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Report to the Chairman, Government Information, Justice and Agriculture Subcommittee, Government Operations Committee, House of Representatives

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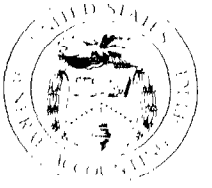
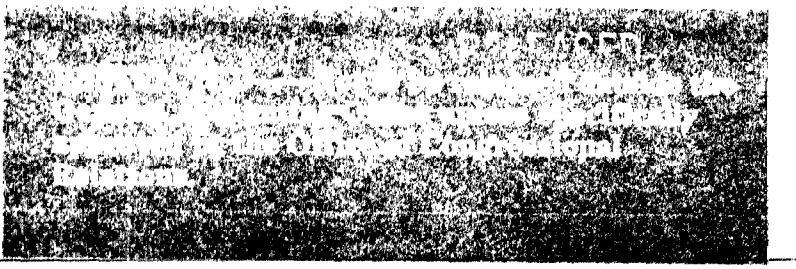
DEFENSE COMMUNICATIONS

Millions May Be Spent Unnecessarily to Expand Data Network





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Information Management and
Technology Division

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The Honorable Robert Wise
Chairman, Government Information,
Justice, and Agriculture Subcommittee
Government Operations Committee
House of Representatives

Dear Mr. Chairman:

This report responds to your request to provide information on the Defense Data Network's (DDN) cost effectiveness and the Defense Communications Agency's (DCA) plans to spend $126 million over 7 years to expand it. The network, with an annual budget of almost $100 million, is intended to provide long distance data communications throughout the Department of Defense. DCA manages and operates the network. A detailed explanation of our objectives, scope, and methodology is in appendix I.

Results in Brief

DDN may not be the most cost effective solution to Defense long distance data communication needs. Despite this, DCA plans to spend millions of dollars to expand DDN over the next several years. Moreover, millions would have to be spent by some Defense users to make their systems compatible with DDN. Without knowing that this approach to meeting Defense communication needs is the most cost effective, such spending could prove unnecessary.

Satisfying the wide variety of long distance data communication needs of the Department of Defense is both difficult and expensive. To do so cost effectively is even a greater challenge. Since 1982, DCA has basically followed a single network approach to meeting this challenge, believing that economies of scale will result as more and more systems use the network. However, this approach is not supported by a current economic analysis evaluating alternatives to the network. Moreover, it fails to recognize that (1) cheaper alternatives to the network exist for certain systems, (2) technical incompatibilities exist between the network and some systems which would be expensive to eliminate, and (3) part of the network's user base may switch to the government's new long distance communication system, called Federal Telecommunications System (FTS) 2000.

For these reasons, we are recommending that (1) the Office of the Secretary of Defense reassess the mandated use of DDN and determine the most cost effective way to meet Defense long distance data communication needs, and (2) DCA reflect the results of this reassessment in any plans for the network's future.

Background

In 1982, the Office of the Secretary of Defense tasked DCA with providing secure, survivable, interoperable, and cost effective long distance data communication support for all Defense components' automated information systems. To accomplish this, DCA established DDN; in 1983, the then Under Secretary of Defense (Research and Engineering) mandated that all Defense components use this network. The mandate was intended to achieve economies of scale by having all Defense systems on a single, common network.

DDN is a worldwide, computer-based data communication system that uses packet switching technology. With packet switching, messages are grouped into packets or fixed-length blocks of characters for independent transmission on the network, so that a single communication channel can be shared by many users. Once the packets reach their final destination, they are reassembled into the complete message. Along the network are nodes or computers that identify, check, and route many different packets along communication lines or circuits.

DDN Growth

DDN's operations have grown significantly over the years, and more growth is forecast. To illustrate, the number of connections[1] to the network has grown from an estimated 2,156 to 3,946 or 83 percent since 1986, and it is expected to jump to 8,159 or another 107 percent over the next 6 years.

Despite this growth, satisfying all Defense users' long distance data communication needs has remained an elusive target. As of December 1989, DCA had waived[2] the mandate to use DDN for 91 systems. Generally, these waivers were granted because of technical incompatibilities between the systems and DDN. For example, 21 systems were waived

[1]An information system using DDN can have many connections (i.e., devices connected to the network). Examples of devices are host computers, front-end processors, and terminals.

[2]Waivers are temporary relief from the mandate. DCA grants them with the expectation that the reason for the waiver will be addressed, thereby allowing connection to DDN at a later date.

because DDN cannot recognize the systems' communication protocols,[3] and 13 systems were waived because DDN's communication lines could not carry the systems' volume of data traffic.

Mandating DDN May Not Be Cost Effective

The Department of Defense established DDN in part to provide its users cost effective long distance data communications. However, we question whether DDN is the most cost effective solution to Defense long distance data communication needs because (1) a current economic analysis to evaluate alternative data communication solutions does not exist, (2) less costly alternative data communication services exist for some users, (3) the network's packet switching technology is not well suited for all Defense users' needs, and (4) millions of dollars are necessary to eliminate technical incompatibilities that currently exist between the network and some users.

No Current Economic Analysis

Defense policy[4] requires an economic analysis for system development projects. These analyses identify and evaluate the relative costs and benefits of all feasible solutions to a given information problem. The policy states that these analyses should consider a full range of alternatives so that decision makers will have the information needed to select the most cost effective option available. Additionally, the policy states that such analyses apply to ongoing programs as well as new development efforts to (1) ensure that expected benefits are being achieved in the most cost effective manner and (2) determine how best to improve the program.

The Department of Defense does not have a current economic analysis evaluating alternative ways to meet the varied long distance data communication needs of its users. While an analysis was performed when DDN was conceived, 8 years have passed since then during which the communications environment has changed dramatically. Further, although DCA recently studied whether a commercially-leased replica of DDN would be a more cost effective approach, this study did not evaluate alternatives to the current, single network approach to meeting all Defense users' needs. For example, it did not consider whether it would be more cost effective for each Defense user to select a network service

[3]Protocols are rules for sending data between computers or between a computer and a communication device.

[4]Department of Defense Instruction 7041.3, Economic Analysis and Program Evaluation for Resource Management, October 18, 1972.

(government or commercial) based upon individual needs. Without an analysis of alternatives, the cost effectiveness of this current approach is unknown.

DDN Is Not Cost Effective for Some Systems

DDN is not the least costly solution to some systems' long distance data communication needs. We compared the operating costs of using DDN versus the operating costs of alternative data communication services for four Defense systems that had sought waivers from DDN. While these systems are not a statistically valid sample, and our findings cannot be projected to DDN's entire customer base, they do demonstrate that less costly communication alternatives exist. These four systems were the only ones for which cost data were available. While we did not independently validate these costs, we discussed one of the systems (Marine Corps Data Network) with DCA comptroller officials who confirmed the validity of the costs.

The data we examined are presented in Table 1. The cost of using DDN was between 39 to 558 percent higher than using alternative communication services. For example, Navy documents estimated the annual operating cost of using DDN for its Naval Facilities System to be about $1.9 million. In contrast, it reported the annual operating cost for alternative services to be about $300,000, almost one-sixth the cost of DDN.

Table 1: Comparison of the Annual Operating Cost for DDN Versus Alternative Services[a]

System	DDN Costs	Alternative Costs	Difference
Marine Corps Data Network	$4,244,400	$2,076,000	$2,168,400
Standard Depot System	957,368	588,937	368,431
Naval Facilities System	1,942,346	295,396	1,646,950
European Medical Network	420,000	302,000	118,000

[a]According to DCA waiver files as of December 1989. Cost data dated between April 1988 and February 1989.

According to DCA officials, some of the differences in operating costs can be attributed to DDN's military features,[5] such as increased network security, survivability, and interoperability.[6] In 1988, DCA estimated that

[5]We did not attempt to determine either the extent to which DDN provides these features or its users require them.

[6]Interoperability is the ability of systems to work together (e.g., to send and interpret messages, share data, etc.).

these features raised DDN's cost about 35 percent over comparable commercial services. However, Defense officials were unable to explain what might account for the remaining differences in costs shown in Table 1. Also, they stated that even if some systems are paying more for DDN than they would for alternative data communication services, this does not mean that the network as a whole is not cost effective. However, they could not provide any analysis to support this assertion.

DDN Mandated for All Users But Its Technology Not Well-Suited for Some

DDN is the mandated solution to the varied long distance data communication needs of all Defense users, even those that may not need the military features discussed above and those for which DDN's packet switching technology is not well-suited. This technology divides messages into small packets, which are transmitted separately, perhaps over different pathways, and are reassembled at their destination. It allows for efficient use of each pathway by dynamically allocating the network's capacity among the many small message units it is carrying to many different user locations. While this technology is well-suited for low to medium volumes of data transmitted intermittently (e.g., interactive queries, data entry), it is not suited for large volumes of data traffic between two locations on a continuous basis (e.g., bulk file transfers, long messages in a continuous stream). This kind of traffic is more cost effectively carried over dedicated lines or by a connection-based service. However, since cost is not a factor in deciding whether or not to use DDN, such alternatives are not considered.

We did not try to identify specific examples of DDN being misapplied in this way. However, the mandate to use DDN does not consider the characteristics of a user's work load, and using packet switching technology in this way will yield inefficiencies.

Making Some Systems Compatible With DDN Will Be Costly

Not all Defense systems are compatible with DDN. For example, some older Defense systems use versions of a particular communication protocol[7] that DDN does not recognize. As a result, DCA has waived the requirement to use the network for 21 systems that use this protocol while network enhancements are made to service them in the future. Another problem is that some Defense systems require greater capacity than DDN's 56 kilobits per second lines can accept. In particular, the Defense Logistics Agency recently consolidated its financial processing from 26 locations to six, and DDN could not support this redirection and

[7]The protocol is called synchronous terminal protocol.

concentration of data communication traffic. Similarly, the Air Force currently uses lines that have 23 times the capacity of DDN's packet switching lines to transmit scientific and graphic data. While DCA officials said that T1[8] lines are now available on a limited basis to begin addressing this problem, full T1 capability is not expected until fiscal year 1993.

Eliminating these technical incompatibilities will be expensive. In addition to the improvements in DCA's business plan, each service will have to spend millions on some of their systems' communications hardware and software. Although DCA does not know the total cost to Defense components to achieve compatibility, we found that in preparing requests for waivers from the DDN, seven Defense users estimated the cost to make their systems compatible. The costs total about $27.7 million and are shown in table 2.

Table 2: Cost to Defense Users to Make Waived Systems Compatible With DDN[a]

System	Cost
Army Standard Depot System	$502,000
Army Task Measurement and Diagnostic Equipment Recall and Control System	11,960
Air Force Strategic Air Command Digital Network	26,000,000
Navy Claimancy Accounting Consolidation	234,927
Naval Security and Investigative Command Communications Network	109,000
Navy Reserve Financial Management System	668,359
Navy Support Equipment Resources Management Information System	184,505

[a]According to DCA waiver files as of December 1989. Data dated between March 1986 and February 1989.

Expanding DDN May Not Be Warranted

DCA is one year into a 7-year, $126-million dollar business plan for expanding and enhancing DDN. The plan, which extends through fiscal year 1996, continues to build on the Department of Defense's long standing approach to meeting its long distance data communication needs—one network for all Defense users.

[8]T1 is a digital transmission line that can transmit data or voice traffic at 1.544 million bits per second. It has become a standard for high-capacity connections between users.

DCA Is Planning to Expand DDN

In January 1990, DCA updated its strategic business plan for DDN. This plan details the specific steps DCA plans to take between fiscal years 1990 and 1996. The plan calls for spending about $126 million on communication hardware and software improvements to expand and enhance the network's capabilities. The capital improvements for fiscal years 1990 and 1991 are intended to allow DCA to add 154 systems to DDN, including 12 currently waived systems.[9] These capital improvements include new and improved nodes as well as more modems and encryption devices. According to DCA officials, the capital improvements planned for fiscal years 1992 through 1996 are not tied to specific systems that DDN is expected to support, but rather are very general, historically-based projections. Appendix II gives a detailed accounting of DCA's planned investment.

Plan Does Not Reflect Impact of FTS 2000

DDN is likely to lose part of its current and projected customer base if Defense systems that do not perform command and control applications move to FTS 2000. However, DCA has yet to determine either the extent of this loss or its effect on DDN's $126 million expansion plans.

FTS 2000 is managed by the General Services Administration (GSA), and is intended to satisfy the federal government's long distance voice, data, and video telecommunications needs in the continental United States for the next 10 years. With the passage of Public Law 100-440 in September 1988, using FTS 2000 telecommunications services became mandatory for federal agencies, except for command and control applications. Although no agency is totally exempt from FTS 2000, GSA will exempt an agency if it determines that (1) an agency's requirements are unique and cannot be satisfied under FTS 2000 and (2) the agency's procurement to satisfy these unique requirements would be cost effective and not adversely affect the cost effectiveness of the FTS 2000 procurement.

Initially, the Department of Defense and GSA agreed that systems using DDN would be exempt from using FTS 2000 because these systems were transmitting data for command and control applications. However, both agencies are now reviewing this agreement, and the Office of the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) is attempting to identify systems supporting purely administrative applications (i.e., non-command and control). Once identified, these administrative systems will transfer to FTS 2000. The command

[9]The plan does not specifically provide for improvements to address the remaining 79 waived systems.

and control systems, however, will continue to be exempt from FTS 2000. When we finished our field work in July 1990, the Office of the Assistant Secretary was still trying to identify the systems that would move to FTS 2000. While the full impact of FTS 2000 on DDN was not yet known, an Office of the Assistant Secretary official stated that some DDN users would migrate to FTS 2000, and DCA officials estimated that 25 percent of DDN's current customer base are non-command and control systems.

Conclusions

The Department of Defense's current approach to providing long distance data communications—using a single network design to meet heterogeneous user requirements—may not be cost effective. Moreover, the impact that FTS 2000 will have on this approach is currently unknown. As a result, Defense plans to spend millions of dollars to build on this current approach need to be reassessed.

This approach is based on the assumption that economies of scale can be achieved if all Defense systems are mandated to use a single network. However, this assumption is not based on a current analysis showing that this is the most cost effective way to proceed in today's communications environment, and in fact some evidence exists to the contrary. For example, DCA data shows that less costly alternatives exist for some Defense users. Further, expensive modifications will be needed to achieve compatibility between DDN and some users' systems. Finally, the advent of FTS 2000 will probably cut into DDN's current and future user base. While we recognize that mandating a single network may have been appropriate 8 years ago when few communication alternatives were available, today more options are available to meet the individual needs of Defense users—options which may be more cost effective.

Recommendations

We recommend that the Secretary of Defense direct the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) to (1) perform a thorough economic analysis to determine the most cost effective way to meet Defense long distance data communication needs, and (2) require the Director, DCA to reflect the results of this analysis in any plans for DDN. At a minimum, this analysis should consider (1) discarding the policy of mandating DDN's use; (2) focusing on the needs of individual users on a case by case basis, particularly those that are not well-suited for DDN's packet switching technology; (3) recognizing the impact of some DDN users switching to FTS 2000; and (4) including cost as a factor in all decisions.

As requested by your office, we did not obtain official agency comments on a draft of this report. However, we discussed its contents with DCA, service, and Office of the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) officials, and have incorporated their comments where appropriate. As an overall comment, these officials stated that the cost data we obtained from DCA waiver files were dated; however, they were unable to provide more current data. We conducted our review from July 1989 to July 1990, in accordance with generally accepted government auditing standards.

As arranged with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the date of this letter. At that time, we will send copies to the Chairmen, House and Senate Committees on Appropriations; Chairmen, House and Senate Committees on Armed Services; Chairman, House Committee on Government Operations; Chairman, Senate Committee on Governmental Affairs; the Secretary of Defense; the Secretaries of the Air Force, Army, and Navy; the Director, DCA; and the Administrator, GSA. We will make copies available to other interested parties upon request.

This report was prepared under the direction of Samuel W. Bowlin, Director, Defense and Security Information Systems, who can be reached at (202) 275-4649. Other major contributors are listed in appendix III.

Sincerely yours,

Ralph V. Carlone
Assistant Comptroller General

Contents

Tables

Abbreviations

DCA	Defense Communications Agency
DDN	Defense Data Network
FTS	Federal Telecommunications System
GAO	General Accounting Office
GSA	General Services Administration
IMTEC	Information Management and Technology Division

Objectives, Scope, and Methodology

As part of our continuing effort to evaluate Defense information resources, we reviewed DDN's cost effectiveness and DCA's plans for expanding the network. Our objectives were to determine (1) whether DDN was providing cost effective long distance data communication services to Defense users and (2) whether DCA's plans for expanding and enhancing DDN considered the advent of FTS 2000 and were justified. In August 1990, the Chairman, Government Information, Justice and Agriculture Subcommittee, House Government Operations Committee, asked that we prepare our final report for him.

To accomplish our objectives, we reviewed legislation and Defense policy requirements related to long distance data communications, as well as recent reports and other literature addressing this subject and its use within the Department of Defense. We also analyzed DCA's 7-year strategic business plan for DDN to determine the type of capital improvements planned and the basis for these improvements. We then compared the plan to DDN's operating environment. This comparative analysis focused on examining selected systems to determine whether (1) technological incompatibilities, if any, between these systems and DDN could be cost effectively remedied, and (2) less costly alternative data communication sources existed for these systems. Our analysis also addressed the probable impact of FTS 2000 on DDN and whether the strategic business plan provided for it. We supplemented our analysis of the plan and the relationship between DDN and selected systems by interviewing (1) DCA officials responsible for managing DDN's development and operations, (2) Office of the Assistant Secretary of Defense (Command, Control, Communications, and Intelligence) officials responsible for DDN policy oversight, (3) GSA officials responsible for managing FTS 2000 and determining its effect on DDN, and (4) Marine Corps officials responsible for data communications operations.

Our analysis of selected systems was limited to systems for which the DDN mandate was waived because these are the only systems that had information on the cost of alternative data communication services and the existence of technological incompatibilities.

We performed our work between July 1989 and July 1990, primarily at the DCA headquarters in Arlington, Virginia, and the DDN project office in McLean, Virginia. Our review was conducted in accordance with generally accepted government auditing standards.

Planned Capital Improvements to DDN

Dollars in thousands				
Capital Improvement	**1990**	**1991**	**1992-96**	**Total**
Node upgrades	$1,650	$1,650	$8,250	**$11,550**
Computer and upgrade kits	1,500	1,500	5,670	**8,670**
High capacity nodes	200	200	1,250	**1,650**
Mini-terminal access controllers	201	141	475	**817**
Encryption devices	0	4,182	10,119	**14,301**
Minor equipment	3,400	2,900	11,600	**17,900**
Low-cost encryption devices	202	176	775	**1,153**
Modems	2,062	1,297	5,615	**8,974**
Special host gateways	485	260	2,080	**2,825**
Node installation	628	628	2,831	**4,087**
Node removals	70	70	350	**490**
Classified improvements	6,653	8,214	38,810	**53,677**
Total	$17,051	$21,218	$87,825	**$126,094**

Major Contributors to This Report

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