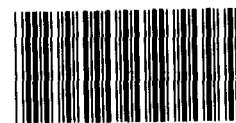United States General Accounting Office

GAO

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

September 1990

INFORMATION RESOURCES

Management Improvements Essential for Key Agriculture Automated Systems

142219

RELEASED

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Information Management and
Technology Division

B-240109

September 12, 1990

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

Dear Mr. Chairman:

After expressing interest in our ongoing work at the Department of
Agriculture's Agricultural Stabilization and Conservation Service (ASCS),
on February 14, 1990, you requested information on two major ASCS
information resources management (IRM) projects. You asked us to (1)
explain escalating costs and schedule delays for ASCS' Grain Inventory
Management System (GIMS) and Processed Commodity Inventory Man-
agement System (PCIMS), and (2) evaluate how ASCS monitors and man-
ages disk capacity to determine upgrades for minicomputers in its
approximately 2,800 county offices.

Results in Brief

Ineffective project management and oversight contributed to cost
growth, schedule delays, and important user needs not being met for the
grain and processed commodity inventory systems. Current cost esti-
mates for these systems amount to approximately $62 million, which is
almost 9 times the initial estimate of about $7 million. One system was
installed 2 years later than planned, and the other is scheduled to be
installed in July 1991, which would be almost a 6-year delay. The pri-
mary factors leading to cost increases and schedule delays were poor
initial estimates, ill-defined user requirements, an ambiguous systems
concept design, and weak change order controls. Changes in legislation
and policy also accounted for some of the cost and schedule overruns.

ASCS has drafted a request for about a $57-million increase in procure-
ment authority, primarily to purchase additional minicomputer disk
drives and computer equipment for county offices between July 1990
and September 1992. Our analysis, however, identified flaws in the
method ASCS uses to justify these purchases. On average, about 12 per-
cent of county offices' disk capacity is wasted to maintain unnecessary
files—files that should be deleted or offloaded to other storage devices.
Including these files, as well as other deficiencies, distorts projections of
future disk capacity requirements at county offices. We believe that cur-
rently available funds can cover county office disk capacity needs until

September 1992, and that the $57-million procurement request is not justified.

We are making a series of recommendations to improve the way ASCS (1) manages system development projects and (2) estimates and justifies computer needs at county offices.

Background

As an agency of the Department of Agriculture, ASCS administers farm commodity, conservation, and emergency assistance programs, including commodity loans and price support payments to farmers. To support this mission, ASCS has automated the acquisition, storage, movement, sale, and donation of grain and processed commodities inventories. ASCS also has equipped its county offices with minicomputers to help process commodity loans, pay price supports, and enroll farmers in conservation programs.

The GIMS, PCIMS, and network of county office minicomputers are critical components of ASCS' information resources management. These automated information systems directly bear on how well ASCS performs its major program responsibilities. In fiscal year 1989, ASCS' program and administrative costs amounted to some $13 billion. In addition, at the end of fiscal year 1989, ASCS' commodity inventories amounted to nearly $4 billion.

ASCS awarded a contract in 1983 to develop the two major automated inventory systems at a combined cost of about $7 million. ASCS' estimates of scheduled completion and estimated costs for GIMS and PCIMS changed substantially between 1983 and 1990. About a 2-year delay occurred in GIMS installation, and numerous enhancements were required to meet users' needs immediately after the system was installed in 1987. After the contractor completed the initial user requirements analysis and system design, ASCS terminated PCIMS' system development in 1986, only to restart it in 1987. It is still in the acceptance testing phase and is now scheduled for phased installation that ASCS expects to complete by July 1991, nearly 6 years late. The cost of both systems has grown to a current estimate of about $62 million.

Besides these two large inventory systems projects, ASCS acquired and installed IBM System 36 minicomputers in each of its approximately 2,800 county offices to support program administration and office automation. As of June 1990, ASCS had spent about $181 million to install, upgrade, and maintain these minicomputers.

ASCS originally planned for a complete equipment replacement in its county offices by the end of fiscal year 1992. According to the Assistant Deputy Administrator for Management, planning for this replacement project was begun and later postponed by top ASCS management several times because of higher agency priorities. It now expects to completely replace all existing equipment by 1996 at an estimated cost of $960 million over its 10-year life, making it one of the largest ADP projects the agency will undertake in the next few years. Delays in starting this equipment replacement have made it necessary to upgrade existing county office equipment on an interim basis until the replacement occurs. ASCS is planning to request the General Services Administration's approval of about $258 million in additional procurement authority, most of which will be used for the interim upgrades to existing equipment.

Inadequate Project Management and Oversight Contributed to Inventory Systems' Cost Growth and Schedule Delays

Federal Information Processing Standards Publications provide guidance to federal agencies for effective management of automated system development projects.[1] The principal cause of the cost growth and schedule delays was a lack of adherence to these guidelines, resulting in inadequate project management and oversight. Additional factors outside the agency's control explain some of the cost and schedule overruns, such as changes in legislation and agricultural policies.

ASCS' Shortcomings in Determining Systems Requirements

ASCS' initial attempts to determine both systems' size and scope were inadequate because it misjudged user requirements. A comparison of ASCS' original user requirements and those initially produced by the contractor demonstrates the extent of this misjudgment. The contractor's requirements showed about a 60-percent increase in the number of data entry screens and reports needed for GIMS and about a 250-percent increase in those needed for PCIMS. In other words, ASCS significantly underestimated the size of the system it needed.

One reason for this underestimate was that management did not involve key users in defining requirements. User representatives stated that

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[1] Guidelines For Documentation Of Computer Programs And Automated Data Systems, Federal Information Processing Standards Publication 38 (Feb. 15, 1976); Guidelines For Documentation Of Computer Programs And Automated Data Systems For The Initiation Phase, Federal Information Processing Standards Publication 64 (Aug. 1, 1979); Guideline For Lifecycle Validation, Verification, And Testing Of Computer Software, Federal Information Processing Standards Publication 101 (June 6, 1983).

some key users were not available because they were needed to manage an increasing work load. In addition, a division chief in ASCS' Kansas City Commodity Office said some users were not fully committed to helping identify requirements because, given past management actions, they did not believe the new system would become a reality. For example, ASCS management had terminated several previous development efforts because of conflicting demands for in-house resources and higher-than-anticipated bids for system development provided by contractors.

Lack of management control over system design changes also increased GIMS' cost. According to an internal agency document, contractor representatives stated that ASCS project managers permitted users to go unchecked in submitting modifications affecting system design after the contractor began building the system. This agency document also noted that ASCS' lack of management control over system design modifications increased system complexity and may have automated unnecessary functions with no cost-saving potential.

Poor Contract Management Contributed to System Development Problems

PCIMS' cost increases stem partially from ASCS' failure to thoroughly review the contractor's system design document before approving and accepting it. Documentation prepared by the contracting officer noted that ASCS accepted an ambiguous design that could only be corrected by additional system changes. In some instances, this may have led to the government's paying extra for functions that should have been included in the original system design because system changes late in a development effort are generally more expensive than changes made during design.

ASCS' decision to start, stop, and then restart development of PCIMS had further negative effects on the system's cost and original completion schedule. In May 1986, after the contractor prepared the requirements and design for PCIMS, ASCS terminated this project segment after considering several factors, including the contractor's estimated development cost. However, in September 1987, ASCS senior management reversed this decision and amended the contract to restart the project because the existing system technology was not meeting current needs. According to the contracting officer, the long delays between starting, stopping, and then restarting work on the contract resulted in additional costs.

Interagency Project Management Has Contributed to System Delays

ASCS waited until after awarding the development contract for PCIMS before bringing two other Agriculture agencies—the Agricultural Marketing Service (AMS) and the Food and Nutrition Service (FNS)—into the effort. According to ASCS officials, the three agencies need to share information on processed commodity inventories to accomplish their individual missions. However, the contractor noted that having three agencies involved in the project increased the system's complexity, size, and cost.

The contractor further noted that the increase in the number of participants and perspectives that had to be considered in reaching key project decisions contributed to schedule delays and cost growth. As a result, the process used to coordinate and agree on refinements to system requirements invited delays. For example, according to information provided by project management officials, lack of an effective resolution mechanism slowed the agencies in agreeing whether PCIMS would be implemented in phases or all at once.

ASCS Top Management Has Not Provided Clear and Consistent Direction

Another contributing factor to PCIMS' delay was top ASCS management's failure to provide clear and consistent direction. The Deputy Administrators for Management at AMS and FNS and the Director of ASCS' Kansas City Commodity Office, the principal user organization, identified this as a major problem. The ASCS official responsible for the project is the Deputy Administrator for Management. From 1983 to 1990, six people filled this position or served in an acting capacity. Decisions to start, stop, and then restart the development of PCIMS are attributable, in part, to decisions made by three ASCS deputy administrators for management. Overall project direction and decision making suffered from this lack of continuity in a key senior management post.

External Factors Have Played Secondary Roles in Affecting System Development

Finally, some factors outside ASCS' control contributed to the difficulty in developing the two systems. Specifically, legislation such as the Food Security Act of 1985 changed GIMS' requirements after ASCS accepted the system design. Similarly, legislative requirements such as those coming from the Prompt Payment Act and other agricultural policy changes, including commodity packaging and shipping period initiatives, affected PCIMS requirements after design acceptance. However, ASCS records and our discussions with project management officials indicate that these legislative and policy changes were not the principal causes in the two systems' cost growth and schedule delays. According to ASCS records, at

most about $7 million of the nearly $55 million in contract cost growth for both systems was due to these new requirements.[2]

Problems Remain Despite Significant Investment

GIMS is installed and operating, and several users told us that the new system is an improvement over its predecessor. Nevertheless, it does not meet some important inventory managers' needs that were deleted in 1985 to conserve contract funds. For instance, besides keying data into GIMS, users key some of the same data into separate personal computer-based systems to prepare management information reports. ASCS is also using in-house resources and another contractor to enhance GIMS to satisfy user needs that were not met when the system was implemented in 1987. Through June 1990, the agency incurred about $5 million in direct costs for in-house programmer staff and had obligated about $1 million in funds for the other contractor to continue developing and modifying GIMS.

The three user agencies have no available means to resolve potential disagreements that may arise during PCIMS acceptance testing, installation, and maintenance. According to the AMS Deputy Administrator for Management, each agency seeks its own interests rather than a common goal because the project management structure has offered no strong central control over project development. Representatives of ASCS and FNS had similar concerns.

Having an effective project management structure in place to provide direction, control, and oversight is important during the rest of the systems' implementation phases as well as the remaining phases of operation and maintenance. According to their representatives, each agency expects to correct or enhance the computer programs during the system's life cycle, but they have no final agreement on orderly and cost-effective software maintenance. Federal guidance states that establishing a structured software maintenance policy is a vital step in creating and supporting an orderly process in which all requested changes are formally submitted, reviewed, ranked, and scheduled.[3] Such a maintenance policy is necessary to ensure that all changes are reviewed for their effect on the whole system.

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[2]ASCS records indicate that at most about $5.5 million of the nearly $13.5 million cost increase for GIMS and about $1.5 million of the approximately $41.5 million cost increase for PCIMS can be attributed to new legislative requirements.

[3]Guidelines On Software Maintenance, Federal Information Processing Standards Publication 106 (June 15, 1984).

Weaknesses Exist in ASCS' County Office Minicomputer Disk Capacity Management

Just as information management weaknesses contributed to problems with ASCS' inventory systems, they present problems for enhancements being planned for its county office minicomputers. In May 1990, ASCS planned to request the General Services Administration's approval of about $258 million in additional procurement authority through December 1996. This procurement authority is mainly for more mini-computer disk drives and equipment upgrades at its county offices. To determine whether these additional purchases are justified, we examined ASCS' procedures used to manage disk capacity for its county office minicomputers. We also evaluated disk file use for each county office.

Wasteful Disk Utilization Found on County Office Minicomputers

The ASCS Kansas City Management Office (KCMO) is responsible for managing county office minicomputer disk capacity and procuring additional disk capacity for the offices. ASCS county offices are staffed with employees who do not report directly to KCMO. Most of these offices do not have staff with highly technical computer skills. KCMO centrally manages ADP support for the county offices, including procuring, writing, testing, and installing the computer software and related equipment used to perform administrative and operational functions.

In this regard, KCMO manages disk capacity at the county offices by periodically monitoring directories listing all computer programs and data files stored on the offices' disks. KCMO staff purchase, develop, and revise the software run on the county minicomputers and maintain an official list of programs and associated data files that should reside on the disks. KCMO updates this list quarterly and supplements it through discussions with programmers. KCMO compares this list against county office directories, identifies files for deletion, and tells the counties to purge these files. In addition, storage of county-generated data files, such as word processing files, is monitored by KCMO. If they are unusually large, KCMO recommends that they be off-loaded to diskettes or tape.

KCMO performs capacity management checks when county offices pass a 70-percent disk utilization threshold. KCMO purchases additional disk storage upgrades only after checking that the county disk drives do not contain program or data files that either should be deleted or off-loaded to diskettes or tape.

We examined file directories for the minicomputer disks in each ASCS county office to determine how efficiently disk space was being used. As of June 1990, computer programs and files meeting ASCS criteria for

deletion or off-loading to temporary storage devices (i.e., floppy disks or computer tape) accounted for about 12 percent of the total disk space used by all ASCS county offices.[4] On a county-by-county basis, we found that as little as 2 percent and as much as 36 percent of the disk space used was occupied by files identified for deletion or backup storage on an alternative medium. Table 1 presents a frequency distribution for specified ranges of disk space occupied by these files.

Table 1: Distribution of County Office Disk Space Occupied by Files Identified for Deletion or Alternative Storage

Percentage of disk space occupied	Number of counties
5 or less	155
6 to 10	1,241
11 to 15	982
16 to 20	321
Over 20	83
Total	**2,782**

In January 1990 KCMO took steps to improve disk capacity management procedures. For instance, it is planning to improve disk capacity management procedures by providing a computer program to assist county office staff in purging files from disks. In addition, KCMO is providing more comprehensive written guidance on methods that county employees can use to help better use and manage disk capacity.

These are positive steps, and the changes could improve the accuracy and timeliness of KCMO's disk capacity monitoring. However, it is unclear whether they will result in more effective disk space use in the county offices. The capacity monitoring process is not resulting in unneeded files (those identified for deletion or migration to other storage devices) being promptly purged on a regular basis. KCMO can tell the counties to purge unneeded files, but it is the power of KCMO to deny purchases of additional disk drives that appears to serve as the real incentive for the county offices to take disk management actions.

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[4]To identify the computer programs and files that could be deleted or temporarily removed from county office disks, we used ASCS criteria as of June 1990. (See app. III for more details.) At the completion of our audit work in August 1990, KCMO was evaluating the criteria to determine whether changes should be made.

ASCS' Projections for Interim Upgrades Are Questionable

ASCS' method for projecting future county office minicomputer disk capacity requirements is based upon current inefficient disk use. Furthermore, new farm legislation expected to be enacted soon may significantly change those requirements. As a result, ASCS lacks reliable information to justify its request for interim computer equipment upgrades.

ASCS uses a computer model to estimate its future disk storage, computer upgrade, and associated maintenance needs.[5] The model is based on historical trends in disk capacity use and estimates of disk space requirements for major new software planned for the county office minicomputers. These trends are projected into the future to identify equipment needs and support requests for procurement authority.

ASCS' projections can result in questionable results for two reasons. First, ASCS projects wasted disk space into future periods. By not eliminating these files from ASCS' projections, inaccurate estimates of disk capacity requirements and associated equipment needs occur. Second, ASCS does not use an overall file growth rate for an historical base period in projecting disk capacity for the future. Instead, ASCS uses assumptions and procedures—which are not fully documented and which we were unable to fully evaluate—that attempt to assess the impact of major new software it plans to install. However, since ASCS does not know its software plans beyond 1991, it would appear more reasonable to use an overall growth rate when projecting future capacity needs. This simple, straightforward solution assumes new software will be introduced at rates determined by previous growth patterns.

Additionally, the 1990 farm bill may require ASCS to implement new farm programs, revise some, and discontinue others. This, in turn, may affect future minicomputer disk capacity needs because of changes in number and size of files. Consequently, ASCS' future disk requirements may differ substantially from those indicated by the historical trends. To accommodate unpredictable requirements changes such as legislative modifications, ASCS now builds a 25 percent additional growth parameter into its projections at the suggestion of Agriculture's Office of Information Resources Management. This figure is based, in part, upon the agency's observation of past effects on capacity requirements resulting from legislative changes, and does not appear to be unreasonable.

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[5]Our ability to fully evaluate ASCS' model was limited because ASCS never prepared complete written documentation such as logic charts, detailed narrative descriptions, or flow charts to describe the methodology used to develop the model.

Estimates for Interim Minicomputer Upgrade Funding Through Fiscal Year 1992 Are Unreliable

As of June 1990, the agency had about $26 million remaining under its existing procurement authority for minicomputer equipment upgrades, maintenance, and software in its county offices. This authorization extends through September 1992. In May 1990 ASCS drafted procurement requests indicating the agency needed an additional $57 million in procurement authority for minicomputer equipment upgrades, maintenance, and software between July 1990 and September 1992.[6] This estimate includes about $32 million for additional disk capacity. The estimate consists of (1) an additional $53 million of additional procurement authority under the existing contract, and (2) $4 million under a new contract to get larger computers for those county offices that require more disk storage than current systems can provide.[7] But these estimates are derived mainly from the model's questionable projections.

Given our concerns with ASCS' procedure for estimating future disk storage and equipment upgrade needs, we made our own estimate. We made calculations based on more judicious disk usage and historical rates of growth for software and data files, and then used this to project future needs. (See app. III for details.) Our estimates indicate that ASCS funding requirements for minicomputer equipment upgrades, maintenance, and software for the remainder of fiscal year 1990 through fiscal year 1992 would be approximately $20 million. Our projections assume that the average disk storage trend in growth for the past 2 years would continue through 1992. If we increase our funding estimate by 25 percent to account for automation changes ASCS may face after such events as the passage of the 1990 farm bill (the practice employed by ASCS for its own funding estimates), the figure would rise to about $25 million. This increase could be met within ASCS' remaining procurement authority, eliminating the need for the additional $57 million in procurement authority ASCS is requesting.

In May 1990 ASCS also estimated that, for fiscal year 1993 through the first quarter of fiscal year 1997, it will need about $143 million for interim equipment upgrades, maintenance, software, and support services. However, we limited our estimate of ASCS' needs to the 1990 to 1992 period because the new farm bill may substantially change the agency's future equipment needs. Before the end of 1992, ASCS should be

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[6]We used ASCS actual expenditures through June 1990 and adjusted the procurement request to eliminate estimated funding needs before that date.

[7]ASCS is pursuing alternatives to acquiring these larger computers. One alternative involves changes to the IBM System 36 processors to increase the maximum disk capacity the systems can support.

able to evaluate the farm bill's impact and modify its request for procurement funds to more accurately estimate computer equipment upgrades and associated maintenance needs for fiscal years 1993 through 1996.

Conclusions

Our review of two major automation projects raises considerable question about ASCS' management of information systems development and enhancement projects. The grain and processed commodity inventory systems support an important ASCS responsibility involving the management of large commodity inventories worth billions of dollars. Poor planning, insufficient requirements analyses, and faulty contract management have kept ASCS from finishing the systems on time, staying within original cost estimates, and meeting important user needs. These problems are contributing in a major way to ASCS spending some nine times more in systems' development costs for the two projects than was originally estimated. Unless these deficiencies in information resources management are corrected, future information systems projects may suffer similar problems.

The capacity management process ASCS uses for its some 2,800 minicomputers housed in county offices across the country likewise contains deficiencies. An improved disk capacity management program would help ASCS better manage existing disk space usage and more accurately identify requirements for future disk capacity needs. Improvements in its minicomputer capacity and performance monitoring could lessen the need for the additional equipment purchases planned through 1992. Until ASCS corrects shortcomings in its disk management procedures and the methodology used to estimate future minicomputer equipment needs, risks increase that additional ASCS funding requests will not be fully justified.

More important, these problems raise concerns for ASCS' upcoming effort to replace all county office computer equipment by the end of 1996. This project will be one of the most significant automation undertakings the agency will face in the 1990s. The delay in starting this effort has resulted in the need for millions to be spent on interim computer upgrades. In constructing its approach to this major agency automation project, ASCS will need to resolve the weaknesses found in our review of important information systems development projects.

Recommendations

Because of the management and oversight problems evident in these ASCS automation projects, we recommend that the Secretary of Agriculture

- direct the Administrator, ASCS, to improve project management and oversight for new information systems development or enhancement projects by ensuring that (1) information needs are sufficiently identified to describe the scope and magnitude of software systems projects before advancing to the development phase, and (2) project size and scope are reasonably controlled;
- direct the Administrators of ASCS, AMS, and FNS to complete an agreement governing software maintenance for PCIMS and establish an effective resolution process to arbitrate interagency disagreements to ensure orderly and timely system implementation and maintenance;
- direct that ASCS' fiscal years 1990-92 funding request for county office minicomputer upgrades, maintenance, software, and other equipment be reestimated and that any additional funding needed beyond the approximately $26 million remaining in existing procurement authority be contingent upon correcting the flaws in ASCS' forecasting to more accurately estimate equipment upgrade needs; and
- direct that approval of ASCS' requests for county office minicomputer equipment procurement authority for fiscal year 1993 and beyond be contingent upon the agency's implementing a more effective disk capacity management program, as verified by the Department's Office of Information Resources Management.
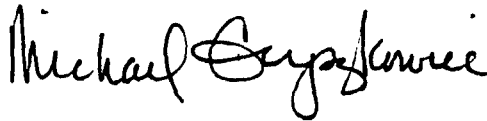
We conducted our work in accordance with generally accepted government auditing standards. The views of ASCS officials were sought during the course of our work and their informal comments were obtained on this report. We have incorporated these comments where appropriate. At your office's request, we did not obtain written ASCS comments on a draft of this report.

As arranged with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time, we will send copies to the Secretary of Agriculture, the Administrators of the Agricultural Stabilization and Conservation Service, Agricultural Marketing Service, and Food and Nutrition Service, and other interested parties. We will also make copies available to others upon request.

This work was performed under the direction of JayEtta Z. Hecker, Director, Resources, Community, and Economic Development Information Systems, who can be reached at (202) 275-9675. Other major contributors are listed in appendix IV.

Sincerely yours,

Ralph V. Carlone
Assistant Comptroller General

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Abbreviations

ADP	automated data processing
AMS	Agricultural Marketing Service
ASCS	Agricultural Stabilization and Conservation Service
FNS	Food and Nutrition Service
GAO	General Accounting Office
GIMS	Grain Inventory Management System
IBM	International Business Machines
IMTEC	Information Management and Technology Division
IRM	information resources management
KCMO	Kansas City Management Office
PCIMS	Processed Commodity Inventory Management System

Objectives, Scope, and Methodology

The objectives of our review were to provide information on ASCS' (1) contract to develop two large inventory management systems, GIMS and PCIMS, and (2) planned interim county office computer equipment upgrade. We focused on the inventory systems' original and current estimated completion dates, reasons for cost increases and schedule delays, and whether the two systems meet users' needs. We were also to provide information on the methods ASCS uses, or could use, to determine when county office computer upgrades are needed, and the actions taken or available to improve the use and extend the life of county office computer equipment.

To accomplish these objectives, we interviewed and obtained documents from officials and personnel at the Agricultural Stabilization and Conservation Service in Washington, D.C., and at ASCS' Kansas City Management Office and Kansas City Commodity Office. In addition, we interviewed Department of Agriculture Office of Information Resources Management officials, Agricultural Marketing Service officials and personnel, and Food and Nutrition Service officials and personnel in Washington, D.C.

To respond to the questions on the development of these two inventory systems, we reviewed pertinent contract, agency procurement, and systems design documents. We also reviewed documents relating to ASCS' development and installation of GIMS and PCIMS. We interviewed a contractor representative involved in these system development efforts. We also interviewed users of the systems at ASCS, AMS, and FNS to determine how well their needs are being met.

To respond to questions about the planned interim computer upgrade, we reviewed federal regulations identifying actions agencies should take in planning, acquiring, and using computer resources as part of an agency's capacity management activities. We also determined ASCS' current and planned disk capacity management activities for county office computers and the process used to determine the need for the interim computer upgrades at these sites. We analyzed the impact of improving disk management at the county offices and reviewed ASCS' methodology for projecting equipment needs. Finally, we independently estimated ASCS' future equipment funding needs.

Our audit work was conducted between September 1989 and August 1990. We performed the review in accordance with generally accepted government auditing standards.

We did not obtain official agency comments on a draft of the report. However, we discussed its contents with responsible ASCS officials, and have incorporated their comments where appropriate.

Dates of Key Events and Cost Estimates for GIMS and PCIMS

Dollars in millions

Date	Event	Estimated Cost[a]		Cumulative Total	Percentage Increase Over Initial Estimated Cost
		GIMS	PCIMS		
Dec. 1983	Contract awarded	$4.4	$2.6	$7.0	•
Jan. 1986	Additional GIMS costs after user requirements definition and design prepared	5.8	•	12.8	80
May 1986	PCIMS development terminated after user requirements definition and design prepared	•	•	12.8	80
Aug. 1986	Additional GIMS user requirements identified, plus new requirements as a result of legislation	7.7	•	20.4	190
Mar. 1987	GIMS phased installation completed	•	•	20.4	190
Sep. 1987	Contract modified to restart PCIMS and to reflect design requirements of ASCS, AMS, and FNS	•	18.9	39.3	460
Feb. 1989	PCIMS requirements identified after reviewing design and adding functions originally planned to be developed with in-house resources	•	7.1	46.4	560
Apr. 1989-July 1990	Additional PCIMS requirements identified at acceptance testing	•	6.2	52.6	650
Aug. 1990-July 1991	Planned contract increase for PCIMS implementation support	•	9.3	61.9	780
July 1991	PCIMS expected to be installed	•	•	61.9	780
	Totals[b]	$17.8	$44.1	$61.9	780[b]

[a]Represents projected cost of completion at specified time. Additionally, for ease of presentation, some events are combined and only major cost factors shown.

[b]Totals may not add due to rounding.

GAO Methodology for Estimating ASCS County Office Minicomputer Upgrade Needs

We independently estimated ASCS' minicomputer disk and associated funding needs for the remaining portion of fiscal year 1990 through fiscal year 1992. In basic terms, our methodology involved the following steps. First, we calculated the disk space currently being used by each county office, assuming the removal of files and software ASCS identified for deletion or migration to other media, such as tape drives or diskettes. Next, we calculated an estimate of disk space growth for all county offices based on historical data from the past 2 years, a period for which ASCS could readily provide the requisite data. We computed the average monthly growth in megabytes over the 2-year period and, using linear projections, estimated future county office disk storage needs through September 1992. Using these results, we estimated the cost of purchasing and maintaining additional computer equipment as well as the currently installed equipment and other related costs through September 1992. Each step is further explained below.

To determine the data and software files that could be deleted or temporarily migrated to other devices, we relied upon ASCS criteria. These files included (1) those identified by ASCS for deletion, (2) those identified by ASCS guidance as temporary files not requiring storage on disk, and (3) county office training files that ASCS instructions state can be migrated from disk when space becomes limited.

To determine the growth estimate for future disk space requirements, we obtained ASCS monthly data on average disk space use for all counties between May 1988 and May 1990. Using this information, we estimated the average amount of disk storage growth for all files at all county offices using linear regression analysis.[1] To account for differences in monthly disk space growth for individual counties, we multiplied the average growth rate by the ratio of each county's existing disk space usage to the overall average existing disk space usage requirement.[2] For example, if the average growth rate for all counties was 5 megabytes per month and the overall average existing disk usage was 500 megabytes, the estimated growth rate for a county whose existing

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[1]Linear regression analysis is a statistical technique for evaluating a linear relationship of one or more independent variables to a single continuous dependent variable. It can be used to determine the best interpretive mathematical model for describing this relationship, and subsequently estimating future values of the dependent variable. We used time series regression analysis because of the temporal ordering of the independent variables (periods of time), which allows one to see how the dependent variable (megabytes of disk space) has varied in the past and how it is likely to vary in the future.

[2]An ASCS Kansas City Management Office assistant deputy director agreed that this approach for estimating disk space growth is appropriate and should provide a reasonable estimate of ASCS' needs.

disk space usage was 400 megabytes would be 4 megabytes a month (400/500 times 5 megabytes).

We calculated each county office's disk needs for each month between June 1990 and September 1992, by (1) calculating disk space that would remain as of June 1990, after removing from each county office's disk those files ASCS has identified for deletion, and (2) increasing each office's disk space usage by the county's estimated monthly growth rate.

After computing each county office's disk space needs, we estimated the funding requirements for this period using ASCS' equipment cost information. The projected funding estimates include the cost for computer and equipment upgrades plus other costs, including the maintenance of existing and new equipment, system software, and other equipment such as printers and terminals.

Using this methodology, our estimates indicate that ASCS funding requirements for these items for the remainder of fiscal year 1990 through fiscal year 1992 would be approximately $20 million. ASCS' May 1990 draft procurement request indicates that it needs about $83 million for these items for this period. The agency has approximately $26 million in procurement authority remaining until the end of fiscal year 1992. Thus, the agency's estimates indicate that it will need an additional $57 million through the end of fiscal year 1992. Our analysis questions the validity of ASCS' estimates of additional minicomputer disk storage needs through fiscal year 1992 and the associated request for an increase in procurement authority. Our methodology assumes that the disk storage growth rate computed from the past 2-year period would continue through 1992. If we increase our estimate by 25 percent to account for new requirements imposed by imponderable events, such as passage of the 1990 farm bill (the practice employed by ASCS in its own funding estimates), our estimate would rise to about $25 million. This would be far less than the $57 million in additional procurement authority ASCS is requesting to cover July 1990 through September 1992 and would amount to about $1 million less than ASCS' remaining procurement authority.

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