Problems And Progress Of The U.S. Army Materiel Command's Automated Data Processing Service Center Concept

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Department of the Army

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

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The Honorable Frank E. Moss
United States Senate
The Honorable Bill Nichols
House of Representatives
The Honorable Wayne Owens
House of Representatives
The Honorable John B. Breckinridge
House of Representatives

This is our report on the U.S. Army Materiel Command's automated data processing service center concept. We made our review pursuant to your requests. We do not plan to distribute this report further unless you agree or publicly announce its contents. Officials of the U.S. Army Materiel Command reviewed the contents of this report and we have included their comments.

Comptroller General
of the United States

Contents

ABBREVIATIONS

SPEED	System-wide Project for Electronic Equipment at Depots
SPEEDEX	System-wide Project for Electronic Equipment at Depots Extended

COMPTROLLER GENERAL'S REPORT

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D I G E S T

WHY THE REVIEW WAS MADE

At the requests of Senator Frank E. Moss and Congressmen Bill Nichols, Wayne Owens, and John B. Breckinridge, GAO examined the U.S. Army Materiel Command's automated data processing service center concept to ascertain whether

--centralization of automated data processing operations as planned by the Army would result in expected economies and

--the System-wide Project for Electronic Equipment at Depots Extended (SPEEDEX) would enable functional managers to more effectively perform their duties.

During fiscal year 1973, SPEEDEX's annual operating costs exceeded $34 million and, for fiscal year 1974, are estimated to have been more than $36 million. Although under development since 1966, the SPEEDEX system is not yet fully operational.

SPEEDEX was conceived as a standardized, but decentralized, system with each major depot having its own computer. Data included in the system covered the full range of depot activities; i.e., supply, maintenance, and administration.

In 1972 the Command adopted a service center plan for its depots which called initially for the formation of automated data processing service centers at three major depots within the continental United States. These centers were to provide centralized computer processing support for the Command's depot system. The plan envisions centralizing 13 other service or support-type functions, including comptroller, civilian personnel, and property disposal.

FINDINGS AND CONCLUSIONS

Is SPEEDEX efficient and effective?

SPEEDEX affects the Army's entire logistical mission. Developing and implementing SPEEDEX is a large, complex, and demanding undertaking. Difficulties in designing, developing, and implementing SPEEDEX are to be expected, because of the high degree of integration demanded by the functional user and the service center concept.

During system development and implementation, the Command has actively sought solutions to the numerous problems encountered and often resolved them.

However, the fact remains that even though extensive time and effort has been expended by the Command in developing SPEEDEX, the system continues to be burdened with a

combination of computer equipment and computer program problems.

The frequency and magnitude of these problems have limited the system's efficiency and effectiveness for the functional manager. For example, the computer equipment is extremely sensitive to minor power fluctuations lasting a half second or less. (See p. 13.) This problem coupled with computer programs which do not produce accurate reports or reports which satisfy functional managers' needs has limited its usefulness. (See p. 18.)

Economies Expected by the Command

As originally conceived by the Army, SPEEDEX was expected to result in annual recurring savings ranging from $6.3 to $9.7 million. (See p. 25.)

Service centering was expected to add greatly to those savings. The bulk of the recurring savings was expected to result primarily from reductions in functional and operating personnel. (See p. 28.)

However, dramatic decreases in the Command's total work force, primarily attributable to U.S. disengagement in Southeast Asia, make it appear questionable whether the Army will realize the economies expected from SPEEDEX and service centering. (See p. 29.)

SPEEDEX's lengthy development period has also reduced the expected savings. SPEEDEX was originally expected to be completed by the end of fiscal year 1972 at an estimated cost of $10.2 million. However, through August 1972 total development costs were $13.4 million and SPEEDEX had not yet been completed. (See p. 26.) An estimated 160 to 200 man-years will be required through 1975 to correct system deficiencies. Thus, development costs continue to increase. (See p. 18.)

RECOMMENDATIONS

Because of the combined effect of computer hardware and software problems, the Command should:

1. Extend the existing development contract with the vendor.
2. Reevaluate the computer configuration to realize full benefits of centralization.
3. Rebid the computer configuration.
4. Redesign the software to
   - --correct faulty program logic,
   - --make better and more efficient use of third-generation computer equipment,
   - --better meet the needs of the functional manager, and
   - --reduce the tremendous volumes of printed output. (See p. 41.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

The Department of Defense, the Army, and the Command told GAO that they propose the following ways to resolve the problems described in this report. (See pp. 41 and 42.)

First, for the time being, the Command will stop any further implementation of the service center concept. Second, the Command will

renew its contract with the Control Data Corporation for a reasonable period, to allow for the continued operation of SPEEDEX until a new system can be developed.

Third, the Command plans to reduce the time required to process data by making changes in computer operating procedures. These changes are intended to make the computer more responsive to the functional manager. Fourth, the Command plans to reduce the frequency of minor power outages by installing uninterruptible power systems (specifically dedicated storage batteries for limited standby power). Finally, the Command will refine computer programs so that the most pressing problems are corrected first and enhancements to those programs are considered second.

After meeting these objectives, the Command will develop a new system to more appropriately support depot mission responsibilities in a service center environment.

If properly followed, the Command's plan should resolve the problems described in this report. Periodically, GAO plans to continue its evaluation of the Command's implementation of these plans.

CHAPTER 1

INTRODUCTION

The U.S. Army Materiel Command is one of the Army's three major commands within the continental United States. It was organized in May 1962 to unify control over the Army's logistics function which had previously been divided among six separate technical services; i.e., Chemical, Ordnance, Quartermaster, Signal, Transportation, and the Corps of Engineers.

Today the Command consists of a nationwide network of 78 military installations, with more than 120 activities in the United States and throughout the world. The Command manages an inventory valued at about $28.3 billion, including materiel in the hands of users. It has approximately 128,200 employees, of whom more than 116,700 are civilians.

Individual installations and activities, including the depots, laboratories, arsenals, schools, maintenance facilities, and a procurement office are responsible for executing the command's mission.

THE DEPOT SYSTEM

The depot system plays a large and vital role in the Command's organization. Essentially, the depots are the backbone of the Army's supply distribution and maintenance system which has the responsibility of meeting worldwide Army materiel needs. The depots are responsible for receiving, storing, issuing, and maintaining most weapons, equipment, and supplies managed by the Command.

Currently, this system includes 15 depots. They represent an investment of nearly $806 million, and in fiscal year 1973 their cost of operation approached $741 million. Of this amount, $489 million, or 58 percent of the depots' total operating costs, was spent on salaries for more than 42,000 civilian employees.

The two primary functions of most depots are maintenance and supply. The depot system provides for the central workloading of the Army's maintenance operations. The U.S. Major Item Data Agency is responsible for programing and controlling the depots' maintenance workloads. This agency analyzes the Army's current and future programed maintenance workloads and

then allocates this work to the depots based on their capability, capacity, and cost effectiveness. During fiscal year 1973 the depots overhauled and repaired equipment valued at approximately $73.3 billion.

Supply operations at the depots are controlled by the Command's six commodity commands. The commodity commands are the Army's national inventory control points. For example, the Missile Command is responsible for all items related to Army missiles. These commodity commands determine requirements, procure items that are to be stored at the depots, and direct the depots when to ship items to customers. The depot commanders are responsible for storing materiel and for insuring that items are received and shipped when required. In fiscal year 1973 the depots handled over 704,000 line items and received and shipped almost 2.8 million tons of materiel.

The Command operates its depot system by centralizing administrative command and control of the depots at the Command headquarters. Consequently, each depot commander is directly responsible to headquarters for his depot's operation and performance. Depot commanders, however, are responsible for managing their installation's resources and facilities. The different mission and staff directorates in the headquarters support the depot commanders through policy, technical guidance, and problem resolution.

THE SPEED SYSTEM

The System-wide Project for Electronic Equipment at Depots (SPEED) was originally established in 1960 within the Ordnance Corps. By 1965, 10 major Army depots used the system. In general, it was an initial attempt at operating a standardized computer system within the depot structure. The system used IBM 1410/1401 computers with immediate access capability and standard programs and procedures, which were centrally maintained by the Logistic System Support Center, Chambersburg, Pennsylvania, since renamed the Logistic System Support Agency.

System development was divided into 2 phases because the 21 areas conducive to automation were just too many to accomplish in a single effort. Phase I was primarily concerned with the depots' supply mission. It included 10 applications which were developed centrally by the Logistic System Support Agency in conjunction with functional specialists. These applications were:

Shipment planning
Location and inventory
Supply performance
Maintenance rebuild and consumption data
Stock accounting
Change letters
File maintenance
Financial accounting
Automated data processing control operations
Army field stock control

During phase II, the depots were responsible for developing 11 other applications. Generally, these applications were designed to automate much of the depots' management operations, such as their maintenance production and control system, financial applications, and the internal depot supply functions. However, not all applications were implemented at all depots because of equipment saturation problems, implementation of other priority applications, and system redesign efforts resulting from changes in Army policy and procedures.

By early 1966 it became apparent that the IBM 1410/1401 equipment could no longer satisfy depot requirements. The large processing workload supporting operations in Southeast Asia and the additional requirements of changing standard Department of Defense military procedures did not permit processing of all applications. Therefore, in order to allow more time for processing supply data, the depots had to eliminate many of their other management applications. This, in addition to the fact that the equipment had been used 24 hours a day for nearly 5 years, revealed to the Command that specifications were needed for a more sophisticated computer capability. Consequently, Project SPEEDEX (SPEED Extended) was initiated.

THE SPEEDEX SYSTEM

Development of the new computer specifications used the existing systems as the foundation for SPEEDEX. The depots were responsible for developing specifications for specific application areas. A headquarters group was established in April 1966 to review, integrate, and standardize these specifications.

The three basic objectives incorporated in the specifications were to:

1. Eliminate data redundancy in computer files for two or more areas of application.

2. Integrate the depot management information systems.

3. Take advantage of the latest innovations in the computer industry so that the Army logistic system would be as responsive to the field commanders' requirements as possible.

In January 1967 the Army approved the new specifications and on May 16, 1967, released them to interested manufacturers.

Control Data Corporation, International Business Machine Corporation, and General Electric Corporation submitted equipment and software proposals by the January 17, 1968 deadline.

The proposals were evaluated and each firm was given a weighted score based on the following criteria.

Overall total cost of the proposal	80%
Software responsiveness	10
Compatibility	5
Manufacturer's support	5
Total	100%

The winning proposal, submitted by the Control Data Corporation, was then negotiated by the General Services Administration and a contract was signed March 3, 1969. It was contingent upon the equipment's successful completion of a benchmark test. The test was conducted at the vendor's Data Management Systems Laboratory, Los Angeles, California, on June 2 to 7, 1969. It was successful and a later 30-day acceptance period demonstrated that the proposed equipment could be available for data processing activities more than 95 percent of the time. The equipment was not tested under the environmental restrictions it would be subjected to by the Army. As a result, the equipment's ultrasensitivity to minor power fluctuations was not detected. The problems the Army later experienced due to the equipment's sensitivity are described on page 13.

The original equipment configuration included Control Data Model 3300 central processing units with related core, disk storage modules, and up to 11 remote terminals that were to be

located at each depot. This equipment was obtained under a lease-with-option-to-buy contract. The purchase price for the equipment was estimated at $25 million. However, the Command has continued to lease the equipment at about $11 million annually. At the time of our review, the Command was considing renewing its contract with the Control Data Corporation.

Late in 1967 the Letterkenny Army Depot, Chambersburg, was designated the prototype depot for the design and development of SPEEDEX. The Army did not officially accept the prototype computer equipment at Letterkenny until June 1970. The Command attributes much of this delay to vendor troubles encountered during benchmark tests.

The initial software package, referred to as hardcore, was placed on the prototype computer soon after its installation. In October 1970 the Army held a review of the hardcore system and discovered that computer run time was excessive. A later review resulted in conditional approval for extending the hardcore applications to only two additional depots. The Army held further reviews after the hardcore applications had been implemented at the two approved depots. Ultimately the Command received final approval to export hardcore to the remaining depots.

The Army evaluated the remaining software applications, referred to as Big 6 and follow-on, in May 1972. The Command then received approval to extend SPEEDEX.

SPEEDEX OBJECTIVES

SPEEDEX has been designed and implemented to satisfy four broad objectives: (1) to automate all essential functional areas through a greater data-processing capability, (2) to provide a faster response for information and documentation, (3) to provide continuing access to computer-stored records, and (4) to provide for a total systems design.

Achievement of the first objective depends on the acquisition of third-generation computer equipment enabling the depots to process a given workload more quickly than with second-generation computers.

To satisfy the second objective, SPEEDEX has been designed to eliminate many of the internal listings and reports functional managers had been accustomed to using under SPEED.

Consequently, the functional manager must place greater reliance on the records maintained internally by the computer.

The desirability of the third objective had previously been demonstrated in SPEED. However, in SPEED, the demand for immediate access storage had exceeded its availability. Therefore SPEEDEX was designed to greatly expand capability in this area. Numerous remote terminals, each with an inquiry capability, were to be used to preclude waiting for documentation and data to be distributed on a cyclical basis.

The final objective basically refers to an optimum systems integration. Some file integration had taken place under SPEED, but the equipment's size and capability severely limited its application. Consequently, the SPEEDEX design has emphasized file integration which tends to eliminate redundancy.

ORGANIZATIONAL RESPONSIBILITIES FOR SPEEDEX

The Logistics Systems Support Agency was assigned responsibility for developing SPEEDEX. It serves as a central systems design agency under the operational control of the Command's Director, Mangement Information Systems. The Agency began developing SPEEDEX in September 1967.

As a result of an evaluation of the 21 SPEED applications, it was determined that SPEEDEX should be extended to include all feasible depot functions.

SPEEDEX APPLICATION AREAS

In an attempt to control system development and to insure integration, the depot functions included in SPEEDEX were broadly categorized into 3 basic subsystems consisting of 16 application areas. (See app. I.) The first, the depot supply distribution system, also referred to as hardcore, includes four application areas that support the depot's receipt, storage, issuance, transportation, and quality assurance functions. The second, the depot maintenance and financially oriented systems, includes eight application areas supporting the depot's comptroller, maintenance, and work measurement activities. Six of these applications are included in one large complex and highly integrated subsystem referred to as Big 6. Within Big 6, the data generated from the operation of one

application automatically provides input data for the operation of the other applications. This high degree of integration has presented the Command with its greatest challenge in SPEEDEX systems development. The third subsystem, the depot control systems, includes four applications directed toward the management of people or equipment. These four applications do not use common files or common data elements. Consequently, they are not integrated.

SPEEDEX IMPLEMENTATION

The SPEEDEX system was planned for implementation at the depots on an incremental basis. Originally, the computer equipment was scheduled for installation at 12 depots during the period October 1968 through April 1970. However, this timetable slipped considerably due to the vendor's delays in passing benchmark tests. As a result, actual installation of the equipment was accomplished during the period June 1970 through August 1972, or about 2 years later than expected.

The application programs were extended to the depots in two phases. The first phase involved implementation of the applications required for depot supply and distribution operations and support activities. By November 1972, all the depots, except Seneca and Savanna, were employing SPEEDEX hard-core applications.

The second phase concerned implementation of the Big 6 and follow-on applications. These systems were placed in operation at the Command's major depots by July 1973.

CHAPTER 2

RECENT DEPOT MANAGEMENT CONCEPTS

Recent trends toward diminishing defense resources, reductions in force structure, and the advent of sophisticated computer systems have blended to increase the Command's incentive to increase efficiency and effectiveness by improving its depot system's operations.

Accordingly, over the past few years the Command has considered various means of changing the established depot system to optimize its operation within the limits of available resources.

DEPOT COMPLEXING

In an earlier GAO study, we noted that as early as March 1970, the Command was working on plans to restructure its depots under a concept known as depot complexing. Under this concept the Command contemplated establishing three theater-oriented depot complexes, each consisting of a headquarters depot and several member depots. The three complexes were to be located in the western, central, and eastern regions of the United States and were to support the Pacific, the U.S., and the European theaters of operation, respectively. (See app. II.) The Command reasoned that, if the right supplies were stored in the eastern complex for Europe and in the western complex for the Pacific, then considerable savings should accrue through more economical handling of materiel, both in distribution and depot maintenance. Furthermore, additional savings were expected in manpower, transportation, equipment, and tools by having several depots specialize in overhauling certain types of equipment.

Under depot complexing, one depot--designated as a headquarters depot reporting directly to the Command headquarters--controls the operations of one or more member depots and provides centralized support to all depots within the complex.

This concept was designed primarily to improve overall supply and maintenance performance by concentrating management's attention and skills at a single depot in each geographic area and directing their efforts toward a specific theater of operation. Further, depot complexing was expected to reduce administrative overhead costs by consolidating various support functions, such as finance, accounting, budgeting, fund control,

planning and production controls, procurement, and ADP at the headquarters depot.

On March 23, 1972, in a letter report (B-162394) to the Secretary of Defense, we said that the concept of creating a complex of depots with centralized management and control could result in savings but that each situation must be considered individually.

Later the Command set aside this concept in favor of the service center concept. The Command concluded that service centering could achieve the benefits of complexing without superimposing a regional command and control system on the depots, which was considered undesirable at that time.

SERVICE CENTERING

Under service centering a depot or other activity provides total or partial support to one or more other activities. Each activity, however, retains control of its operations. Basically, this involves centralizing a service or support-type function, such as data processing, at a single depot. The service center depot then performs this service for one or more other depots or other activities.

The Command's 5-year depot master plan identified 14 services or support-type functions which it believed could be centralized. They were:

Automated data processing	Force development
Comptroller	Installations and services
Civilian personnel	Depot property
Military personnel	Equipment management
Legal	Property disposal
Safety	Procurement
Information	Inspector General

Data processing was selected as the initial function to be centralized. Data processing was not only best suited to the concept but was also the function needed to implement some of the follow-on functions or services listed above.

The data processing service center plan as identified in the 5-year depot master plan called for the formation of three automated data processing service centers in the United States by fiscal year 1976 to satisfy total depot information

requirements. To facilitate theater orientation, the three service centers were to be located in the western, central, and northeastern regions of the United States. (See app. III.)

The plan also established the Sacramento Army Depot, Sacramento, California; the Red River Army Depot, Texarkana, Texas; and the Letterkenny Army Depot, Chambersburg, Pennsylvania, as the western, central, and northeastern service centers, respectively.

The selection of the above depots as service centers was determined by ranking all depots on the basis of their missions, workloads, locations, and capabilities. The choice of Letterkenny as the northeastern service center was later rescinded, but a replacement had not been named at the end of our review.

HOW DOES THE CONCEPT OF SERVICE CENTERING DIFFER FROM DEPOT COMPLEXING?

The major differences between the service center concept and depot complexing are: (1) service centering permits each depot to retain command while complexing requires centralization of command at each headquarters depot complex and (2) centralization of functions, as it applies to service centering, includes only support-type functions and not the primary mission functions, such as supply and maintenance. Complexing envisioned centralizing all depot activities.

Since both concepts are similar, we believe they offer similar potential for savings.

RELATIONSHIP BETWEEN SERVICE CENTERING AND SPEEDEX

SPEEDEX is an integral part of the Command's overall standardization program and is the standard automated data processing system for the depots. Currently, the system includes 12 Control Data Corporation model 3300 main frames which are in operation at the Army Aeronautical Depot Maintenance Center, Corpus Christi, Texas, and at the following Army depots.

Letterkenny Army Depot (2), Chambersburg, Pennsylvania
Tobyhanna Army Depot, Tobyhanna, Pennsylvania
New Cumberland Army Depot, New Cumberland, Pennsylvania

Lexington-Bluegrass Army Depot, Lexington, Kentucky
Anniston Army Depot, Anniston, Alabama
Pueblo Army Depot, Pueblo, Colorado
Tooele Army Depot, Tooele, Utah
Sacramento Army Depot (2), Sacramento, California
Red River Army Depot, Texarkana, Texas

In general, SPEEDEX was conceived as a decentralized system with each major depot having its own computer. This concept of operation, however, changed in 1971 as a result of what is now referred to as the Sierra SPEEDEX test. This test was made between the Letterkenny and Sierra Army Depots from October through December 1971. It proved that existing communications and computer technology could provide the foundation for the service center concept.

Soon after the Sierra test, the Command decided to test the concept of data processing service centering in an operational environment. To do this, the Sharpe Army Depot was satellited on the Sacramento Army Depot by using remote devices. In this instance, Sacramento acted as the service center for Sharpe.

As a result of the test, the concept of service centering was formalized and eventually adopted. The plan called for centralizing the 12 existing SPEEDEX computers at the 3 service centers. At those depots where the computers were to be moved to the central site, remote input/output devices needed to handle data processing were to be installed and access provided to one of the service centers via communication lines.

CHAPTER 3

IS SPEEDEX EFFICIENT AND EFFECTIVE?

Basically, SPEEDEX is an association of computer hardware and computer programs that encompasses a variety of logistical applications. The system was developed to increase standardization among the depots and to automate most depot operations through the use of third-generation computer equipment.

As is the case with most automated data processing systems, the efficiency and effectiveness of SPEEDEX rest primarily with its computer's ability to handle required workload and the efficiency of the programs executed by the computer. Consequently, our review of SPEEDEX was directed toward examining these two critical aspects of overall system performance.

There is no doubt that developing and implementing a data processing system that affected the Army's entire logistical mission was a large, complex, and demanding undertaking, and difficulties were to be expected. System development presents the designer with challenges, both known and unknown, which must be resolved to achieve system objectives. SPEEDEX was no exception. Throughout system development and implementation numerous problems have been encountered and many of them have been solved. For example, in an attempt to upgrade unsatisfactory computer hardware performance, the Command obtained from the manufacturer, at no additional cost, newer and more sophisticated disk storage drives than were originally specified in the contract. In another instance, the Command increased computer efficiency by upgrading a number of programs which directed the computer's internal operation.

Although the Command has actively sought to surface and resolve any problems affecting SPEEDEX, some major hardware and software deficiencies seriously endangering overall system performance still exist.

HARDWARE PROBLEMS

SPEEDEX, as conceived, required the use of sophisticated third-generation computer equipment to handle the large

processing volumes anticipated as a result of standardization and automation of all feasible depot functions.

To meet this need, Control Data Corporation's model 3300 central processing units with related core and disk storage modules were selected for SPEEDEX. The model 3300 is considered a large-scale, third-generation computer because of its speed, disk storage, and multiprograming capabilities. However, it uses transistor circuitry, normally associated with second generation computers, as opposed to the micro-monolithic (integrated) circuitry of third-generation computers. The important distinction is that transistor circuitry is more susceptible to heat failure.

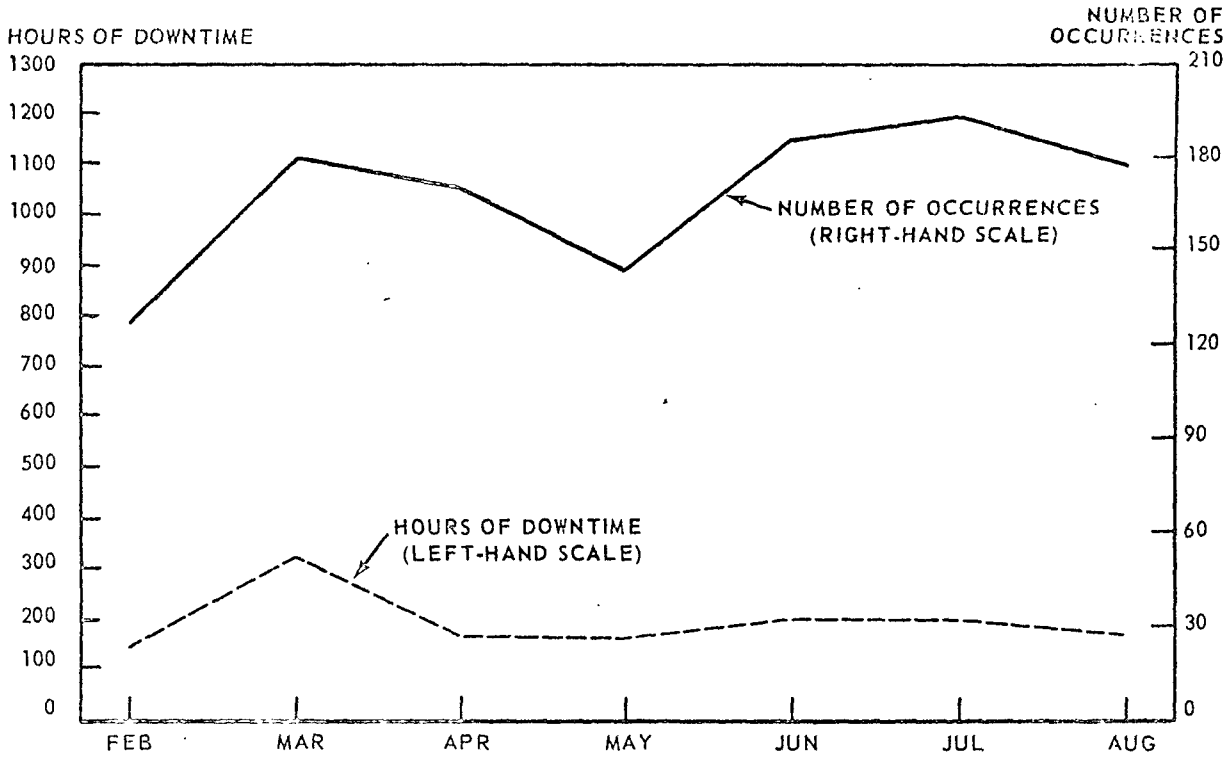
During our review, we found that the Command's experience with the model 3300 computer had been something less than expected. Basically, this assessment of the equipment's performance stemmed from the computer's extreme sensitivity to its environment. This sensitivity is characterized by the equipment's apparent inability to cope with the slightest power fluctuation.

To illustrate, a power outage of a half second, or less, will cause files and data to be lost or destroyed. Furthermore, restart from such an outage can take up to several hours and total recovery may take several weeks because of related equipment problems.

The manufacturer contends that its equipment is reliable and is meeting contract specifications because it is available for use more than 95 percent of the time. Although this is an accepted measure of an equipment's reliability, it fails to consider the amount of time required to fully recover from an equipment failure and the detrimental effect that frequent failures have on the depot's ability to process data within specified time frames.

The hardware problem (main frame) summary presented on the following page graphically portrays, for the period February to August 1973, the relationship between the number of central processing unit failures and the amount of equipment downtime.

HARDWARE PROBLEMS MAIN FRAME (3304)



Studies made by the manufacturer have shown that 98 percent of the power outages causing a computer to break down are outages that last less than a half second. Many of these short outages are absorbed by the motor-generating sets and therefore do not harm the main frame. However, the disk files are not controlled by the motor generator, and almost all power outages will cause them to electronically become disconnected from the computer and to lose data stored on the file or being transferred from the file to the computer or from the computer to the file. The effect this type of fluctuation has on data being written on the files is a primary concern. The chance of writing altered data because of a power fluctuation is extremely high. As the depots have discovered, a considerable number of man-hours and amount of rerun time can be spent correcting problems associated with data errors.

Power failures lasting longer than a half second can cause extensive problems to all areas of a computer system. These problems are primarily caused by heat. When a system is powered down normally, the built-in fans continue to operate, which allows a reasonable cooling-off period. When

a power failure or fluctuation occurs, the computer's fans and air-conditioning are unable to function. This inevitably results in overheating, which weakens the computer's electronic components. The transistor circuitry common to the model 3300 is subject to rapid changes in temperature cycling, which often causes transistors to fail prematurely. This leads to the ruining of data on the files. It may be weeks after a power failure or fluctuation before the altered data can be detected. This, of course, is a source of great frustration to system operators as well as to functional users, who depend on the output's daily accuracy.

Providing restart and recovery capabilities at strategic points throughout the computer programs is one way to minimize the impact of power fluctuations on data processing operations. SPEEDEX does not provide effective restart and recovery capabilities. The system is based primarily on a batch sequential mode of operation. Therefore a power fluctuation occurring 95 percent of the way through a production run can require rerunning the entire routine.

Another, but more costly, method of lessening the effects of power failures is by installing an external, uninterruptable power source, such as a battery system and/or diesel-generated power units. The Command contracted with Control Data Corporation to investigate this alternative for the Red River Army Depot, because numerous power outages had occurred there. At the conclusion of the survey, Control Data Corporation informed the Command that it would cost between $90,000 and $450,000, depending on the degree of security desired, to install a power source that would reduce the impact of power outages.

The hardware's configuration presents another problem. The existing SPEEDEX equipment configuration is not suitable for realizing the full benefits of the service centering concept. The SPEEDEX main frames or central processing units are not large enough to handle the known and anticipated depot workloads. To illustrate, the original SPEEDEX specifications required the system to process a depot's workload within an average 110 hours of monthly computer time. SPEEDEX now requires an average of over 591 computer hours a month to process all applications, and this is in periods when workloads are declining. The Command has recognized this critical problem and has contracted with Technalysis

Corporation for the development of a computer program that would tie two of these central processors together as an integrated system to increase the computers' data processing capability. At the end of our review, preliminary tests of this software package were being made at the Red River Army Depot and therefore results were not available.

One of the most heralded features of SPEEDEX is its expansion of remote terminal processing which was intended to eliminate the need to carry documentation back and forth between the depot computer and the work areas. However, the printing speed of the remote terminals is too slow to process existing and planned workloads. For example, large volumes of computer printouts are being trucked over 50 miles from the Sacramento Army Depot to the Sharpe Army Depot because the latter's remote printers cannot handle large-volume printing, particularly for weekend, monthend, and yearend processing. In addition, nearly 80 percent of Sacramento's materiel release orders are printed on the high-speed printers at the central site rather than at its remote printers. In our opinion, this condition, which we found at most of the depots we visited, indicates the remote printer's inability to handle current operations and, more importantly, its inability to handle large increases in processing volumes which could be expected from increased military activity.

During our review, we also found that data being introduced at the remote terminals did not always reach the central computer. This is primarily caused by the remote site-card readers' failure to read and transmit data correctly. Inadequate recovery procedures, incomplete backup files, and bad disk files are other causes of lost input.

In addition, we learned that the depots were experiencing difficulties with their terminal card punches which had a tendency to overheat after an hour's use. This rendered them inoperable and, on occasion, created lengthy delays in processing of data.

Another problem that surfaced during our review concerned the system's lack of written plans and procedures for backup support. Written plans and procedures for backup support are extremely important if the depots are to continue operations after experiencing degraded conditions. This problem becomes much more acute as applications are added and the system becomes more complex.

The individual hardware problems mentioned are not all inclusive. However, they demonstrate the critical nature and variety of hardware problems plaguing the system. To measure their effect on the system, they must be considered collectively and in conjunction with those conditions which prevail in the software portion of the system.

SOFTWARE PROBLEMS

A computer system's utility depends upon the equipment's reliability, the central processing unit's capacity, and how efficiently this capacity is used. The design and size of the computers' programs greatly affects system efficiency.

Our analysis of SPEEDEX software indicates that the portion of the system pertaining to line-item accountability of wholesale assets is performing successfully. However, our analysis of software pertaining to depot supply and maintenance management reveals major inadequacies which prevent attaining depot supply and maintenance management objectives.

In a recent projection, the Logistic System Support Agency estimated that an additional 160 to 200 man-years of effort through 1975 will be required to correct known system software problems and to get the system to do what it was intended to do.

The major software problems identified during our review were: computer processing was not timely, application software was unstable, application software produced inaccurate reports, and the system did not satisfy functional users' needs in many respects. A discussion of each of these problems follows.

Computer processing was not timely

During our review, we found that software problems, combined with repeated hardware failures, seriously impaired the timely processing of depot workloads. A great many depot operations, including preparing vast volumes of printed output, are being processed at the central computer site. Consequently, the system is extremely sensitive to any fluctuations in workload. For example, all payroll transactions; all job accounting information; and many different daily, weekly, and monthly reports are handled at the central site. When the frequency of hardware failures due to power fluctuations is also considered, the central computer site becomes saturated and can recover only by delaying or canceling production runs or cycles. These delays and cancellations seriously impaired routine depot operations.

Officials at Anniston Army Depot told us that the lack of timely management data that should have been provided by

SPEEDEX greatly affected their performance. This was a particularly serious problem during the period April through August 1973. During that period, SPEEDEX reports were late 100 of the 153 days, or more than 65 percent of the time. These delays ranged from 1 to 23 days, and as a result:

--Depot maintenance production had to be curtailed due to the manager's inability to requisition and distribute parts and materials when needed.

--General fund accounting records had to be processed on another computer because SPEEDEX data was late.

--Manual records had to be kept to control Army industrial funds and to schedule maintenance repair workloads. The data should have been provided through SPEEDEX.

--The Major Item Data Agency work authorizations were not processed within the required 5-day limit. This resulted in duplicate processing.

--Up to 42 maintenance employees had to be used to manually search property receipts and storage locations to locate needed repair parts.

--Maintenance employees worked 4,634 overtime hours.

--Delays in receiving the parts analysis report caused some repair parts to be reported as "line stoppers" even though they had been received. Minimizing the effect on maintenance operations took a great deal of manual effort.

Equipment downtime was again identified as one of the key factors contributing to the delay experienced by users in receiving SPEEDEX output.

Another factor adversely affecting the depots' efficient operation is missed synchronization of processing cycles. An important part of the depot's supply mission is insuring the timely processing of materiel shipments. When SPEEDEX was designed, a synchronized system was developed that established specific schedules for processing materiel release orders received from the various inventory control points. When these processing cycles are not met on time, supply

performance is degraded. For example, we found that the Anniston Army Depot had experienced delays in receiving parts and parts status information as a result of missed synchronization with inventory control points. This led to the resubmission of parts requirements and resulted in issuing duplicate repair parts. Delays in receiving necessary daily information at the inventory control points prevented them from detecting the duplication until after the parts had been shipped.

Hardware problems repeatedly impaired the timely processing of depot workloads. For example, at Tooele Army Depot, during the 6-month period, January to June 1973, hardware problems were the primary cause of 70 of 308 scheduled material release order processing cycles being either late or completely canceled. This represents almost 23 percent of the scheduled cycles. Also, at Tooele this condition was further compounded by a software problem related to the handling of data from remote terminals. In this instance, 51 percent of the user inquiries made through remote terminals took 1 day or more to obtain a response. This was not responsive to the users' needs. The system development plan intended immediate responses to inquiries from remote cathode-ray tube devices and responses in less than 1 day for remote batch inquiries from punchcard equipment. Processing specific transactions was delayed until those responses were received.

Application software was unstable

After more than a year of operation, 1,150 changes to correct reported or known problems were made to SPEEDEX programs during the 3-month period June through August 1973. These included 272 changes to the hardcore subsystems, 816 changes to the Big 6 subsystems, and 62 changes to other follow-on subsystems. This represented more than 12 changes a day. About half of these changes were due to software problems and half were due to Army regulatory changes.

The number of software problems included in the depots' periodic reports to the Systems Support Agency and the number of depot-recommended changes to currently provided SPEEDEX output further indicate software instability.

At Tooele Army Depot we found that, for the year ended August 31, 1973, Tooele had submitted 482 problem reports to

the Systems Support Agency. At the end of our review, 83 of the problems had not been corrected. Furthermore, the Support Agency did not consider 4 of these 83 uncorrected reports as problems, although the depot did.

Recently, all depots participated in a review of SPEEDEX-provided output for the supply applications. In summary, the depots recommended to the Command that 93 reports be eliminated, revised, or added to the current SPEEDEX system. The System Support Agency and the Command have concurred in approximately 50 percent of the recommendations. They have rejected 33 percent of the depot's recommendations and are considering the remaining 17 percent. During our review depot officials interviewed in areas other than supply identified various reports (listings, inquiries, etc.) that in their opinion should also be considered for elimination, revision, or addition to the existing system. Although the SPEEDEX program testing for finance and maintenance functions has been in process for nearly 2 years and an operational environment for these functions has been maintained at a number of depots for nearly a year, software instability remains a major deficiency of the system.

Application software
produced inaccurate reports

During our review we identified a series of program logic breaks, of varying complexity, which impaired depot operations. The following examples will identify some of these problems and illustrate the chain reaction that occurs when hardware problems compound system software problems.

The maintenance planning, production, and control application provides for the automatic adjustment of depot maintenance levels to properly reflect the quantity of parts and materials needed to complete a maintenance project. Program logic is based on the assumption that future parts requirements will be similar to those quantities used in the past. Thus, the program provides for maintaining or decreasing depot maintenance parts levels. It does not, however, contain any provision for increasing the depot parts levels when requirements warrant. This can result in maintenance line shutdowns or delays, which are also referred to as line stoppers.

Line stoppers result in ineffective utilization of labor. Such labor costs are normally charged to overhead and are distributed among all future maintenance work. During our review we learned that the frequency and magnitude of these situations could force some depots to increase their billing rates to a point where they would no longer be competitive with other depots or possibly with commercial enterprises engaged in similar activities. For example, Red River Army Depot officials said that the SPEEDEX maintenance planning, production, and control application's inability to handle increased parts requirements, coupled with a parts shortage, was the main reason repair parts were not available to maintain Red River production schedules. This resulted in unproductive labor costs which would have forced Red River's overhead rate up dramatically. To avoid this and to keep its competitive position, Red River officials reclassified $945,000 from indirect expense to direct expense for unrelated maintenance projects.

SPEEDEX software also appears deficient in the logic used to fill back-ordered items. Prior to implementation of SPEEDEX, all back-ordered items were identified at the point of receipt and sent directly to the customer most in need without first placing the item in stock. Under the SPEEDEX system, however, only those incoming receipts that can be identified to specific back orders are sent immediately to the requesting activity. Receipts of back-ordered items which are not specifically tied to a customer back order are placed in stock prior to release to customers. Therefore in some instances, there is a delay in releasing back-ordered items to the requisitioner after they have been placed in stock. This is often very frustating to maintenance managers who, while awaiting arrival of a back-ordered item, make a system inquiry and find that the item is in stock. Thus, the current system not only is time consuming but also requires double handling of materials. This is partially caused by the lack of internal controls that would help insure matching back orders with materials on hand.

A further example of questionable program logic involves substitute items. We found that customer requirements frequently were back ordered even though substitute items were in stock. This was attributable to program logic which failed to identify interchangeable or substitute items.

User needs not fully satisfied

As discussed, major deficiencies exist in those applications supporting depot supply and maintenance management. As a result, we found that certain functional users were being adversely affected, some to the point where operation of manual backup systems became a necessity. For example, at Anniston Army Depot we found that 7,800 requisitions for maintenance parts had to be processed off line because of delays in receiving SPEEDEX data. This was necessary to insure availability of parts for maintenance production schedules. It also required the extensive use of maintenance personnel to manually research records to locate needed parts. Another example involves Sharpe Army Depot where parallel systems obtain valid data for many required reports because SPEEDEX data has been inaccurate. The cost of the parallel systems is estimated at about $4,300 a month. A further example involves Tooele Army Depot, where supply personnel were expending considerable manual effort preparing Government bills of lading. A limited analysis of Government bills of lading preparation revealed that 69 percent had been prepared manually. We also found that Tooele personnel were spending almost 2 hours a day to manually maintain denial statistics that were erroneously prepared by SPEEDEX.

Most depot officials questioned during our review believed that in a number of instances SPEEDEX-provided output was not satisfying their needs because it did not provide (1) certain required data, (2) data in a usable format, or (3) accurate data. The following examples illustrate these points.

During our review we found that SPEEDEX did not provide all the data required by various Army regulations. For instance, data needed to determine storage space occupancy and tonnage in storage is not included in SPEEDEX-provided output. This information is needed to complete occupancy and utilization reports. Further, SPEEDEX does not provide the ability to screen excess material for demands and report this information to the national inventory control points. This information is required by Army Materiel Command Regulation 700-1 and Army Regulations 755-1. Regarding improper format of some SPEEDEX output, we found that, under SPEEDEX, the monthly calibration performance list and the monthly calibration delinquent list were broken down by unit identification code instead of by work center-team serial number and unit

identification code which is the format in which the data is needed. This results in spending about 6 man-days a month to manually separate these reports.

CHAPTER 4

ECONOMIES EXPECTED BY THE ARMY MATERIEL COMMAND

The rationale supporting the development and implementation of a new, more sophisticated automated data processing system almost invariably depends upon both tangible and intangible benefits which are expected to accrue to the organization as a result of replacing the old system. These expected benefits are crucial to selling the new system because they must outweigh the costs of system development and existing or proposed alternatives. Therefore, it becomes imperative to quantify these expected benefits.

Expected benefits have been traditionally translated into manpower savings in the computer area. This apparently is in part tied to the commonly held belief that automation inevitably results in manpower savings and in part to the difficulty encountered in attempting to quantify other benefits which are not readily quantifiable.

The Command has attempted to quantify benefits expected from SPEEDEX on three separate occasions. The methods used in each of the three studies were similar, and the traditional approach to quantifying expected benefits was followed. Consequently, practically all the annual recurring savings projected by each of the studies is due to possible reductions in manpower. The quantified benefits of each of the studies is presented below.

Study	Annual recurring savings
Touche Ross & Co. FY 1972 Cost-Benefit Study (September 1970)	$8,330,000
Army Materiel Command automated data processing FY 1973 Cost-Benefit Study (November 1971)	9,734,000
Army Materiel Command automated data processing FY 1974 Cost-Benefit Study (March 1973)	6,338,204

Of the three studies listed above, only the most recent study recognizes savings expected from sources other than manpower. However, the study does associate all but $212,000 of the projected $6.3 million recurring savings to personnel reductions.

Also significant is the rather dramatic decrease, almost $3.4 million, in the annual recurring savings projected for SPEEDEX between the Command's fiscal year 1973 and fiscal year 1974 cost-benefit studies. Most of this reduction in benefits was due to a decrease of over $2.8 million in the savings projected for the maintenance planning, production, and control area. An Army official informed us that the recurring savings projected for the maintenance planning, production, and control area were arbitrarily reduced by 50 percent during the fiscal year 1974 study. He said this reduction was necessary because the original estimates were somewhat overstated and because all benefits would not be realized.

Also during our review, we found that the depots were required to report to the Command Headquarters all manpower reductions directly attributable to the implementation of SPEEDEX. As of October 1973, more than 18 months after the hardcore applications were implemented at all depots, only 4 had reported reductions, totaling 79 funtional (non-data-processing) personnel, as a result of the hardcore applications. On the basis of savings projected in the fiscal year 1974 automated data processing cost-benefit study, this is far less than either the 555 functional personnel reductions projected for the SPEEDEX system by fiscal year 1975 or the partial reductions of 364 personnel projected for fiscal year 1974.

SPEEDEX DEVELOPMENT COSTS

The cost of developing SPEEDEX was originally estimated at $10.2 million. This estimate included $6.1 million in civilian and military salaries for a projected 514 man-years of effort.

According to the Command, the actual cost of system development from inception to August 1972 (the latest date that such costs were available) was $13.4 million, or about $3.2 million more than expected. A 23-percent increase in the projected man-years of effort required to develop the system is primarily responsible for this increase. A breakdown of the actual costs incurred in developing SPEEDEX is presented below.

SPEEDEX Development Costs (note a)

Capital costs	$ 186,000
Civilian and military salaries	9,785,000
Computer rentals	1,314,000
Supplies	38,000
Other operating costs	2,039,000
Total	$13,362,000

[a]The above cost figures were supplied by the Command; however, they were not validated during our review.

EXPECTED ECONOMIES WITH SERVICE CENTERING

The Command's movement toward centralization of its SPEEDEX system under the concept known as service centering has, in large part, been prompted by the savings expected in both manpower and machine time.

The Command initially selected its data processing function to implement service centering. It reasoned that this area was not only the most promising from the standpoint of the benefits to be obtained but it was also the vehicle needed to centralize other functions and services.

The Command's service center plan was first formalized during 1972 in its 5-year depot master plan. In general, it called for formation of three service centers in the continental United States by fiscal year 1976. The purpose of this centralization was to permit the Command to perform its necessary depot functions with fewer resources.

In addition to the functional manpower savings projected for SPEEDEX, the original service center plan proposed savings of 418 data processing personnel and two computers. It was estimated that this would result in more than $3.7 million annual recurring savings by fiscal year 1976, as shown below:

Automated Data Processing Service Centering
FY 1976 Estimated Annual Operating Costs (notes a and b)

	(A) Normal SPEEDEX status quo	(B) SPEEDEX service centering	Difference (A minus B)
Number of personnel	[c]1,638	[c]1,220	[c]418
Personnel expense	$18,018,000	$13,420,000	$4,598,000
Communication lines	105,000	290,000	-185,000
Other (note d)	16,652,000	17,330,000	-678,000
Total	$34,775,000	$31,040,000	[e]$3,785,000

[a]From 5-year depot master plan study.

[b]Estimated one-time costs associated with data processing service centering, installation of communication lines, site preparation, and computer relocation costs that must be amortized total $221,000.

[c]At $11,000 a year.

[d]Computer rental, per diem and travel, and computer supplies.

[e]Annual operating cost reduction for FY 1976 and beyond as a result of service centering.

In July 1973 the Command reassessed the projected benefits of service centering in the light of the Atlanta Army Depot's closure and congressionally directed manpower reductions. As a result, the Command reduced its original estimate of personnel savings from 418 to 302 after full implementation of the concept. This reduced the estimated annual recurring savings by almost $1.3 million.

With regard to computer acquisition and use, the change from a decentralized concept to a centralized, or service center, concept was expected to result in eliminating the need for two computers.

Under the existing decentralized arrangement, 12 SPEEDEX computers are located at the Army Aeronautical Depot Maintenance Center and 9 of the Command's major depots. Three other depots are provided access to a computer for SPEEDEX processing via remote terminals.

Under the service center concept, SPEEDEX computers would be located at only three depots, referred to as service centers, with the remaining SPEEDEX depots having access to one of the service center's computers via remote terminals. The Command expected to need only 10 of the original 12 computers to fully implement the concept. Eliminating two of the computers was based on developing a software program that would link two or more computers together as a single entity at each service center.

During our review we were unable to assess the development of this software capability because tests had not been completed. However, we did learn that the Command estimated that it would cost about $150,000 for the Technalysis Corporation to develop this program.

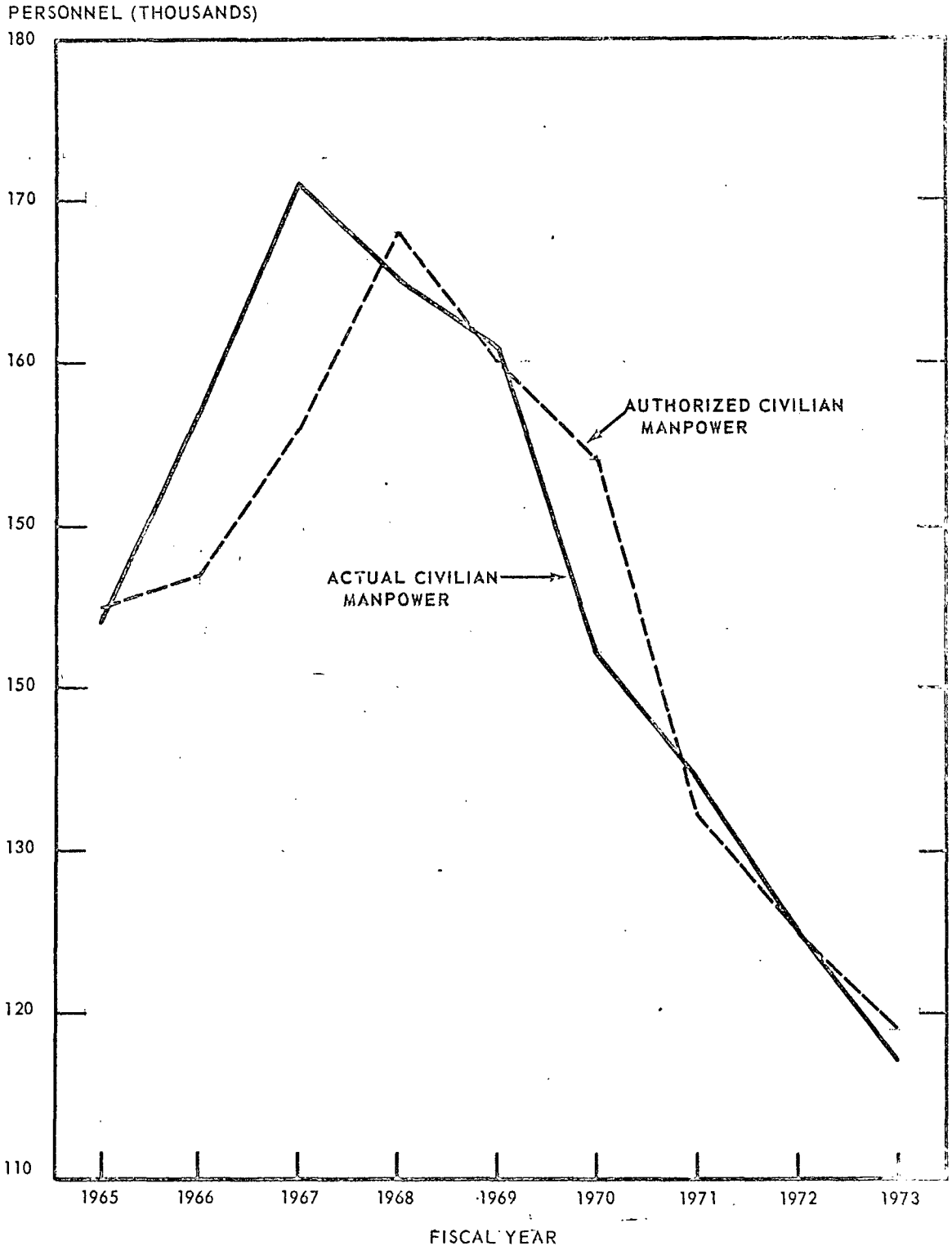
DECLINING ARMY MATERIEL COMMAND WORKFORCE IMPAIRS EXPECTED ECONOMIES

During the past decade, the Command has undergone dramatic changes in its workload and in the resources available to accomplish its mission. These changes are due primarily to U.S. involvement and disengagement in Southeast Asia during this period.

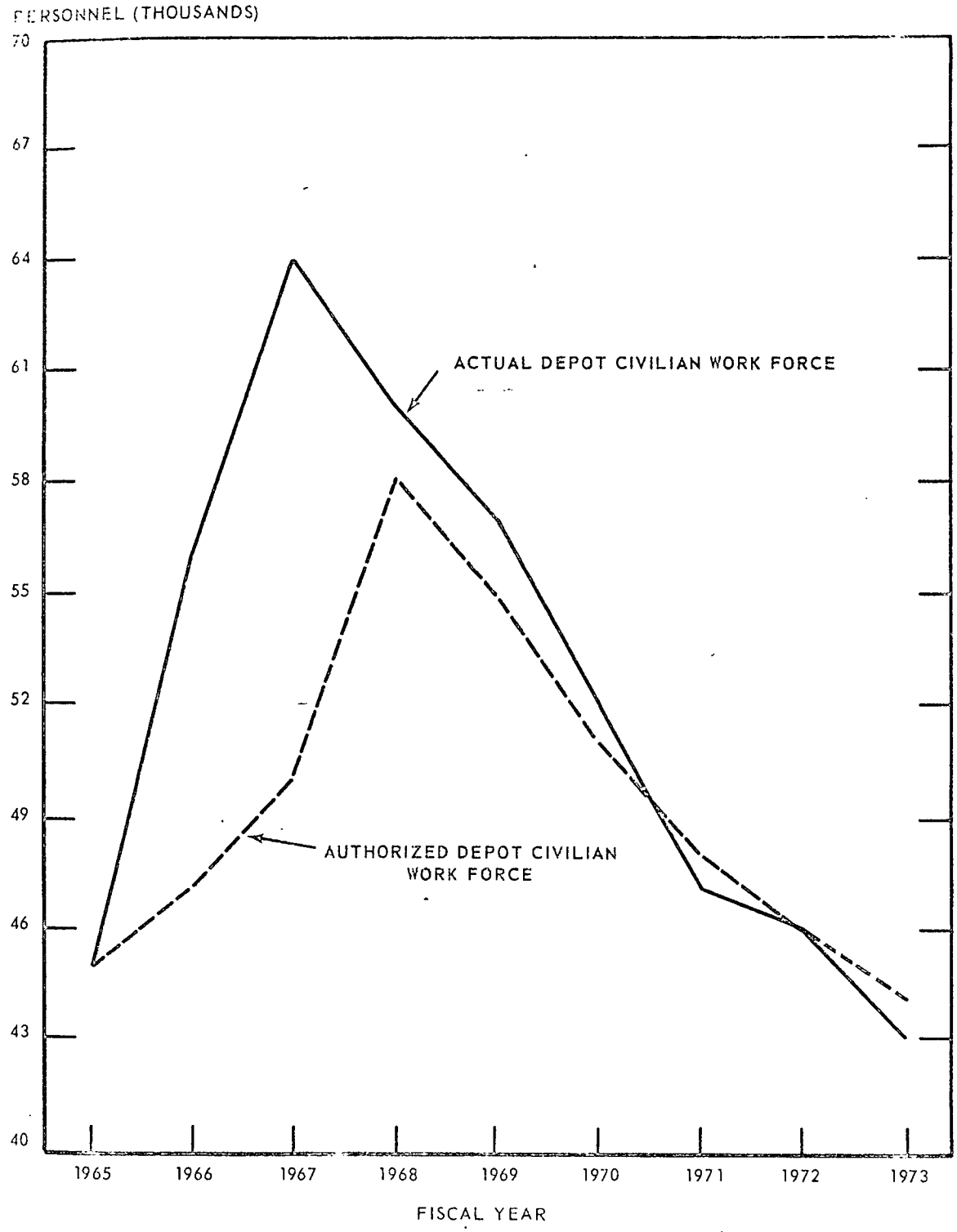
We were particularly concerned with the impact of recent trends in the Command's work force on the economies the Command expected from SPEEDEX and service centering. The following three graphs depict the magnitude of the changes that have occurred in the Command's total civilian work force, the depot's civilian work force, and the Command's management information system civilian work force since fiscal year 1965. The graphs also illustrate the trends that have developed.

The first graph shows the total work force has declined steadily from a high of nearly 171,000 in fiscal year 1967 to a low of about 116,800 at the end of fiscal year 1973. This represents a decrease of almost 32 percent during the past several years. Similarly, the depot work force has been reduced by almost one-third since reaching a high of 64,000 employees in fiscal year 1967.

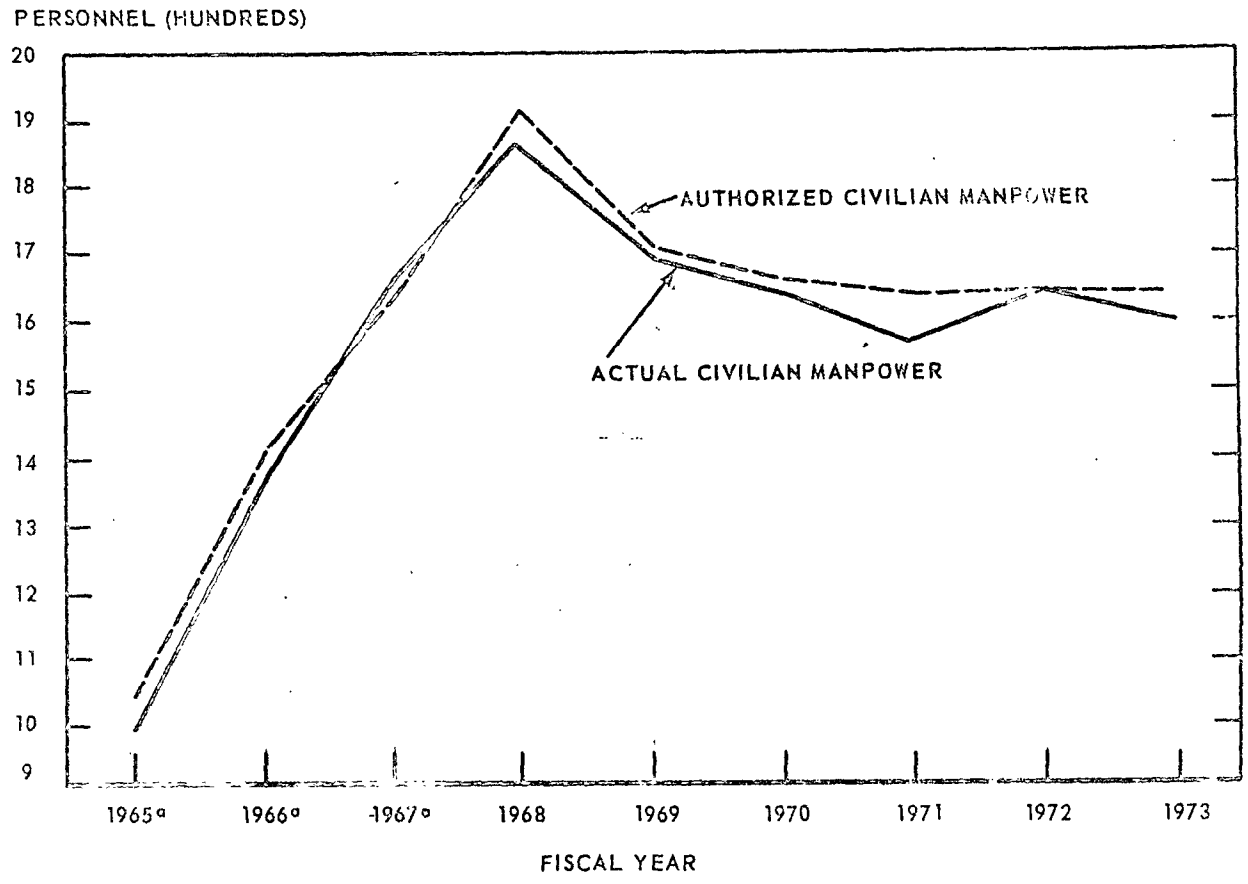
ARMY MATERIEL COMMAND'S CIVILIAN WORK FORCE



ARMY MATERIEL COMMAND'S DEPOT CIVILIAN WORK FORCE



ARMY MATERIEL COMMAND'S MANAGEMENT INFORMATION SYSTEM CIVILIAN WORK FORCE



[a] Records unavailable for Tooele and Umatilla Army Depots.

The last graph shows a decrease in the number of management information system personnel since fiscal year 1968. However, the decrease of personnel in this area has been much more gradual than the Command-wide manpower reductions.

The impact of a continuing downward trend in the work force could materially affect the projected savings for SPEEDEX and service centering. The expected savings have almost exclusively been based upon personnel reductions that the Command believes will result from the operation of SPEEDEX and centralization. Consequently, any erosion in the base line upon which these manpower savings were measured also erodes and therefore limits the magnitude of the savings.

We examined the economies projected by the Command with implementation of the service centering concept. Our analysis was limited because we could consider the effect of centralization on only two of the three proposed service centers, since the exact location of the northeastern center had not yet been determined.

To determine the impact of currently directed Command-wide manpower reductions on the savings expected from service centering, we made separate evaluations for the Sacramento and Red River Service Centers. The first analysis was based on actual staffing levels found at these two depots as of August 1, 1973. The second analysis was based on the authorized staffing for the same depots as of January 1974. Both staffing patterns were then individually compared with the Command's service center staffing model, to determine the savings in manpower that could result from service centering.

The service centering staffing model was not adjusted during our analysis because it reflected the Command's best estimate of the number of data processing personnel needed to operate under a service center environment.

The results of our analysis for the proposed Sacramento and Red River Service Centers are presented below.

Sacramento Service Center Cost-Benefit Analysis
For Actual Staffing as of August 1, 1973 (note a)

Personnel spaces	Average GS level: Current DMIS (note b)	Average GS level: Service center model	Authorized staffing	Actual staffing	Service center model staffing	Projected manpower difference
Sacramento	7.15	7.51	153	154	175	+21
Sharpe	5.34	5.19	58	53	59	+ 6
Pueblo	6.66	5.27	100	104	63	-41
Tooele	6.55	5.27	150	142	63	-79
Sierra	-	-	28	28	28	-
			489	481	388	
Projected manpower reductions						-93

	Actual	Army Materiel Command model	Cost savings
Annual costs:			
Civilian personnel	$5,042,805	$3,902,285	$1,140,520
Communications	28,645	138,281	-109,636
Projected annual recurring savings			$1,030,884
Service center costs--nonrecurring:			
Site preparation--Sacramento			$ 37,000
Communications lines--connect/disconnect			2,000
Personnel relocation/termination to be incurred			488,717
Total			$527,717

[a]Automated data processing hardware rental costs and operating costs other than personnel and communications were excluded from analysis because the Command believes they will not be affected by implementation of the service center concept.

[b]Director Management Information Systems.

Sacramento Service Center Cost-Benefit Analysis
For Authorized Staffing as of January 1974 (note a)

Personnel spaces	Average GS level: Current DMIS	Average GS level: Service center model	Authorized staffing	Service center model staffing	Projected manpower difference
Sacramento	7.15	7.51	141	175	+34
Sharpe	5.34	5.19	58	59	+ 1
Pueblo	6.66	5.27	97	63	-34
Tooele	6.55	5.27	116	63	-53
Sierra	-	-	28	28	-
			440	388	
Projected manpower reductions					-52

	Projected	Army Materiel Command model	Cost savings
Annual costs:			
Civilian personnel	$4,574,284	$3,902,285	$671,999
Communications	28,645	138,281	-109,636
Projected annual recurring savings			$562,363
Service center costs--nonrecurring:			
Site preparation--Sacramento			$ 37,000
Communications lines--connect-disconnect			2,000
Personnel relocation-termination to be incurred			488,717
Total			$527,717

[a]Automated data processing hardware rental costs and operating costs other than personnel and communications were excluded from analysis because the Command believes they will not be affected by implementation of the service center concept.

The above analysis demonstrates the effect of currently directed Command-wide manpower reductions being implemented independently of SPEEDEX and service centering. Between August 1973 and January 1974, the authorized staffing of the Sacramento Service Center was reduced from 489 to 440. Consequently, there was a loss of 41 personnel positions (93 - 52) that were expected to be eliminated as a result of service centering. This reduced the estimated annual recurring savings for the Sacramento Service Center by $468,521.

Our analysis of the proposed Red River Service Center showed a similar reduction in expected economies.

Red River Service Center Cost-Benefit Analysis
Actual Staffing as of August 1, 1973 (note a)

Personnel spaces	Average GS level: Current DMIS	Average GS level: Service center model	Authorized staffing	Actual staffing	Service center model staffing	Projected manpower difference
Red River	6.56	7.51	145	149	175	+ 26
Lexington-Bluegrass	6.43	5.27	126	122	63	- 59
Anniston	6.36	5.27	120	95	63	- 32
Ardmac	5.72	5.19	118	123	59	- 64
Savanna	-	-	19	19	19	-
			528	508	379	
Projected manpower reductions						-129

	Actual	Army Materiel Command model	Cost savings
Annual costs:			
Civilian personnel	$5,241,987	$3,902,285	$1,339,702
Communications	10,250	146,444	-136,194
Projected annual recurring savings			$1,203,508
Service center costs--nonrecurring:			
Site preparation			$199,482
Communications lines--connect-disconnect			2,900
Personnel relocation-termination to be incurred			770,895
Total			$973,277

a/Automated data processing hardware rental costs and operating costs other than personnel and communications were excluded from analysis because the Command believes they will not be affected by implementation of the service center concept.

Red River Service Center Cost-Benefit Analysis
Authorized Staffing As Of January 1974 (note a)

Personnel spaces	Average GS level: Current DMIS	Average GS level: Service center model	Authorized staffing	Service center model staffing	Projected manpower difference
Red River	6.56	7.51	121	175	+ 54
Lexington-Bluegrass	6.43	5.27	96	63	- 33
Anniston	6.36	5.27	93	63	- 30
Ardmac	5.72	5.19	105	59	- 46
Savanna	-	-	19	19	-
			434	379	
Projected manpower reductions					- 55

	Projected	Army Materiel Command model	Cost savings
Annual costs:			
Civilian personnel	$4,446,302	$3,902,285	$544,017
Communications	10,250	146,444	-136,194
Projected annual recurring savings			$407,823
Service center costs--nonrecurring:			
Site preparation			$199,482
Communications lines--connect-disconnect			2,900
Personnel relocation-termination to be incurred			770,895
Total			$973,277

a/Automated data processing hardware rental costs and operating costs other than personnel and communications were excluded from analysis because the Command believes they will not be affected by implementation of the service center concept.

The preceding analysis of the proposed Red River Service Center further demonstrates that economies expected by the Command through service centering are rapidly disappearing. By January 1974, personnel savings that could be attributed to service centering at the Red River Service Center had been reduced from 129 to 55. The difference of 74 spaces (129 - 55) is the result of directed reductions in the Command's work force. Expected savings were, therefore, reduced from over $1.2 million to $407,823 annually.

WILL THE ARMY MATERIEL COMMAND REALIZE EXPECTED ECONOMIES?

In light of the foregoing analyses and after consideration of other factors impacting implementation of the service centering concept, it appears unlikely that the Command will realize all the expected economies.

Personnel savings that were expected from service centering are rapidly disappearing because of recently directed reductions in the total work force. Furthermore, additional Command-wide reductions can be expected. For example, other manpower reductions in the total work force are currently in process but their impact on service centering cannot, as yet, be determined. Nevertheless, the manpower savings projected for the Sacramento and Red River Service Centers as of January 1974 appear overstated and will remain so until the final impact of these new personnel reductions can be determined.

During our review, we also found that nonrecurring costs associated with service centering would be greater than originally expected. For example, we found that:

1. Site preparation costs for service centering were more than anticipated.

2. The cost of installing an uninterruptible power system to lessen the impact of power fluctuations and outages was estimated to range from $90,000 to $450,000 for each depot, depending on the degree of protection desired. A costly backup power source might be required for each service center to address the additional problem of survivability.

3. Developing the software program capability to link three computers was estimated to cost $150,000.

4. Telecommunication costs (circuit connect and disconnect charges) would increase if 4,800 baud communication lines were required for service centering. Also high-speed remote printers might be needed for satellited depots instead of the low-speed printers currently in use.

5. Personnel turbulence associated with service centering could adversely affect depot operations and necessitate extensive retraining. For example, many skilled SPEEDEX personnel might be unwilling to relocate as required under existing plans for service centering.

6. Initially, extensive overtime and increased work hours can be expected with implementation of the service centering concept. The extent of the problem would depend on the ease with which transition was made and the amount of retraining required. (See item 5 above.)

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The service center concept is a sound management technique that offers potential for economies when approached on a case-by-case basis. Normally, concentrating a specialized function, such as data processing, should provide some economies in equipment, facilities, and personnel. However, this attraction can be offset by inefficiencies created as a result of centralization. Therefore it is imperative that any movement toward centralization be approached cautiously and be accompanied with sufficient management attention, planning, and skill.

The Command's present plan for implementing its data processing service center concept does not take full advantage of the economies of scale normally associated with centralizing a large data processing function. This condition is somewhat understandable considering the constraints under which the present plan was apparently developed. The requirement for immediate personnel reductions and for retention of existing computer equipment placed the Command in the unenviable position of satisfying centralization requirements with existing SPEEDEX hardware which was designed for decentralized operations.

The single, most important factor affecting the Command's movement toward service centering is the current condition of the SPEEDEX system. Our review demonstrated that the existing SPEEDEX system, which is an integral part of the Command's service centering concept, is encountering many hardware and software problems that seriously impair operating efficiency and effectiveness. Since these problems are not easily resolved, SPEEDEX cannot provide the strong foundation that is required for centralization. Furthermore, any movement toward service centering without regard to the existing condition of the SPEEDEX system would magnify known problems and further jeopardize the benefits expected from centralization. The frequency of the problems encountered has already had an effect on the functional users' confidence in the system.

System software problems are a further source of difficulty. Currently, these problems are of such a magnitude that an estimated 160 to 200 additional man-years of effort will be required through 1975 to get the system to do what it was intended to do.

Resolving the Command's numerous problems effectively calls for a departure from past decisions and a recognition of centralization's differing requirements. Attempts to materially alter the existing system to conform to current constraints would not be a viable, long-term solution. Other, more acceptable alternatives are available to the Command. One such alternative would be for the Command to reconfigure and redesign the system to take full advantage of the benefits offered by centralization. We recognize that uninterrupted service must be maintained and that the Command cannot convert from one system to another overnight. Considerable planning and coordination of all persons involved is necessary so that computer equipment and computer program changes of the magnitude envisioned will take place smoothly and with little disruption to normal operations. Indefinitely extending the existing Control Data Corporation contract offers no real potential for solving the Command's current problems. However, since a change from one equipment and software to another cannot be done overnight, the existing contract should be extended only for a period long enough to reevaluate the computer configuration and to develop the necessary functional specifications for obtaining bids for equipment more suitable to the Command's needs.

RECOMMENDATIONS

We recommend that the Commanding General, Army Materiel Command, treat the existing SPEEDEX system as an interim system and design it to take full advantage of the benefits offered by centralization. This should include:

1. Extending the existing contract with Control Data Corporation for a reasonable period to allow for development of the new system.

2. Reevaluating the computer configuration required to realize the full potential of data processing centralization.

3. Rebidding the computer configuration.

4. Redesigning the software to

   --correct faulty program logic,

   --make better and more efficient use of third-generation computer equipment,

   --better meet the needs of the functional user, and

   --reduce computer runtime and the tremendous volumes of printed output.

AGENCY COMMENTS

Officials of the Army Materiel Command reviewed this report and agreed with its contents. In response to our recommendations, they have proposed the following actions.

1. Discontinue any further implementation of the service centering concept at this time.

2. Renew the contract with Control Data Corporation for a reasonable period to continue operation of SPEEDEX until a new system can be developed.[1]

3. Treat SPEEDEX as an interim system and reconfigure and redesign it, using the following approach.

   --Change system operating procedures to reduce the time required to process supply maintenance and financial transactions.

   --Improve the computer's reliability by adding uninterruptible power supply to each computer. Presently this is estimated to cost $100,000 for each depot.

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[1]As of July 3, 1974, the Command did renew its contract with Control Data Corporation.

--Refine application programs to correct faulty program logic, reduce computer runtime, and reduce the volume of printed output.

4. Following the accomplishment of the above objectives, develop a new system to more appropriately support depot mission responsibilities in a service center environment.

We have discussed the Command's proposed actions in detail and have determined that, if followed, they should minimize the problems currently being experienced in developing, implementing, and operating a service center environment for data processing activities. From time to time we intend to evaluate the Army's progress in attaining these objectives.

CHAPTER 6

SCOPE OF REVIEW

Our review was directed primarily toward assessing the reasonableness of the Command's service center concept, the validity of the economies expected with its implementation, and the condition of SPEEDEX.

We made our review at the Command's Headquarters, Alexandria, Virginia; the Logistic Systems Support Agency, Chambersburg, Pennsylvania; the Army Aeronautical Depot Maintenance Center, Corpus Christi, Texas; the Defense Commercial Communications Office, Scott Air Force Base, Illinois; and the following Army depots.

Anniston Army Depot, Anniston, Alabama

Letterkenny Army Depot, Chambersburg, Pennsylvania

Lexington-Bluegrass Army Depot, Lexington, Kentucky

New Cumberland Army Depot, New Cumberland, Pennsylvania

Red River Army Depot, Texarkana, Texas

Sacramento Army Depot, Sacramento, California

Sharpe Army Depot, Lathrop, California

Tobyhanna Army Depot, Tobyhanna, Pennsylvania

Tooele Army Depot, Tooele, Utah

At these locations, we obtained data and examined plans, documents, records, and management decisions relating to the service center concept and the SPEEDEX system. We also interviewed responsible Department of Defense, Army, and contractor officials.

SPEEDEX SUBSYSTEMS

	HARDCORE	BIG 6	FOLLOW-ON
DEPOT SUPPLY DISTRIBUTION SYSTEM:			
MATERIEL RELEASE ORDER PROCESSING	X		
STORAGE MANAGEMENT	X		
AMMUNITIONS SURVEILLANCE	X		
QUALITY ASSURANCE	X		
DEPOT MAINTENANCE AND FINANCIALLY ORIENTED SYSTEMS:			
MAINTENANCE PRODUCTION, PLANNING AND CONTROL		X	
EXPENSE APPROPRIATIONS MANAGEMENT/ ARMY INDUSTRIAL FUND FOR MAINTENANCE		X	
DEFENSE INTEGRATED MANAGEMENT ENGINEERING SYSTEM		X	
INSTALLATION DIVISION-STOCK FUND		X	
PROCUREMENT HISTORY		X	
INSTALLATION SUPPLY ACCOUNTING		X	
FACILITIES ENGINEERING WORK MANAGEMENT			X
PAYROLL/LEAVE ACCOUNTING			X
DEPOT CONTROL SYSTEMS:			
CALIBRATION			X
MANAGEMENT OF INSTALLATION OPERATING EQUIPMENT			X
ACCOUNTING FOR IN-USE NONEXPENDABLE PROPERTY			X
CIVILIAN PERSONNEL MANAGEMENT INFORMATION SYSTEMS			X

DEPOT COMPLEXING
(PROPOSED 1970 DEPOT ORGANIZATION)