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REPORT TO THE CONGRESS

Why Performance Of Automatic Voice Network (Autovon) Service Needs Improvement

B-169857

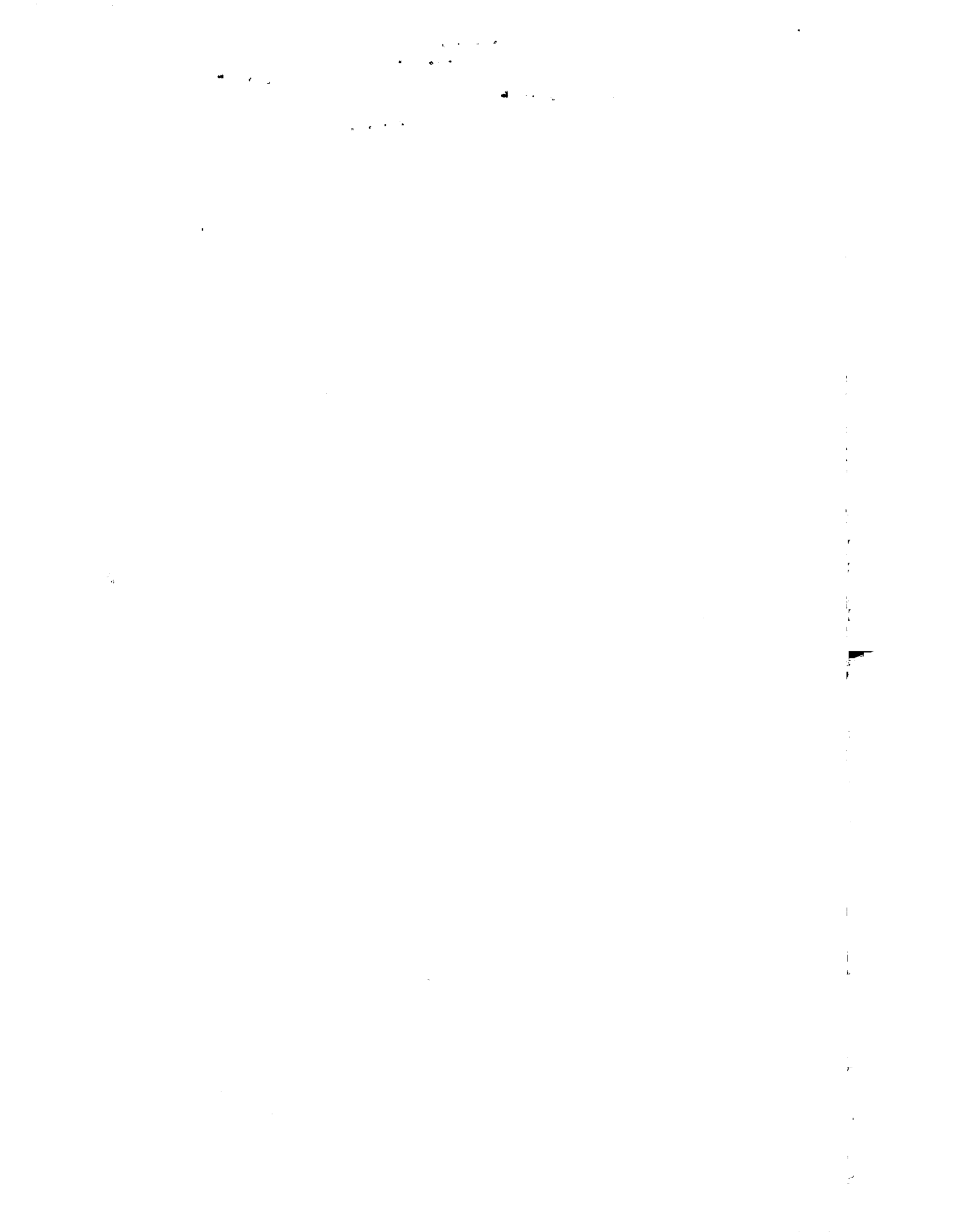
Department of Defense

**BY THE COMPTROLLER GENERAL
OF THE UNITED STATES**

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SEPT. 11, 1974





COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-169857

To the Speaker of the House of Representatives
and the President pro tempore of the Senate

This our report on why performance of the Automatic Voice Network (AUTOVON) service of the Department of Defense needs improvement.

We made our review pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Director, Office of Telecommunications Policy; the Secretary of Defense; the Secretaries of the Army, Navy, and Air Force, and the Director, Defense Communications Agency.

A handwritten signature in black ink, reading "James B. Stacks".

Comptroller General
of the United States

The following table shows the results of the survey conducted in the year 1998-1999. The data is presented in a tabular format, showing the number of respondents for each category. The categories are listed in the first column, and the number of respondents is listed in the second column. The total number of respondents is 100.

Category	Number of Respondents
Male	55
Female	45
Age Group 18-25	30
Age Group 26-35	25
Age Group 36-45	20
Age Group 46-55	15
Age Group 56-65	10
Age Group 66+	5
Education Level: High School	40
Education Level: Bachelor's Degree	35
Education Level: Master's Degree	15
Education Level: Doctorate	10
Occupation: Student	20
Occupation: Professional	30
Occupation: Managerial	25
Occupation: Service	15
Occupation: Unemployed	10

The survey results indicate that the majority of respondents are male (55%) and have a high school or bachelor's degree (75%). The majority of respondents are in the 18-25 age group (30%) and are currently students (20%). The majority of respondents are in the professional or managerial occupations (55%).

The following table shows the results of the survey conducted in the year 1998-1999. The data is presented in a tabular format, showing the number of respondents for each category. The categories are listed in the first column, and the number of respondents is listed in the second column. The total number of respondents is 100.

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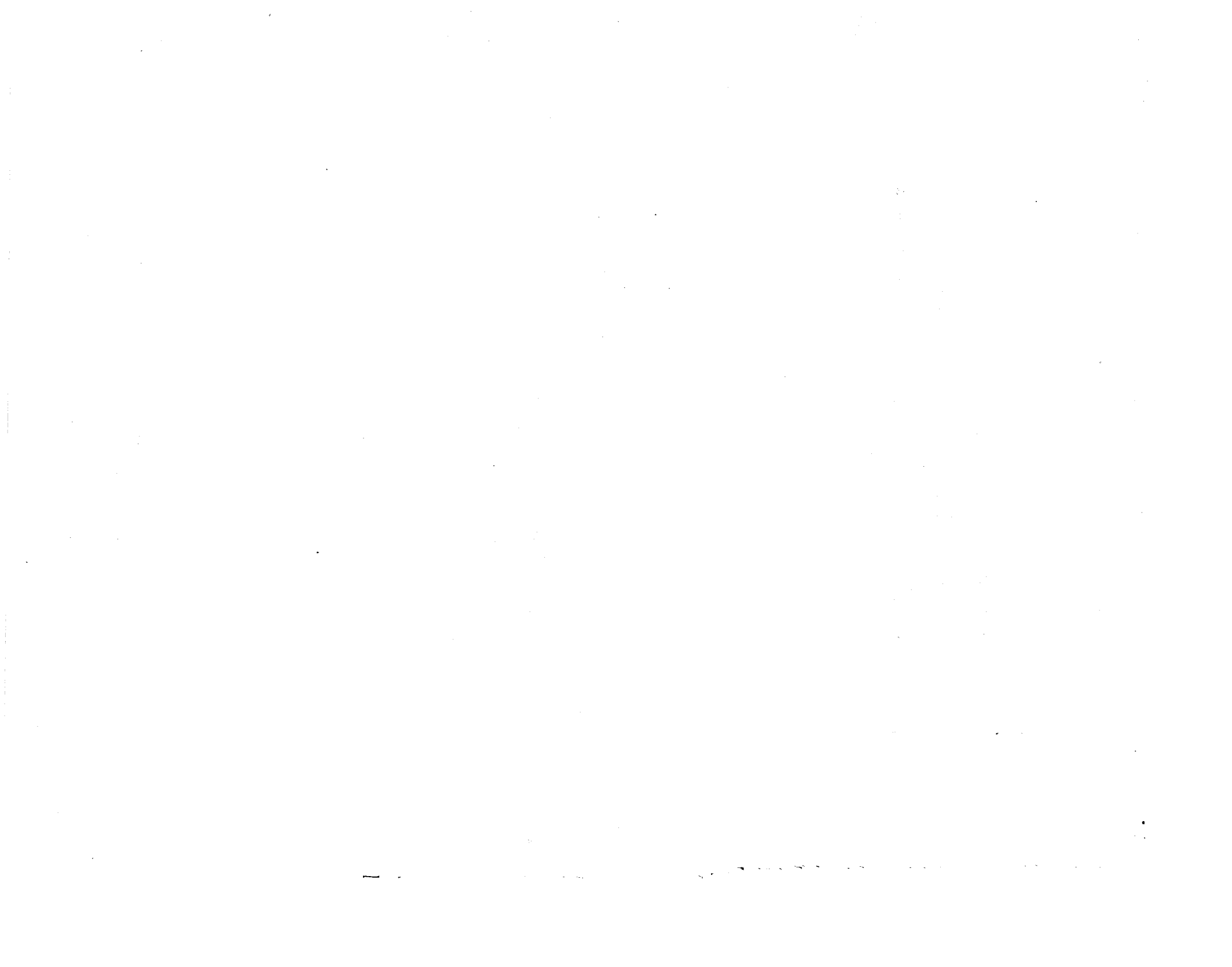
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ABBREVIATIONS

AUTOVON	Automatic Voice Network
CONUS	continental United States
DCA	Defense Communications Agency
DOD	Department of Defense
D, TACCS	Director, Telecommunications and Command and Control Systems
FTS	Federal Telecommunications System
GAO	General Accounting Office

ABBREVIATIONS (Continued)

JCS	Joint Chiefs of Staff
MOP	Memorandum of Policy
PABX	private automatic branch exchange
USACC	United States Army Communications Command



COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

DIGEST

WHY THE REVIEW WAS MADE

Earlier GAO reviews indicated problems in managing Department of Defense (DOD) communications. (See app. II.) This review concerns opportunities for improving performance and reducing operating costs of the Automatic Voice Network (AUTOVON) system.

AUTOVON's Government owned and leased communications facilities comprise the principal long-distance voice communications network within the Defense Communications System, providing direct distance dialing telephone service throughout the world. (See p. 1.)

The Government's investment in the AUTOVON system's assets is about \$92 million, and it costs about \$168 million a year to operate. (See p. 1.)

FINDINGS AND CONCLUSIONS

AUTOVON funding, provided through the military departments, has been insufficient to achieve grade of service objectives established by the Joint Chiefs of Staff. (See pp. 8 and 9.)

Although the Defense Communications Agency (DCA) is

WHY PERFORMANCE OF
AUTOMATIC VOICE NETWORK
(AUTOVON) SERVICE NEEDS
IMPROVEMENT

Department of Defense
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responsible for the management control and operational direction of AUTOVON, it has not been given either the authority or control of resources provided, which is necessary for maximum efficiency and for achieving its chartered responsibilities for accountable system management. (See p. 5.)

Of the 390 locations in DCA's analysis for a 3-month period ended July 31, 1973, 258, or 66 percent, failed to meet the objective for inward grade of service established by the Joint Chiefs of Staff. The number of locations experiencing below-par service varied from 20 to 80 percent overall among the installations of the various military departments. (See p. 9.)

Service ranged from excellent at some locations to poor at other locations, including one location where 9 of 10 incoming calls were not completed. At 27 installations, the grade of service was such that one-half or less of the attempted calls were completed. Unquestionably, much time is being lost by personnel because of the need to reattempt calls. (See p. 10.)

By not providing enough inward access lines to clear traffic

off the network which also adds traffic from reattempt calls, users prevent the most efficient and economical operation of the total system. This, of course, impairs service to other users. (See p. 11.)

Since DCA's management authority over AUTOVON resources extends only to the backbone of the system (switching centers and interswitch trunks), subscribers configure the access lines connecting them to the switching centers according to their own needs and funding abilities. (See pp. 8 and 30.)

DCA regularly makes analyses and recommendations for changes in access lines. These include numerous locations where the grade of service causes, in DCA's words, "the most serious impact upon network service."

They also include locations where the grade of service exceeds the standard; hence where resources could be re-allocated to needed improvements in service at other locations. These efforts have been largely ignored by military users. (See pp. 9 and 26 to 28.)

To encourage subscribers to use access lines that only take calls off the network and to discourage use of access lines that only enter calls into the network, DCA has consistently resorted to an unbalanced rate structure for distributing backbone costs to the subscribers.

(See p. 14.) Although this device may appear sound, it has resulted in configurations of access lines which are uneconomical and inefficient.

Based on the unbalanced subscriber-rate structure, one military department has proposed and begun access-line reconfigurations at a number of locations which, if completed, could result in a decrease of about \$500,000 a year in charges to the department, while at the same time adding about \$184,000 a year to DOD's overall AUTOVON costs. Another military department is considering this method. (See pp. 15 to 17.)

Under these conditions, when DOD and the military departments have consistently provided insufficient funds to meet specified grade of service levels and when DCA has not been given the authority or control of resources provided, GAO does not consider it feasible to assess the effectiveness of DCA's management. (See p. 31.)

Although DCA apparently has the ability to monitor the system's performance and the expertise to determine the corrections needed in access-line configurations, it has been unable to prevail on the military departments and other users to adopt the configurations necessary for efficient system operation. (See p. 30.)

In contrast to DCA's limited authority over AUTOVON, the General Service Administration's authority over its

Federal Telecommunications System extends to the access lines and switchboards or local exchange equipment. The overall telephone-to-telephone completion rate for this system has been about 70 percent, while the rate for AUTOVON in the continental United States in recent years has been 50 to 60 percent. Similarly, while about 66 percent of U.S. AUTOVON locations experience a grade of service worse than P.05 (5 unsuccessful calls for each 100 calls attempted), only about 22 percent of Federal Telecommunication System locations tested experienced service which was poorer than P.05. (See pp. 17 and 18.)

A system manager should be given the authority and control of the resources, if he is to achieve maximum total system effectiveness and efficiency, and be held accountable for system management. Both the Deputy Assistant Secretary of Defense (Audit) and the Blue Ribbon Panel reached similar conclusions in their reviews of DOD communications. (See p. 31.)

RECOMMENDATIONS

DOD should

- take steps to prevent use of the AUTOVON rate structure for uneconomical configuration of access lines and
- give to the system manager the authority and control of resources necessary to balance the components of the AUTOVON system to achieve its maximum efficiency within the directed

quality and funding parameters. (See p. 31.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

DOD agreed with GAO proposal to prevent the use of the AUTOVON rate structure for uneconomical configuration of access lines and said that it would take steps to stop manipulation solely to reduce backbone apportionment to a particular user.

However, DOD did not agree that alternative methods for the management of AUTOVON as a total system should be considered. (See p. 29.)

DOD disagreed because AUTOVON's main purpose is communications for command, control, and support of combat forces and because, under current funding conditions, individual users should control the system's access lines based on their own operation-mission requirements. (See p. 29.)

However, this report addresses only routine traffic. The requirements placed on AUTOVON for higher precedence command, control, and support communications are, according to DOD, satisfied through preemption capabilities incorporated in the AUTOVON system.

GAO believes that the conditions described in this report will continue unless present management arrangements are changed. (See p. 31.)

MATTERS FOR CONSIDERATION BY
THE CONGRESS

This report provides information on fragmented management in the area of DOD communications, which

is a recurring obstacle to efficient management and effective control of DOD communications. (See pp. 22, 24, and app. II.)

It also provides DOD's views opposing actions considered appropriate to improve management of AUTOVON on a total system basis. (See app. I.)

CHAPTER 1

INTRODUCTION

The Automatic Voice Network (AUTOVON) is the principal long-distance common-user voice communications network within the Defense Communications System, providing unsecure (unencrypted) direct distance dialing service, worldwide, through a system of Government owned and leased communications facilities.

Before AUTOVON was initiated, the Defense Communications System was made up of a number of point-to-point systems and a few switched networks. In 1964, two of these small networks--the Army's Switched Circuit Automatic Network and the North American Air Defense Command's Automatic Dial Switching Network--were combined to form AUTOVON. Later, other networks were added and AUTOVON itself was further expanded.

CONUS AUTOVON is the title applied to the network within the continental United States (CONUS) including Alaska and Canada. OVERSEAS AUTOVON covers all other areas.

Through fiscal year 1971, the investment in AUTOVON had reached \$92 million. Its annual operating costs have been estimated to be about \$168 million. The tables below present the physical structure of the AUTOVON system as of January 31, 1973.

	<u>CONUS AUTOVON</u>	<u>OVERSEAS AUTOVON</u>	<u>Total</u>
Intra-area facilities:			
Switching centers	^a 69	^b 17	86
Access lines (note c)	15,261	1,670	16,931
Intra-area interswitch trunks (note d)	6,961	498	7,459

Inter-area facilities:

Inter-area interswitch trunks

between United States and

Canada	312
Europe	49
Pacific	60
Panama	<u>12</u>
	<u>433</u>

^aAll leased from carriers.

^bSixteen Government owned, one leased (Hawaii).

^cCircuits connecting the user's switchboard or direct access telephone to an AUTOVON switch.

^dCircuits connecting AUTOVON switches.

Automatic alternate routing of calls is an AUTOVON feature. A call is advanced toward its destination by selecting trunks that interconnect switches. The most direct route is usually attempted first, but, if a busy condition is encountered, the switching center equipment searches for an idle trunk to an alternate route. Polygrid routing provides for interconnecting switching centers in a grid structure

complex which is based on a wide diversification of trunk routes and intermediate switching centers, to avoid target areas and to insure high survivability under nuclear attack.

AUTOVON service may be selected on an unrestricted worldwide access basis or may be restricted to certain geographical areas. For example, a CONUS subscriber can choose to have his calling area capability limited to CONUS or to CONUS and an overseas area (area plus) or unlimited (global).

To further automate AUTOVON and to provide more rapid and equitable use of the network, consistent with the validated requirements of the subscribers,¹ a multilevel precedence preemption feature is provided. The precedence system may be used only by authorized users² and subscribers, and its effectiveness depends on the cooperation of persons authorized to use it. An established call may be preempted (interrupted) when the circuit is needed to complete a call of higher precedence.

The four levels of precedence (in descending order) are flash override, flash, immediate, and priority. The routine level has no preemption capability.

Although switchboards on which AUTOVON circuits terminate may have a capability to extend calls into the local commercial system, such extension is not always feasible or desirable. Local manual switchboards or PABXs are configured and manned to satisfy the requirements of the parent activity, not a distant user. Therefore, off-net calling may or may not be within the local capability. Authorities controlling the local switchboard at the distant end will determine whether off-net calling will be accommodated. Off-net extension will not be completed unless adequate call supervision equipment is installed.

¹An individual desk telephone, private branch exchange (manual switchboard), or private automatic branch exchange (PABX) (automatic switchboard) with direct access to the network.

²An individual with indirect access to the network, i.e., via a manual switchboard, PABX, or console.

As a result, AUTOVON-served users make many commercial long-distance toll calls. Although precise data is not available, Department of Defense (DOD) components' estimates indicate that DOD spends about \$25 million annually for toll calls.

MANAGEMENT ARRANGEMENTS

In 1970 DOD established the Office of Assistant to the Secretary of Defense for Telecommunications to consolidate the communications responsibilities which were previously dispersed among several assistant secretaries. His responsibilities include advising the Secretary of Defense on all DOD telecommunications matters, coordinating DOD efforts in the area of communications, and reviewing DOD-validated telecommunications requirements to affirm their need and to recommend alternatives. The office designation was changed to Assistant Secretary of Defense (Telecommunications) in 1972 and to Director, Telecommunications and Command and Control Systems (D,TACCS), in 1974, with added responsibilities for command and control. We will refer hereinafter to the Director or his office as D,TACCS.

As a part of their communications responsibilities, the Joint Chiefs of Staff (JCS) have established, in their Memorandum of Policy (MOP) No. 151, the following goals for the grades of service to be attained in the AUTOVON system.

	<u>Service goal</u>
Trunks:	
Within CONUS	^a P.03 (now P.07, see note b)
Within overseas areas (except western Pacific transoceanic circuits)	P.03 (P.10 for Western Pacific)
Transoceanic	P.10
Worldwide	^c flash nonblocking
Access lines:	
All	^d P.05 inward grade of service

^aThe probability of blockage of calls expressed as decimal fraction. The grade P.03 denotes that 3 calls for each 100 offered will probably fail to complete. Grade of service normally applies to busy-hour traffic; that is, the consecutive 60 minutes during an average business day when the largest number of calls are offered through a communications entity, such as a group of trunks or access lines.

^bAlthough MOP No. 151 specifies a P.03 grade of service, on June 24, 1971, the Acting Assistant to the Secretary of Defense (Telecommunications) advised the Director, Defense Communications Agency (DCA), by memo that AUTOVON trunking grade of service within CONUS shall be designed to be no better than P.07.

^cFlash nonblocking means that flash and flash override calls will have a P.00 grade of service.

^dThe outward grade of service objective is established by the appropriate activity based on mission requirements.

DCA was created in 1960 to establish and control the Defense Communications System, of which AUTOVON is a part. In addition to including this common-user network, the Defense Communications System includes other voice networks which are dedicated to the use of particular organizations

within DOD. The Director of DCA is responsible to the Secretary of Defense through JCS. DCA, according to DOD Directive 5105.19, dated September 18, 1967, is responsible, among other things for:

- Insuring that the Defense Communications System will be so planned, engineered, improved, and operated as to effectively, efficiently, and economically meet the long-distance point-to-point telecommunications requirements of DOD and of other Government agencies as directed.

- Obtaining the maximum economy and efficiency in allocating and managing Defense Communications System resources.

DCA is organized into a headquarters and field activities acting for the Director in assigned geographical areas of responsibility. For instance, the DCA Western Hemisphere area, headquartered at Fort Carson, Colorado, covers the operational direction and management control of the Defense Communications System in North, Central, and South America; the Caribbean area; and Greenland. Similarly, DCA Europe and DCA Pacific have the same responsibilities in their assigned geographical areas.

DCA-managed AUTOVON system costs are financed through the Communications Services Industrial Fund which is administered by the Defense Commercial Communications Office, a DCA field activity. The Office is also responsible for procuring, accounting for, and paying for, on a reimbursable basis through the industrial fund, all leased private line communications facilities and equipment within, or emanating from, CONUS, Alaska, Europe, and Hawaii for DOD and certain other Government agencies. The Defense Commercial Communications Office provides the management information needed by headquarters, DCA, the military departments, and other agencies served by the Office to budget, fund, inventory, manage, and control their leased-communications services.

The military departments support the unified and specified commands and their combatant components and operate the administrative, logistic, and training activities of the departments. These functions include engineering,

installation, and operation of various segments of the Defense Communications System, of which AUTOVON is a part, as well as their own systems which are not in the Defense Communications System.

Each military department has a communications headquarters staff and field communications commands to carry out these responsibilities. The communications headquarters staffs act as the focal point for command, control, and communications matters affecting their respective military departments. The field commands provide installation, engineering, and material support for, and operate communications facilities of, the Defense communications structure, both within and outside the Defense Communications System. The field communications commands of the Army, Navy, and Air Force are the United States Army Communications Command (USACC) (formerly United States Army Strategic Communications Command); the Commander, Naval Telecommunications Command; and the Air Force Communications Service, respectively.

It is important to note that DCA does not (1) command the personnel, facilities, and installations of the Defense Communications System, (2) train personnel in procedures, (3) implement improvement plans for the system, (4) validate operational requirements, and (5) set priorities for the use of the system. All but the last two functions are performed by the military departments. Validation of operational requirements is a task of either JCS, the unified-specified commands, or the military departments according to the circumstances; and priorities are set by JCS.

SCOPE OF REVIEW

Our review concerned opportunities for improving the performance and reducing the operating costs of AUTOVON. We made our review at headquarters and communications commands of the military departments, DCA headquarters and selected field offices, and other selected lower echelon military activities.

CHAPTER 2

DCA HAS RESPONSIBILITY BUT NOT AUTHORITY

OR RESOURCES TO MANAGE AUTOVON

In previous GAO reports we discussed problems existing in DOD communications management in accomplishing DOD communications objectives. These problems were mainly related to the fragmented and parochial management of DOD's communications in general and to certain aspects of AUTOVON management in particular. (See app. II.)

Funding for AUTOVON has been insufficient to achieve the JCS-established grade of service objectives described on page 5. Although DCA is responsible for the management control and operational direction of AUTOVON, it does not have either the authority or the resources necessary for maximum system efficiency and for achieving its chartered responsibilities for accountable system management. Further, although DCA does manage the switches and the trunks between switches (the so-called backbone of the network), the subscribers control the access lines from the users to the switches. Users have not provided sufficient funding to acquire enough access lines to maintain the prescribed service standard. This, in turn, adversely affects the grade of service on the interswitch trunks of the network.

Because DCA has little control over AUTOVON access lines, it has consistently structured subscriber rates to encourage use of access lines that only take calls off the network and to discourage use of lines that only enter calls into the network. Superficially, this device appears sound, but the unbalanced rate structure was recently used by the Army to reconfigure its access-line groups at the least cost to the Army. The new arrangement will, however, increase overall AUTOVON operating costs. Implementation of these uneconomical and inefficient configurations has already begun and, if completed as proposed by USACC, will result in additional cost to the Government of about \$184,000 annually. The Air Force was also considering similar reconfigurations.

The DOD internal audit report (see p. 22) also showed the fragmented management and DCA's lack of authority and

resources to manage AUTOVON. The recommendations to improve management were not accepted. In contrast to AUTOVON management, the General Services Administration manages the entire Federal Telecommunications System (FTS), i.e., provides user-to-user service.

GRADE OF SERVICE OBJECTIVES
NOT BEING ACHIEVED

Access-line grade of service

The JCS-established objective for access lines is P.05 inward grade of service, and the appropriate activity establishes the outward grade of service for such lines on the basis of mission requirements.

However, the latest information available at the time of our review showed that many locations had not attained the JCS-established goal. The DCA Western Hemisphere area office calculates periodically the inward grades of service for the preceding 3 months for CONUS switchboards having four or more AUTOVON access lines. The table below summarizes the inward grade of service for the 3 months ended July 31, 1973, which is typical of the grade of service achieved during at least the past 2 years.

Inward grade of service	Number of locations					Total
	Army	Navy	Air Force	Defense Telephone Service Washington	Defense Supply Agency	
P.21 and higher	21	41	57	6	1	126
P.11 to P.20	21	37	21	2	2	83
P.06 to P.10	<u>21</u>	<u>8</u>	<u>15</u>	<u>2</u>	<u>3</u>	<u>49</u>
Total	63	86	93	10	6	258
P.00 to P.05	<u>48</u>	<u>22</u>	<u>30</u>	<u>8</u>	<u>24</u>	<u>132</u>
Total	<u>111</u>	<u>108</u>	<u>123</u>	<u>18</u>	<u>30</u>	<u>390</u>

Percent of installations with worse than P.05 grade of service

Army	57	80	76	56	20	66
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The DCA Western Hemisphere area office sends copies of its calculations to AUTOVON subscribers and requests that action be taken to improve the grade of service to P.05 at those locations where the objective has not been met. The area office also provides reconfiguration recommendations at those locations where the grade of service is particularly poor. However, DCA cannot direct the AUTOVON subscribers to install the necessary access lines or to reconfigure them; it can only recommend such actions; and we found that DCA's recommendations for access-line reconfiguration were not being implemented by the subscribers, as discussed on page 26.

Shortage of access lines adversely affects trunking grade of service

Our review indicates that low grades of service in access lines contribute to problems in achieving the grade of service objectives in interswitch trunks. As shown in

the table, the number of locations with worse than P.05 grade of service in each DOD component ranged from 20 to 80 percent, and for individual installations it ranged from P.00 at Fort Huachuca, Arizona, and 66 other locations to P.92 at a Defense Telephone Service-Washington switchboard in Alexandria, Virginia. Twenty-seven installations had a grade of service of P.50 or worse. Unquestionably, much time is being lost by personnel because of the need to reattempt calls.

When users do not provide enough inward access lines to clear traffic off the network, service to other users of the system is impaired. When a calling party finds the incoming access lines busy at the far end of the circuit, logically he will try to place his call again. Each time the call is attempted and blocked at the incoming access lines, the caller's outgoing access line is occupied, and, if the call is routed through more than one switching center, an inter-switch trunk is also occupied and unavailable to other callers.

Thus, even though DCA has management control over the numbers of interswitch trunks in the system, its ability to maintain grade of service objectives in interswitch trunks is impaired due to the reattempts caused by access-line blockage. The impairment can be relieved by adding access lines. This was illustrated in reconfiguring the access lines at five PABXs in the Washington, D.C., area.

The five PABXs are a part of the Army-operated Defense Telephone Service-Washington. They are known as the Arlington-Dranesville dual-homed combination because they are connected to AUTOVON via access lines to both Arlington and Dranesville, Virginia, switching centers. In this configuration, an incoming call meeting a busy condition on the access lines from one switching center to the destination PABX will be automatically routed through interswitch trunks to the other switching center and then to the destination PABX via the other set of access lines. The reverse procedure applies to outgoing calls.

In January 1973, 62 one-way incoming access lines were added to the 5 PABXs to improve their inward grades of service. Concurrently, the number of interswitch trunks between the Arlington and Dranesville switching centers was reduced by 20. An analysis of 1 month's data, indicated that adding the one-way inward access lines had improved the inward grade of service at the PABXs and permitted removal of interswitch trunks without reducing the interswitch grade of service. The following tables show the results.

Number of access lines

<u>PABX location</u>	<u>Before</u>		<u>After</u>		<u>Increase</u>
	<u>Arlington</u>	<u>Dranesville</u>	<u>Arlington</u>	<u>Dranesville</u>	
Columbia Pike (No. 1)	52	20	52	24	4
Columbia Pike (No. 2)	21	4	28	9	12
Southwest	24	20	34	30	20
Pentagon	133	114	128	125	6
Cameron Station	<u>14</u>	<u>18</u>	<u>34</u>	<u>18</u>	<u>20</u>
Total	<u>244</u>	<u>176</u>	<u>276</u>	<u>206</u>	<u>62</u>

Grade of service

<u>PABX location</u>	<u>Before</u>		<u>After</u>	
	<u>Arlington</u>	<u>Dranesville</u>	<u>Arlington</u>	<u>Dranesville</u>
Columbia Pike (No. 1)	P.03	P.39	P.05	P.04
Columbia Pike (No. 2)	P.42	P.88	P.02	P.52
Southwest	P.85	P.88	P.39	P.58
Pentagon	P.09	P.58	P.05	P.07

Cameron Station (note a)

a/Results not shown because about 400 additional users were activated at Cameron Station after the reconfiguration, which distorted the comparison.

Apparently, as a result of the reconfiguration, more calls to the PABXs in the dual-homed combination were being completed, which, in turn, decreased the number of attempts to call the PABXs from 14,600 in January to 11,000 in February. As more calls were completed on the first attempt, reattempts became unnecessary. Additionally, although the number of call attempts during the busy hour for all CONUS AUTOVON increased about 9 percent (from 94,967 in January to 103,658 in February 1973) and the overall CONUS trunking grade of service decreased from P.10 to P.14, the grade of service for the Arlington-Dranesville interswitch trunk group actually improved--from P.49 to P.41--with 20 fewer trunks. The need for fewer trunks can be attributed to the improved completion rate for the five PABXs, because fewer incoming calls at one switching center were forced to use the alternate route via the interswitch trunks to complete through the access lines at the other switching center.

SUBSCRIBER-RATE STRUCTURE FOSTERS
IMPROPER ACCESS-LINE CONFIGURATIONS
AT HIGHER COSTS

Subscriber-rate structure

AUTOVON costs are financed through the Communications Services Industrial Fund, which has two primary divisions of costs--access line costs and backbone costs. Backbone costs equate to the term "subscriber rates" as used in this report and are a surcharge in addition to the access-line costs. Access-line costs include monthly recurring charges for circuit mileage, connection charges, and other miscellaneous costs and are charged directly to the subscribers. Access-line costs totaled about \$41 million for fiscal year 1973.

Backbone costs consist of lease costs for switching centers and interswitch trunks, minimum service charges at certain switching centers, AUTOVON assistance operators, operation and maintenance of Government-owned overseas switching centers, AUTOVON directories, switching center contract termination liabilities, overhead, and amortization of aid-to-construction expenditures for five leased CONUS AUTOVON switching centers. Backbone costs totaled about \$84 million for fiscal year 1973.

Backbone costs paid from the industrial fund are reimbursed by monthly charges to AUTOVON subscribers. The monthly charges apply to each access line and vary depending on the class of service provided and the geographical area, or areas, the subscriber is authorized to call. These subscriber rates are developed; recommended; and, after approval by the Assistant Secretary of Defense (Comptroller), disseminated by DCA.

Each access line is established as one of three basic types, which determines the direction of traffic flow on that line--incoming only, outgoing only, or two way. For several years DCA has structured subscriber rates to encourage use of access lines that take calls off the network. For example, fiscal year 1973 monthly subscriber rates, as amended, for all full-period CONUS AUTOVON subscribers, excluding differences for preemption capability and for the capability to place calls to locations outside CONUS were for each:

--Out-only access line (usable only for placing calls)	\$342
--Two-way access line (usable both to place and receive calls)	\$171
--In-only access line (usable only for receiving calls)	zero

Thus, DCA has eliminated backbone charges altogether for in-only lines, and the charges for two-way lines are only half the rate for out-only lines. DCA intended that the total cost to the user would be in proportion to his capability to place calls on the network.

This unbalanced rate structure was used to solve DCA's dilemma--being responsible for maximum economy and efficiency in the allocation and management of DOD communications resources as opposed to having little control over AUTOVON access lines. It was intended to restrict the number of calls which can be entered into AUTOVON and to induce subscribers to have sufficient access lines to take calls off the network. Superficially, this device appears sound, but our review showed that it could result in uneconomical and inefficient configurations of access lines.

Unbalanced subscriber-rate structure

JCS policy is for AUTOVON access-line groups to be configured as two-way, one-way, or a combination of both, as traffic studies dictate. Various configurations can satisfy the same service objectives. Therefore, to maximize economy when configuring access-line groups, the most efficient mix of lines should be selected. Because the subscriber rates for in-only access lines are zero and those for two-way lines are half those for out-only lines, maximizing the use of in-only lines to carry most inward traffic and two-way lines to carry outward traffic would generally be the least costly way for a military department to configure AUTOVON access-line groups.

Such configurations, however, generally require more lines than those having the most efficient mix of all three types of access lines. Even though a military department must pay the lease costs of the additional lines, the decrease in backbone charges can greatly exceed the additional line costs. Thus, a military department can decrease its total costs while increasing overall AUTOVON operating costs.

In August and September 1972, USACC recommended to some major commands that AUTOVON access-line groups at several locations be reconfigured to achieve grade of service objectives of P.05 inward and P.10 outward at the least cost to the Army using two-way and in-only lines. We estimated and USACC concurred that the same grade of service objectives for 47 locations could be satisfied with 89 fewer lines, if the access-line groups were using an efficient mix of all three types of lines.

A USACC official told us that we used the same method to determine the most efficient access-line configuration that he would use to recommend access-line configurations based on efficiency rather than on the least cost of the Army.

We estimate that, if USACC's recommendations were carried out, the Government's AUTOVON operating costs would be unnecessarily increased by about \$184,000 annually. The Army, however, would realize a net decrease in AUTOVON operating costs of about \$500,000 annually (\$683,316 backbone savings less \$183,696 increased line costs) as shown below.

Method 1

(least cost to the Army)

	<u>Army cost</u>	<u>Government cost</u>
Backbone (note a)	\$1,641,600	^b \$2,324,916
Access-line costs (note c)		
(457 in-only lines)		
(800 two-way lines)	<u>2,594,448</u>	<u>2,594,448</u>
	<u>1,257</u>	<u>\$4,919,364</u>

Method 2

(least cost to the Government)

Backbone (note a)	\$2,324,916	^b \$2,324,916
Access-line costs (note c)		
(391 in-only lines)		
(356 out-only lines)		
(421 two-way lines)	<u>2,410,752</u>	<u>2,410,752</u>
	<u>1,168</u>	<u>\$4,735,668</u>

Decrease in the Army's cost if method 1 were used instead of method 2

\$499,620

Excess cost to the Government if method 1 were used instead of method 2

\$183,696

^aComputed using revised fiscal year 1973 subscriber rates.

^bActual backbone costs are presumed to be the same in either case.

^cComputed using the Army's average cost per line.

Inefficient access-line group configurations can also result in some additional costs for common control equipment (equipment used by every call to establish a connection) which we did not attempt to estimate. The loss in backbone revenue to the industrial fund under method 1 would ultimately have to be absorbed by all users, including the Army, through revised subscriber rates.

Furthermore, at the time of our review the Air Force Communications Service was considering using a methodology similar to USACC's for determining AUTOVON access-line requirements.

Subsequently, many of the inefficient configurations of AUTOVON access lines recommended by USACC were being carried out. (See discussion on p. 26.)

Concern with the cost of AUTOVON to the military department user rather than to the Government could cause the proliferation of such reconfigurations.

It should be recognized that DCA and the military departments use differing methods for determining the proper number and mix of lines required to satisfy specific grade of service objectives, and the results are not uniform. We did not attempt to reconcile the effects of such practices because, at the time of our review, DCA was conducting simulation studies of access-line configurations to develop a standardized access-line engineering methodology. DCA subsequently developed a new methodology and printed it as a proposed revision to its Technical Engineering Practices Manual, which was distributed to concerned DOD components for review. However, such a DCA methodology would not be mandatory for military departments unless prescribed by an authority higher than DCA. If not so prescribed, it is not likely to be used, unless it were accompanied by a change in the subscriber-rate structure which would make the most efficient configuration also the most economical for the subscriber, as well as for the Government as a whole.

Contrasting management of FTS

In contrast to DCA's limited authority over AUTOVON, the General Services Administration's authority over FTS,

another major Government telephone system used primarily by the civil agencies, covers the access lines and switchboards or local exchange equipment. The design criteria for FTS service have been established at P.03 for trunks and P.02 for access lines.

FTS has an intercity telephone network that serves executive agencies and departments in nearly 500 cities. It can be used to call any telephone in the system and all commercial telephones in the 50 States, Puerto Rico, the Virgin Islands, and Canada. Although some DOD activities will transfer incoming AUTOVON calls to commercial telephones within their local-dialing areas, AUTOVON is generally used to call other AUTOVON telephones.

Unlike AUTOVON billing procedures where an installation is charged by the number and types of access lines it uses, the General Services Administration uses statistical sampling techniques to determine use. It charges by the number of calls made.

The overall telephone-to-telephone call completion rate for the FTS system has been about 70 percent, while the CONUS AUTOVON overall completion rate for routine calls has been 50 to 60 percent in recent years.

Furthermore, our computation of the average grade of service achieved on FTS for January, March, and May 1973 showed that, of the 549 locations tested, only 122 (or 22 percent) were experiencing a grade of service poorer than P.05; whereas, 66 percent of the AUTOVON locations were experiencing a grade of service which was poorer than P.05. (See p. 10.)

We recognize that the types of service offered by AUTOVON, such as priority preemption and worldwide calling (see pp. 2 to 4), and FTS are different and that AUTOVON's primary purpose is to provide communications for command and control of the Armed Forces. Also, the grade of service objectives and achievements for precedence preemption calls on AUTOVON are higher than for routine calls, about which this report is concerned. However, the grade of service being attained by AUTOVON for routine calls in CONUS is inferior to FTS service being provided to civil agencies.

IMPACT OF FISCAL CONSTRAINTS ON AUTOVON

Fiscal constraints on AUTOVON are applied at various levels of command within DOD. For example, a major command may find its budget request reduced as a result of departmental level staff decisions or the Office of the Secretary of Defense may reduce the proposed budget of a military department. Also, funds programmed for AUTOVON can be reprogrammed unilaterally by a military department without DCA's approval. Such actions can detrimentally affect AUTOVON system performance.

For example, the AUTOVON portion of the Communications Services Industrial Fund for fiscal year 1971, which reflected the backbone funding by the military departments, was \$80.9 million, or \$7.9 million below the amount required to provide trunking capacity for an operationally viable network as specified in earlier budget decisions. To effectively balance the offered traffic load (access lines) and network capacity (trunks and switches), it was necessary for DCA, effective November 28, 1970, to reconfigure the network by a net reduction of 786 access lines and 223 interswitch trunks.

Thus the budgetary restrictions forced DCA (with the advice and consent of the military departments, defense agencies, and JCS) to reconfigure the network to provide a poorer grade of service than specified in previous budget decisions and in JCS guidelines.

As another example, DCA's proposed fiscal year 1973 budget included \$86.7 million for AUTOVON backbone expense. DCA estimates for fiscal years 1973 and 1974 requested ratification of actions taken, at an annual cost of \$3.8 million, to continue leasing 28 additional transoceanic interswitch trunks, thereby maintaining the quality of service to subscribers, most of whom were in the Pacific area.

DCA's dollar estimates were within previous budget decision totals but exceeded the DOD-approved quantity of transoceanic trunks. The \$3.8 million was available in fiscal years 1973 and 1974 because (1) a requirement for

CONUS trunks (estimated at \$1.9 million), was not expected to materialize, (2) the later 1973 traffic assessment was more accurate, and (3) existing and planned circuitry was repriced. However, in November 1972, the Deputy Secretary of Defense denied DCA's request to continue leasing the additional transoceanic trunks, and on December 31, 1972, 5 CONUS-Europe trunks and 23 CONUS-Pacific trunks were terminated. As a result, the budget was reduced from \$86.7 million to \$84.8 million.

Consequently, there was a significant degradation of AUTOVON service between CONUS and Europe and between CONUS and the Pacific, which was already considerably worse than the JCS-established goal. The busy-hour grades of service between CONUS and Europe and CONUS and the Pacific (which were P.39 and P.30, respectively, in December 1972) deteriorated to P.60 and P.81, respectively, in January 1973. Thus, even though the required funds had been approved (although not the additional trunks), DCA was not permitted to use the funds to improve the network.

Again, in submitting its fiscal year 1973 budget request for AUTOVON backbone costs, DCA estimated the number of trunks and the cost required to provide the grade of service goals established by JCS. Two alternative estimates were prepared, the first used the JCS grades of service for all segments of the backbone. The second alternative was exactly the same except for the intra-CONUS segment, which was computed at P.07 rather than at the JCS P.03 goal.

The following table compares the DCA second alternative estimate with the actual situation as of January 31, 1973.

	<u>DCA estimate</u>			<u>January 31, 1973, actual</u>		
	<u>Grade of service</u>	<u>Leased trunks</u>	<u>Cost (millions)</u>	<u>Grade of service</u>	<u>Leased trunks</u>	<u>Cost (millions)</u>
CONUS	P.07	7,317	\$43.2	P.10	7,273	
Inter-Pacific	P.10	95	11.2	P.81	60	
Intra-Pacific	P.10	113	14.9	P.18	98	
Inter-European	P.10	79	9.7	P.60	49	
Intra-European	P.03	29	.6	P.01	28	
Inter-Caribbean	P.10	22	<u>2.2</u>	P.55	12	
Total (CONUS and overseas trunks)			81.8			
Other recurring expenses (note a)			<u>11.7</u>			
Total backbone			<u>\$93.5</u>			^b <u>\$84.8</u>

^aSwitching center costs, overhead, etc.

^bAs revised to reflect the program-budget decision to discontinue 28 transoceanic trunks. (See p. 19.)

As stated earlier and as shown above, the budget approved for fiscal year 1973 was \$84.8 million, and the grade of backbone service proposed was therefore not approved.

AGENCY INTERNAL AUDIT OF AUTOVON MANAGEMENT

On October 12, 1972, the Deputy Assistant Secretary of Defense (Audit) issued an audit report on AUTOVON management. The report covered seven specific management areas, including control of access lines, about which the report said:

"Our reviews indicated that management responsibilities for major segments of the AUTOVON system were divided in various ways and defined with varying degrees of clarity. These divided responsibilities created obstacles to efficient management or effective control of the system. For example, DCA lacked authority to require Military Department action for improvement of the AUTOVON access lines performance and correction of telephone practices that affected AUTOVON performance. Substantial degradation of AUTOVON service was experienced because of a lack of AUTOVON access lines installed in the most effective mix."

The report recommended that:

1. JCS consider revising MOP 151 to establish a criteria or ratio (minimum number) of access lines required to terminate at each switchboard sufficient to provide P.05 inward grade of service.
2. The DCA charter be revised authorizing DCA to review AUTOVON access-line configurations and performance and to require that subscribers comply with the revised MOP 151 criteria or ratios.
3. DCA and the military departments initiate joint measures to
 - develop improved procedures to recognize, define, and develop solutions to AUTOVON performance problems;
 - place greater reliance on the DCA traffic analysis function as a source of problem identification;

--initiate positive efforts to reduce unfair precedence assignments and excessive availability of four-wire¹ telephones; and

--control abuses, including call duration and precedence abuse.

D, TACCS, disagreed that DCA should be authorized to restrict access-line ratios to those established by JCS because operational requirements and fiscal constraints often preclude their achievement.

JCS stated that the establishment of a ratio of access lines required to terminate at each switchboard, sufficient to achieve a P.05 inward grade of service, would not allow the flexibility users required to obtain service under the monetary constraints imposed at that time. They disagreed with the proposed revision to DCA's charter because DCA has the support of JCS and the Office of the Secretary of Defense, ensuring compliance with established communications criteria. DCA is responsible for reporting to JCS matters which might impact adversely on AUTOVON.

DCA took the position that necessary improvements can only be accomplished through professional traffic-engineering methods tailored specifically for each access-line configuration. Although it exercises its authority to review subscriber access-line configurations, DCA can only review and recommend, but not require, compliance. Furthermore, although close cooperation has occurred between DCA and the military departments, a large part of the problem stems from budget limitations which have caused the funding of AUTOVON access lines at less than desired levels.

¹A telephone that has direct access to an AUTOVON switching center.

CHAPTER 3

BLUE RIBBON DEFENSE PANEL'S RECOMMENDATION FOR

CHANGES IN AUTOVON MANAGEMENT NOT IMPLEMENTED

The Blue Ribbon Defense Panel, a 16-member group, was appointed by the President and Secretary of Defense in July 1969. The Panel studied the entire organization, structure, and operation of DOD, including communications. Its objective was to discover the cause of shortcomings and to devise and recommend changes in organization and procedures which appeared to have the potential for increasing the efficiency and therefore the economy of DOD. The panel made recommendations on the organization and management of DOD, including JCS, the Defense agencies, and the military services.

The Panel submitted its report, with one concurring statement and two dissenting statements, on July 1, 1970. These statements did not comment specifically on the recommendation quoted below, although the dissenting statements were, in general, opposed to overcentralized management.

The Panel had three recommendations for telecommunications. One is directly pertinent to the subject matter of our report and reads as follows:

"The responsibility for all existing and future defense long-haul transmission systems, regardless of their current or intended use, should be assigned to the Defense Communications Agency as part of the Defense Communications System, except those vehicular and air transportable types when held as contingencies or while in temporary deployment for active combat support. In addition, the Defense Communications System (DCS) should be redefined so as to include base, post, camp and station telecommunications in the United States and garrison (permanent) type installations overseas. The DCA should also be assigned the fiscal control of DCS elements. The communications and electronics officers of the Unified Commands should be under the operational and technical supervision of the Defense Communications Agency."

In its report, the panel stated that, although DCA, operating under JCS, exercises management control and operational direction over the Defense Communications System, the system stops at the mainframe (the point at which access lines interface with Private Branch Exchange and PABX equipment) of bases, posts, camps, and stations--a point considerably short of the total system. DCA does control AUTOVON switching centers and interswitch trunks, but military departments and other users retain control over the base, post, camp, and station equipment, as well as the quantities of access lines which govern the inward and outward grades of service. The only control of these facilities DCA can exercise is setting standards for their interface at the local mainframes.

Our recommendation (see p. 31) is directed to partial achievement of the objectives defined by the Panel, i.e., increasing DCA's ability to reconfigure system access lines. Our review and this report did not cover mainframes and other equipment behind the mainframes.

The Panel concluded that no one exercises research and development, planning, engineering, and management on an overall user-to-user basis for DOD's complex communications systems, such as AUTOVON. It also stated that DCA has little fiscal control over the Defense Communications System in that the system's funds may be unilaterally reprogramed without DCA's approval or concurrence.

In our opinion, the observations, conclusions, and recommendation of the Panel are still valid. They are consistent with our conclusions (see p. 30) and recommendation (see p. 31).

D, TACCS told us that there have been no specific studies, analyses, or data produced as a result of the Panel's recommendation.

CHAPTER 4

AGENCY COMMENTS AND OUR EVALUATION

We brought our findings to the attention of the Secretary of Defense on August 8, 1973. We proposed that the Secretary consider alternative methods for managing AUTOVON on a total system basis and that he take immediate steps to prevent use of the AUTOVON rate structure for uneconomical configuration of access lines.

D,TACCS, presented DOD's comments on February 19, 1974. (See app. I.) Because of their volume, the enclosures accompanying DOD's comments have been deleted. However, the information in the enclosures was summarized in D,TACCS comments and was considered, when appropriate, in preparing this report. A discussion of the principal DOD comments and our evaluation follows.

IMPLEMENTATION OF USACC RECONFIGURATION PROPOSAL

DOD stated that the USACC proposal to reconfigure access lines at Army locations was not approved in its entirety and that implementation of the proposal had not been extensive.

We reviewed access-line configurations as shown on DCA's periodic reports (see p. 8) and copies of approved Telecommunications Service Requests received by DCA for the 47 locations (see p. 15). By using reports and approved requests for the 3-month periods ended July and September 1973, we found 23 locations--or 49 percent--had carried out the USACC proposal in whole or in part. Fifteen locations had either carried out the proposed reconfiguration or had requests approved to implement exactly as proposed. Eight others had partially carried it out. This, in our opinion, shows extensive implementation and acceptance of the concept for general reconfiguration of Army access lines.

DCA's AUTHORITY OVER ACCESS LINES

DOD implied disagreement with our statement that DCA can only recommend improvements in access lines but cannot direct such improvements to be made. DOD used the example of the Defense Telephone Service-Washington (see pp. 11 to

13) to demonstrate DCA's influence in the grade of service improvement. The enclosure to DOD's comments provided evidence that the reconfiguration discussed in the example was initiated as a result of information DCA provided and was accomplished with DCA's continued support.

However, if the other parties declined to cooperate in the reconfiguration, it would not have taken place. In order for the reconfiguration to be accomplished, the Defense Telephone Service-Washington had to formally request the necessary changes; D,TACCS had to approve them; and the Department of the Army had to provide funds not previously available. It should be noted that the accompanying removal of interswitch trunks, which DCA directly controls, was accomplished without the necessity of meetings, outside funding, or higher level approval.

To further determine DCA's influence over access-line configurations, we compared DCA's April 1973 recommendations with its August 1973 report showing actual July 1973 configurations at the same locations. Of the 136 locations involved, 63 had an inward grade of service of P.30 or worse. Such service, in DCA's words, causes the "most serious impact upon network service." We found that:

--101 locations showed no change in their access-line configurations.

--35 locations did reconfigure their access lines but not to the configuration DCA recommended.

Additionally, a June 1973 DCA report identified 14 locations with excellent inward grades of service (P.00-P.02) as of February 1973. DCA stated that access lines could be removed to improve service at other locations "without jeopardizing an inward grade of service that is as good as or better than JCS MOP 151 objectives." It proposed reconfigurations which would result in net reductions of 3 to 18 access lines at each location, totaling a net reduction of 126 access lines. Comparison of the June 1973 reported

configurations and proposed reconfigurations with the actual September 1973 configurations for the 14 locations showed that:

--Seven had not changed their access-line configurations.

--Seven changed their configurations. Of the seven, two added lines, four removed lines, and one re-configured its existing lines. None of the reconfigurations conformed to the DCA recommendations; they resulted in a total net reduction of only 12 access lines, compared with the 126 line-proposed reduction.

Therefore, the present structure for managing AUTOVON access lines prevents DCA from effectively managing the system by denying the authority and control of resources necessary for such management. Also, the structure for managing the access-line portion of the system constrains DCA to a passive role in that management.

REVISED ACCESS-LINE CONFIGURATION METHODOLOGY

Following our review, DCA prepared a proposed revision to its Technical Engineering Practices Manual incorporating a refined access-line engineering methodology resulting from its simulation studies of access-line configurations. DOD components are reviewing the proposed revision to determine whether the proposed traffic engineering procedures are operationally and cost effective. The new procedures were developed under simulated conditions, and whether they will be operable under actual conditions and operationally acceptable to the military departments is unknown. The military departments will, as in the past, be free to accept or reject the new procedures in computing access-line requirements, unless made mandatory by an authority higher than DCA.

FISCAL CONSTRAINTS

DOD agreed that underfunding of the AUTOVON system by DOD and the military departments had prevented achieving the grade of service objectives and providing validated service

requirements. DOD stated that, if all required funding could be provided, then the investigation of alternative methods for managing AUTOVON, as we proposed, would definitely be warranted. DOD objected, however, in the absence of adequate funding, to giving DCA the responsibility, authority, and resources necessary for the effective control of the entire network, because this would place DCA in a position of giving priority to the operation-mission requirements of individual bases against those of all other bases. Under current funding conditions, such decisions should be left up to the users of the networks for command, control, and support of combat forces.

We believe recognizing (see p. 3) there are different classes of service within AUTOVON, each with a different prescribed grade of service is important. This report, however, addresses only message traffic classified as routine. As DOD states and we recognize, AUTOVON does satisfy the high-precedence requirements for command, control, and support of combat forces because of its preemption capabilities.

Because the system is underfunded, we believe it is essential for a single manager to have authority and control of the resources provided. This is necessary to balance the components of the system to achieve the highest efficiency possible (for routine traffic) within the funding limitations imposed.

DOD agreed with our proposal to prevent use of the AUTOVON access-line rate structure for uneconomical configurations of access lines and said that it would take steps to stop manipulation solely to reduce backbone apportionment to a particular user.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

The grade of service specified by JCS for routine AUTOVON traffic is substantially inferior to the grade of service specified for FTS. Further, the P.05 grade of service specified for AUTOVON was not achieved at about 66 percent of the locations tested, while for FTS, only about 22 percent of the locations failed to achieve a P.05 grade of service.

DCA controls AUTOVON switches and interswitch trunks but has no control over the quantities and configurations of access lines. The military departments and other individual DOD users determine the quantities and configurations of access lines in the system. Most users do not provide sufficient funds to acquire enough access lines to achieve the grade of service prescribed.

The provision of insufficient access lines to complete the connection from the network to the called location causes inefficient and uneconomical operation of the network. Trunks and switching facilities occupied by calls, which cannot be completed due to access-line blockage and reattempted calls previously blocked, are unavailable to other users. Therefore, even though DCA has control over the backbone of the system, its ability to effectively manage the interswitch facilities to meet grade of service objectives is impaired.

Although DCA appears to have the ability to monitor the system's performance and the expertise to determine the corrections needed in access-line configurations to improve service, it has been unable to prevail upon the military departments and other users to adopt the configurations it believes necessary for efficient system operation. (See p. 26.) DCA has, therefore, resorted to economic incentives in an attempt to motivate the users to adopt more efficient configurations. However, at the time of our review, the Army had initiated a program to revise its access-line structure at several locations in a manner which would serve its

own economic interests but which would be inefficient and uneconomical for the system; the Air Force was considering similar reconfigurations.

Also, in certain cases where users enjoy a grade of service which is better than that prescribed, DCA has been similarly unable to persuade them to remove access lines to make funds available for improvements elsewhere. We believe that, due to the fragmented AUTOVON management structure and the prevailing funding limitations, it is not feasible to assess DCA's performance in managing the system.

The conditions described in this report will continue unless present management arrangements are changed. A system manager should be given the authority and resources to balance the components of the system to achieve its maximum efficiency. Both the Deputy Assistant Secretary of Defense (Audit) and the Blue Ribbon Defense Panel reached similar conclusions from their reviews involving DOD communications; and the Panel recommended an even more far-reaching reallocation of responsibilities. Further, FTS management is structured in this manner. DOD agrees that, if sufficient funding were available to meet its grade of service objectives, investigating alternative management methods, as we previously proposed, would be in order. However, DOD objects essentially because, under current conditions, users of the network should make individual access-line decisions on the basis of their own operational requirements and budgetary constraints.

We recognize that AUTOVON does satisfy high-precedence requirements for command, control, and support of combat forces because of its preemption capabilities. However, of the different classes of service AUTOVON provides, this report addresses only routine message traffic. DOD should establish a realistic grade of service objective for routine traffic that would be consistent with funding authority.

RECOMMENDATIONS

We recommend that the Secretary of Defense

--take steps to prevent use of the AUTOVON rate structure for uneconomical configuration of access lines and

--give to the system manager the authority and control of resources necessary to balance the components of the AUTOVON system to achieve its maximum efficiency within the directed quality and funding parameters.



OFFICE OF THE SECRETARY OF DEFENSE
DIRECTOR, TELECOMMUNICATIONS AND
COMMAND AND CONTROL SYSTEMS
WASHINGTON, D.C. 20301

FEB 19, 1974

Mr. Donald L. Eirich
Assistant Director-in-Charge
(C&DP Group)
Logistics and Communications Division
General Accounting Office
Washington, D. C. 20548

Dear Mr. Eirich:

This is in response to your letter of August 8, 1973 to the Secretary of Defense, regarding the draft report on limited effectiveness of Automatic Voice Network (AUTOVON) Service (OSD Case #3680).

I apologize for the delay in forwarding our comments but believe that the discussions between our staffs during the interim, clarification of our respective positions, and the information developed for inclusion herein are beneficial results of the delay.

The recommendations and comments contained in the report emphasize satisfaction of grade of service objectives but in our opinion do not fully address their achievement under current budgetary levels. It is also believed that the report should provide a more detailed addressal of other important considerations such as DCA network management, OSD and Departmental/Agency fiscal constraints, and the AUTOVON responsiveness to essential command and control requirements.

Detailed comments on the specific audit statements and recommendations are contained in the subparagraphs below. The following comments are keyed to the page and paragraph numbering of the draft report:

(See GAO notes, p. 40.)

APPENDIX I

[8]

2. Reference page 15, third paragraph.

The text of this paragraph, and other references to the Army proposed reconfigurations, should be revised to --

- a. indicate that the Army program was not approved in its entirety and that DCA indicates implementation of the plan has not been extensive;

- b. reflect the comments contained in paragraph 7 below regarding revision of GAO statements of individual Department "cost savings;"

[10]

3. Reference page 17, Table.

In order to provide a more accurate representation of the facts regarding inward grades of service (GOS) this section of the report should also address Departmental/Agency programs to improve GOS. As an example through the budgetary review process the Defense Supply Agency was provided funds to improve their inward GOS and now only 5 of their locations (13% of the total) do not have P.05 or better service and the remaining five locations will be upgraded before the end of the current fiscal year.

[10]

4. Reference page 17, first paragraph.

The referenced paragraph and other parts of the report might impart the impression that DCA can only recommend access line reconfigurations. The following three pages of the report indicate how access line reconfigurations can improve both access line and interswitch trunk grades of service. However, the report does not indicate that the actions (See GAO notes, p. 40.)

and improvements utilized as an example by GAO were the direct result of the DCA quarterly action report which focused attention on Defense Telephone System (DTS) problem. The resulting coordination and inter-Service/Agency support by DCA, DTS, Army with the AT&T demonstrated how effective improvements could be achieved in a short time frame under the existing organizational relationships and Military Department funding procedures. A brief summary of the sequence of events leading to the improvement in service is forwarded as enclosure 1 per your verbal request of November 2, 1973. It is requested that the final revision correct the text to omit statements or impressions such as that described above where the available information does not support the statement.

(See GAO notes, p. 40.)

[15] [17]

7. Reference pages 22 through 25, Unbalanced Rate Structure Section.

a. The establishment of the current subscriber rate structure was based on the logic of charges in proportion to the relative capacity to place calls on the network. For billing purposes out-only lines were assumed to have twice the call origination capability as two-way lines which share time with incoming calls. The removal of backbone charges on in-only lines, commencing in FY 73, was intended to encourage the addition of such lines to improve inward GOS without a degradation in outward GOS. It is not an unbalanced rate structure in itself but its misapplication could result in uneconomical reconfiguration plans.

(See GAO notes, p. 40.)

APPENDIX I

[17]

[15] d. The last paragraph on page 25 briefly addresses the
through differing methods of traffic engineering and the DCA development
[17] of a standardized access line engineering methodology. The state-
ments contained in the following subparagraphs are pertinent to
several sections of the draft report dealing with traffic engineering
and examples, it is recommended that the report (particularly pages
23 through 25 and Appendix 2) be revised to reflect the information
contained below:

(1) The methods used by USASTRATCOM and GAO to determine access line requirements are in accordance with currently published guidance in the DCA Traffic Engineering Practices (TEPs). Application of this methodology could produce results which support the GAO statements relative to the interrelationship of subscriber rates and inefficient and uneconomical access line configurations. However, DCA now considers this methodology outdated. Calculations using more sophisticated traffic engineering methods, confirmed by their simulation studies, indicated that an in-only, and two-way system is more efficient than an in-only, out-only and two-way system when performance objectives favor one direction over the other, as is the case with the P. 05 inward and P. 10 outward objectives. Application of the revised traffic engineering procedures produces results superior to the GAO findings. Enclosure 2 provides a comparison of results for both the individual example and total access line tabulations presented in the GAO report. As shown in the enclosure, application of the new engineering methodology will result in the generation of access line configurations at less total cost to the government than those configurations produced by current procedures. Prior to distribution of the

draft GAO report, DCA worked closely with representatives of the GAO in the study of the AUTOVON. During this period, they exposed the new access line engineering methodology and recalculated selected PBX examples, provided by the GAO, to demonstrate the relative inaccuracy of the access line methodology being employed. Discussions with you on November 2, 1973 indicate that one of the reasons the draft report did not place greater emphasis on addressing these recent findings and proposed DCA techniques was the unavailability of the procedures in final form. Your position is understood and at such time as the approved publication is available copies will be forwarded for your detailed review and appraisal.

(2) The revised traffic engineering procedures discussed in the preceding subparagraph are being prepared for publication as revisions of the DCA traffic engineering procedures. When a joint review by the concerned DoD activities reveal that they are operationally and cost effective their use is expected to be made mandatory. The precise method of promulgation for mandatory use (i. e. ASD(T)² memoranda, DoD Directive/Instruction, or JCS Memorandum of Policy) has not been determined. The procedures provide means for determining grades of service to be expected on various configurations of access lines and for estimating the number of lines required to attain given grade of service objectives. The revisions will delete older methods which tended toward over-engineering through the use of Poisson capacity tables. The procedures called for in the more sophisticated equivalent random theory (also referred to as Wilkinson, Bretschneider or peakness factor techniques) will be included for application within designated ranges of load and service levels. These revised procedures will facilitate determination of the most efficient access line configurations. It is our intent that the most efficient access line configurations, will also be the most economical from a total network viewpoint. However, it should be noted that in some cases the ultimate determination of the most economical arrangement will reflect the cost impact which may be associated with changes in base telephone exchange equipment configurations such as line selectors. Thus, the potential efficiency and cost advantages of properly engineered access line configurations may be more than offset by additional one time facility costs at the exchange.

(See GAO notes, p. 40.)

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[19]

[21]

9. Reference pages 27 through 29, Impact of Fiscal Constraints on AUTOVON.

The DoD admits that the service within the AUTOVON could be improved if additional funds were made available. The lack of adequate funds within the approved OSD budget continues to be the prime factor in limiting the performance of the AUTOVON and its service to the user. However, the DoD within its fiscal ceilings must determine and establish the priority and criticality of its needs and the fiscal balance to be achieved between (and within) communications and other non-communications requirements.

(See GAO notes, p. 40.)

[30]

[32]

11. Reference pages 34 through 37, Conclusions and Recommendations.

a. Recommendation #1: "... consider alternative methods for the management of AUTOVON on a total system basis..."

Comment: As indicated in the report the DoD has concluded as recently as calendar year 1972 that major consolidation and centralization of DCA AUTOVON management authority is not required or feasible within current and forecast budgetary levels. However, the report again recommends that the Secretary of Defense reopen this matter including making DCA directly responsible to the Assistant Secretary of Defense (Telecommunications).² It cites the failure to achieve general realization of the grade of service (GOS) specified by JCS Memorandum of Policy, subject: "AUTOVON and AUTOSEVOCOM Service," as the basis for these observations and conclusions. The recommendation appears to be predicated primarily on the economy expected of single managership as is provided for users of the Federal

Telecommunications System to meet administrative requirements. The report notes but then fails to follow up that the AUTOVON is a multi-level-precedence network that does satisfy the high-precedence GOS/reliability requirements for command, control, and support of combat forces, and could satisfy the less stringent GOS OBJECTIVES of lower-precedence users if cost were no object and funds were made available. However, the budgetary review process in the past two fiscal years has in effect frozen the quality of service at levels which the telecommunications community considers to be very poor. It further concludes that authority for DCA to control access lines and the designation of a GOS consistent with funding authority would provide maximum system effectiveness and efficiency. However, the conclusions stated in the report do not allow for the satisfaction of operational requirements as a criteria for access line configuration and does not explain how budgetary constraints and related problems will be alleviated by changes in management authority. To impose a system which would require compliance with a designated GOS regardless of mission/operational requirements would be operationally and fiscally unacceptable. The DCA has adequate responsibility to report those items which may adversely impact on the DCS and that recourse is available through the JCS and OSD. Therefore, the prior DoD conclusion that DCA must continue to be responsive through the operational chain of command to the Joint Chiefs of Staff in order to permit the timely and effective utilization of communications resources for command, control, and support of combat forces is reaffirmed.

b. Recommendation #2: "... take immediate steps to prevent use of the AUTOVON rate structure for uneconomical configuration of access lines such as is being done by the Army."

Comment: Concur. Actions will be initiated to stop manipulation solely to reduce backbone apportionment to a particular user. Additionally, the investigation and promulgation of more effective traffic engineering practices and equitable rate structures will be supported.

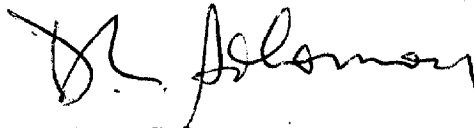
12. Concluding Statement

A recurring point in the preceding paragraphs has been the limitation of available funds for AUTOVON despite Agency/Service requests for improved performance, capability and additional access lines and

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transoceanic trunking. If the Department were able to identify additional funds (in its evaluation of the total needs of the DoD) to provide for all the validated Service requirements and Grade of Service objectives the further investigation of alternative methods of AUTOVON management would definitely be warranted. However, in the absence of these funds the DCA (if given the authority proposed in the GAO report) would be placed in the untenable position of attempting to prioritize the operational/mission requirements of individual bases against those of all other bases (regardless of Service) and allocate funds accordingly. The DCA should not be placed in this position. Until such time as sufficient funds can be made available the existing interplay and prioritization of requirements within the individual Services, and in concert with the DCA evaluation of the network, is the recommended approach to this problem area.

I thank you for the opportunity to comment on your draft report.



D. L. Solomon
Acting Director

2 Enclosures

GAO notes: Deleted material relates to data included in our draft report which has been revised in this report to reflect DOD comments. Numbers in brackets are page numbers in this final report on which the referenced material appears.

¹Appendix II of our draft report contained technical information of use only to DCA and, therefore, has been deleted from this report.

²Now D, TACCS

PREVIOUS GAO REPORTS CONCERNING
DOD COMMUNICATIONS MANAGEMENT

Previous GAO reports discussed problems existing in DOD communications management and in the accomplishment of DOD communications objectives.

--Our report, "Improvements Needed in Management of Department of Defense Communications" (B-169857, Oct. 19, 1970), described the lack of coordination between DOD components concerned with communications, including the staff offices of the Secretary of Defense, JCS, DCA, and the military departments. The report also described the costly results attributable, at least in part, to the fragmented management. In reference to AUTOVON in that report we stated,

"With the poor completion rate experienced on AUTOVON, requirements are not met and additional communications services, such as dedicated circuits and networks¹--at additional costs--are required. As a result, the military departments allocate funds for AUTOVON access lines on the basis of what they consider to be their needs only. Thus, access lines acquired are insufficient to meet the needs of all users of AUTOVON. We believe sound management requires that such decisions be made on a total system basis by the system manager to balance the parts of the system for the most efficient and effective use of the entire system."

We recommended that DCA be removed from the chain of command under JCS to provide a direct relationship between DCA and D,TACCS, and that the office of Director, DCA, be made a civilian position in order to reduce the stresses of parochialism and conflict of roles to

¹Those which are reserved for a particular user as opposed to common-user circuits and networks, such as AUTOVON, which serve all DOD users.

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which a military director of DCA is subjected. In commenting on our report, DOD did not feel that the case was conclusive for removing DCA from the chain of command under JCS, but stated that the chain of command to DCA remained an issue for active consideration within DOD.

- Our report, "Benefits from Centralized Management of Leased Communications Services" (B-169857, Dec. 22, 1971), pointed out to the Secretary of Defense the absence of independent evaluation and coordinated control of leased communications services; and it described the fragmented and parochial management and some of the costly and duplicative results. We pointed out the need for improvement in traffic studies and in providing data for evaluation of AUTOVON requirements.
- Our report, "Economies Available Through Increased Use of the Federal Telecommunications System by Military Installations" (B-146864, Aug. 24, 1972), discussed the consequences of DOD's procedures and practices which generally precluded the extension of AUTOVON service to off-network telephones. This resulted in a large number of long-distance calls being completed over commercial toll facilities. As a result of our proposal, DOD and the General Services Administration initiated tests at selected locations to consider the feasibility of increased use of FTS instead of commercial toll service for long-distance calls.

AUTOVON did not satisfy the voice communications requirements of many DOD activities. Although some DOD installations will transfer incoming AUTOVON calls to commercial telephones within their local-dialing areas, AUTOVON is used generally to call other AUTOVON telephones. With proper controls, AUTOVON and FTS could be used concurrently to serve military installations. AUTOVON could continue to serve as the primary means of communications between DOD activities; and FTS could provide a less expensive means, instead of commercial long-distance telephone service, for DOD activities to communicate with commercial organizations, civilian agencies, and other non-AUTOVON subscribers.

--In our report, "Reduction of Communications Costs Through Centralized Management of Multiplex Systems" (B-169857, Jan. 18, 1973), we demonstrated a specific application in which we believe the benefits of centralized management are apparent. Multiplexing is a technique in which electronic devices at each end of a single circuit simultaneously transmit a number of messages, eliminating the need for numerous individual circuits between terminal points.

APPENDIX III

PRINCIPAL OFFICIALS OF THE DEPARTMENT OF DEFENSE
RESPONSIBLE FOR THE ADMINISTRATION OF
ACTIVITIES DISCUSSED IN THIS REPORT

	<u>Tenure of office</u>	
	<u>From</u>	<u>To</u>
<u>DEPARTMENT OF DEFENSE</u>		
SECRETARY OF DEFENSE:		
James R. Schlesinger	June 1973	Present
William P. Clements, Jr. (acting)	May 1973	June 1973
Elliot L. Richardson	Jan. 1973	April 1973
Melvin R. Laird	Jan. 1969	Jan. 1973
Clark M. Clifford	March 1968	Jan. 1969
DIRECTOR, TELECOMMUNICATIONS AND COMMAND AND CONTROL SYSTEMS (note a):		
Thomas C. Reed	Feb. 1974	Present
David L. Solomon (acting)	Sept. 1973	Jan. 1974
Dr. Eberhardt Rechtin	Feb. 1972	Sept. 1973
David L. Solomon (acting)	Sept. 1971	Feb. 1972
Louis A. deRosa	May 1970	Sept. 1971
CHAIRMAN, JOINT CHIEFS OF STAFF:		
Gen. George S. Brown	July 1974	Present
Adm. Thomas H. Moorer	July 1970	July 1974
Gen. Earle G. Wheeler	July 1964	July 1970
DIRECTOR, DEFENSE COMMUNICATIONS AGENCY:		
Lt. Gen. Lee M. Paschall	Aug. 1974	Present
Lt. Gen. Gordon T. Gould, Jr.	Sept. 1971	July 1974
Lt. Gen. Richard P. Klocko	Nov. 1967	Sept. 1971

^aThis position was created in 1970 as Assistant to the Secretary of Defense for Telecommunications. In January 1972 it was changed to Assistant Secretary of Defense (Telecommunications), and in January 1974 it was changed to Director, Telecommunications and Command and Control Systems.

PRINCIPAL OFFICIALS OF THE DEPARTMENT OF DEFENSE
RESPONSIBLE FOR THE ADMINISTRATION OF
ACTIVITIES DISCUSSED IN THIS REPORT
(Continued)

	Tenure of office	
	From	To
<u>DEPARTMENT OF THE ARMY</u>		
SECRETARY OF THE ARMY:		
Howard H. Callaway	May 1973	Present
Robert F. Froehlke	July 1971	May 1973
Stanley R. Resor	July 1965	June 1971
<u>DEPARTMENT OF THE NAVY</u>		
SECRETARY OF THE NAVY:		
J. William Middendorf II	April 1974	Present
John W. Warner	May 1972	April 1974
John H. Chafee	Jan. 1969	April 1972
Paul R. Ignatius	Sept. 1967	Jan. 1969
<u>DEPARTMENT OF THE AIR FORCE</u>		
SECRETARY OF THE AIR FORCE:		
John L. McLucas	July 1973	Present
Dr. Robert C. Seamans, Jr.	Jan. 1969	May 1973
Dr. Harold Brown	Oct. 1965	Jan. 1969

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