of working for DPS and posting notices to advertise the positions available.

Second, DPS should consider offering hiring bonuses to attract new applicants and counter-offers to existing staff who have received employment offers from other companies. Currently, DOA is conducting its Decentralized Pilot Project, which allows four executive state agencies to offer hiring bonuses to potential applicants and counter-offers to existing staff, if they have current fiscal year appropriations available. According to a DOA official, this program is a result of findings from the Personnel Rules and Review Committee, which was created by the Legislature in 1997 to devise new ways of coping with personnel challenges. While DPS is not under DOA personnel rules, it could consider proposing a similar program to the Law Enforcement Merit Council, the entity responsible for overseeing personnel issues for DPS. DPS could finance the program through the Telecommunications Bureau's vacancy savings, which totaled almost \$319,000 in fiscal year 2000.

Recommendations

1. DPS should continue with its current efforts to hire apprentices and trainees, and extend the time frame required to obtain an FCC license or similar certification.
2. DPS should continue researching the feasibility of modifying its background requirements for all civilian applicants, including technical applicants, to ensure a broad applicant pool.
3. DPS should make further efforts to recruit applicants by arranging to give presentations about the advantages of working with DPS telecommunications and through written job postings at technical institutes and community colleges sites.
4. DPS should assess the feasibility of offering hiring bonuses and counter-offers to attract and retain technicians.

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Agency Response

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ARIZONA DEPARTMENT OF PUBLIC SAFETY

2102 WEST ENCANTO BLVD. P.O. BOX 6638 PHOENIX, ARIZONA 85005-6638 (602) 223-2000



JANE DEE HULL DENNIS A. GARRETT
GOVERNOR DIRECTOR

February 28, 2001

Ms. Debra K. Davenport, CPA
Auditor General, State of Arizona
Office of the Auditor General
2910 North 44" Street
Phoenix, Arizona 85018

Dear Ms. Davenport:

Enclosed is the Department's written response to the Auditor General's revised preliminary report draft of the performance audit of the Department of Public Safety Telecommunications bureau.

Please do not hesitate to contact my office if you have any questions.

Sincerely

Dennis A. Garrett, Colonel
Director

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Enclosures

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DEPARTMENT OF PUBLIC SAFETY
RESPONSE TO
THE OFFICE OF THE AUDITOR GENERAL'S
REVISED PRELIMINARY REPORT DRAFT PERFORMANCE AUDIT OF THE
TELECOMMUNICATIONS BUREAU

GENERAL RESPONSE

The Arizona Department of Public Safety, Telecommunications Bureau, recognizes that audits and inspections provide a valuable means to evaluate Department operations from an external source and make recommendations for improvement. The following is in response to the draft report and recommendations provided to us.

RESPONSE TO FINDING I RECOMMENDATIONS

Recommendations from the Office of the Auditor General:

1. DPS should develop a plan for converting, as soon as possible, its entire telecommunications system from an analog system to a digital system. This plan should include the operational requirements, such as the additional buildings and towers needed, as well as the associated costs. In addition, the plan should include estimated time frames for completing each major phase of the conversion project.

DPS' Response to the Office of the Auditor General:

1. The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Recommendations from the Office of the Auditor General:

2. DPS should seek grants to help finance the cost of digital conversion, and the cost of preparing its digital conversion plan.

DPS' Response to the Office of the Auditor General:

1. The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Recommendations from the Office of the Auditor General:

3. Once DPS has completed its plan and thoroughly pursued grant funding, DPS should seek additional monies needed from the Legislature so that it can begin converting to a digital

communications network as soon as possible. In doing so, DPS should pursue digital conversion separately from its goal of an interoperable system.

DPS' Response to the Office of the Auditor General:

- 1 . The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Recommendations from the Office of the Auditor General:

4. DPS should report periodically to the Legislature on its progress toward fulfilling its plan.

DPS' Response to the Office of the Auditor General:

- 1 . The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

RESPONSE TO FINDING II RECOMMENDATIONS

Recommendations from the Office of the Auditor General:

- 1 . DPS should continue with its current efforts to hire apprentices and trainees, and extend the time frame required to obtain an FCC license or similar certification.

DPS1 Response to the Office of the Auditor General:

- 1 . The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Recommendations from the Office of the Auditor General:

2. DPS should continue researching the feasibility of modifying its background requirements for all civilian applicants, including technical applicants, to ensure a broad applicant pool.

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Recommendations from the Office of the Auditor General:

3. DPS should make further efforts to recruit applicants by arranging to give presentations about the advantages of working with DPS telecommunications and through written job postings at technical institutes and community colleges sites.

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1. The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Recommendations from the Office of the Auditor General:

4. DPS should assess the feasibility of offering hiring bonuses and counter-offers to attract and retain technicians.

DPS' Response to the Office of the Auditor General:

1. The findings of the Auditor General are agreed to and the audit recommendations will be implemented.

Other Performance Audit Reports Issued Within the Last 12 Months

00-7	Department of Public Safety— Aviation Section	00-17	Arizona Department of Agriculture— Sunset Factors
00-8	Arizona Department of Agriculture— Animal Disease, Ownership and Welfare Protection Program	00-18	Arizona State Boxing Commission
00-9	Arizona Naturopathic Physicians Board of Medical Examiners	00-19	Department of Economic Security— Division of Developmental Disabilities
00-10	Arizona Department of Agriculture— Food Safety and Quality Assurance Program and Non-Food Product Quality Assurance Program	00-20	Department of Corrections— Security Operations
00-11	Arizona Office of Tourism	00-21	Universities—Funding Study
00-12	Department of Public Safety— Scientific Analysis Bureau	00-22	Annual Evaluation—Arizona’s Family Literacy Program
00-13	Arizona Department of Agriculture Pest Exclusion and Management Program	01-01	Department of Economic Security— Child Support Enforcement
00-14	Arizona Department of Agriculture State Agricultural Laboratory	01-02	Department of Economic Security— Healthy Families Program
00-15	Arizona Department of Agriculture— Commodity Development Program	01-03	Department of Public Safety— Drug Abuse Resistance Education (D.A.R.E.) Program
00-16	Arizona Department of Agriculture— Pesticide Compliance and Worker Safety Program	01-04	Department of Corrections—Human Resources Management

Future Performance Audit Reports

Board of Osteopathic Examiners in Medicine and Surgery

Game and Fish Department—Wildlife Management Program

Game and Fish Department—Heritage Fund