REPORT TO THE CONGRESS

Reduction Of Communications Costs Through Centralized Management Of Multiplex Systems

B-169857

Office of Telecommunications Policy
Department of Defense
General Services Administration

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

JAN. 18, 1973

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

B-169857

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

This is our report showing that communications costs of the Department of Defense and other Federal agencies could be reduced through centralized management of multiplex systems.

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).

Copies of this report are being sent to the Director, Office of Management and Budget; the Director, Office of Telecommunications Policy; the Acting Administrator, General Services Administration; the Secretary of Defense; the Secretaries of the Army, Navy, and Air Force; and the Director, Defense Communications Agency.

Elmer B. Staats

Comptroller General
of the United States

Contents

ABBREVIATIONS

CONUS	continental United States
DCA	Defense Communications Agency
DCS	Defense Communications System
DOD	Department of Defense
GAO	General Accounting Office
GSA	General Services Administration
FTS	Federal Telecommunications System
NCS	National Communications System
OTP	Office of Telecommunications Policy

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

REDUCTION OF COMMUNICATIONS COSTS THROUGH CENTRALIZED MANAGEMENT OF MULTIPLEX SYSTEMS

Office of Telecommunications Policy
Department of Defense
General Services Administration
B-169857

D I G E S T

WHY THE REVIEW WAS MADE

To readily understand the purposes for which the General Accounting Office (GAO) undertook this review of certain management aspects of both military and civil Federal communications, certain background information is essential.

In 1960 the Defense Communications System (DCS) was established and the Defense Communications Agency (DCA) was organized to manage it as the single integrated long-distance communications system of the Department of Defense (DOD). The objective was to obtain maximum economy and efficiency in allocating and managing DOD communications resources. (See p. 5.)

In 1961 the General Services Administration (GSA) was authorized to establish the Federal Telecommunications System (FTS) to integrate, with certain exceptions, all Government civil communications systems. (See p. 5.)

In 1963 the President established the National Communications System (NCS) to strengthen the communications support of all major Government functions. The NCS includes the DCS and the FTS, as well as other telecommunications networks. (See p. 6.)

GAO has previously reported some problems caused by diffused management of DOD communications and the unique relationships between DCA and the military departments and between DOD and civil agencies. (See pp. 6 and 7.)

GAO made this review to demonstrate possible cost savings through centralized management in a specific application--increased use of multiplex systems for both military and civil Federal agency communications. Multiplexing, a technique in which electronic devices at each end of a single circuit simultaneously transmit a number of messages, eliminates the need for numerous individual long-distance circuits between terminal points. (See p. 7.)

FINDINGS AND CONCLUSIONS

Although multiplexing has been available since June 1968, when the Federal Communications Commission removed restrictions on use of interconnecting devices not furnished by common carrier, Federal agencies have made little use of the technique in the continental United States (CONUS).

--DOD has directed that communications systems be established and operated efficiently and economically, but it has not established

specific procedures to develop and manage multiplex systems. (See pp. 14, 17, and 18.)

--Military departments have independently developed some multiplex systems and have achieved savings. (See p. 16.)

--DCA has proposed additional multiplex systems but the more significant of these have not been established because it does not have authority or resources to carry out its proposals. (See p. 16.)

--GSA had established only two multiplex systems at the time of the GAO review--both dedicated to specific programs--and had not developed a single joint-use system, although one of the systems was subsequently shared by military users. (See p. 22.)

GAO's study, which included only 200 circuits, showed that new multiplex systems could be established and communications costs could be reduced by about $400,000 a year. For example, by installing multiplex equipment at Homestead Air Force Base, Florida; Andrews Air Force Base, Maryland; and Norfolk, Virginia, and connecting them by a single multiplexed circuit, 54 individual circuits leased for eight agencies (including two civil agencies) could be eliminated. The multiplex system costing about $72,000 would result in savings of over $50,000 a year compared with current circuit costs. (See p. 11.)

The savings potential is significant because

--although GAO's choice of circuits for review was selective, DOD leases, at about $15 million annually, 3,200 circuits of the type included in GAO's review--many of which appear susceptible to multiplexing (see p. 9);

--only a token number of circuits leased by civil agencies were included in GAO's review (see p. 19);

--the lease cost of the type of circuits reviewed by GAO (costs increased from about 2 cents a mile in March 1967 to about 21 cents a mile as of November 1, 1972) increases the advantages of multiplexing (see p. 10); and

--systems proposed by GAO included only low-speed data and teletype circuits, whereas multiplex equipment capable of handling higher speed DOD and civil agency requirements is available (see p. 9).

Benefits of multiplexing can best be obtained by a single organization with authority and responsibility to develop and manage systems meeting requirements of all Government users. (See p. 26.)

Without additional policy and procedural guidance in the framework of the NCS, the present fragmented and parochial arrangements will continue and will result in unnecessary costs as well as in duplicate systems. (See p. 27.)

RECOMMENDATIONS AND SUGGESTIONS

GAO is recommending that the Director, Office of Telecommunications Policy (OTP), establish a policy

that departments and agencies identify their communications requirements which are susceptible to multiplexing as described in this report and that the requirements be satisfied by multiplexed facilities when economically and operationally feasible.

GAO is recommending also that the Secretary of Defense, in accordance with his responsibilities as Executive Agent, NCS, develop specific procedures for coordinating civil and nontactical military communications which are susceptible to multiplexing.

Since OTP has agreed that the Government should take advantage of the benefits of multiplexing where appropriate and is proceeding with the establishment of a Government policy in this area, GAO has no further recommendations at this time. GAO suggests, however, that, in the formulation of such policy, consideration be given to the establishment of a single entity to be responsible for development and management of multiplex systems for the entire Government. GAO plans to evaluate the effectiveness of the policy and its implementation at a future date. (See p. 27.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

DOD advised GAO that it plans to make DCA the central organization in DOD with authority and responsibility for all nontactical multiplex systems. GAO plans to review the new arrangement when it is established. (See p. 26.)

OTP and DOD questioned the desirability or necessity of centralized management or high-level policy direction, rather than suitable and appropriate interagency coordination. (See p. 20.)

GSA said it has the responsibility for telecommunications for the civil activities of executive departments and agencies. (See p. 21.)

On the basis of responses to its draft of this report and on its experience on communications management discussed in previous reports, GAO believes coordination may only continue separate multiplex systems within and between military and civil agencies. (See pp. 21 and 27.)

MATTERS FOR CONSIDERATION BY THE CONGRESS

The Armed Services Investigating Subcommittee of the House Armed Services Committee, the House Appropriations Committee, and other committees and subcommittees have expressed concern over the high and increasing costs of DOD communications. This report apprises those committees and subcommittees of opportunities for cost savings in a specific aspect of communications.

CHAPTER 1

INTRODUCTION

In 1960 the Secretary of Defense established the Defense Communications System (DCS) and the Defense Communications Agency (DCA) to supervise it. DCA has a wide range of responsibilities and functions to meet the Department of Defense (DOD) goal of having a single integrated long-distance communications system capable of providing reliable, rapid, and, when necessary, secure means of exchanging information. DCA's charter provides that it will:

> "*** Ensure that the Defense Communications System (DCS) will be so planned, engineered, established, improved and operated as to effectively, efficiently, and economically meet the long-haul, point-to-point telecommunications requirements of the DOD and of other governmental agencies as directed.
>
> *** Obtain the maximum economy and efficiency in the allocation and management of DOD communications resources. ***"[1]

Although DCA is charged with managing and supervising the DCS, the military departments are responsible for providing funds, equipment, personnel, and other resources needed to operate and maintain it. The military departments are also individually responsible for establishing facilities to meet their communications requirements. Some of these facilities become a part of the DCS, but others remain under the control of the military departments.

In 1961 the General Services Administration (GSA) was authorized to proceed with the establishment of the Federal

---

[1]The DCS does not, however, include (1) mobile and transportable facilities organic to tactical units of the military services, (2) ship-to-ship, ship-to-shore-to-ship, air-to-air, ground-to-air-to-ground, and specified tactical systems, (3) communications facilities integral to weapons systems, and (4) post, camp, base, and station facilities.

Telecommunications System (FTS). The voice portion of this System was activated in fiscal year 1963 and the record (teletypewriter, facsimile, and data) portion was activated in fiscal year 1966. The FTS evolved from a 1960 study directed toward the integration of all civil Government communications systems. However, exceptions were made, and some civilian agencies established separate networks. Additionally, it should be noted that some DOD activities use FTS; in fact, DOD is one of the largest individual users, accounting for about 11 percent of the total FTS traffic.

In 1963 the President directed the establishment of a unified National Communications System (NCS) to strengthen the communications support of all major functions of the Government. This System encompassed the DCS and the FTS as well as other selected telecommunications networks. The objective was to provide necessary communications for the Federal Government under all conditions ranging from normal situations to national emergencies and international crises.

The President directed that the NCS:

> "*** shall be established and developed by linking together, improving, and extending on an evolutionary basis the communications facilities and components of the various Federal agencies."

Previous General Accounting Office (GAO) reports have discussed some of the problems caused by the diffused management of communications in the DOD and the unique relationships between DCA and the military departments and between DOD and civil agencies.

--In our report, "Review of Status of Development Toward Establishment of a Unified National Communications System" (B-166655, July 14, 1969), we described the organizational arrangements under which the Secretary of Defense and the Director, DCA, were assigned as Executive Agent and Manager, respectively, of that System. We reported that this arrangement gave rise to suspicions by the civilian agency members of the System that DOD "runs the show" for its own benefit. We also pointed out that, although some progress had been made, much remained to be

done if NCS was to achieve its objectives of economies and improvements in communications for the Federal Government. Subsequently, Reorganization Plan No. 1 of 1970 established a new policy office, the Office of Telecommunications Policy (OTP), and the Director of the office assumed various duties including policy direction over the development and operation of NCS.

--In our report, "Improvements Needed in Management of Department of Defense Communications" (B-169857, October 19, 1970), we described the organizational arrangement under which no one office or person, except the Secretary of Defense, served as a focal point with authority and responsibility to coordinate all aspects of DOD communications. We also described the costly results attributable, at least in part, to the fragmented management. Subsequently, a new office was established at the secretarial level with responsibilities for communications.

--In our report, "Benefits from Centralized Management of Leased Communications Services" (B-169857, December 22, 1971), we pointed out to the Secretary of Defense the absence of independent evaluation and coordinated control of leased communications services. We described the fragmented and parochial management arrangements and some of the costly and duplicative results.

This report is to demonstrate a specific application in which we believe that the benefits of centralized management are apparent.

Multiplexing, a technique in which electronic devices at each end of a single circuit simultaneously transmit a number of messages, eliminates the need for numerous individual long-distance circuits between terminal points.

SCOPE

We reviewed OTP, DOD, DCA, and military department policies and procedures for planning, leasing, using, and controlling communications facilities, particularly multiplexed

facilities, in the continental United States (CONUS). We also considered the policy and practices of GSA concerning multiplexing and its use by civil Government agencies. We examined about 200 teletype and low-speed data circuits which we considered susceptible to multiplexing, but we did not evaluate the need for the circuits examined.

CHAPTER 2

SIGNIFICANT SAVINGS THROUGH MULTIPLEX SYSTEMS

The Government can realize significant savings in communications costs by establishing and effectively using additional multiplex systems. These savings can be achieved either by leasing commercial multiplexers or by using Government-owned equipment. The cost reductions can be accomplished by combining circuit requirements of Government departments without impairing the quality or reliability of communications services.

Although the overall benefits achievable through a comprehensive multiplex program cannot be readily ascertained, we believe the potential to be significant because

--the systems proposed in this report include less than 200 teletype or low-speed data circuits with a potential annual cost reduction of over $400,000,

--although our choice of circuits was selective, DCA's Defense Commercial Communications Office leases, at about $15 million annually, 3,200 teletype or low-speed data circuits in CONUS--many of which appear susceptible to multiplexing,

--a DCA Western Hemisphere Area plan had, at the time of our review, identified 579 of these circuits as eligible for multiplexing,

--only a token number of circuits leased by civil agencies were included in our review, and

--our proposed systems and those proposed by DCA's area office included only low-speed data and teletype service, whereas multiplex equipment capable of handling higher speed DOD and civil agency requirements is available.

ECONOMY OF MULTIPLEXING

Multiplexing is a means of sending two or more messages simultaneously over a single circuit. It is more economical

to use multiplexing than separate circuits when the cost of leasing a number of separate (usually long-distance) circuits exceeds the cost of acquiring a multiplexed circuit. This cost includes the multiplexer with associated equipment and services, the lease cost of one circuit to be multiplexed, and short-distance circuitry between user locations and the multiplexers.

For the eight examples in the table on page 11, we proposed replacing numerous low-speed data or teletype circuits with one multiplexed voice circuit. Although the cost of a voice circuit is about twice the cost of a low-speed data or teletype circuit, its use in this application is more economical since, as shown in the table, it can accommodate numerous low-speed data or teletype circuits.

DOD's monthly cost for circuits most susceptible to multiplexing (low-speed data or teletype circuits) increased from about 2 cents a mile in March 1967 to 21 cents a mile in February 1970, and this rate was still in effect on November 1, 1972. The increased rate makes multiplexing, which can be achieved either by leasing multiplexers or by using Government-owned equipment, very advantageous.

SAVINGS USING LEASED EQUIPMENT

The potential economic benefits from establishing multiplex systems, using leased equipment, are demonstrated for the eight systems shown in the table below. These proposed systems show that annual savings of over $400,000 could be achieved by eliminating 189 individual circuits being leased for military and civil departments.

Proposed system	Circuits to be multiplexed (note a)	Annual costs Present	Annual costs Proposed	Estimated savings
		(000 omitted)		
Homestead AFB, Fla., via Norfolk, Va., to Andrews AFB, Md.	54	$122.3	$ 72.1	$ 50.2
Cheyenne Mt., Colo., to Ft. Detrick, Md.	19	87.0	43.0	44.0
Cheyenne Mt., Colo., to Ft. Meade, Md.	16	71.8	34.5	37.3
MacDill AFB, Fla., via Robins AFB, Ga., to Andrews AFB, Md.	20	58.9	33.3	25.6
Los Angeles, Calif., via Kelly AFB, Tex., to Pentagon, Va.	20	124.9	60.3	64.6
Patrick AFB, Fla., via Norfolk, Va., to Cheltenham, Md.	20	49.2	29.2	20.0
Stockton, Calif., to Pentagon, Va.	20	150.6	51.1	99.5
McClellan AFB, Calif., via Kelly AFB, Tex., to Andrews AFB, Md.	20	114.9	55.2	59.7
Total	189	$779.6	$378.7	$400.9

[a]Includes seven being used by civil agencies. (See p. 19.)

In our draft of this report, which was circulated to the agencies for comment, we provided complete details for all eight of the proposed systems, including diagrams of existing and proposed configurations and cost schedules. We have provided in exhibit A such details for three of the eight proposed systems.

For example, diagrams of the proposed Homestead-Norfolk-Andrews system and the individual circuits it would replace are shown in exhibit A, pages 31 and 33. The diagram of existing services contains 12 circuits between southern Florida and the Norfolk, Virginia, area; eight circuits between southern Florida and the Washington, D.C., area; and 34 circuits between the Norfolk, Virginia, area and the Washington, D.C., area. These individual circuits traverse about 30,500 miles and cost $122,300 a year. (See table above.)

By installing multiplexers at Homestead Air Force Base, Florida; Andrews Air Force Base, Maryland; and Norfolk, Virginia, and connecting them with a single multiplexed circuit, 54 long-distance teletype or low-speed data circuits leased for eight agencies (including two civil agencies) could be eliminated. The estimated annual cost for the proposed system--including leasing multiplexers with associated equipment and services, the primary circuit, and circuitry to user locations--is about $72,100, which is $50,200 a year less than the costs being incurred for the individual circuits.

The new short-distance circuits between user locations and the multiplexers, referred to as tail circuits, are needed to provide required connections at the ends of the multiplexed circuit. The monthly charges used throughout exhibit A exclude costs of terminal equipment and associated services at the user locations because multiplexing has no effect on such costs. We do not suggest that the proposed systems would achieve maximum cost effectiveness; in fact, our discussions with agency engineering personnel indicated that careful system engineering should further increase the estimated savings.

SAVINGS USING GOVERNMENT-OWNED EQUIPMENT

At the time of our review, the military departments had 32 spare multiplexers at seven major CONUS communications centers and the Army had 16 serviceable units in storage. A sufficient number were compatible and could be used to establish seven multiplex systems similar to those proposed by us under the leasing concept described above. However, systems established using Government-owned equipment would provide a maximum of 16 channels each, whereas the proposed leased systems, with one exception, would provide a maximum of 20 channels each. Although a 16-circuit capacity could not be used as economically as a 20-circuit capacity, eliminating the rental cost of leased multiplexers would be an offsetting factor.

Of the proposed leased systems, the only one that cannot be established using available Government-owned equipment is the Homestead-Norfolk-Andrews system. This system requires

equipment providing a capacity of 54 channels; such equipment is not currently available in the military departments, but it can be purchased.

According to communications officials, multiplexers are highly reliable and seldom fail. We were advised that maintenance personnel presently assigned to communications centers would generally be adequate to support one or two additional multiplexers. Therefore we believe that maintenance costs for the systems using Government-owned multiplexers would be nominal. Since monthly rentals of multiplexers could be avoided by using the Government-owned equipment, savings should be greater than in comparable systems using leased equipment.

CHAPTER 3

NEED FOR CENTRALIZED DEVELOPMENT AND MANAGEMENT OF MULTIPLEX SYSTEMS

For over 4 years multiplexing has been available to DOD for providing economical teletype and low-speed data circuits. Although it is reliable and flexible, the military departments have made relatively little use of it. The departments have independently established multiplexed systems and there has been some interservice use of these systems. However, no single DOD activity has (1) enough knowledge of defensewide communications requirements and existing circuitry to determine how the requirements could be met at less cost through multiplexing or (2) the authority or resources to implement such systems if the requirements were known.

RELIABILITY AND FLEXIBILITY OF MULTIPLEXERS

The Government has used multiplexers for a number of years outside CONUS and within 75 miles of international communications gateway points. Common carrier tariffs prohibited their use elsewhere in the CONUS until June 1968, when the Federal Communications Commission ordered removal of restrictions on the use of interconnecting devices not furnished by the common carrier. Since then, such devices could have been acquired by lease or purchase from a number of sources and used on circuits leased from common carriers. A number of manufacturers provide a variety of models with different performance characteristics.

Records of DCA-Western Hemisphere Area, the activity which accumulates data on the performance of selected multiplex systems, show that teletype channels derived from a multiplex system are highly reliable. Records for a 6-month period ended March 1971 show them to be between 96.7 and 100 percent reliable. In only five instances of 150 did the reliability drop below 99 percent. Communications officials of the military departments and DCA told us that a channel derived by multiplexing is as reliable as an individual leased circuit.

Multiplexing also has the advantage of flexibility. High-priority traffic passing through a military facility can be promptly rerouted when an outage occurs; changes in channel allocations can be made rapidly because leasing actions are not involved; and spare channels can be used to satisfy new requirements, eliminating the leasing process.

Sometimes, military departments require that their circuits not be routed through critical junctions, known target areas, or other specified locations. Communications carriers, when requested, comply with this requirement by avoidance routing service--routing circuits to avoid the designated locations--at additional cost. To provide alternate capability, some military communications requirements prohibit two or more circuits from using the same physical route. The carriers, when requested, also provide this diverse routing service at additional cost.

Avoidance and diverse circuit routing can be provided in multiplexed systems. Avoidance can be accomplished by routing the primary multiplexed circuit to miss the critical locations. Diverse routing can be obtained by using circuits of two multiplex systems providing service between the same terminal locations.

LITTLE USE BEING MADE OF MULTIPLEXING

A system developer should have complete information on long-distance circuits originating and terminating in each general area. Such information is rarely available to the individual military departments. Generally there is an insufficient number of eligible circuit requirements within a single department to form cost-effective multiplex systems.

The communications commands of the Army and the Navy, in developing multiplex systems, had not considered the requirements of the other departments because they had had no knowledge of such requirements.

Air Force major commands are responsible for developing multiplex systems to meet their own requirements. The Air Force Communications Service, the principal Air Force communications command, is responsible for determining the

technical adequacy and feasibility of multiplex systems proposed by certain commands, but it is not responsible for consolidating either Air Force requirements or those of the other military departments for multiplex applications. A significant part of Air Force requirements is not even reviewed by the Communications Service.

At the time of our review, there were 32 DOD multiplex systems for low-speed data or teletype service in CONUS, 22 of which were used by more than one military department. Generally interservice use of these systems evolved after they were established independently by the departments. The originators notified DCA of the systems, and DCA subsequently assigned spare channels to other departments.

Only six of the 32 systems have been established since February 1970, when the use of multiplex systems became particularly economical because of an increase in monthly circuit lease costs from 5.15 to 21 cents a mile.

In comparison to the 352 channels provided by the 22 interservice multiplex systems, DCA was leasing, at an annual estimated cost of $15 million, 3,200 individual low-speed data or teletype circuits--many of which appeared to meet the basic criteria for multiplexing.

DCA headquarters and its field office--Western Hemisphere Area--have long recognized the economic and operational benefits of multiplexing and within their limited authority have proposed a number of new multiplex systems, only a few of which have been established. DCA, having neither the authority nor the resources to implement its proposals, was dependent on the military departments and agencies to accept them. DCA, however, attempted to persuade the departments--who had funds, manpower, and equipment--to accept the proposals by pointing out the economies and operational advantages of such systems.

Since 1967 the DCA Area office had made eight proposals to establish or revise multiplex systems of varying capabilities and complexities. Of the eight proposals, two were adopted, two were partially accepted, three were rejected or tabled, and one is pending. The eight proposals advocated the replacement of 813 individual circuits. At the time of

our fieldwork in late 1971, only 54 circuits had been replaced by systems proposed by the Area office and a proposal submitted in July 1971 for the replacement of 579 circuits had not been resolved. Thus the environment under which previous proposals of DCA failed to materialize still exists--as stated previously, no single DOD activity has the authority or resources to implement such a plan.

NEED FOR CENTRALIZED MANAGEMENT OF SYSTEMS

The maximum economic benefits of a multiplex system are realized when all of the communications channels derived from a circuit are being used. Because one military department seldom has enough requirements to fully use the channels of a system, spare channels exist. Also, since communications requirements frequently change, a centralized DOD management organization could most effectively assign channels. To perform this function the organization needs information on all existing multiplex systems, including current uses. The organization should be responsible also for processing new requirements and changes and assigning channels to meet requirements.

The DCA-Western Hemisphere Area office has assigned spare channels in a few existing multiplex systems, but it cannot effectively carry out this function because it does not have all of the necessary information. Under current practices a multiplex system developed by a military department can be classified by the originator as either DCS or non-DCS. When a system is classified non-DCS, the Area office is not notified; and the non-DCS circuits therefore cannot be considered for replacement by channels in multiplex systems. Twelve of the DOD circuits included in our study, with total annual leasing costs of about $65,300, were classified as non-DCS. If these 12 circuits were replaced by multiplex-derived channels, costs would be reduced about $47,600 a year.

Further, even for a DCS system the procedures under which the Area office operates have not insured maximum use. Procedures in effect provide that requests for CONUS communications be forwarded to the DCA leasing office for procurement before being reviewed by the Area office to determine whether the requirements can be met by available multiplex channels.

Records were not available to determine whether spare multiplex channels were available at the time individual circuits were leased; but a number of individual circuits were being leased even though spare multiplex channels could have provided the services. For instance, four multiplex systems connect Ft. Ritchie and Ft. Detrick in Maryland; an Arlington, Virginia, facility; and the Pentagon. At the same time that these systems had 11 spare channels between the Pentagon and Ft. Ritchie, 42 individual circuits were being leased to provide service between these same two locations. The replacement of any 11 individual circuits with the spare multiplex channels would save about $11,000 a year. Similarly, in multiplex systems servicing the Washington, D.C., and adjacent areas, six other spare channels existed which could replace individual leased circuits. Use of these spare channels would save almost $6,000 a year.

Another limitation of dispersed management is the present method of funding and assigning spare channels in multiplex systems in the CONUS. Generally, the military department that originates a multiplex system provides funds for the entire system and other users do not share the cost. If DCA assigned spare channels to other users as their requirements became known, the originator of a system, after all channels in the system had been assigned, might incur additional departmental expenses to lease more circuits. This problem could be resolved through use of the existing communications industrial fund, which is managed by DCA, to prorate the costs of multiplexed circuits and equipment among users.

Records of the DCA leasing office show that transactions--starts, stops, and changes--for long-distance, low-speed data and teletype circuits are voluminous and frequent. During the past several years, an average of about 800 such leases a year were entered into with the two major communications carriers. Developing and managing multiplex systems would thus require a continuous effort.

FURTHER BENEFITS BY COORDINATING MILITARY AND CIVIL AGENCY REQUIREMENTS

Although low-speed data and teletype circuits are used in the CONUS by both military and civil agencies of the

Government, procedures do not exist for coordinating their requirements to develop joint-use multiplex systems. Further, procedures do not exist for civil agencies to use spare channels in military multiplex systems or vice versa. Accordingly, opportunities to reduce overall Government communications costs are not being realized.

The eight proposed systems (see p. 11) include only seven civil agency circuits leased by GSA, which we selected for demonstration. The annual leasing cost of these circuits was about $47,500. The services provided by these circuits could be provided by the proposed multiplex systems at a savings of more than $35,000 a year.

The Federal Property and Administrative Services Act of 1949 (40 U.S.C. 481) made the Administrator of GSA responsible for procuring and supplying communications services to civil agencies of the Government, and civil agencies usually obtain their long-distance requirements through GSA.

GSA officials recognize that multiplexing is an economical means of providing communications, and savings have been achieved by its use in a few instances. An official told us that GSA currently has insufficient data on services of the various civil agencies to systematically develop multiplex systems; however, a GSA program is being implemented to establish a data base to provide information for this purpose.

There is no requirement for coordinating civil agency communications needs with those of the DOD for establishing multiplex systems. Although needs are not coordinated for this specific purpose, some communications activities of the military and civil agencies are conducted jointly. For instance, the DCA leasing activity consolidates requirements of GSA and DOD in leasing interstate Telpaks.[1] This leasing costs about $99 million annually, of which GSA pays about $37.5 million. Also, the military and civil departments jointly use FTS.

---

[1]"Telpak" is an industry term for a reduced pricing arrangement offered to users leasing quantities of circuits between rate centers.

CHAPTER 4

AGENCY COMMENTS AND OUR EVALUATION

We brought our findings to the attention of OTP, DOD, and GSA in a draft report dated March 7, 1972.

We proposed that the Secretary of Defense designate a central organization in the DOD with the authority and responsibility to develop and manage multiplex systems to meet requirements of all DOD users. We suggested that the designated organization should be responsible for (1) maintaining necessary information on all applicable circuitry, (2) processing all requirements to determine how they are to be met, (3) consolidating requirements of all users to form new economical systems, including the selection of multiplex equipment sites, (4) making cost studies to determine whether equipment should be purchased or leased, (5) ordering through the leasing activity the necessary circuits and equipment, and (6) analyzing existing systems on a continuous basis to determine the need for expansion, discontinuance, or reconfiguration.

We proposed also that the Director, OTP, establish as policy that the Secretary of Defense, as Executive Agent, NCS, would be responsible for development of procedures for coordinating civil and military communications requirements so that the economic benefits of multiplexing could be more fully realized.

Comments on our draft report from OTP, DOD, and GSA are appendixes I, II, and III, respectively. The agencies agreed that communications costs could be reduced through further application of multiplexing but expressed reservations concerning certain aspects of either our findings or our conclusions. We have summarized and consolidated their principal exceptions, together with our evaluation, below.

MANAGEMENT ARRANGEMENTS

OTP and DOD questioned the desirability or necessity of centralized management or high-level policy direction, rather than appropriate interagency coordination, for accommodating military and civil multiplex requirements. DOD stated that

it would be more appropriate for GSA and DOD to work together to (1) develop procedures, (2) keep OTP and the Executive Agent, NCS, informed, and (3) solicit the views of the Executive Agent, NCS,

> "*** to ensure that those Government requirements which are not normally served by the communications system of either agency would be considered in the development and implementation of multiplexing programs."

OTP stated that it would proceed deliberately with the establishment of a Government policy and that, in the meantime, GSA and DOD would be asked to undertake a coordinated effort to evaluate the applicability of multiplexing and to determine the feasibility and desirability of adopting compatible multiplexing techniques for civil and military use.

We believe that our previous reports relating to communications management, discussed briefly in chapter 1, have demonstrated the limitations of "coordinated efforts" in other communications networks and systems. A policy of coordinated efforts may only continue separate multiplex systems between and within military and civil agencies.

GSA did not agree that the Executive Agent, NCS, should coordinate requirements to establish joint military and civil multiplex systems because Office of Management and Budget Bulletin 61-13 and Executive Order No. 11490 assign to GSA the responsibility for day-to-day communications functions and, more importantly, the responsibility to plan, provide, operate, and maintain telecommunications to support emergency functions of civil activities of executive departments and agencies.

Although we recognize that GSA has been given such responsibilities, these responsibilities must be considered in a Government-wide framework. Executive Order No. 11490 specifically provides that GSA

> "*** Plan for and provide, operate and maintain appropriate telecommunications facilities *** <u>within the framework of the National Communications System</u> ***." (underscoring added)

Nevertheless, at the time of our review, GSA had only two multiplex systems--both dedicated to specific programs--and it had not established a single joint-use multiplex system, although one of the dedicated systems was subsequently shared with military users. Further, a GSA official advised us that GSA did not have sufficient information (inventory of circuits) on services for the development of Government-wide multiplex systems.

Since the Executive Agent, NCS, has the responsibility for designing the NCS, developing plans for fulfilling approved requirements and priority determinations, and for recommending assignment of responsibilities for implementation, we believe unified procedures should be developed within the framework of the NCS at the Executive Agent, NCS, level.

DOD stated that DCA already has the basic authority and responsibility to develop and manage DCS multiplex systems and that expansion of this authority and responsibility to include all nontactical DOD requirements is planned. DOD contended that (1) DCA does have procedures to develop and manage DCS Government-owned multiplex systems (since December 1971, seven systems covering more than 70 teletype circuits have been, or are designated to be, implemented) and is refining and improving these procedures and (2) future DCA recommendations will include leasing commercial multiplex equipment or procuring new Government-owned systems.

We do not question DCA's ability to plan and propose the development of multiplex systems, but we do question its authority and the existence of ongoing procedures (rather than one-time efforts) for the establishment and management of DOD multiplex systems. The facilities and personnel of the DCS, for the most part, are funded by the military departments. DCA has no authority to specify the manner in which a military department communications requirement is to be fulfilled; it can only recommend. The multiplex systems established since December 1971 have resulted from a one-time plan prepared by DCA and accepted by the military departments. We agree that DOD's plan to extend DCA's responsibility from only DCS to total DOD nontactical requirements is a step in the right direction. However, we believe that the authority and resources necessary for DCA to establish and control DOD multiplex systems as an ongoing effort must be expressly provided for.

AMOUNT OF SAVINGS AND QUALITY OF SERVICE

OTP stated that it intends to explore fully with communications carriers their plans for applying multiplex devices and the potential for reduced charges for data service. OTP expressed concern that if current tariff imbalances were corrected at some future date, the Government might have acquired a substantial inventory of equipment which might become obsolete and more costly than new service offerings of the carriers. The Government would then have little recourse but to continue to use the obsolete and expensive facilities because of its investment.

Although the correction of tariff imbalances may be a distinct possibility for the future, we believe that implementation of a comprehensive Government multiplexing program need not be predicated on purchasing multiplexing equipment. The demonstrated savings of our proposed multiplex systems were based completely on equipment that can be leased on a month-to-month basis with commitment extending no more than 1 year. Thus, under such an arrangement, the Government would not be placed in the untenable position of owning obsolete or uneconomical equipment. This is not to be construed as advocating the leasing of multiplexing equipment without due consideration to purchase of the equipment. We believe that a lease-or-buy determination is properly a responsibility of management at the time of system acquisition.

DOD and GSA pointed out that circuits released from a Telpak to establish a multiplex system do not necessarily result in a reduction in leased circuit costs. Released Telpak circuits must be reassigned to other demands, the Telpak must be reconfigured, or the Telpak size must be reduced to compensate for the released circuits before savings can be realized.

Intrastate groups of 12, 24, 60, and 240 circuits are available in Telpaks A, B, C, and D, respectively. The same groups were available for interstate circuits until recently when the interstate A and B Telpaks were held to be discriminatory by the Federal Communications Commission.

We agree that released Telpak circuits would not result in immediate savings unless the conditions specified by DOD

and GSA are met. In theory, situations could exist in which released circuits would not be required, but this has not been true historically. The cost of GSA and DOD Telpaks has increased from $48 million to $99 million annually from June 30, 1966, to June 30, 1972. Although some of this growth was caused by increased prices, the majority was caused by increased circuit requirements.

At present the Telpaks are about 88 percent filled. Short-distance Telpaks to out-of-the-way locations (although still cost effective) have much less than an 88-percent fill while long-distance Telpaks between major communications points (such as used in our proposed systems) approach 100-percent fill. Therefore multiplexing can release existing circuits for other assignments, and we believe that this will be reflected over the long term in more effective and more economical use of leased circuitry.

DOD stated that significant additional factors which will have a negative impact on predicted savings are not identified in our draft report. These include test and patch facilities, transmission test equipment, distortion alarms, regenerative repeaters, order wires, voice frequency restoral facilities, and operation and maintenance of these equipments and facilities. DOD also stated that final design of a multiplex network must be based on such engineering and operational factors as flexibility, restorability, survivability, quality control, and diverse routing, as well as on economic considerations.

Our proposed systems consisted of leased equipment, for which the carriers' charges would cover the cost of the facilities and services cited by DOD. Using Government-owned equipment the services cited would be required, but the majority of the sites in our examples are major communications centers of the military departments and DCS where, we were informed, existing resouces could probably support one or two additional multiplex units. Thus we believe that in most cases these expenses would be nominal.

We recognize also that multiplex systems must consider engineering and operational as well as economic factors. We have pointed out (see p. 14) the reliability and flexibility of multiplexers. As to survivability, we have

demonstrated the capability for diverse routing by placing one of two related diverse-routed circuits (Cheyenne Mt.-Blue Ridge, Pa.) in our Cheyenne Mt.-Ft. Detrick proposed system (see footnote b, p. 41) and the other in our Cheyenne Mt.-Ft. Meade proposed system. (See footnote e, p. 47.)

We agree that some of the circuits which we proposed to eliminate in our examples may not be susceptible to replacement as proposed because of peculiar operational requirements. Also the proposed locations for the multiplexers are, in most instances, major communications centers; operational, contingency, or pending DOD communications plans may require the use of other sites in the areas. However, our selection of circuits in most cases did not include all existing circuits between the locations selected so that other circuits could be substituted if certain of the circuits were deleted from the plan because of operational requirements. Also, as shown in the table on page 11, the costs of the eight proposed systems are less than half of present costs; therefore, not all the circuits need to be eliminated to produce substantial savings.

DOD contended that some degradation of service could be anticipated by spreading responsibility from one carrier to three separate carriers providing three independent circuits. It stated that locating troubles on such a three-section circuit would be time consuming and result in increased downtime. Conceivably, each section could be operating within acceptable tolerances with end-to-end service being unacceptable.

Although DOD's contention is a valid generalization, we do not believe it is material to the present situation. We have shown (see p. 14) that multiplex systems are highly reliable. Furthermore, DOD multiplex systems to overseas locations have invariably involved the services of three different carriers: the CONUS tail circuit being provided by a U.S. common carrier, the transoceanic portion by an international carrier, and the overseas tail by a foreign carrier (or Government-furnished). Any degradation of service that could be anticipated through multiplexing should therefore be no less acceptable than it is under the current practices.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Our review has demonstrated potential economic benefits achievable through applying multiplexing, especially when circuit requirements of all military departments are collectively considered and combined into groups to form systems. This, in our opinion, can best be accomplished by a single organization that has the necessary information on existing circuitry and facilities and has the responsibility and authority to determine the method for satisfying communications requirements.

The military departments have independently developed and used multiplex systems and have achieved some savings. However, greater benefits are achievable by establishing systems and efficiently managing those in existence on a unified, centralized basis.

Although DCA has proposed that additional multiplex systems be established, the more significant proposals have not been established. We believe this is because DCA does not have sufficient authority or resources to implement its proposals.

Because the Assistant Secretary of Defense (Telecommunications) has stated that he intends to recommend designation of DCA as the central organization in DOD with authority and responsibility for all nontactical multiplex systems (see p. 50), we have no recommendations for the Secretary of Defense, pending such action and our evaluation of the new arrangement.

Circuits susceptible to multiplexing are used not only by military but also by civil Government agencies; however, procedures do not exist for coordinating their requirements to develop joint-use multiplex systems or for interagency use of spare multiplex channels. In our opinion, the Secretary of Defense, in his capacity as the Executive Agent, NCS, should perform the coordination of requirements to establish joint military and civil multiplex systems. The Executive

Agent is responsible for design of this System "taking into consideration the communications needs and resources of all Federal agencies." Furthermore, he is "to ensure effective utilization" of the System. On the basis of our past experience and the responses to our draft report, we believe that such coordination between military and civil agencies will not be fully effective without additional policy and procedural guidance.

We are concerned, therefore, that Government departments and agencies may not be made aware of and motivated to obtain the benefits of multiplexing, unless OTP provides specific policy guidance.

We are concerned also that DOD and GSA may not consider civil agency and military requirements, respectively, unless specific procedural guidance is provided within the framework of the NCS. We suggest that a fragmented arrangement would lead to duplicated functions and operations within the Government, as well as parallel or duplicated multiplex systems that would not maximize the benefits of this technique for total Government requirements.

RECOMMENDATIONS

We recommend that the Director, OTP, establish a policy that departments and agencies identify their communications requirements which are susceptible to multiplexing as described in this report and that the requirements be satisfied by multiplexed facilities when economically and operationally feasible.

We recommend also that the Secretary of Defense, in accordance with his responsibilities as Executive Agent, NCS, develop specific procedures for coordinating civil and nontactical military communications which are susceptible to multiplexing.

Since OTP has agreed that the Government should take advantage of the benefits of multiplexing where appropriate and is proceeding with the establishment of a Government policy in this area, we have no further recommendations at this time. We suggest, however, that in the formulation of such policy, consideration be given to the establishment of

a single entity to be responsible for development and management of multiplex systems for the entire Government. We plan to evaluate the effectiveness of the policy and its implementation at a future date.

DIAGRAMS OF EXISTING SERVICES, PROPOSED MULTIPLEX SYSTEMS, AND COST COMPARISONS

Contents

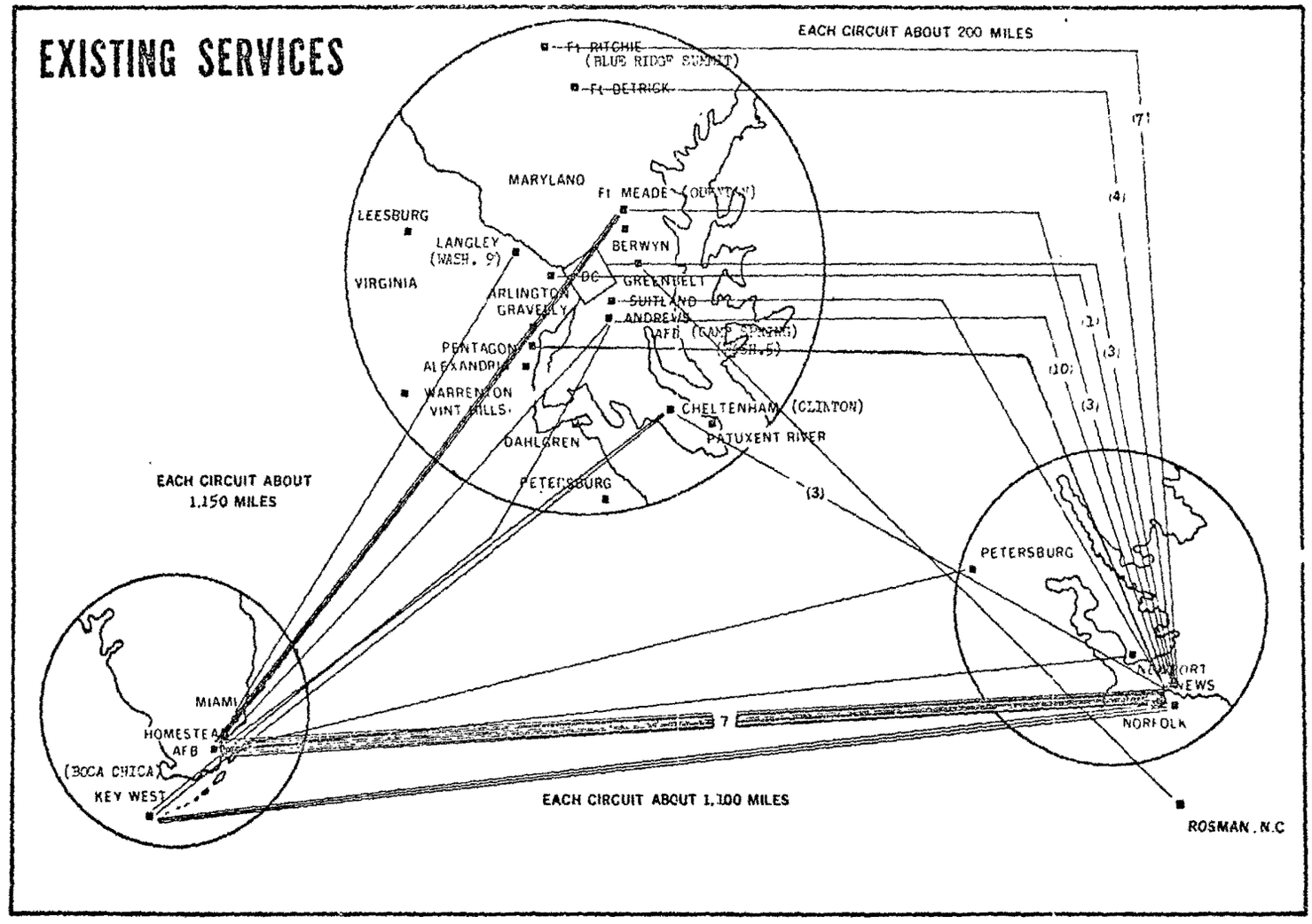
General Notes

Baud	number of bits (contraction of the term "binary digit") per second that can be transmitted over a circuit
Data Sets	modulation-demodulation devices which convert low-speed data signals to voice frequency signals and vice versa
Service Terminals	communications carriers' charges for connecting service
Conditioning Charges	communications carriers' charges to assure that a circuit meets specific tolerances
Channel Cards	modular components which establish the spacing for the independent channel within the derived system
Intermediate Stations	devices which permit multiplexed signals to pass through a terminal without affecting the signal stream and without necessitating extra channel cards
Parenthetical Numbers	numbers in parenthesis on the diagrams indicate the number of circuits or channels

SYSTEM 1

HOMESTEAD-NORFOLK-ANDREWS

EXHIBIT A



SYSTEM 1

HOMESTEAD-NORFOLK-ANDREWS

EXHIBIT A

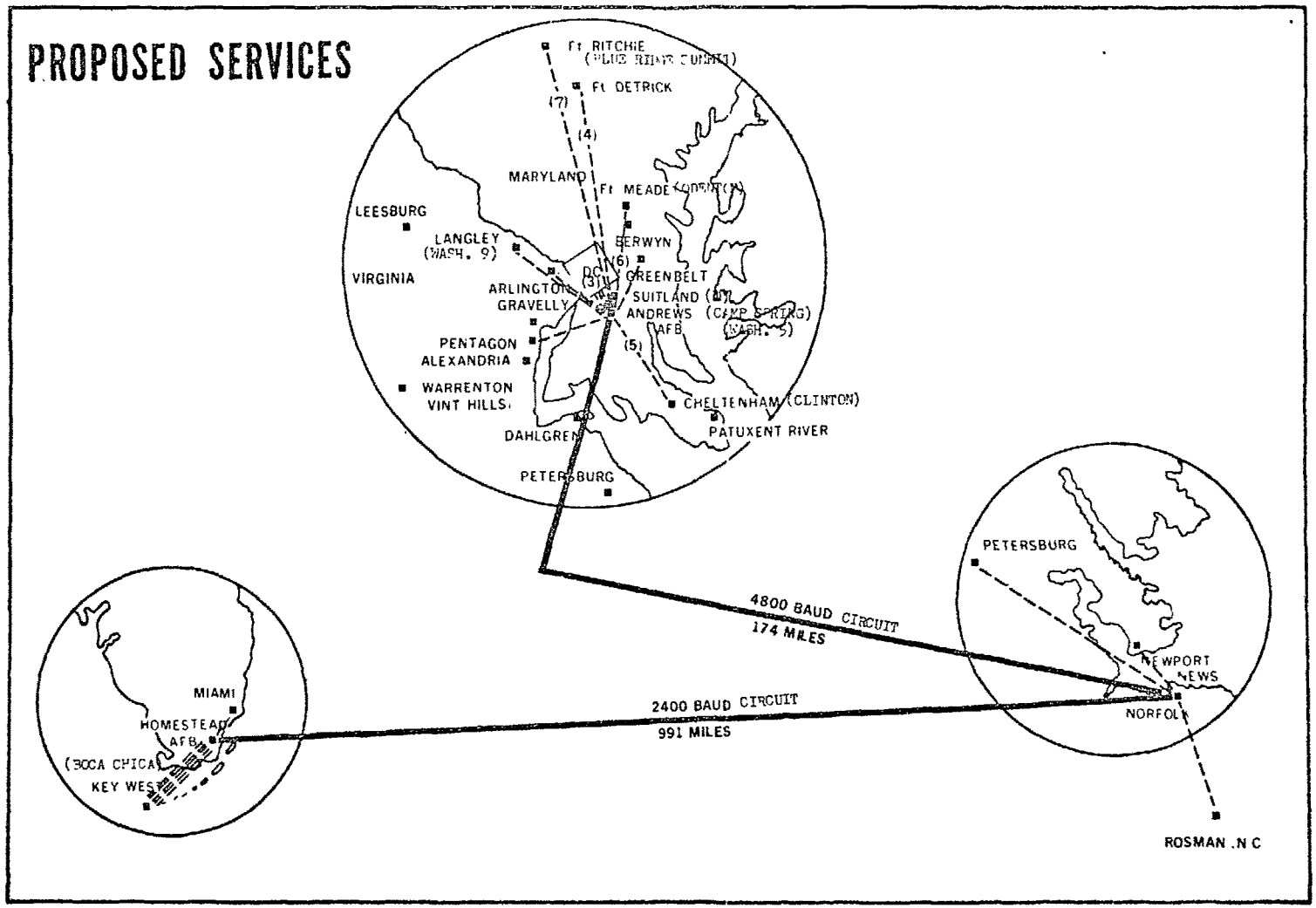


EXHIBIT A

SUMMARY OF COSTS

PROPOSED MULTIPLEX SYSTEM

System 1-Homestead AFB, Florida, via Norfolk, Virginia,

to Andrews AFB, Maryland

Circuit	User code (note a)	Circuit number	Present monthly cost	Proposed monthly tail circuit costs	
				To Homestead or Norfolk	To Andrews
Key West, Fla. - Norfolk, Va.	CNNDD	AT-B-28024	$318.64	$93.94	-
" - "	"	AT-B-28023	318.64	93.94	-
" - "	"	AT-B-28025	318.64	93.94	-
" - Cheltenham, Md.	"	WU-T-03504	326.62	93.94	$35.62
Boca Chica, Fla. - Andrews, Md.	CNPTD	AT-B-22264	343.84	93.94	-
Homestead, Fla. - Norfolk, Va.	CNNMD	WU-T-03398	293.44	-	-
" - "	"	WU-T-03400	293.44	-	-
" - "	"	WU-T-03396	293.44	-	-
" - "	"	WU-T-03397	293.44	-	-
" - "	"	WU-T-03699	314.44	-	-
" - "	"	WU-T-03399	293.44	-	-
" - "	CNNTD	AT-B-28009	297.43	-	-
" - Andrews, Md.	CNPMD	AT-B-22237	306.04	-	-
" - Cheltenham, Md.	AFBDD	AT-T-13332	307.09	-	35.62
" - Petersburg, Va.	ABH1D	AT-B-10738	279.58	86.80	-
" - Newport News, Va.	AFBDD	AT-B-13327	296.17	73.36	-
" - Odenton, Md.	CNNMD	AT-B-28055	309.19	-	76.09
" - "	"	AT-B-28056	309.19	-	76.09
" - Ft. Meade, Md.	"	WU-T-03893	331.03	-	76.09
Miami, Fla. - Washington, D.C. zone 9, Va.[b]	MHD4N	AT-T-19190-096[c]	300.79	77.35	73.78
Norfolk, Va. - Andrews, Md.	CNNMD	AT-B-28064	109.90	-	-
" - "	"	AT-B-28066	112.42	-	-
" - "	CNNGD	WU-T-00002	110.74	-	-
" - "	CNPHD	AT-B-22234	109.69	-	-
" - "	CNPMD	WU-T-03420	113.68	-	-
" - "	CNPJD	WU-T-03456	113.68	-	-
" - "	CNPKD	AT-B-22245	109.27	-	-
" - Camp Springs, Md.	CNNMD	AT-B-28070	109.90	-	1.32
" - Ft. Meade, Md.	"	AT-B-28119	112.42	-	76.09
" - "	"	WU-T-03246	107.80	-	76.09
" - "	XLWED	WU-T-03552	113.05	-	76.09
" - Suitland, Md.	CNNJD	AT-B-07910-025	109.27	-	16.50
" - Clinton, Md.	CNPGD	AT-B-07957	110.32	-	42.24
" - Arlington, Va.	CNNFD	AT-T-22219	109.06	-	72.31
" - Clinton, Md.	CNNDD	AT-B-07965	110.95	-	42.24
" - "	CNNFD	AT-B-07937	110.32	-	42.24
" - Camp Springs, Md.	CNNMD	AT-B-28071	112.42	-	1.32
" - Washington, D.C.	CNNKD	WU-T-03450	107.80	-	76.09
" - "	CNNMD	AT-B-22222	107.80	-	76.09
" - Ft. Detrick, Md.	CC7DD	WU-T-05919	129.85	-	81.55
" - "	CNNFD	WU-T-03114	117.46	-	81.55
" - Washington, D.C.	CNNMD	WU-T-03767	107.80	-	76.09
" - Ft. Detrick, Md.	XSCCN	AT-B-30526	117.88	-	81.55
" - "	"	AT-B-30528	117.88	-	81.55
" - Ft. Ritchie, Md.	XSCCD	WU-T-03200	126.70	-	85.33
" - "	XSCCN	AT-B-30556	121.87	-	85.33
" - "	"	WU-T-03118	127.33	-	85.33
" - Pentagon, Va.	CNNMD	WU-T-03931[d]	110.11	-	72.31
" - Blue Ridge, Pa.	BNNLD	AT-B-03538[d]	115.78	-	85.33
" - "	BEALD	AT-B-11806	122.08	-	85.33
" - "	AAC5D	AT-B-30387	121.24	-	85.33
" - "	CNNMD	AT-B-28114	125.86	-	85.33
" - Washington, D.C. zone 5, Md.[b]	National Weather Service	GT-22120E[e]	118.58	-	-
Rosman, N.C. - Greenbelt, Md.	NASA	NST-3307[e]	264.30	166.81	72.10
		Total	$10,189.74	$874.02	$2,115.92

EXHIBIT A

SYSTEM 1

HOMESTEAD-NORFOLK-ANDREWS (continued)

Cost comparison

Present costs	$10,189.74
New costs	6,007.24
Monthly savings	$ 4,182.50
Annual savings	$50,190.00

Monthly costs of proposed multiplex equipment and services

Multiplex equipment (3)	$ 655.00
Maintenance charge	50.00
Circuit cost	489.30
Data sets (4)	544.00
Service terminals (4)	140.00
Conditioning charges (4)	76.00
Channel cards (108)	1,040.00
Intermediate station	23.00
	3,017.30
Proposed tail circuits	2,989.94
Total new cost	$6,007.24

[a]First and/or second letters indicate agency:
A = Air Force
B = Army
C = Navy
M = Army Headquarters
XL = National Security Agency
XS = Supreme Allied Commander, Atlantic (NATO).

[b]Washington, D.C., and environs are divided into 20 zones for rate purposes.

[c]Non-DCS circuit.

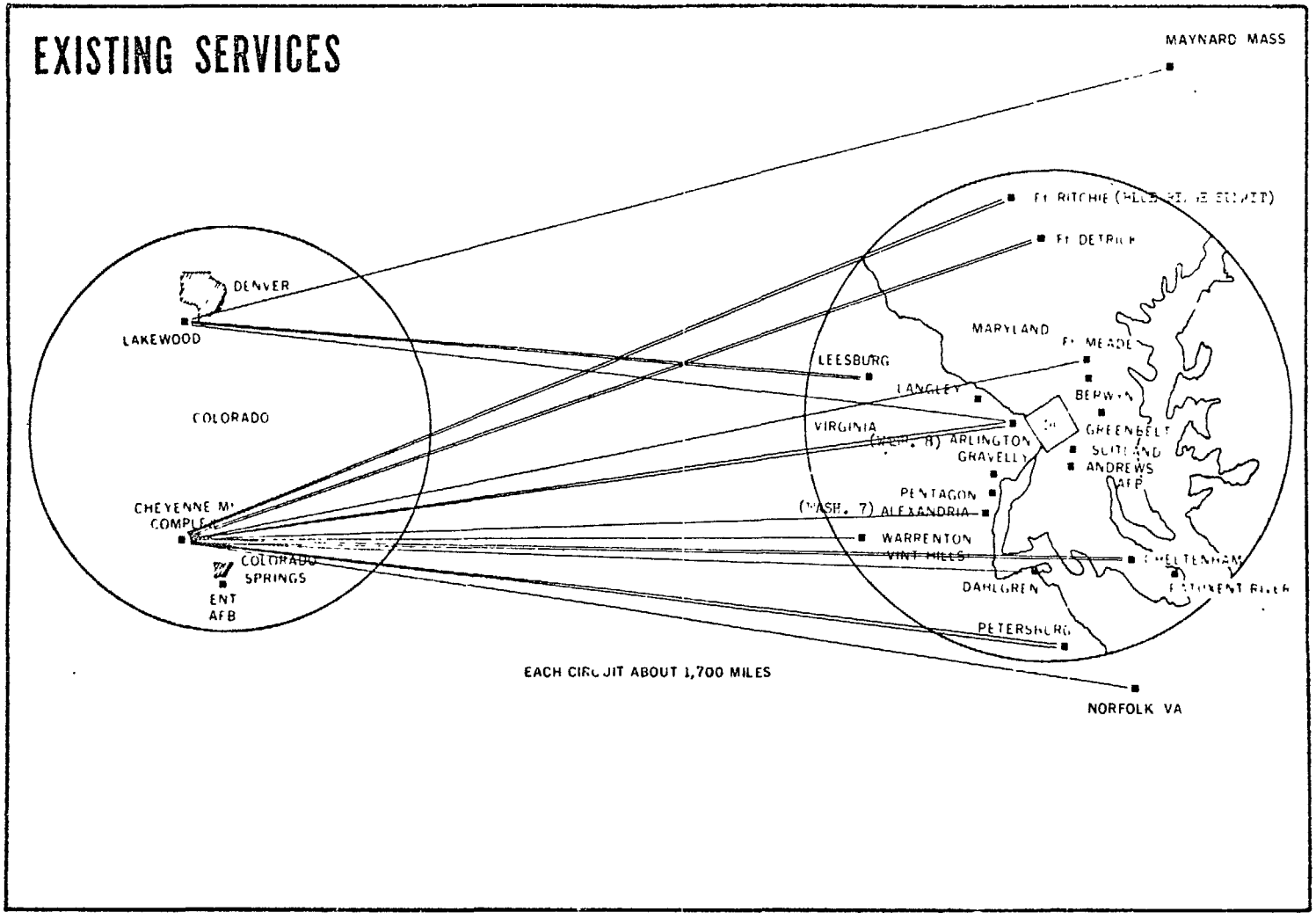
[d]This circuit is diversely routed from circuit AT-T-11618.

[e]Civil agency circuit.

SYSTEM 2

CHEYENNE MT.-FT. DETRICK

EXHIBIT A



SYSTEM 2

CHLYENNE MT.-FT. DETRICK

EXHIBIT A

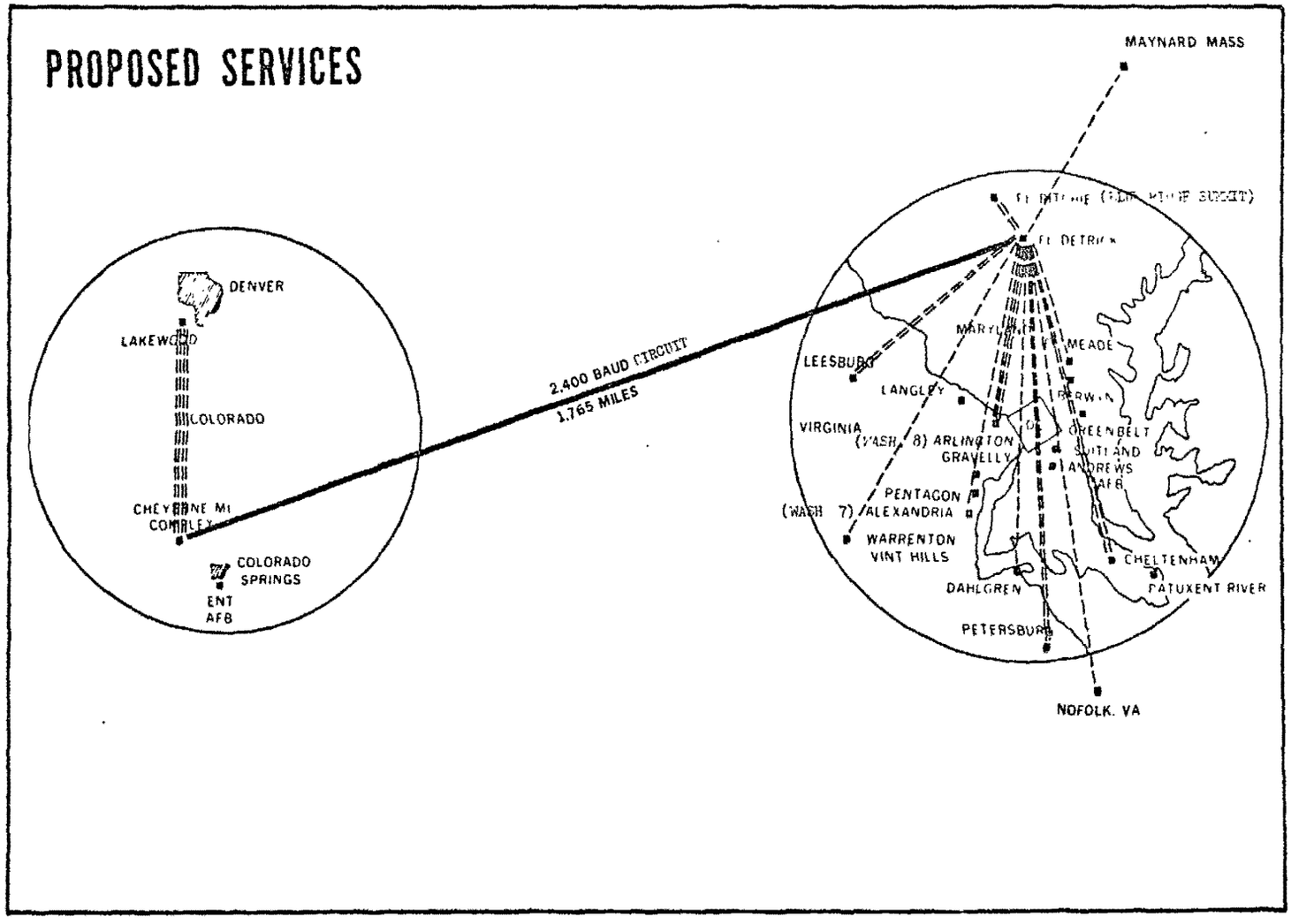


EXHIBIT A

SUMMARY OF COSTS

PROPOSED MULTIPLEX SYSTEM

System 2-Cheyenne Mt., Colorado, to

Ft. Detrick, Maryland

Circuit	User code (note a)	Circuit number	Present monthly cost	Proposed monthly tail circuit costs To Cheyenne Mt.	Proposed monthly tail circuit costs To Ft. Detrick
Cheyenne Mt., Colo. - Ft. Detrick, Md.	ABH1D	WU-T-03205	$ 385.84	-	-
" "	ABXWD	AT-T-10741	380.59	-	-
" Cheltenham, Md.	ABDCD	AT-B-09725-204	417.55	-	$ 77.14
" Blue Ridge, Pa.	ABKWD	AT-T-10745	384.79	-	77.56
" "	BNNLD	AT-B-11909[b]	389.62	-	77.56
" Ft. Meade, Md.	ABDZD	WU-T-03001[c]	387.31	-	82.81
" Cheltenham, Md.	AAESD	AT-T-09656	494.76	-	77.14
" Washington, D.C. zone 7, Va.[d]	ABDZD	AT-B-10733	427.21	-	80.50
" Washington, D.C. zone 8, Va.[d]	ABFYD	AT-T-98000	388.99	-	79.24
" "	ABH1D	AT-B-10705	298.90	-	79.24
Lakewood, Colo. - Washington, D.C. zone 8, Va.[d]	BBU4D	AT-T-15083	289.87	$ 85.96	79.24
Cheyenne Mt., Colo. - Vint Hills, Va.	ABH1D	AT-B-10732	391.51	-	84.28
" Norfolk, Va.	ABFYD	AT-T-98002	427.42	-	117.88
" Petersburg, Va.	ABDHD	AT-T-09720-164	416.71	-	108.22
" "	ABH1D	AT-B-10737	407.26	-	108.22
" Dahlgren, Va.	ABDYD	AT-B-09725-068	308.98	-	89.95
Lakewood, Colo. - Leesburg, Va.	BBU4D	AT-T-15002	288.40	85.96	77.77
" "	BBU4D	AT-T-15001	288.40	85.96	77.77
" Maynard, Mass.	BBU4D	AT-T-15077	475.30	85.96	164.29
		Total	$7,249.41	$343.84	$1,538.81

Cost comparison

Present costs	$ 7,249.41
New costs	3,586.17
Monthly savings	$ 3,663.24
Annual savings	$43,958.88

Monthly costs of proposed multiplex equipment and services

Multiplex equipment (2)	$ 310.00
Maintenance charges (2)	100.00
Circuit cost	737.52
Data sets (2)	144.00
Service terminals (2)	70.00
Conditioning charges (2)	38.00
Channel cards (38)	304.00
	1,703.52
Proposed tail circuits	1,882.65
Total new costs	$3,586.17

[a]First and/or second letter indicates agency:
A - Air Force
B - Army

[b]This circuit diversely routed from circuit AT-B-11606.

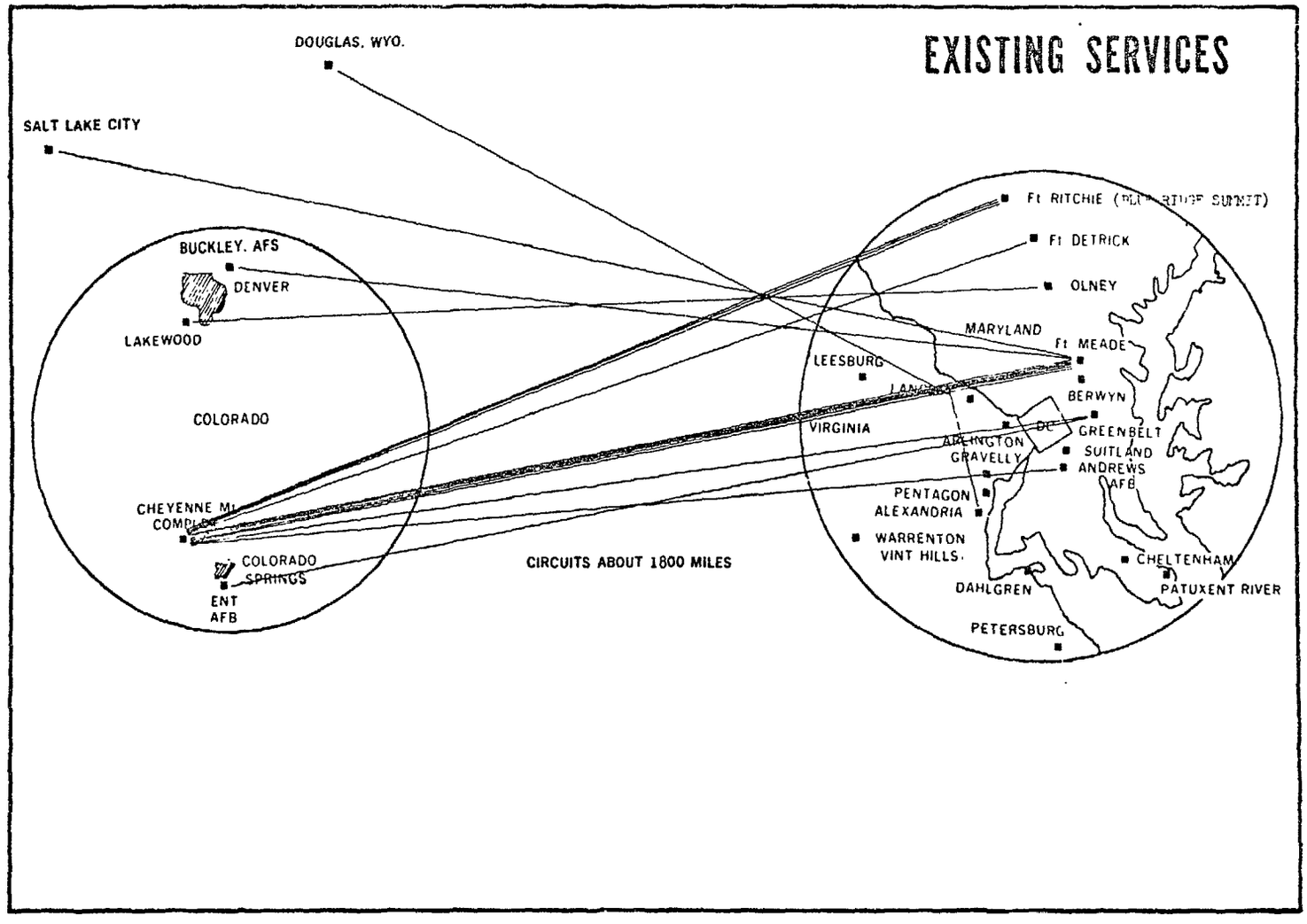
[c]This circuit diversely routed from circuit WU-T-03002.

[d]Washington, D.C., and environs are divided into 20 zones for rate purposes.

SYSTEM 3

CHEYENNE MT.-FT. MEADE

EXHIBIT A



SYSTEM 3

CHEYENNE MT.-FT. MEADE

EXHIBIT A

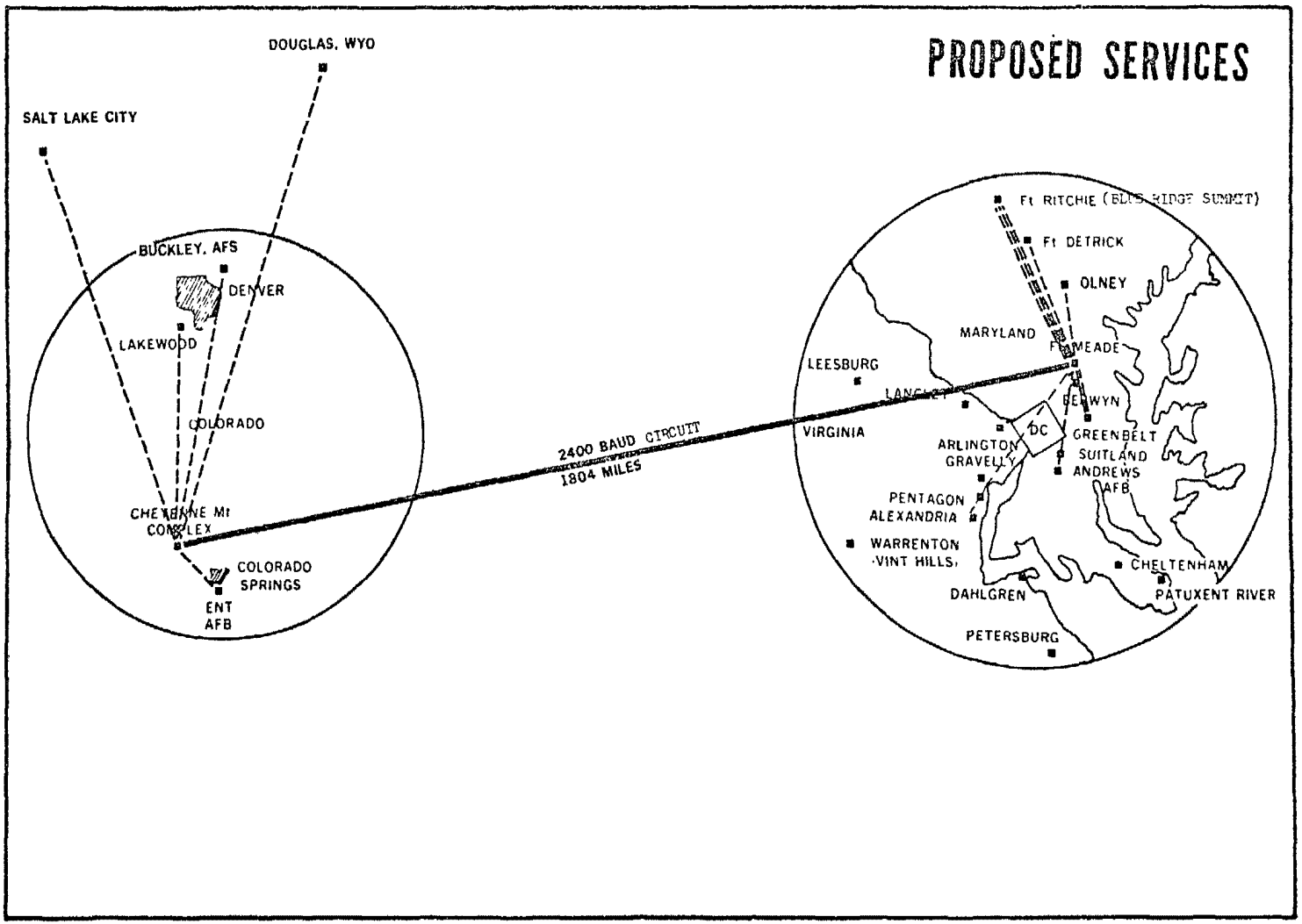


EXHIBIT A

SUMMARY OF COSTS

PROPOSED MULTIPLEX SYSTEM

System 3-Cheyenne Mt., Colorado, to

Ft. Meade, Maryland

Circuit	User code (note a)	Circuit number	Present monthly cost	Proposed monthly tail circuit costs To Cheyenne Mt.	To Ft. Meade
Cheyenne Mt., Colo. - Ft. Meade, Md.	ABDYD	AT-B-09725-069	$ 307.72	-	-
" - "	ABDZD	WU-T-03002[b]	387.31	-	-
" - "	ABH1D	AT-B-10704	302.05	-	-
" - "	ABH1D	AT-B-09725-075	302.26	-	-
" - "	EWWAD	WU-T-03640	394.03	-	-
Buckley, Colo. - Ft. Meade, Md.	AAC1D	AT-B-22421	404.53	$ 85.33	-
Salt Lake City, Utah - "	AGEKD	AT-B-22442	605.08	170.38	-
Cheyenne Mt., Colo. - Greenbelt, Md.	ABDYD	AT-B-09725-071	304.99	-	$ 73.36
Ent AFB, Colo. - "	ABDYD	AT-B-09725-170	392.56	(note c)	73.36
Cheyenne Mt., Colo. - Andrews, Md.	AAEPD	AT-T-09640	305.20	-	76.09
Lakewood, Colo. - Olney, Md.	BBU4D	AT-T-15078	285.88	85.96	74.62
Cheyenne Mt., Colo. - Ft. Ritchie, Md.	EWWAD	WU-T-01616	381.85	-	86.80
Douglas, Wyo. - Alexandria, Va.	ADBAD	WU-T-03181[d]	437.71	138.04	76.93
Cheyenne Mt., Colo. - Blue Ridge Summit, Pa.	BNNLD	AT-B-11606[e]	398.65	-	86.38
" - Ft. Ritchie, Md.	AAC5D	AT-B-30388	382.48	-	86.80
" - Ft. Detrick, Md.	ABXWD	AT-T-10750	390.67	-	82.81
Total			$5,982.97	$ 479.71	$717.15

Cost comparison

Present costs	$ 5,982.97
New costs	2,872.54
Monthly savings	$ 3,110.43
Annual savings	$37,325.16

Monthly costs of proposed multiplex equipment and services

Multiplex equipment (2)	$ 310.00
Maintenance charges (2)	100.00
Circuit cost	757.68
Data sets (2)	144.00
Service terminals (2)	70.00
Conditioning charges (2)	38.00
Channel cards (32)	256.00
	1,675.68
Proposed tail circuits	1,196.86
Total new costs	$2,872.54

[a]First and/or second letters indicate agency:

A - Air Force
B - Army
E - DCA

[b]This circuit diversely routed from circuit WU-T-03001.

[c]Spare channel available at no cost.

[d]This circuit has tails to two points in Wyoming. Tail mileage is not included since tails will remain in place.

[e]This circuit diversely routed from circuit AT-B-11909.

OFFICE OF TELECOMMUNICATIONS POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20504

May 25, 1972

DIRECTOR

Mr. R. G. Rothwell
Associate Director
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rothwell:

Your draft report to the Congress entitled "Opportunities for Reducing Communications Costs through Centralized Management of Multiplex Systems" dramatically emphasizes the potential saving which might accrue to the Government through optimum exploitation of multiplexing techniques to data circuits. I am not sure of the extent to which centralized management is the necessary or desirable means to achieve such savings. Suitable coordination procedures may be an alternative. This is a matter which we now have under consideration.

The report is very timely as recent technological breakthroughs in multiplexing techniques have increased substantially the potential economies which can be realized through the use of multiplexing devices. I agree that the Government should take advantage of this potential to the extent that economies will result and operational efficiency will not be degraded.

There are, however, some dangers in proceeding in this direction at too fast a pace. The aforementioned technological innovations are equally available to the carriers and the users of data facilities. We intend to explore fully with the carriers their plans for the application of such devices and the potential for reduced charges for data service. I am somewhat concerned that current tariff imbalances might be corrected at some near future date at which time the Government may have acquired a substantial inventory of communications equipment which might soon be obsolete and more costly than the new service offerings of the carriers. Should this happen, the Government, based on past experience, would have little recourse but to continue operation of unnecessarily expensive facilities because of its investment.

As previously stated, I propose to proceed deliberately with the establishment of a Government policy in this area and to explore fully with Government users and the carriers the implications and ramifications of this technology. In the meantime I have asked the Department of Defense and the General Services Administration to undertake a

coordinated effort to evaluate the applicability of multiplexing and to determine the feasibility and desirability of adopting compatible multiplexing techniques for civil and military use.

Sincerely,

Clay T. Whitehead

APPENDIX II

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

TELECOMMUNICATIONS

26 JUN 1972

Mr. R. G. Rothwell
Associate Director
U. S. General Accounting Office
Washington, D. C. 20548

AVAILABLE

Dear Mr. Rothwell:

This is in reply to your letter to the Secretary of Defense dated March 7, 1972 wherein you forwarded a GAO Draft Report, "Opportunities for Reducing Communications Costs Through Centralized Management of Multiplex Systems" (OSD Case #3424).

The report has been reviewed and the Department of Defense (DoD) agrees, in general, with its findings and conclusions. We particularly support the view that communications costs in the Continental U. S. can be reduced through the further application of multiplexing.

With regard to the recommendation for the Secretary of Defense, the Defense Communications Agency (DCA) already has the basic authority and responsibility to develop and manage Defense Communications System (DCS) multiplex systems. It is logical that this responsibility be expanded and I plan to recommend that the Secretary designate DCA as the central organization in the DoD with the authority and the responsibility to engineer and manage multiplex systems to meet all non-tactical DoD requirements.

The recommendation for the Director, Office of Telecommunications Policy (OTP) raises the question of the need for OTP action. While this subject is quite important, it is of a level more commensurate with inter-agency coordination than of high level policy. Therefore, we believe that it would be more appropriate for General Services Administration (GSA) and DoD to work together to develop procedures for accommodating military and civil communications multiplex requirements, keeping the Director, OTP and the Executive Agent, NCS informed of progress and actions instituted. In this regard, the views of the Executive Agent, NCS would be solicited by GSA and DoD to

ensure that those government requirements which are not normally served by the communications system of either agency would be considered in the development and implementation of multiplexing programs.

Additional comments on the report are provided in the enclosure hereto.

Sincerely,

E. Rechtin

Enclosure

OASD(T) Specific Comments on GAO Draft Report dated March 7, 1972 "Opportunities for Reducing Communications Costs Through Centralized Management of Multiplex Systems" (OSD Case #3424)

1. The Findings and Conclusions on page 2 state that the DoD "has not established procedures to develop and manage multiplex systems," and that the more significant of DCA multiplex proposals "have not been established because it does not have the authority or resources to implement its proposals." DCA has established procedures to develop and manage DCS government-owned multiplex systems and is in process of refining and improving these procedures. The DCA Western Hemisphere communications plan referred to in page 20 of the GAO report proposed establishment of nine VFCT's. Five of these multiplex systems have been established since December 1971, covering more than 50 teletype circuits, and two additional systems covering more than 20 teletype circuits are scheduled for implementation in the next 60-90 days. To date, the DCA recommendations have been limited to DCS circuitry and government-owned and operated multiplex equipment. Future studies, however, will include leasing commercial multiplex equipment or procuring new government-owned multiplex systems as appropriate.

2. The GAO has made an excellent in-depth review of 200 teletype circuits, resulting in the design of eight new multiplex systems at an estimated savings of $400,000 annually. These recommendations are very useful to DoD as a sample and will be considered carefully in implementing an overall multiplex network. It should be recognized, however, that there are significant additional factors which have not been identified by the GAO in its study and which will result in a negative impact on the predicted savings. These are

a. Requirement for test and patch facilities.

b. Transmission test equipment, (voice frequency and digital).

c. Distortion alarms.

d. Regenerative repeaters.

e. Order wires.

f. VF restoral facilities.

g. O&M of equipment and facilities listed above.

Further, final design of a multiplex network must be based upon engineering and operational factors, such as flexibility, restorability, survivability, quality control, and diverse routing as well as economic considerations.

3. Circuits removed from a TELPAK and placed on the government telegraph network do not necessarily result in a reduction in leased costs. TELPAK size must be reduced or reconfigured to compensate for the unused channels before any leased savings can be realized.

4. Operationally, some degradation of service can be anticipated by spreading the responsibility for end-to-end service from one carrier to three separate carriers providing three independent circuits, as in the case of a circuit with two tail sections. Sectionalizing troubles on a circuit comprised of three independent sections will be more time consuming and result in increased circuit down-time. Conceivably, each section could be operating within acceptable tolerances with end-to-end service unacceptable.

5. Equitable distribution of costs among users as recommended on page 23 of draft is provided in the DCA Industrially Funded Leased VFCT System. On an interim basis, each user is required to pay a proportionate share of total leased line charges including spare capacity and system order wire channels. It is planned to use a standard rate per mile in the future. The significance of this cost sharing is expected to eliminate some "nice-to-have" service enjoyed by activities whose need was satisfied by the use of spare channels of VFCT's funded by another activity.

UNITED STATES OF AMERICA
GENERAL SERVICES ADMINISTRATION
WASHINGTON, D.C. 20405

MAY 12 1972

Honorable Elmer B. Staats
Comptroller General of the United States
General Accounting Office
Washington, DC 20548

Dear Mr. Staats:

The General Services Administration has reviewed the General Accounting Office draft report on use of multiplexing techniques and GSA generally concurs in the basic findings. It should, however, be noted that GSA as a principal member of the National Communications System, as well as the procurer of telecommunications services for the Federal agencies, has a definite responsibility in Government multiplex system development and utilization similar to that in the Telpak procurement.

The General Services Administration does not concur in the item on page 13 which states "the coordination of requirements to establish joint military and civil multiplex systems should be performed by the Secretary of Defense in his capacity as the Executive Agent for the National Communications System." Further, GSA does not concur in the recommendations shown on page 26 implementing this item.

Our nonconcurrence is based on the Bureau of Budget Bulletin 6-13 dated June 19, 1961, and Executive Order No. 11490 dated October 28, 1969. These assign to GSA the responsibility for day-to-day communications functions and more importantly, the responsibility to plan, provide, operate and maintain necessary telecommunications facilities and services to support emergency functions of civil activities of executive departments and agencies. We categorize multiplex systems as an integral part of telecommunications facilities.

We also would like to point out that savings through multiplex systems are dependent upon certain factors such as distance and demand within specified routes. Under certain conditions the savings can be substantial and under other conditions multiplexing can result in false economy. Multiplex systems concentrate teletype grade channels usually acquired through Telpak procurement into a single voice channel. If multiplexing creates unusable spare Telpak capacity in the designated route, it would then not be in the best interest of the Government to multiplex. Conversely, where the released Telpak channels can be reassigned to other demands or Telpak procurement can be reduced, substantial savings can be realized. We believe this report has failed to take such possibilities into consideration.

We appreciate having had the opportunity to review this draft report and should there be any questions regarding our comments, please contact Mr. T. W. Snyder, Assistant Commissioner for Telecommunications Engineering and Requirements, telephone number 254-6372.

Sincerely,