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Using Micro Computers in GAO Audits: Improving Quality and Productivity

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Preface

Micro computers will play an increasingly important role in the GAO audit process over the next few years. These easy-to-use, yet powerful tools provide a means for significantly increasing productivity if used appropriately. The purpose of this paper is to provide interim guidelines to GAO evaluators to help identify when and how computers may be productively used in conducting audits and evaluations, and to avoid common pitfalls in using micros which can compromise the quality of the product.

The increased use of micro computers places an added responsibility on GAO evaluators to assure that computer generated data are accurate and reliable. Subjects such as data management, verification, review, indexing, referencing and storing of information are discussed.

The guidelines use the terms "audit" and auditing in a broad sense. They are meant to include the whole range of work which GAO does - financial, economy and efficiency, program results, program evaluation, and general management studies.

These guidelines supplement and do not replace any other GAO policies or procedures. We anticipate these guidelines will change as micro computer technology evolves over time.

We hope that readers of these guidelines will be able to better deal with and avoid quality and reliability problems in micro computer assisted audits.



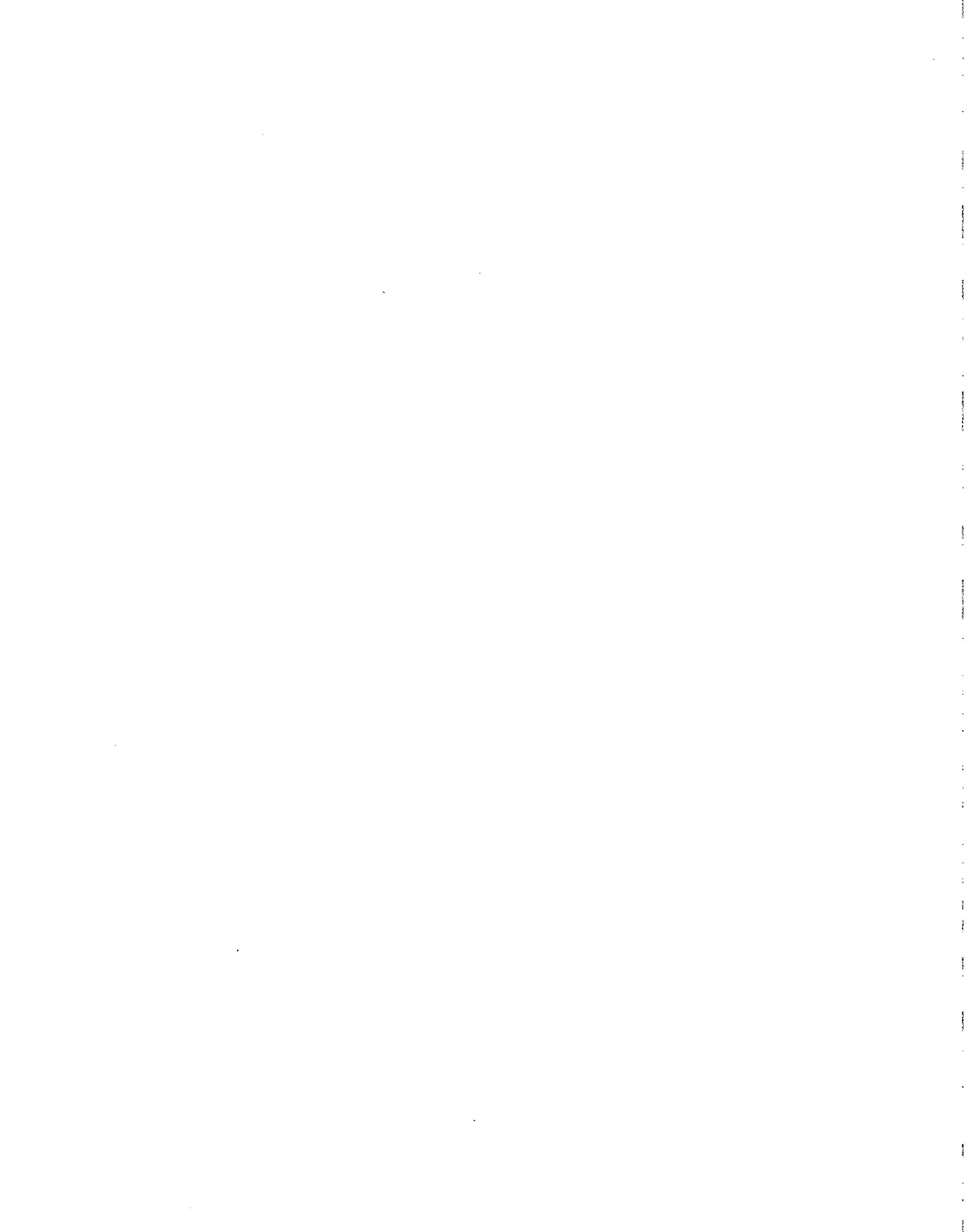
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Introduction

GAO is rapidly expanding the use of computer technology in its audits and evaluations. It is an explicit goal of the agency to make effective use of emerging information technology to improve the way we do our work and to increase office productivity. The emergence of micro computers over the past few years makes it possible to anticipate placing in the hands of all evaluators a powerful tool which can be used for virtually all aspects of the job.

Computer - Assisted Auditing in GAO

The use of computer technology in the audit process is not new. Mainframe computers have been used for a number of years for completing complex analytical tasks and for analyzing large databases from agencies being evaluated. For the most part, these computers have been used by technical specialists with special training in computer usage and analytical methods.

The special promise of micro computers is they are relatively easy to learn to use and cheap enough to make it cost effective to provide them to individuals who have little or no prior training in computer use. Software is available off the shelf for many of the types of applications which would be useful in improving the audit process. The expectation, articulated in several memos from the ACG/OPS, is that micro computers will be used by virtually everybody in GAO in the near future.

Wide-spread use of micro technology will make it possible to do work faster and at less cost. It will also permit improving the quality of analyses and reports. However, the use of micro computers and other computers by individuals without extensive specialized training raises some concerns about maintaining quality in the products of the audit process. When tools are introduced and used without detailed understanding, the potential for misapplication always exists. Errors can be introduced and automatically extended throughout an automated analysis. The auditor who is unfamiliar with data processing standards and procedures may not be able to identify problems when micros are used.

This document is designed for an audience of evaluators and supervisors. Its focus is on providing guidance to help generalist evaluators and auditors maintain quality in the audit process while improving the efficiency and effectiveness of the process

through the introduction and wide-spread use of micro and other technology. The document is structured around the major steps or phases of the audit process itself and addresses many of the issues which auditors and managers must consider when introducing micro computers into the audit environment. While it does not deal exclusively with micro computers, it clearly focuses on them. When other computers play a major role in an audit, it is likely that technical specialists will continue to have responsibility for ensuring their appropriate and proper use.

These guidelines do not replace any GAO policy, procedures or guidelines on maintaining quality in the audit process. They are based on the assumption that existing policy provides an adequate statement of requirements for quality and that these requirements are not materially changed when computers are used more extensively. This document supplements existing policy and procedures by pointing to special considerations which must be recognized when computers are used in the process.

It is anticipated that additional requirements may be needed as GAO gains more experience with micro computers. These guidelines are preliminary and are expected to evolve substantially over time.

A variety of related guidelines, manuals, aids and applications have been developed during the past year as micros were first introduced to GAO on a large scale basis. This document reflects the influence of several of these other papers. The Microcomputer Audit Guidelines, put out by the President's Council on Integrity and Efficiency in 1985, exerted a major influence on the development of these guidelines. In June, 1988 the TAG Managers Group, Quality Assurance Committee, issued a paper on Microcomputer Do's and Don'ts. This useful paper provides a number of very specific recommendations for using GAO standard software packages in the audit process. The Do's and Don'ts paper should be used as a companion document.

New and promising applications of available technology are being developed in virtually all GAO regions and divisions. Draft working documents on Electronic Workpapers developed by the Atlanta regional office and on Referencing by the Boston regional office were influential in developing this document. Applications of an IMTEC-developed document indexing system using dBASEIII; of an AFMD project management application using LOTUS; and of standard templates for workpaper preparation developed by WRO pointed to new opportunities for

increasing productivity using micros in the audit process and to related pitfalls.

Roles and Responsibilities

Responsibilities for assuring quality in the GAO audit products do not change when computers play an increasing role in the audit process. However, to help assure that computers are used to best advantage and that quality is maintained as people learn to make effective use of them, new roles have been defined within individual offices and for new units within the agency.

Divisions and Regions

Primary responsibility for ensuring the quality in the audit process rests with the divisions and regions. All of the activities related to the planning, design, execution, and management of audits have an impact on the quality of the products of the process. When micro computers are used in these activities, the individual user is responsible for making sure that quality of the product is not adversely affected as a result of computer usage. This requires that all people associated with a computer-assisted audit should have some working knowledge of micros and their use.

DMTAGs and TAGs have special responsibilities to provide assistance, as required, to maintain quality when audits involve complex technical questions which require specialized knowledge. Because, in the past, many of the computer applications required this type of specialized knowledge, TAGs have played an important role by undertaking computer analyses for particular jobs. Additionally, many TAGs have served as either a formal or informal source of training and advice on appropriate computer usage.

GAO has established a network of micro focal points to serve as the primary vehicle for introducing micro computers into divisions and regions. Each unit has selected an individual to serve as focal point; to receive early training in the use of the micros and standard GAO software; and to provide assistance to others in the unit. In some units, the micro focal point is a member of the TAG or a specialized Information Center. Other units have evaluators serving as micro focal points in addition to other audit responsibilities. Some units have also created an internal group of focal points and other micro specialists. These individuals should be consulted by audit staff in the job planning phases to obtain helpful information about potential use of micros in the audit process.

**Office of Information
Resources Management**

In 1985, a special office was established within GAO to handle information resource management for the agency. OIRM has responsibility for GAO's ADP planning activities and will be coordinating the development of a long-range plan for integrating micro and other computer resources into GAO operations.

OIRM also has a key role in the procurement of computer hardware, software, time-sharing services and ADP supplies. E serving as a point of coordination for ADP-related planning, budgeting, and procurement activities, OIRM facilitates acquisition and operation of micro computers and other computing resources.

An Information Technology Center jointly run by OIRM and OOHD provides a range of services to micro end users. Formal micro training is offered on a continual basis, with courses available on each of the GAO standard software packages. The ITC provides consultation on the use of micro computers on a walk-in basis or through a telephone hotline. It also coordinates micro focal point activities and facilitates the development of user groups. Information on a wide range of micro applications is being collected and the ITC serves as a clearinghouse for such material. This information can provide critical documentation on opportunities for increasing computer usage in the audit process and on points where problems are likely to arise.

OIRM will also coordinate research and development projects designed to identify and test promising new technology. For example, several pilot projects are currently testing various local area network and office automation options. Results from these and other R&D efforts will have an impact on future directions in the use of information technology in GAO.

Other Offices

Other offices will have special responsibilities for addressing issues related to using computers in the audit process. ACG/OPS and OP will have a role to play in determining how wide-spread computer use will change GAO policies and procedures. OOHD is developing a number of courses involving computer usage. Additionally, they are conducting studies which will help us understand how new information technology impacts on the way we work.

Building Quality In - Audit Planning Using Micros and Other Computers

Front-end Planning and Review

The importance of comprehensive planning in the audit process has long been recognized. Generally accepted government auditing standards state that audit work is to be adequately planned. Within GAO, policy and procedures have been developed to ensure that job planning constitutes an essential step in the audit process. As computers assume an increasingly important place in the audit process, careful planning takes on additional importance.

Computer usage can significantly improve the efficiency and effectiveness of the process and can be used to enhance the quality of the outcomes and products. However, like other tools which can be used to improve the way work is done, computers can be used effectively to increase productivity and improve quality or they can be used in ways which do not contribute to these objectives. The planning process should be used to ensure that every effort is made to use computer resources in conjunction with other resources to achieve the objectives of the audit process.

In audit planning, the audit team must clearly formulate the objectives of the investigation, indicating what the purposes of the effort are and what is to be accomplished. Additionally, it is important to provide estimates of the significance of the problem and the benefits that could result from addressing these issues. The audit plan must also identify how the objectives are to be realized. The job must be designed so that appropriate methods are employed at each step along the way. Without precise, unambiguous statements of objectives and proposed methods of achieving them, it is very difficult to determine how computer resources can best be utilized.

The availability of computers may have an important impact on various aspects of the job design and methodology. For example, using a computer may permit an evaluator to gather more data, or to select a more representative sample. Types of analysis which are too time consuming or difficult to do manually may be quite feasible with adequate computer resources. Thus, computer use can contribute directly to improving the quality of the work by permitting better data collection and analysis. Conversely, use of the computer can also introduce new quality assurance problems. Errors can be introduced, and if undetected, can be subsequently magnified or automatically spread through an application. If micros and other computers are to contribute

to improving the audit process, a range of issues must be addressed in job planning.

Overview of the Entire Audit Process - Comprehensive Planning

Computers can be productively used at each step of the audit process: for planning, data collection, data analysis, report drafting, review, presentation and final report. Potentially, they can also be used to automate the flow of work, integrating results from different stages of the audit process. The more extensively computers will be used, the more carefully their use should be planned. Getting the most value from available computer resources requires that they be managed like any other resource. A computer use plan developed as a part of the study design can significantly contribute to achieving the potential offered by the machines.

Because micro computers are currently a limited resource in GAO, it is important that divisions and regions consider how to allocate available equipment to best advantage and to provide relevant guidance to staff members for job planning. A key question is whether computer resources should be concentrated so that they are available as needed to a limited number of jobs or whether they should be made available to all on an equal basis. There are pluses and minuses to each approach, but units should have some basis for determining priorities.

Determining Appropriate Computer Use

As a part of the job planning process, EICs, working with TAG or DMTAG staff or micro focal points as appropriate, should consider how computer resources will be used throughout the entire job. It is important to look for ways to increase productivity through the application of available computer technology. It is also essential to estimate when it will not be cost effective to rely on computer applications.

To evaluate the potential and cost effectiveness of computer uses in the audit process requires precise definition of the total job: of its objectives; of the methodology, including precise identification of the types and sources of data to be used; of the data analysis and reporting plans. Carefully addressing these issues will provide grounds for answering a series of questions related to appropriate computer use.

1. How much of the audit process will be automated? Virtually all GAO jobs are now at least partially automated since Micros are currently used for word processing and document production.

Additionally, the predominant use of micro computers in GAO is for word processing and many individual auditors are now doing a significant amount of drafting at the keyboard. It is important to indicate whether micro use will be primarily for individual tasks, such as the preparation of individual workpapers, or whether team activities and common data resources will also be automated and shared.

In general, it is desirable to minimize the number of times that information must be entered into the computer. Rekeying of information is duplicative, time consuming and increases the possibility of introducing new errors. If information can be entered once reviewed and edited, and integrated with other information in the audit process, productivity gains are maximized. Automating the work flow as well as the individual tasks should have an impact on the time required to complete the job.

2. What tasks should be automated? In addition to word processing, a variety of other tasks in an audit may be good targets for automation. Jobs involving large data collection and analysis efforts are primary candidates. Automating these efforts can not only increase the options for analysis, but can also contribute to timely completion of the job. Investments in automating data will have significant payoffs if the data will be analyzed and examined by multiple users or many times by the same user.

3. What types of computers should be used? A variety of computers are now in use within GAO. In planning a job the EIC needs to determine what types of computers will be used for what tasks. For word processing, will micros be used in addition to Micoms? How will output from one be integrated with output from the other? Will micros handle the data analysis needs of the project or will some mix of micros and mainframes be required? Are appropriate communication links available to facilitate moving data among computers?

4. What software should be used? During the planning phase, key software needs should also be identified. It should be determined whether the standard GAO micro software packages will be sufficient for the anticipated computer uses or whether additional software will be needed. If other software will be required, is it available in an off-the-shelf version or will special programming be required?

5. Who will use the computers on the audit? It is important to consider not only which computers will be used for what purposes, but also who will be the primary users. Expectations should be clearly articulated concerning the roles and responsibilities of the evaluators, the technical assistance staff the support staff and others. If potential users are identified early enough in the process, they will have time for scheduling additional training which may be required.

6. How can coordination and compatibility be achieved and maintained throughout the course of the audit? This is a key question which should be addressed in planning for any job which will make substantial use of computer resources. The more extensive the anticipated use, and the more complex the projected applications, the more important planning and coordination of computer resource utilization become.

Factors Affecting Computer Usage

In answering the types of questions listed above several factors will have major impact.

1. Expertise of the audit team. The experience and expertise of the EIC and other members of the audit team should be a primary consideration in planning computer usage for a job. While micro computers are relatively easy to learn and use, it is important that usage plans take into account the experience of the team members and ensure that all members have training the use of the computers and software which will be used on the job. If team members are not familiar with micros, they should be provided with the opportunity for appropriate training.

2. Availability of computer specialists. More complex applications of computer technology will require that computer specialists be available as required. For some jobs, it will be sufficient to obtain the assistance of a computer specialist from the DMTAG/TAG on an occasional basis. Other applications may require that a computer specialist be available as a regular member of the audit team. As the audit becomes more fully automated, some individual with a good understanding of the technology should be assigned responsibility for coordinating computer use, managing the databases and other information and for developing special applications. databases and other information and for developing special applications.

3. Equipment availability. A major factor which may limit extensive use of computers on the job is the availability of an

adequate number of machines. Before planning for extensive use of micros on a job, it is essential to determine if appropriate machines will be available throughout the period when they are needed. If plans call for use of micros in the field, it is important that portables, preferably lap size portables, be available for the evaluator to take to the field. Relatedly, if communications between computers is important in a job, the computers to be used must be equipped with modems or linked to a communications network.

In many jobs, micros can easily be shared among team members at certain phases of the project. At other points it is essential that key people have assured use of the micro. Particularly in the writing and revision phases, significant delays can result if micros are not readily accessible, as required. Productivity gains from using computers can rapidly evaporate if there are delays while individuals wait for machines.

4. Application software. To the extent that available micro software can be used for the major applications needed for a particular audit, it may make sense to extensively automate those applications. However, if special purpose software must be acquired or developed, the cost/benefit calculations can change significantly. It is important to develop realistic estimates of how long it will take and how much it will cost to develop the specific applications identified in the planning process.

5. Special requirements. When working with classified documents or data, special consideration must be given to the requirements for automating and securing such information. Classified data cannot be stored on the same system with non-classified data, nor can it be communicated on non-secure networks.

Planning the Execution Phase of the Audit

As the audit enters the execution phase, the major decisions concerning the design of the study and resources to be allocated should have been made. These include the decisions concerning computer usage. Additional planning for project implementation should include development of specific procedures and plans.

1. Assignments. Designating who will be responsible for the various activities related to use of computers in the audit process is particularly important. For computers to serve as effective tools on the job, strict rules must be developed and followed for formatting and processing data. The EIC or another appointed member of the team must have responsibility for developing

standard database designs and definitions to be used by the entire team. Additionally, this person or another must coordinate data collection and analysis activities. It may be desirable to assign someone to develop standard automated documentation and forms, and to undertake helpful applications development.

2. Approach. Specific issues related to the collection of the data must be spelled out. Will data be input directly into the computer in the field or will it be collected and submitted to a central point for data entry? Procedures for data verification must also be developed. Planning the workpapers - how they will be designed, coordinated and stored - must also be done at this point.

3. Audit Management. In addition to aiding in the audit process, the micro computer can be an invaluable tool in managing the audit itself. Programs for project management and tracking are available. Some decisions must be made in the planning phase about how progress will be assessed throughout the course of the audit. When using computers in the audit process, procedures for feedback and for tracking progress are very helpful. Identifying potential problems early in the process means that these problems can be addressed and corrected at a point where it is still relatively easy to do. Inconsistencies in data collection procedures or errors in data collected which are identified early can be corrected far more easily than those which are not discovered until data collection is completed.

4. Environmental Factors. A multitude of characteristics of the place where the computer will be used should be addressed in planning. Efforts should be made to check out the power supply, available phone lines, the level of static electricity, and the temperature in the area where the computer will be predominantly used. Each of these factors can have an impact on the performance of the computer. Attention should also be given to the type of furniture which will be used and to available lighting. These and other ergonomic factors will have an impact on the performance of the human beings using the computer.

If the computer will be moved from location to location, care must be exercised to ensure that the particular computer can be moved easily without risk of damage to the machine. It should be determined what will be done in case the computer malfunctions on the road. If climate extremes are likely, will damage to the machine be covered by warranty?

Chapter 2
Building Quality In - Audit Planning
Using Micros and Other Computers

Since some locations for security reasons will not permit auditors to use micros at their site, some advanced checking may be profitable. If foreign travel is expected, special consideration should be given to the laws of the country relating to computer usage. Also, any environmental factors such as differences in power should be considered.

If plans call for data transmission from field to home unit, the computer on the road must either be equipped with an internal modem or an external modem must be taken along. Communications hardware and software must be compatible between field and home unit. It is also important to consider whether or not a printer will be required in the field.

Data Collection, Data Entry, Data Management, and Verification

Types and Sources of Data

A variety of information is collected in the course of any audit. The source of the data and its type dictate some of the options for automation. A significant amount of information is likely to come from interviews, meetings, discussions, or other communications with individuals in the entity being studied. In each case, a record of the interaction and of the information produced is generated and becomes part of the work papers. The evaluators involved may record this information manually or may opt for using a micro computer and word processing software.

In many instances, procedures are being developed for automating templates or forms which simplify and standardize the recording of such information. The evaluator chooses the form appropriate to the particular information recorded. These standard forms may also be used as part of a database which can be searched for key items.

Documents in text form constitute another major source of information for the auditor. Sometimes hard copies of relevant documents are provided. At other times, the auditor may have access to documents only within an agency itself. In either instance, developing procedures for reviewing relevant information, abstracting key items, and subsequently retrieving information in support of particular findings can greatly improve the efficiency of the audit process. The evaluator makes judgments about what is critical in a document at the time it is first reviewed. How much of the information from documents is automated will vary with the particular system adopted. In some instances, only an index to the collected documents may be put on the computer. At other times, it may make sense to provide extensive textual abstracts that can be automatically searched at later points in the audit process.

Standard GAO word processing software is being used for indexing and abstracting in some instances. Other audit teams are using capabilities in dBASEIII to perform these functions. Still other groups are making use of other "knowledge-ware" types of software. None of these options is fully satisfactory for all document indexing and analysis operations. This is an important application area where GAO must continue to review options and look for a more adequate solution.

Non-textual data also play a major role in many audits. Data may be obtained from agency record systems either in automated or paper form. It may be collected using structured data collection instruments developed explicitly for the particular audit. These types of data are particularly amenable to automation and subsequent computer-assisted analysis.

Deciding What to Automate

In general, information should be automated only if there are clear benefits to be gained from doing so. Information which is collected during the course of an audit which is unlikely to be used should not be automated just for the sake of automation.

Knowing how information will be analyzed and used in developing the audit products should help determine whether or not it should be put in machine readable form. If the information will be analyzed in several ways or analyzed by various members of the audit team, then automation makes sense.

Developing and using automated indexing and abstracting systems for all information resources used on a job can greatly facilitate subsequent information searches. It requires a systematic and disciplined approach which in itself can increase the efficiency of the audit process. Additionally, the system developed can be used to provide the documentation required for comprehensive workpapers.

Another critical issue in deciding what information to automate is the mix of computers that may be used in the audit. While micro computers are fully adequate for many of the audits done in GAO, there are situations where the size of particular data files, or the total amount of information being processed exceeds the limits of available micro computers. Required analytic tools may not be available for the micro. In such instances, it may make sense to complete parts of the analysis on an available mainframe. The auditor should seek help from computer specialists to understand when using a mainframe may be preferable to using a micro.

If more than one computer is used in the course of an audit, it is imperative that consideration be given to coordinating results and achieving compatibility where possible. Automation should allow for the smooth flow of information from one phase of the audit to the next.

Data Entry

There are three primary forms of data entry which are widely used in the audit process. Which form or forms are used in a particular job will depend on what form the original data were and on how the data will be used after they are entered.

Direct Keyboard Entry

When the data to be entered are available only in manual form, they must be keyed into the computer from the keyboard. This task may be assigned to a data entry clerk if there are few decisions to be made and little interpretation of the source documents required. Otherwise, the task should be handled by the auditor who is responsible for the data entry.

Regardless of who enters the data, the data elements must be defined and the format or record design must be set before data entry begins. Otherwise non-standard records are likely to be generated and to cause a problem when applications are run. The specific design of the input format will be partially determined by the particular software package being used. Data entered into a LOTUS spreadsheet will have a different format than a dBASEIII record. While it is possible to transfer data among files, some of the power of a particular software package may be lost.

If data will be analyzed using various software packages, the format should be designed to ease the process of moving data from one program to another. If the data will be merged with other data files, care should be exercised to ensure that the separate files share a common identifier that can be used for matching records.

Downloading from a Mainframe Computer

Downloading is a process for selecting and retrieving data from another computer system in a way that makes it useable on a micro. This requires that a compatible communication link be established between the micro and the mainframe. This method is used when data exist in automated form already. The data may be available on the agency computer system or on another electronic medium such as magnetic tape. Downloading is frequently used when selecting data from very large data files stored on a mainframe or on tape used on the mainframe.

To establish the link between the micro and mainframe, the auditor must establish the appropriate communication protocol and have access rights on the mainframe. Standard software for downloading data can be used to select the desired data elements

for use. In GAO the DYL software is frequently used. Once the data have been downloaded into the micro, it may be necessary to reformat the data into a different form for use with available micro software.

Communication from Another Micro

Another method of entering data into a particular micro is to communicate it from another micro. Two compatible micros can exchange data using diskettes or by using existing phone lines and a communications program like Crosstalk. Communication links among micros permit data entered into a micro in the field to be transferred to a headquarters system.

Local area networks permit data to be transferred to designated recipients on the network or to be stored in common storage files with relative ease. This type of technology is currently being tested in several locations in GAO. It is expected to greatly help the process of communication and resource sharing in the audit process. A LAN offers an important way of integrating the computer resources used on the job. This technology makes it possible to conceive of a much more fully automated or a "paperless" audit.

Data Management

If data and computer resources will be shared among audit team members, someone must have primary responsibility for a range of data management issues. Someone must be assigned the tasks of developing the needed data bases, of providing adequate documentation and of establishing data dictionaries and directories. Standardized data files must be made available in the most convenient form to other members of the audit team.

Needed access to data resources must be assessed and appropriate access rights provided for those people who need them. It must be determined when users will be authorized to make changes in the data files or when they will be limited to "read only" access. Procedures must be developed for tracking changes in databases.

An important area for attention is the security of the systems and the information stored on them. This includes the physical security of the computers and the information security of the data.

Procedures for system and database back-up must be clearly articulated and carefully enforced. Each member of the audit team should be given a clear picture of the dangers inherent in

inadequate back-up of data and text files being used on the audit. Where data are stored on hard disk machines, routine system back-up should take place on a regularly scheduled basis. Tape back-up, now available on some micro hard disk machines, can greatly facilitate routine back-up.

Where data are stored primarily on floppy disks maintained by individual users, periodic reminders of the importance of maintaining up-to-date backups should be offered. All diskettes should be copied with the copy stored separately. Guidance on the care and use of floppy disks should be available to users.

Diskettes which are part of the workpapers of a job should be stored together in the diskette boxes. These diskettes should be labeled with the job code, key person's name, and with a number or other tracking system indicator. They should also include supervisory review signatures. Any writing on the label once it is on the disk must be done with a felt tip pen to avoid damage to the disk. All files should be identified on the disk directory using a standardized coding system developed for file names. Contents of all directories must be listed and stored with the paper files of the job. All diskettes should be write protected.

It is helpful to assign one staff member the responsibility for all file maintenance. Others can assist but there should be a single point of control. This individual should also be able to provide assistance to other members of the audit team on the creation and use of job related files.

Data Verification and Testing

Assuring the quality of results requires verification of the data used in any job. Verification consists of assessing the reliability of the source data prior to the data entry process and of testing the data after data entry is completed.

Source Reliability

For computer generated information which is to be downloaded from another system, GAO's audit guide, "Assessing Reliability of Computer Output," June 1981, provided procedures that should be used for assessing data reliability. These guidelines require the auditor to review both the general and application controls in data processing systems which are supplying information critical to the audit. General controls are those which an organization adopts to fix responsibility for assuring quality in computer systems such as specific assignments of responsibility, separation of duties and internal review

procedures. General controls may apply to a range of systems within an organization. Application controls are more specific to the individual system or application. They are designed as a means of assessing the reliability of data derived from a system or of procedures performed by the system

For data derived from other types of source documents, the data should be verified in the same manner it would be if it were being transferred to manual workpapers. The auditor must try to determine how complete and accurate source documents are and assess the risk associated with data of questionable or unknown quality.

Verification of Data Entry

Data entry is the first major point where error may be introduced in automating the job. When data are entered directly from the keyboard, keying errors are an ever present possibility. It is also possible to omit parts of the data. If data are downloaded from a mainframe or communicated from a micro in a different location, transmission errors constitute a threat. To guard against introducing error in the data entry process, all data entry should be verified.

There are a variety of data verification procedures which offer varying degrees of protection against the introduction of error. In selecting a type of verification, the evaluator should consider the alternatives, balancing the costs and feasibility of various procedures against the risk of error that can be tolerated in a particular job.

1. Reentry. When data are entered from the keyboard, one option for verification is rekeying data and matching the two resulting sets of data. The entire data set may be rekeyed or only some portion of it. There is no set answer to the question of how much of the data should be reentered. Decisions in this area should take account of any other verification procedures to be used and of the ability to return to the data sources to correct errors detected in subsequent procedures. When data are entered into the computer in the field directly from agency records with no paper backup, it is a good idea to have a second person reenter the data on the site.

2. Visual scanning. Whatever other methods of verification may also be used, visual inspection of the results of data entry should always be done. Visual scanning is a way of detecting any gross problems with the data. This is particularly important for data which have been downloaded or transmitted from another

computer. Transmission problems or line noise may result in the transmission of unreadable data. If data are being manually keyed in, sometimes the enterer may have hands misplaced on the keys resulting in unuseable data. This type of error may make it necessary to retransmit or rekey significant portions of the data.

Other types of errors can be detected by visual editing. Particularly with textual information, visual proofreading can frequently lead to the identification of all errors. If the data sources are readily available, the data entered can be compared visually to the source documents. For example, data entered from coding sheets can be compared back to those sheets.

3. Record counts, batch totals and selection parameters. The data collector should know the total number of records in the original data sources. This number should always be compared to a count of the records in the newly entered data set. Any discrepancies should be accounted for.

If data are being selected from a data source according to some selection variable or parameter, counts from the original data or the number of records meeting that selection criterion should be compared to the number of records in the new data set. For example, if one were selecting data from an agency personnel data system on individuals in the data processing field, the number of records in the new data file should be matched against known totals for the agency.

Sometimes data sets will contain information which can be totaled and compared to known totals. Particularly when data are being downloaded or transmitted, it is a good idea to calculate totals and/or frequency distributions on key data fields before transmission and compare these figures with calculations made on the new data set.

4. Internal consistency and logic checks. Wherever possible, editing procedures should be developed to check the internal consistency of data, to verify that formulas on worksheets and the logic used in making queries against databases are correct and producing appropriate results. Key calculations should be made independently and checked against the results obtained from the new data.

The possibility of automating the verification procedures themselves should be examined. The investigator should take advantage of error checking options available in the software

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Data Collection, Data Entry, Data
Management and Verification

being used for data entry. With word processing systems, spelling checkers can be used to quickly identify errors. When data are entered into a spreadsheet, various totals and crossfooting should be used to point to problems. Off-the-shelf software for auditing spreadsheets is also available and can be used to identify any errors in the automated spreadsheet. Many programs for downloading data provide built in options for editing.

Automating Analysis, Review and Presentation

Automation can have a major impact on the quality of the analysis that can be completed as a part of an audit. With the speed, capacity and power offered by computers, even by micro computers, it is possible to undertake types of analysis which could not have been completed manually. While computer assistance in analysis makes possible a range of improvements in projects, it also raises some potential problems which can adversely affect the quality of work. With the availability of micro computers and user friendly software, it is possible for almost anyone to run very sophisticated analytic programs after very minimal levels of training. However, if individuals use complex analytical applications without understanding them, without understanding the assumptions behind them, and when it is appropriate to use them, it is very likely that the analytic tools will be misapplied and create a quality control problem.

Choosing appropriate analytical tools for a project should be a key issue in the design of a project. A related concern in project design should be ascertaining that the individuals conducting the analysis have the appropriate training and skills to properly complete the analysis. This applies whether analysis is completed manually or using extensive computer resources.

Types of Analysis

Much of the analysis done during the course of audits can be done more efficiently and effectively using computers in a carefully planned way.

Identification and Summary of Key Evidence

Virtually all audits make use of significant amounts of information and evidence in textual form. Documents, reports of interviews and contacts, and other materials in written form constitute important material for analysis.

Using the micro computer to develop a system for text abstracting and indexing can contribute significantly to the subsequent analysis and review of the information collected during the audit process. Such a system can speed the process of locating supporting information during the report writing phase of a project or provide a rapid means of locating information in response to questions from reviewers. Additionally, the requirement for abstracting key items in a document when it is collected imposes a discipline for identifying critical information

needs and specifying objectives and issues to be addressed during the audit.

There is currently in GAO no single standard software package recommended for text abstracting and indexing. Word processing packages are being used for this purpose, as are dBASEIII and other available software.

Data Analysis

When audits involve the collection and analysis of quantitative data, computers are likely to greatly facilitate the analysis process. When very large data bases will be analyzed with complex statistical or mathematical models or techniques, the analyst may need to use a large mainframe computer. However, the capacity of micro computers is increasing rapidly and the software for completing complex analyses on micros is becoming more readily available.

For many audits, the standard GAO software packages for spreadsheets and for database analysis offer as much analytic power as is required. As auditors become familiar with these programs and aware of their advanced features and capabilities, it should be possible to have many computer applications completed on the micros.

Many of the statistical packages which are widely used on mainframes are now available in micro computer versions. When using more complex analytical procedures, an individual auditor is more likely to need help. Technical assistance should be available from a variety of sources including divisional micro focal points, TAG/DMTAG personnel, information center staff, user group networks and from the GAO Information Technology Center.

Graphics

Graphic presentation of data is frequently an effective way of making clear the results of an analysis, particularly in oral briefings and presentations. Graphics software packages for micro computers are becoming more sophisticated in the capabilities they offer to users. Several different packages are in use in GAO. Graphics programs which can accept data from other analytical programs and operate off that data in producing a variety of graphic displays are particularly useful.

When translating data into graphic form, it is important to make sure that the data displayed match the data in other analytical programs and/or in the raw data base. If the data are not

properly entered into the graphics program, the results from the graphics analyses may not support the conclusions reached.

Drafting the Report

In drafting a report or preparing for oral briefings, a critical task is bringing together information from a variety of sources and integrating it into a coherent whole. This may involve combining information collected by different individuals and different types of information collected by the same person. If adequate attention has been devoted to achieving compatibility among the different computer resources used in the project, this stage of the work can proceed smoothly, taking advantage of the communication capabilities offered by the micros or other computers. Conversely, if different systems have been used, compatibility problems can impede the work.

Integrating Information from Different Types of Files

Writing a report frequently involves combining different text files. Much of the material to be included in the report may already be in automated form. With careful editing, it may be possible to incorporate this information directly into the draft report without significant amounts of rekeying.

A major reason for selecting standard GAO software for use by all GAO micro users is to reduce the cost and confusion which result when different members of the job team are using different word processing software. For example, if several regions are involved in a job and the team members from the regions are using different software, communicating and combining files can be significantly more difficult.

As long as GAO has the Micom system for word processing and document preparation, as well as IBM compatible micros with word processing software, there will continue to be a widespread need to convert files developed on one system for use on another system. The communication protocols have been developed to permit micro files to be communicated to the Micoms. Text can then be formatted for the Micom. These protocols are available from the OIRM Technical Information Center.

Most word processing systems make it possible to import files produced on other systems as ASCII text files. These files do not contain embedded formatting information which tells the system how to print the text it contains. Since formatting information takes time and effort to develop, losing the formatting results in loss of productivity.

For some word processing systems, Document Interchange Formats or DIF packages have been developed which permit the communication of formatted information between two non-compatible systems. DIF packages must be acquired for both the exporting and the importing software. The availability of DIF packages is a relatively new development and these products are not available for many widely used software packages.

Some software packages permit importing data from another type of program with relative ease. LOTUS123 can accept a file of data derived from a dBASEIII program, for example. With other software packages exporting options may not be provided making transfer of information more difficult.

While there are integrated software packages available which combine spreadsheet, database, graphics, communications and word processing functions, GAO does not currently have a standard integrated package. When combining data and graphics with text using GAO's standard systems, it may be necessary to create separate documents or printouts which can be manually integrated.

Moving Files among Machines

During the course of a project, a variety of computers may come into play. As the report is being drafted, information automated on different machines must be brought together. It may be necessary to move files among micros, which may or may not be fully compatible. If work has been done on the micro, then it will need to be moved from the micro to the Micom for final processing. Additionally, it may be necessary to combine information available on the micro with information downloaded from a mainframe.

Generally, in GAO work there is sufficient compatibility among the different machines and software used so that information can be moved from one machine to another either on diskettes or through a communication link. However, it may sometimes be necessary to rekey significant amounts of information.

Whether transmitting information is best done on diskettes or over communication lines will depend on a number of factors including specific compatibility of features. In moving files among micros, either method can generally be used. Since micros and Micoms have different size floppy diskettes, information must be transmitted through a communication line from a micro equipped with a modem and communication software and a Micom also equipped for communication. To

download information from a mainframe, it is also necessary to establish appropriate communication protocols and to use compatible communication software.

Transmitting Files from One Location to Another

Drafting a report frequently involves obtaining information from a variety of different locations within GAO. Information may be supplied to headquarters from different regions and from different offices within the agency. Relatedly, information may be coming from a variety of audit sites. Decisions about how information is communicated should consider the type of communication facilities available, including such factors as the transmission rate (baud rate) on the communication line, the potential noise level on the line, and the size of the file to be transmitted. In some instances, it may be easier to mail diskettes than to use available on-line facilities. Special care must be taken to properly protect and wrap diskettes for mailing.

The more attention paid to developing standard procedures and using standard software throughout the job, the more fully the report drafting stage of the audit can be automated. The tools of automation can also be used for indexing and for documenting all stages of the audit process in the workpapers of a project.

Using the Computer in the Review Process

Computers potentially have a major role to play in the report review process. While little attention has been devoted to testing the feasibility of on-line report reviewing and real time revision, the information technology currently available makes these real options for improving the review process. GAO will continue to experiment with these and other options and to develop procedures for reviewing and referencing reports at the screen; for making real time editorial changes; and for simultaneously transmitting drafts to multiple reviewers.

When computers have been used in the data collection, analysis and report writing phases of the audit process, the review process must certify that all steps in the process have been appropriately carried out and fully documented. GAO's referencing and report review activities play an important part in assuring quality and accuracy whether or not computers play a significant role in the job.

Since the responsibility for supervisory review and for referencing of reports does not change when computers are used in developing a report, the reviewer must be sufficiently familiar with how computers are used to make sure that the use is fully

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and Presentation

documented and appropriate for the tasks done. The audit team must provide detailed information on all hardware, software and specific applications used in the job. Where complex computer applications are a part of the job, the referencer will need to have expertise in computer usage or to verify that a qualified independent technical specialist has reviewed and approved the work.

For many jobs using micros, the referencer can complete the work without extensive personal experience with the machines. It is advisable that the referencer have a basic knowledge of micros and some experience using them in order to move easily through workpapers that are extensively automated. The job documentation must contain enough information on the use of the computer so that the referencer can follow each step of the process. If the workpapers are automated, they should be accompanied by specific instructions on the steps the reviewer must take to locate and access all relevant files.

Data analyses used to support key report issues that have been conducted by TAG or DMTAG staff or other technical specialists must be reviewed by another technical specialist. The referencer must determine that the work has had proper supervisory review as well as appropriate technical review.

While the number of people with sufficient micro or other computer training for referencing computer-aided work is limited, current plans call for providing enough training on micro computer usage over the next several years to remedy that deficiency. As the number of micro users grows, so too will the number of people with the knowledge required for referencing computer-assisted work. Special courses for managers will provide the knowledge that is required for supervisory review of audit products and documentation.

Documenting the Audit Process - Workpapers

Workpaper Requirements

Workpapers are the primary source of support to substantiate the findings of an audit. Generally accepted audit standards require that audit work be complete, accurate and clearly documented and that the documentation in the form of workpapers be retained. All assignments related to a job must be fully described in workpapers that have been prepared, indexed and reviewed in compliance with Chapter 18 of the Project Manual. When computers have been used on a job, full descriptions of how they are used must also be included. As with other workpapers, workpapers related to computer usage must contain enough details so that the reviewer could, if necessary, replicate the process leading to the conclusions of the study.

Automating Documentation Methods

While standards for what must be included in workpapers remain the same when computers are used to assist in an audit, the methods for producing workpapers may change significantly. With available micro and other electronic word processing systems, major portions of the workpapers can be completed electronically. A key consideration will be the number of individual worksheets and other parts of the audit which have been automated. Where micros have been extensively used to produce individual workpapers on a job, workpaper bundles can be developed in which virtually all of the documentation is in electronic form.

A major unresolved issue in preparing documentation in automated form is how signatures can be added to workpapers and other documents which are stored on diskette. One possibility is to have all diskettes labels include a signature block for the signature of the preparer and reviewer. Alternatively, some portion of job workpapers including official signatures will have to be retained in paper form.

Storage conditions and options must also be considered when deciding how much of the total workpaper bundle will be stored in electronic form. Workpapers which are kept on diskettes cannot be stored in the same way that paper is often stored. Unless clean, temperature-controlled storage space is available for storing diskettes, diskettes can be ruined and information

lost. On the positive side, workpapers stored on diskettes require significantly less space for storage.

Organizing Workpapers

For the immediate future, workpaper bundles will continue to be made up of some combination of paper and electronic media. This makes it doubly important that the workpapers are carefully organized and indexed.

Indexing and Cross-Referencing

For each job, there needs to be a single master index or directory that lists all individual workpapers and materials associated with the job. This master index should show the storage device and location of each workpaper. It should also provide information of the subject of the worksheet, its title and the type of file it is; e.g., a LOTUS spreadsheet. It is also very useful to have an abstract of the content of important workpapers and to develop key words to associate with each.

If the master index or directory is also stored electronically, either on a hard disk or on a floppy diskette, it is possible to use available software for sorting, searching and extracting information from a whole set of individual workpapers and documents collected during the course of an audit.

Indexing can be greatly facilitated by devising and using standard file names which contain coded information on the type of file, the number of the workpaper, or other information relevant to locating particular documents from a whole set of related documentation. For example, all interview notes could be assigned a file name beginning with an I and containing a number which tells which interview it was. With well planned file naming conventions, the reviewer can tell what type of file is being discussed without entering the file at all.

The requirements for cross referencing automated workpapers are the same as for hardcopy workpapers. The cross-references can be included in the automated files. It is possible then, to undertake automated searches for cross-references. There are a variety of approaches to using automation in indexing and cross-referencing processes and GAO is just beginning to examine how these alternatives can be used to improve this aspect of workpaper preparation and job documentation. While there is no standard approach at the present, the different alternatives have a critical feature in common. They all require that careful attention be given to planning for systematic file naming and

description and for an early decision about what software will be used to support the process. Standard word processing, database and spreadsheet software all have some capability for supporting indexing and searching.

Facilitating Review and Referencing

Workpapers should be organized to facilitate supervisory review and referencing. It is essential that the reviewer be provided with a road map through the paper and electronic workpapers showing clearly all steps in the audit process.

Since a reviewer may not have the same computer skill as the audit team, it is very helpful to provide a basic set of instructions about how to access different types of information. For example, the diskette containing the master index should be identified and instructions provided on the commands the reviewer must issue to get to the index. Further instructions can be stored on the diskette.

Special Considerations in Documenting Automated Work

In order to meet the workpaper standards requiring completeness and accuracy, special care must be taken to document all automated procedures and databases used during the course of an audit. For each computerized analysis, a worksheet should be prepared, showing who completed the work, the data involved, the source of the information and the procedures used. Standard forms or worksheets can be developed to capture this type of information. Particularly if similar procedures are used on a number of different occasions, having standard forms or checklists can simplify the documentation process.

Planning

Decisions made in the audit planning phase concerning how computers would be used on the job should be documented and included in the workpapers. Any procedures set up for file naming and data management should be described.

Data Entry

The workpapers should contain a concise, but complete description of all procedures for data entry, editing and verification and of the results obtained using these procedures.

For example, if a 10% sample of data is rekeyed as a verification procedure, the documentation should provide the justification for

selecting that procedure and that sample size. The error rate as determined from the sample should be reported and any subsequent steps to correct errors should be described.

Downloading Data

When data on an audit are obtained by downloading from another computer system, either from an agency system or from a GAO supported system such as CAPS, a description of both the downloading process and of the databases should be included. A separate worksheet should be developed specifically for this application. The worksheet should identify the host computer system, the original database, the software and procedures used for extracting data elements for downloading. Additionally, the communications hardware and software should be described. When non-standard programs are used, copies of the program should also be available. All procedures used to verify the data should be outlined.

Spreadsheets

When the standard GAO spreadsheet package, LOTUS123, is used documentation of the program itself is not required. However, the evaluator using this spreadsheet program is required to provide full documentation of other aspects of spreadsheet usage. As for a manually prepared spreadsheet, the user should clearly indicate what information is contained in each row and column of the spreadsheet; specify the source of the information; identify calculations performed and list all formulas used for automatic calculation.

Much of the information required for good spreadsheet documentation can be entered directly onto the spreadsheet itself. Separate sections of the spreadsheet can be used to list data sources, describe the variables included, detail the assumptions of the analysis and describe models embedded in the spreadsheet. Separate sections can be devoted to information on the preparer, the date, the version of the spreadsheet and on other facets of file management. While it is not required that all versions of a particular spreadsheet be included in the workpapers of a job, a history or record of modifications should be maintained.

It is important that any formulas used in the spreadsheet be carefully examined by the auditor and by the supervisor and referencer and/or an independent technical specialist. LOTUS permits the user to list out formulas for each cell, but does not facilitate printing formulas in an easy to read way. Other

software packages are available which can be used to improve the readability of formula listings.

Database Programs

While there is no official GAO standard database program, dBASEIII is widely recognized as the de facto GAO standard for micro computers. When dBASEIII is used in the audit process, it is necessary to provide documentation on the database itself - on its structure and content - and on the reports generated using the program. If the database is revised, modified or updated, the documentation should include a copy of the database used in a particular application. Where dBASE programs are developed by the user, these programs should be available in the workpapers.

Required Documentation for Software

1. Using standard GAO software. When standard GAO software is used, the evaluator can be relatively confident of the accuracy and performance of the program itself. These programs were tested as part of the process of selecting standard software and have been widely used over a period of time. It is necessary to verify the logic of all operations and calculations and to assure that any user entered formulas are correct. Depending on how fully the workpapers have been automated, the reviewer may need to review some material in automated form. For example, if information in a report is derived from a LOTUS123 spreadsheet which is stored only on diskette, it will be necessary to access the diskette and examine the spreadsheet and the formulas which produce calculations used as support in the report.

2. Using non-standard software. When software packages which are not GAO standard packages are used on a job, the audit staff is required to test the software package itself to ensure its accuracy and precision. The supervisor must make sure that these additional steps are taken for non-standard software packages.

3. Using self developed programs. In some audit work special programs may be written in a programming language such as Basic, Cobol, or Pascal. Additional steps must be taken to assure the quality of software developed by audit staff or technical specialists for a particular job. The supervisor and/or technical specialist must assure that the program does what it is supposed to do and that the results of the program are accurate. The results should be reviewed by someone

knowledgeable in the particular language used to write the program. It is highly desirable that self developed programs be validated with test data having a predetermined result. The referencer should look for evidence that such tests have been made.

Additional Documentation

The documentation describing the use of micro computers in the audit process should also identify the specific equipment used, and the specific version of the software, including the operating system. Occasionally, hardware problems can introduce error and it is important to be able to trace errors when hardware problems are discovered. Relatedly, new versions of operating systems and of software packages can change the way particular features of the system operate.

Workpaper Retention

Electronic workpapers like any others must be retained for at least 3 years. GAO has circulated a draft order (GAO Order 0413.3) concerning Audit Workpapers Created on Computer Magnetic Tape, but no order has yet been developed on audit workpapers stored on floppy diskettes. Like storage of magnetic tapes, storage of floppy diskettes requires special provisions. If magnetic devices are not properly stored in a cool, dry environment, significant loss of information is a major threat. Heat and humidity can ruin diskettes.

Storing Diskettes

When workpapers are stored on floppy diskettes, all diskettes for the audit should be stored together as electronic workpaper bundles. The diskettes should be stored in the original diskette boxes or in special diskette storage boxes. A duplicate copy of every diskette should be made and stored in a physically separate location. Each diskette should be write protected. The diskette boxes should be labeled, showing how many diskettes are a part of the workpaper bundle for the entire job. Each individual diskette should be labeled with the job code, the key person's name, the diskette number and contents. Listings of diskette directories should be stored with each box. Storing diskettes of the same type together can make it easier to undertake integrated searches at a later point in time.

Paper Records

Even where most of the workpapers for a job are available in automated form, it is necessary to maintain hard copy documentation for certain parts of the workpapers. The paper workpaper bundle should first have a master summary in printed form enabling the auditor, reviewer or referencer to move between the electronic and paper files for a job. Printed directories of all diskettes along with information on the numbering and labeling of diskettes should be stored in the bundle. It may be necessary to print some documents requiring official signatures.

Printed copies of electronic files may be used as backup files. If proper storage conditions for electronic diskettes cannot be assured, retaining hardcopy backup for key workpapers is highly recommended. However, only important documents should be printed. In general, it is desirable to minimize paper backups.

Security of Workpapers

The physical security of automated workpapers and of the hardware and software used to produce them must be of concern to the audit team. The team must also ensure the security and integrity of the information contained in the work. Backup of all files is critical throughout each phase of the audit process. Failure to provide appropriate backup in a timely fashion can result minimally in loss of time and more seriously, in loss of key evidence in support of audit findings.

Limiting access to job files can help prevent unauthorized use and inadvertent damage to job files. Particularly, when a job involves working with classified information, it is essential to develop procedures to ensure that only authorized individuals have access to the files. When computers are equipped with communication capability, care must be taken to prevent outside, unauthorized users from gaining access.

Conclusion

Evolving experience with available computer hardware, software, and applications will necessitate continuing refinement of guidelines for computer-assisted work. Additionally, changing technology will make it necessary to address these issues on an on-going basis. The current trend toward more integrated office automation systems linking micro computers into central file storage using local area networks will facilitate further automation of audit processes and shift the emphasis given to various points in this version of the guidelines.



Memorandum

TO : See list

FROM : Director, IMTEC - Warren G. Reed

SUBJECT: Using Micro Computers in GAO Audits

The enclosed document, Using Micro Computers in GAO Audits: Improving Quality and Productivity, provides guidance to GAO evaluators and managers as they introduce micro computers into GAO work processes on a widespread basis. The purpose of the document is to help micro users

- identify when and how computers may be productively used in conducting audits and evaluations,
- identify a number of issues which should be addressed in planning micro computer use on a job, and
- avoid common pitfalls in using micros which can compromise the quality of the product.

This paper is intended as a basic reference for GAO evaluators to be used as an aid for building in quality, improving productivity and assuring reliability in our work as we make increasing use of available information technology.

Using Micro Computers in GAO Audits was developed for the GAO Technical Services Committee and its Quality Assurance Subcommittee. In close coordination with the Office of Policy, we sought to provide guidance on the use of micro computers which would encourage their appropriate use while maintaining the quality of our products.

We anticipate significant modification and revision of this publication as our experience in GAO with micro computers on the job increases. We welcome your comments, questions, and observations on the utility of the document. These may be directed to Elizabeth Powell, IMTEC Information Center, Rm. 6721.



Attachment

**TO: Comptroller General
Special Assistant to the Comptroller General
Assistant Comptrollers General
General Counsel
Heads of Divisions and Offices
Deputy Directors of Divisions
Regional Managers
Assistant Regional Managers
Managers, TAG and DMTAG Groups
Micro Computer Focal Points
Members, GAO Technical Services Committee
Members, GAO IRM Steering Committee
Members, GAO Interdivisional Design Group**

