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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

JUL 07 1976

LOGISTICS AND COMMUNICATIONS  
DIVISION

B-115369

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The Honorable  
The Secretary of Defense



Dear Mr. Secretary:

In May 1975 we completed a survey of data base management practices at selected Government agencies. During our survey we found indications that some of the disk drives at Defense Supply Agency (DSA) computer centers might not be needed. In July 1975 we initiated a review at DSA to determine the extent of utilization of computer disk space, a valuable and costly resource.

We found that disk space was underutilized and, consequently, this report contains recommendations to you which are set forth on page 7. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions taken on our recommendations to the House and Senate Committees on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

BACKGROUND

Five of DSA's six supply centers are equipped with one or more central processing units and related peripheral equipment. At the time of our review, the sixth center, the Defense Fuel Supply Center, did not have automatic data processing (ADP) equipment.

Each computer center has a large amount of data stored on what are known in the data processing field as magnetic disks. Magnetic disks are similar to phonograph records, except that data, rather than being recorded in grooves, is recorded magnetically on "tracks" positioned on concentric circles around the disks' centers. A number of disks are stacked together in a "disk pack" and mounted on a spindle within a "disk drive"--the device that writes data on or reads data from the disks. These components, collectively, are commonly referred to as a disk drive and will have this meaning hereinafter.

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Please Abstract

The five DSA computer centers have about 500 disk drives.

We reviewed disk space utilization at three of the centers--the Defense General Supply Center (DGSC), Richmond, Virginia; Defense Electronics Supply Center (DESC), Dayton, Ohio; and Defense Construction Supply Center (DCSC), Columbus, Ohio. At these centers disk drives make up a large part of the total ADP hardware costs. Investment in owned ADP equipment at the centers totals \$7.4 million; other equipment is rented at a cost of \$1.2 million annually. Investment in owned disk drives at the centers amounts to \$2.2 million; additional disk drives are rented at a cost of \$53,000 annually.

NEED FOR IMPROVED MANAGEMENT  
OF DISK SPACE

Using test periods that were represented to us as typifying current levels of ADP operations, we computed the utilization of disk space at the three computer centers. The computation showed that, of the space on 283 disk drives on line, space equivalent to 83 disk drives, or 30 percent, was not required to support the current levels of operations. Unused disk equipment, which represents an investment of \$808,000, could be used at other Government activities to avoid new procurements or to replace rented equipment.

Unused disk space  
at centers

With the help of ADP personnel at the computer centers, we selected a time period which was said to be representative of the centers' maximum and minimum disk space requirements. Files were stored on disks in sequential access 1/ and random access 2/ modes. To determine the amount of space needed,

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1/ Sequential access is the sequential or consecutive transmission of data to or from storage; time required for access to such data is dependent upon the location of the data in storage.

2/ Random access is the process of obtaining data from, or placing data into, storage where the time required for such access is independent of the location of the data.

we used as the space requirement for sequential files the largest number of tracks used during any day within the representative time period. For random files, we identified the largest amount of space used by the file (i.e., amount of fill) during the period and increased this amount by 15 percent in recognition of the fact that random files require some additional room to operate effectively. Total space needed was then subtracted from total space available. Using this methodology, which was agreed with by technical staffs at each center, we found that an equivalent of 83 disk drives, or 30 percent, was not being used.

The number of unneeded disk drives was established by equating unused track space on the disk packs to an equivalent number of disk drives as shown below.

	<u>DCSC</u>	<u>DGSC</u>	<u>DESC</u>	<u>Total</u>
Number of disks				
drives on line	99	72	112	283
Disk tracks available	421,635	287,928	447,888	-
Total tracks used				
(note a)	321,627	171,510	303,224	-
Number of disk drives				
required	78	45	77	200
Total tracks not used	100,006	116,418	144,664	-
Equivalent number of				
disk drives not used	21	27	35	83
Percent of disk drives				
not used	21	37	31	30

a/Includes 15 percent added to random files.

The amount of unused disk space computed above is conservative inasmuch as any current usage of disk space was considered valid even though we had evidence that some data occupying disk space should not have been stored on disks. To illustrate, at one center we found the equivalent of 1.5 disk drives devoted to files which dated back to 1969. These files were released (space made available for other use) by the center subsequent to our review. This center

also had an equivalent of 3.5 disk drives devoted to un-needed system prints 1/ and unneeded versions of working data sets. 2/ The center had, for example, 255 versions of one working data set. Center personnel expressed the opinion that any more than 40 versions of the working data set would be excessive.

The unused disk space results in considerable cost since the average cost per disk drive at DSA was \$6,926 (purchase price less rental credits). In addition, disk controllers-- hardware devices which support up to eight disk drives and are necessary to enable disk drives to function--cost an average of \$23,363 (purchase price less rental credits) per controller at the centers. As shown below, the unneeded disk drives together with disk controllers represent an investment of about \$808,000.

<u>Equipment</u>	<u>Number</u>	<u>Average cost</u>	<u>Total</u>
Controllers	10	\$23,363	\$233,630
Disk drives	83	6,926	<u>574,858</u>
<b>Total</b>			<u><b>\$808,488</b></u>

Studies and standards for disk space utilization

There was no requirement by DSA that studies of disk space utilization be made, or that available information which could be used to measure disk space utilization be reported regularly to DSA headquarters or to the Data Systems Automation Office (DSAO), a headquarters field extension which provides systems design and programming services within DSA. No studies of disk space utilization had been made at DGSC, DCSC, or DESC by either the centers, DSAO, or DSA headquarters. Functional managers, at their discretion, could review the utilization of disk space.

1/ Files of information which can be printed out and used to analyze the computer system.

2/ Collection of data temporarily reserved for intermediate results during computer program development.

There were no written criteria, either at the center or DSA level, which specified the packing density of data, i.e., the appropriate amount of disk space that should be used for storing data on disk.

How the centers  
managed disk space

Management of data files was carried out by functional managers within the Office of Data Systems at each center. It appeared, however, that as long as the functional managers had enough disk space available for their particular files there was no concern about the total amount of disk space available. In some instances, files were located on disks in such a manner that resulting free space was extremely fragmented, rendering it essentially unusable because the segments of space were too small to be allocated for use.

Actions proposed by DSA

On January 14, 1976, we discussed the results of our review with DSA headquarters officials. They advised us of proposed actions for improving management of disk space. We were told that actions have been taken or will be taken by DSA:

- To attempt to establish criteria for the level of fill for random files. This undertaking will be one of the responsibilities of the Plans and Policy Office.
- To identify data sets no longer needed through modification of the ADP system to show the preparation date of the data set.
- To reduce disk space fragmentation by considering implementing a "housekeeping" computer program.
- To manage data files from a total system concept. DSA plans to implement a data base management concept. Reviewing utilization of disk space would be one of the responsibilities of a data base manager.

These actions should improve DSA's disk management. But with regard to excess disk capacity, in a letter dated April 7, 1976, DSA told us that the currently installed disk drives should be retained to handle increased workload in

the event of mobilization or disaster. During our review, however, DSA could provide us with no information on the amount of disk space needed for this purpose or the amount of space being maintained for this purpose. Furthermore, we were told by DSA technical staff that magnetic tape, which is also used as a storage medium at each center, could be used to absorb the extra workload for short periods or until the workload leveled out.

PROPOSED ACQUISITION OF  
DISK DRIVES

DSA had a disk drive replacement program underway--replacing equipment manufactured by Potter Data Systems, Inc., with ITEL Computer Products Corporation equipment--which, if followed as originally planned, would result in about 70 percent of the space on the new disk drives not being used.

DSA planned to replace Potter disk drives with ITEL drives having substantially more storage capacity. The ITEL disk drives can store about 3.5 times as much data as the Potter disk drives. Consequently, the number of ITEL drives needed should be considerably less than the number of Potter drives presently installed. However, DSA determined that replacement would be on a one-to-one basis for random files and two-to-one for sequential files. The replacement ratio was apparently based on DSA's concern that throughput or overall performance would be reduced due to the data and work files being placed on a fewer number of ITEL disk drives. DSA, however, made no evaluation of equipment performance at various levels of storage capacity.

In a discussion with DSA officials on June 10, 1975, and in a letter dated July 25, 1975, to the Director, DSA, we questioned the acquisition of the new disk drives.

In response, DSA advised us on August 12, 1975, that (1) 8 ITEL drives would be installed at DSAO instead of 16 as previously planned, (2) 72 ITEL drives planned for installation at DESC were being deferred pending the result of additional testing at DSAO and the Defense Industrial Supply Center (DISC), and (3) as originally planned, 68 additional ITEL disk drives would be installed at DISC. The letter further stated that the purpose of installing the disk drives at DSAO and DISC was to perform a study using various levels of storage capacity. DSA advised us that the study would

clarify the costs and benefits which can be achieved at DISC and DESC and provide a sound basis for a further decision as to whether the ITEL replacement program should be continued and, if continued, how many ITEL drives will be required.

Actions by DSA

On May 18, 1976, a DSA official told us that the study had not yet been finalized, but the study thus far has shown increased throughput with fewer ITEL drives than originally anticipated. He advised us that DSA has taken action to reduce the number of ITEL disk drives presently installed at DISC and that the number of ITEL drives previously determined to be installed at other centers will also be reduced. As a result of DSA's action, annual costs under the replacement program will be reduced by \$497,700 or 38 percent.

CONCLUSIONS

At three DSA centers, we identified unused disk space equivalent to 83 disk drives. We believe DSA should study disk space utilization agency-wide and that any excess disk drives be made available for use by other Government activities. The excess disk drives could be used at other Government activities to avoid new procurements or to replace rented equipment. If DSA feels additional disk capacity should be retained for emergency requirements, we believe such needs should be documented so that they can be evaluated.

We believe insufficient attention was being given to the manner in which DSA disk space was being managed. DSA advised us of several proposed actions for improving management of disk space. We believe the actions are both timely and appropriate and, if fully implemented, should result in substantial improvement in the management of DSA's disk space.

RECOMMENDATIONS

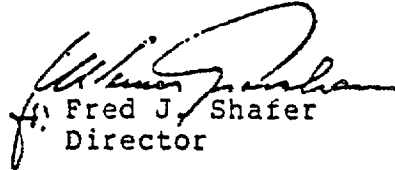
We recommend that you

- have DSA study its disk space utilization to identify disk drives excess to its needs and
- monitor DSA's proposed actions for managing disk space to insure that the expected benefits are actually obtained.

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Copies of this report are being sent to the House and Senate Committees on Appropriations; the House and Senate Committees on Government Operations; and the House and Senate Committees on Armed Services. Copies are also being sent to the Director, Office of Management and Budget, and the Director, Defense Supply Agency.

Sincerely yours,

  
Fred J. Shafer  
Director

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