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Mission Support Project: Report on the Network and Data Collection and Analysis Application Pilot Test

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Foreword

This report responds to the reporting objectives stated in the Mission Support Project's Test and Evaluation Plan and Evaluation Strategy. Specifically, it describes the development of the Data Collection and Analysis application, provides the results of the pilot test of the network and the application, and outlines the strategy for implementing the network and the application GAO-wide.

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Executive Summary

Purpose

Because information technology presents new opportunities for a more efficient work environment, GAO has explored ways to provide its staff with a sophisticated mixture of information tools and systems to collect, analyze, and disseminate information to meet the needs of the Congress and the public. To create this required technical environment, GAO established the Mission Support Project (MSP) in 1990 to develop and pilot-test a computer network and a mission-critical application—the Data Collection and Analysis (DCA) application—to improve work processes. This report summarizes GAO's experience in developing and using this technology. Specifically, the report describes the results of the pilot test of a network environment and the DCA application and GAO's plans for implementing a computer network and the DCA application throughout GAO.

Background

The MSP established four objectives: to install and test network technology, develop and evaluate the DCA application, measure the associated benefits, and determine the best configuration for meeting GAO-wide technology needs. Of primary importance was to enhance communication and collaboration among GAO work groups by improving access to and management of information. The project focused on the effective deployment of and creative use of technology to support the agency's goal of improving the timeliness and the quality of GAO work. The MSP team, a group of evaluators and in-house and contract computer specialists, used information-engineering methodology—a fact-based quality management approach—to design, develop, and implement the DCA application.

To develop the DCA, the team first identified user—evaluator—needs by surveying an extensive and representative sample of evaluators to define, in detail, the work processes for conducting audits and evaluations. The team identified four major user needs: (1) standard workpaper formats, (2) better ways to index information for later retrieval, (3) improved access to assignment information for data analysis, and (4) enhanced capability for managing audits. Evaluators also wanted the DCA to be user friendly; allow for tasks to be performed simultaneously; and operate in an environment in which the user could access, analyze, and electronically communicate information in a timely and effective manner to generate a quality product. These user requirements guided DCA development and provided a comprehensive, easy-to-use suite of Windows-based software designed to streamline and simplify numerous assignment tasks and integrated to permit sharing information across applications.

In 1991, GAO developed a plan for the pilot test of the network and computer technology. The pilot was conducted in three GAO units—the Resources, Community, and Economic Development Division; the Health, Education, and Human Services Division; and the San Francisco Regional Office. Beginning in October 1993, the DCA was used by staff from these units to test its capabilities and evaluate its performance. The MSP team implemented an evaluation strategy as part of the pilot test to identify and measure benefits of using network, computer, and DCA technology. This strategy included measuring cycle time for completing typical assignment tasks and obtaining, through surveys and group discussions, user perceptions on how computer, software, and network technology affected their work and productivity.[1]

GAO developed a comprehensive 3-year strategy and budget to transition from a predominantly stand-alone environment to a total network environment. The implementation strategy provided a fully developed network with the DCA in the pilot test units by the end of fiscal year 1994. By the end of fiscal year 1995, GAO will complete the network installation in all units and will provide the DCA to two headquarters units and four field offices. GAO plans to provide, by the end of fiscal year 1996, the remaining divisions and field locations with DCA capability. The overall implementation approach has been to install the network and Windows™ [2] software, provide training and time for staff to transition to this new environment, install the DCA, and then provide DCA training.

Results in Brief

GAO's pilot demonstrated significant benefits from both the network and the DCA. The local and wide area computer network was of great help in communicating with others. Also, a graphical user interface—Windows—provided staff faster switching capability between software applications and for transferring data from one document to another. Furthermore, the DCA, operating on the network, streamlined work processes and enabled better use of staff time. For example, the network provided staff a better means to communicate and send files and faxes. The DCA enabled staff to create, organize, access, and share information more easily and much faster compared with conventional methods.

[1]We have periodically prepared reports throughout the project to provide the results of surveys and status updates.

[2]Windows is a trademark of Microsoft Corporation.

In addition, evaluators said that the ease and the speed of access from separate locations enabled them to share information on demand, improved workgroup collaboration, and provided enhanced access to a wider range of information from past reports and other assignments that they could research and reuse. The DCA enabled the Team Ag staff—the core group of evaluators conducting Agriculture issue area assignments—to more actively collaborate with their counterparts despite their separate Washington and San Francisco locations. The DCA was installed for the remaining Team Ag locations—Kansas City, Dallas, and Atlanta—during January and February 1995, making this the first core group to have access to and use of the DCA for assignments. This ease of interaction and information access will continue to expand and support GAO's core group concept as the DCA is implemented throughout GAO.

Several best practices were developed from the pilot experience, which GAO used in preparing a detailed plan for GAO-wide implementation of the computer network and the DCA. These practices involved (1) executive commitment and leadership, (2) organizational change management, (3) training strategy, and (4) user support.

Pilot Test Results

Network Improved Communication

The network was almost universally well-received by the pilot units. Nearly all their staff—99 percent—who responded to surveys had used the network system to perform assignment tasks, and over 94 percent were satisfied with it.[3] Over 80 percent said that it was of great or very great help for communicating with others, and over 70 percent said that it was valuable for keeping them informed of work-related matters. In addition, over 80 percent said that the network and electronic mail were much faster and easier for sending and receiving automated files compared with the previous method of using dial-up communications software in a stand-alone setting.

Windows Provided Improved Work Setting

Experienced users also saw benefits to Windows software. Staff who indicated that they used Windows all or almost all the time were satisfied with this software and were more likely to say that it was easier and faster

[3]Pilot unit staff completed questionnaires in November 1993, May 1994, and December 1994 on how the network system, Windows software, and the DCA application affected the way they performed their work.

than non-Windows software. About 90 percent of these respondents said that Windows made it easier to switch from one software application to another. However, of those who used Windows software half the time or less, only 40 percent said that it was easier for this task. This result is quite common because learning how to use new software and transition to a new operating environment takes time. But once staff have worked frequently with Windows, most agree that it is easier and faster.

DCA Streamlined Tasks and Improved Information Access

The cycle time results show that the DCA streamlined typical assignment tasks and processes, such as locating and sharing information and monitoring assignment progress, and that the immediate access to assignment information the DCA provided improved communication and work group collaboration. Staff currently expend significant amounts of time preparing and managing workpapers and sharing information among dispersed team members. The DCA and the network provide tools to accomplish such tasks far more quickly and efficiently, freeing up time that can be more productively used for research and analysis. For example, the DCA's on-line access to workpapers saved time currently spent traveling to separate locations, as well as the time used to fax, mail, or electronically transfer files without the network and the DCA. While the time saved on an individual tasks may be a few minutes, these savings are significant given the frequency of such tasks throughout GAO. In addition, staff reported that the DCA's document management capabilities enabled them to quickly track the history and the status of workpapers and products and facilitated supervisory review. Furthermore, the DCA allowed staff to quickly and easily locate, share, and reuse information, such as segments from prior GAO reports, abstracts, and open recommendations.

The pilot unit staff also said it would have been helpful to have had all units using the DCA so that the entire job team could access and share information, and noted that additional benefits will accrue once all of GAO is using the DCA. As the network and DCA are implemented throughout GAO, all job teams and core groups will have access to and use of the DCA and the improved work setting.

Comprehensive Strategy Developed to Implement Network and DCA Technology

The pilot test results helped GAO understand how to manage a successful GAO-wide implementation of the network and the DCA. The approach developed by GAO had essential elements: (1) install the network and Windows software, (2) provide training and time to prepare for the new technology, and (3) secure executive commitment and active involvement.

Using the experience gained under the pilot DCA application, GAO developed a comprehensive plan for the GAO-wide implementation of the DCA and the network. This plan addresses all aspects of the implementation—communications, facilities preparation, installation of cables, workstation testing, and network and DCA installation. It also identifies the tasks, the resources, and the necessary sequence of actions. The plan contains all tasks and resources to implement the DCA and the network and provides a vehicle for providing effective oversight to ensure a coordinated team approach to implementation.

The pilot test showed that installing the network and Windows software and providing training and time to prepare for the DCA was an effective approach to transition to this new technology. In addition, it was also essential to secure executive commitment and active involvement. Pilot unit staff whose managers actively supported and used the application were more likely to devote the time and the effort needed to make the transition. To ensure this support, GAO's Training Institute developed a comprehensive curriculum that begins with a leadership briefing for Senior Executive Service leaders and staff managers. This curriculum provides a framework for understanding the dynamics of organizational change, the skills and the techniques for managing change involving new technology, and an action plan to lead their units through DCA implementation.

Contents

Abbreviations

DCA	data collection and analysis
GAO	General Accounting Office
IE	information engineering
IRM	information resources management
LAN	local area network
MSP	Mission Support Project
OIMC	Office of Information Management and Communications
OIP	Operations Improvement Program
RCED	Resources, Community, and Economic Development Division
TQM	total quality management

Introduction

GAO's mission is to "serve the public interest by providing members of Congress and others who make policy with accurate information, unbiased analysis, and objective recommendations on how best to utilize public resources in support of the security and well-being of the American people."[1] To carry out this mission, GAO depends on information resources and requires a sophisticated mixture of information tools and systems to collect, analyze, and disseminate complex information on a wide range of subjects, doing so within time frames that meet the needs of the Congress and the public.[2] Furthermore, since GAO staff are dispersed across the country, GAO requires information technologies that link them efficiently, allowing them to work as teams despite their physical locations.

To develop these technological resources, GAO follows its information resources management (IRM) vision, which describes a future in which GAO's teams are empowered by their information tools. This vision is to create an organization in which work groups can be more self-sufficient in meeting the information requirements of their jobs. Such an organization would be characterized by (1) information technology that was so readily available and easy to use that work groups could better create, access, process, and share the information required to complete their tasks; (2) staff who had been prepared to use technology effectively; and (3) improved work processes, which would yield higher quality products and which would be more efficient as a result of this technology.

GAO's Assignment Process

GAO assignments are conducted in three phases:

- job planning and design,
- data collection and analysis, and
- product preparation.

Throughout assignments, staff collect information needed to meet the assignment objectives and to develop a product, such as a report, testimony, or a briefing. They organize the information—assignment plans, background and research materials, interview write-ups, agency documents, spreadsheets, reports, memorandums, and other data—into "workpapers." In addition, communication and access to information is critical throughout the job, as staff need to share the workpapers, collaborate on summaries and analyses, and monitor assignment progress.

[1] Quality Improvement Plan for GAO: Early Implementation (GAO/QMG-92-1, November 1991), p. 4.

[2] IRM Strategic Plan (GAO/OIMC-94-12, September 1994), p. 3.

At the start of every audit, staff complete paperwork and develop an assignment plan to outline key assignment information, such as background, objectives, scope, methodology, issues and questions to address, staff resources and responsibilities, and milestones. They also research past assignments or issued reports to collect information relevant to the current assignments. Staff complete paperwork at decision points throughout the assignment and submit other job correspondence to apprise management of assignment progress.

During the data collection and analysis phase, staff frequently interview agency officials, collect agency documents, and make site visits or inspections. They record this information and include it in their workpapers for subsequent analysis and product development. Once they develop a product, they must have it referenced, a process whereby the staff identify the workpapers used as evidence for the product statements and a staff member (independent of the job team) verifies that the information in the report is supported by the workpapers. Drafts are reviewed at progressively higher levels within GAO, and the team members often need to locate additional workpaper information to revise the drafts in response to review comments. Once GAO management has approved products, staff complete forms to publish and distribute the products.

Project Background

The Mission Support Project (MSP) was created in 1990 and was given the responsibility for identifying user requirements, developing and evaluating mission applications on a pilot network, measuring the associated benefits, and determining the best configuration for meeting GAO-wide network needs. In April 1991, GAO developed a test and evaluation plan to document the selection of the network configuration, the organizational structure for managing and conducting a pilot test, and the methodology for evaluating test results.[3] A pilot group from the Health, Education, and Human Services Division;[4] the Resources, Community, and Economic Development Division (RCED); and the San Francisco Regional Office was selected to test the applicability of the system developed by the MSP.

Mission Support Project

The MSP staff, which is within GAO's Office of Information Management and Communications (OIMC), focused on establishing network capabilities that would enhance communication and improve information access to

[3]"Test and Evaluation Plan for GAO's LAN Project," (Apr. 8, 1991).

[4]This Division was formerly named the Human Resources Division.

support GAO's mission of providing accurate information, unbiased analyses, and objective recommendations.

MSP's key objectives were to (1) work with users to develop a mission-critical application—the Data Collection and Analysis (DCA) application—that streamlined their work and improved performance; (2) pilot-test the DCA in an operational setting; (3) evaluate benefits—time and quality improvements—provided by the application and the network; and (4) determine the best system configuration for GAO-wide implementation. In addition, a key objective was to forge a partnership between systems developers and users to ensure that the DCA and the network environment met user requirements.

Our MSP team consisted of evaluators from divisions and regional offices, technical specialists from OIMC, consultants, and contractor staff. We worked with users who were carrying out GAO assignments to identify user needs for technology and information access. Moreover, we have extensive expertise in conducting GAO assignments and used it to refine the information provided by the users to ensure that requirements were accurately defined.

Objectives, Scope, and Methodology

Our commitment to use technology to more effectively do GAO's work has focused on identifying user needs and then developing and implementing mission-related applications and network technology to meet these needs. We used information engineering (IE) to develop a comprehensive understanding of the processes involved in conducting GAO assignments and to determine what information technology could make these processes more efficient and effective. IE focuses on the importance of information to an organization's success and the need for a constructive and continuing partnership between systems developers and GAO staff. This approach helped us focus on the processes and the tasks inherent in GAO's work so that from a systems development perspective, we could identify (1) requirements needed to improve users' work and (2) technologies that met those requirements.

This approach will also support future GAO information and technology needs from an agencywide perspective and will ensure that relevant requirements are considered in developing the application. In addition, IE complements the total quality management (TQM) principles currently being implemented in GAO as it focuses on interactive teamwork and user participation to address problems and areas needing improvement. As a

result, benefits realized include higher quality systems, improved customer satisfaction, improved processes, better communications, and increased productivity.

User Requirements Identified

Using IE techniques, we identified primary user requirements for a system that would enable users to carry out their work efficiently and effectively. Further, we defined all assignment phases from job design to report production, the first level of processes for each phase, and the relationships between phases. We then concentrated on the data collection and analysis processes and tasks and the specific user requirements for each task.

To determine the baseline of user needs, we interviewed over 150 GAO evaluators to delineate the activities, the tasks, and the steps they completed as part of their assignments. We also obtained their input on application features needed to streamline their work. We interviewed Bands I, II, and III evaluators from GAO divisions and regional offices to ensure that we captured the different roles and responsibilities inherent in each level. The evaluators also reviewed documentation on the detailed steps of the assignment process that had been developed using GAO's Policies/Procedures and Communications Manuals. The documentation identified the assignment phases and the related processes within each phase. The evaluators commented on and revised, as appropriate, the documentation to reflect the tasks and the activities they completed as part of the assignment process.

We also analyzed the suggestions in GAO's Operations Improvement Program (OIP) database to identify (1) potential requirements for the workpaper application and (2) focal points in the user community to interview about ongoing OIP projects relevant to the MSP efforts. The OIP database included suggestions ranging from those that pertained to the assignment process to suggestions related to such topics as promotions and recruiting. We created a subsidiary database of the suggestions directed at improving the assignment process, regardless of whether they proposed the use of technology or not, because many could be implemented in a computer and network environment and could provide the improvements GAO-wide.

In addition, during 1992 and 1993,[5] we sent questionnaires to the pilot unit staff (about 900) to assess computer use and compare network and stand-alone environments. These surveys addressed how computer hardware and software and network technology had affected the timeliness of completing assignments and the quality of products resulting from assignments. The surveys also asked for user perceptions on how computer usage had affected other variables, such as personal productivity and morale. Respondents also commented on productivity gains; the benefits of being directly connected (hard-wired) to the network; dial-in access problems; as well as printer, hardware, software, and training needs.

DCA Application Developed to Address User Requirements

The DCA is a suite of commercial software packages linked to standardize and manage GAO-created documents. It is designed to be used on GAO's local area network (LAN) and wide area network and allows users to quickly and easily communicate and share information with other assignment team members at dispersed locations. These capabilities reduce the time spent transmitting files and related information, increase and enhance communications between staff, and provide a better means to review workpapers and products and monitor assignment progress. Designed to streamline numerous tasks and allow users to realize timeliness and quality benefits throughout their assignments, the DCA works with widely available word processing, spreadsheet, and graphic Windows-based software applications. Additionally, the DCA uses an off-the-shelf software program to facilitate managing, storing, and researching GAO-created documents.

The technical design has several features. First, the design uses standard modular industry-supported hardware and software that support an "open system" standard. An open system standard enables network systems to move toward a standard, less complex, and less risky environment and allows the selection of hardware and software options from different vendors. Second, the user interface uses the graphical design features commonly found in Windows software. Windows presents a consistent, easy-to-use environment that provides a means to create an application that is effective, enhances user productivity, and is easy to learn and use. Third, the design is built on the current GAO base of hardware and software for both the network and the application.

[5]Pilot unit staff completed questionnaires in September 1992 and November 1993 on how the network system, computers, and software affected the way they performed their work.

The application also provides options to simplify and improve assignment processes, such as developing an assignment plan, recording results of interviews and analyses, and reviewing reports and other products. The on-line access to job files and other data, coupled with search and retrieval capability, enables staff to conduct more thorough searches and facilitate the process of locating information. In addition, the application provides features for creating and organizing workpapers, as well as on-line access to GAO guidance, checklists, and forms needed throughout assignments. The following paragraphs summarize GAO assignment processes and user needs and summarizes how the DCA supports them.

Preparing Workpapers

Using commercial word processing software, the application provides users with standard workpaper templates for common types of workpapers, such as a record of an interview, a record of inspection or observation, and congressional or media contact memorandums. To minimize repetitive entry of data, the application automatically moves some data, such as the job title and the job code, to these workpapers when they are created. These templates provide consistent formats and prompt users to provide the information required to comply with GAO's policies for workpaper preparation. In addition, the DCA provides on-line access to GAO's Policies/Procedures and Communications Manuals, which provide additional guidance on workpaper preparation.

Indexing Workpapers

The application uses commercial document management software to meet the requirement that workpapers be indexed to allow teams to organize, manage, and retrieve the workpapers by subject, location, or other distinguishing features of the assignment. In addition, the software enables teams to create electronic file folders to further organize and cross-reference workpapers to characterize information by categories, such as topic, location, or audit task.

Accessing Workpapers for Analysis and Review

The document management and full-text index features also enable staff to search for and access workpapers by specific criteria, easing the process of locating support. The on-line capability allows staff to quickly and easily communicate and share information with other team members at dispersed locations throughout the assignment, providing a means to analyze information more thoroughly. The DCA also provides on-line access to GAO reports published from November 1992 to the present, as well as abstracts of GAO reports published between 1987 and 1992. This access provides an extensive base of information that can be used for research and is often included as background in current assignment work.

Monitoring Assignment Progress

Supervisors can review and comment on workpapers electronically at any time and from any location, thus increasing the ability to monitor assignment progress and reducing the time spent transmitting files and related information. Supervisors can also more easily conduct oversight and thereby provide uniform "team direction" to facilitate the audit execution. In addition, the standard workpaper formats, document management features, and full-text index search capabilities enable supervisors to quickly locate pertinent information.

MSP Evaluation Strategy

We worked with GAO methodologists to develop and implement a strategy to identify and measure benefits of using the application in a network environment. This strategy included (1) measuring the cycle time for completing typical assignment tasks and (2) obtaining, through surveys and group discussions, user perceptions on how the application and the network affected their work.

Cycle Time Measurements

We first identified the tasks that staff typically performed during assignments by interviewing 50 evaluators throughout GAO. On the basis of the interviews, we identified the tasks whose completion time would be affected by the use of technology. These 14 tasks were:

- faxing documents,
- mailing documents,
- transmitting documents via modem and communications software,
- accessing software,
- accessing printers,
- locating policy and procedure guidance,
- preparing congressional contact memorandums,
- preparing forms,
- preparing tables of contents for workpapers,
- preparing records of interviews,
- numbering workpapers,
- cross-referencing workpapers,
- searching workpapers for information, and
- obtaining workpapers for supervisory review.

Before implementing the application at the pilot units, staff completed the above tasks in a nonnetwork setting and in the MSP test environment to provide precycle and postcycle times. We collected this information from March through June 1993 to estimate the time savings expected from using

the application and the network for typical assignment tasks. Specifically, we

- measured the cycle time needed to complete typical assignment tasks in both a stand-alone environment (i.e., not linked to a computer network) and an application and network setting;
- sent questionnaires to a GAO-wide random sample of evaluators to obtain information on how frequently staff completed the tasks; and
- used the cycle time results and task frequency information to estimate the time savings expected throughout GAO.

To obtain the stand-alone, or baseline, cycle time measurements, we had a random sample of 25 pilot unit evaluators simulate the tasks in a stand-alone setting at their own work locations. We provided the instructions, time log sheets, and documents required so that the staff could each complete the tasks using the same information and scenarios. A second random sample of 25 pilot unit staff then simulated the same tasks using the application and network setting at the MSP location in the GAO Building. We recorded the time and the steps the 25 evaluators had needed to complete the tasks and asked them to provide their perceptions on how the application had affected task completion and compared this with what would have been required in a stand-alone setting. We then sent questionnaires to a random sample of evaluators (400) throughout GAO who worked in a stand-alone setting to obtain information for estimating the frequency of the tasks and associated time savings GAO-wide.

After the DCA was implemented at the pilot sites, we measured cycle time for the same tasks to verify that the application and the network provided the same work environment as the MSP work location did. We also focused our evaluation on several specific jobs and audit teams at the pilot locations to assess the impact of the application and the network in carrying out their work.

Questionnaires

During the pilot test, we surveyed the pilot unit staff to obtain their perceptions on the benefits of (1) the network environment, (2) Windows software and the graphical user interface, and (3) the DCA application. While the surveys covered these three categories, not all staff were using Windows and/or the DCA throughout the entire pilot test. Therefore, staff completed the portions of the survey applicable for their experiences. We also conducted periodic telephone surveys with pilot unit staff using the DCA application to obtain feedback on experiences with the application. Also, we obtained users' suggestions for enhancements to modify the

application to better meet user needs. A structured interview format was used to ensure that all users were asked the same questions and given the same opportunities to provide feedback.

Group Discussions

We conducted group discussions with the pilot unit staff whose jobs had been selected to use the application for assignments. These jobs are case studies to illustrate how the network and the application made a difference in completing assignment tasks, compared with a stand-alone setting. The group discussions addressed the application's features and the way in which they met user needs, the ease and/or the difficulty of using the application, the availability and the reliability of the application, and any other information that further helped us evaluate the DCA and its impact on the assignment process. We also asked staff to describe time and quality improvements for their assignments. Another discussion topic was DCA application training to determine whether it met user needs. Issues addressed included whether (1) training had been available and had been provided in a "just-in-time" manner, (2) it had covered all aspects of the application, (3) follow-on training had been required and the reasons why, (4) the training had covered the basic needs, and (5) the staff needed only subsequent "hot-line" assistance.

Network and DCA Streamlined Work Processes and Improved Access to Information

The pilot test showed that the network and the DCA application enabled staff to use significant segments of time far more productively. Staff indicated that a network environment saved time, as well as paper, fax, and telephone expenses. Numerous and frequently performed tasks were simplified, particularly the organization of and access to workpapers, the volumes of information that are the "heart" of all GAO audits. Communication and work group collaboration were enhanced because of the easy and immediate access to the assignment information from any place at any time.

Network Improved Communication and Information Access

Overall, GAO's network environment kept users better informed and more aware of relevant issues. It provided users a more efficient distribution of information and encouraged and enhanced coordination. In addition, the network allowed users to use their time more efficiently and provided increased and enhanced access to information, compared with a stand-alone environment.

Users surveyed believed that a network environment was much more efficient for communicating with others and sending documents and positively affected their personal productivity and morale. Nearly all the pilot unit staff—99 percent—who responded to surveys used the network to perform assignment tasks and over 94 percent were satisfied with it.[6] Over 80 percent said that it was of great or very great help for communicating with others, and over 70 percent said that it was valuable for keeping them informed of work-related matters.

Over 80 percent said that the network had positively affected morale. They indicated that morale had improved by connecting staff even though they were located at various places. Further, staff responded very positively to the issue of what the impact might be on their ability to communicate and share information if the network were in place throughout GAO. The following are examples of some of these responses:

- "It would be easier to receive communications from headquarters and to share information with issue areas regarding jobs."
- "This would greatly enhance my ability to communicate, etc., with folks in D.C. I worked on a job in RCED where we had access to the network, and it allowed us both greater communication and more timely communication."

[6]Information from questionnaires pilot unit staff completed in November 1993, May 1994, and December 1994 on how the network system, Windows software, and the DCA application affected the way they performed their work.

- "A network really facilitates sending products to other locations and receiving comments from others—expeditiously."
- "Communication and ability to do my work would greatly improve."
- "It would make it a lot easier to communicate across division lines. In fact, I've delayed getting messages to people in non-LAN divisions because of the relative difficulty communicating with them."

Access to information also has improved with the introduction of a network environment. Over 80 percent of the respondents said that the network was much faster and easier for sending and receiving automated files compared with the previous method of using dial-up communications software in a stand-alone setting. Also, staff who sent or received files more frequently indicated to a greater extent that it was easier and faster, compared with staff who performed these tasks less often. For example, of staff who sent files 10 or more times a month, over 80 percent said that the network was much faster and easier. Of staff who sent fewer than 10 files a month, about 68 percent said that the network was much faster and easier.

Moreover, staff also responded that the network environment provided a faster and easier access to some software packages, compared with a stand-alone setting. For example, over 50 percent said that to use graphics software was faster and easier, given that the network enabled staff to access this software from their desktops. In a stand-alone setting, graphics software was not always easily accessible since it was located only on certain workstations.

Windows Software Improved Work Setting

The introduction of Windows software also improved staff's computer and work environment. Staff who indicated that they used Windows software all or almost all the time were satisfied with this software and were more likely to say that it was easier and faster than non-Windows software. About 90 percent of these respondents said that Windows made it easier to switch from one software application to another. But of those who used Windows software half the time or less, only 40 percent said that it was easier for this task. This is not uncommon as it takes time to learn how to use new software and transition to this new operating environment. But once staff have worked frequently with Windows, most agree that it is easier and faster.

Staff also indicated that using Windows software on the network was easier and faster than using non-Windows software in a stand-alone

setting. Over 85 percent of the staff said that the Windows version of electronic mail was faster and easier for sending and receiving automated files, compared with the previous method of using dial-up communications software in a stand-alone setting. In addition, staff who sent and received files more often indicated that using Windows on the network was faster and easier.

DCA Provided Qualitative and Quantitative Benefits

Our pilot test showed that the DCA in a network setting, compared with a stand-alone setting, provided a more efficient work environment and enabled the staff to use their time more productively. The application provided the users with several benefits, such as on-line access to workpapers created at different locations and an easier method for organizing and locating information. Complementing these benefits, improved access to software and printers was provided by the network. The DCA and the network saved time by automating routine tasks and streamlining numerous processes. While the time saved on an individual task may be a few minutes, these savings multiply dramatically given the frequency of that task throughout the agency.

DCA Enhanced the Assignment Process

The application benefited staff throughout the assignment process. Specifically, the 25 evaluators who tested the application said that it

- provided a faster and easier method for organizing workpapers and locating information;
- better ensured that they identified and used all relevant information and evidence for analysis, indexing, and referencing;
- enabled them to access and review workpapers in a more timely manner;
- enhanced access to information, software, and printers;
- fostered compliance with GAO requirements; and
- streamlined administrative tasks, such as completing forms and memorandums.

DCA Saved Time

We believe that on the tasks we assessed, evaluators would be able to use significant segments of their time far more productively using the DCA rather than working in a stand-alone mode. Table 2.1 shows an estimate of the time savings for typical tasks in the assignment process.

Table 2.1: Time Savings for Typical Tasks in GAO Assignments

Task	Minutes to complete task without application	Minutes saved when task is done using application
Faxing document	13	11.5
Mailing document	9	7.3
Transmitting document by modem	23	20
Accessing software	6	5.4
Accessing printer	9.5	7.2
Locating policy guidance	8	6.8
Preparing congressional contact memorandum	15	12.4
Preparing distribution forms	17.5	15.2
Preparing workpapers[a]	43.5	40.1
Cross-referencing workpapers	15.5	14
Searching for information in workpapers	15.5	14.9
Retrieving workpapers to review	4	3.4

Note: Individual column information cannot be used to calculate annual staff-days savings since some tasks represent a series of steps that were summarized for the task and for this table. Additionally, some of the tasks may be done more often during one assignment versus during another. For example, an assignment that has two regional offices working with a headquarters division may fax or transmit documents more often than an assignment where only headquarters staff are involved.

[a]Includes creating a standard Record of Interview format for a workpaper, assigning numbers to workpapers, and preparing tables of contents for workpapers. The time needed to develop the workpaper content was not measured as this will vary, depending on such things as the length of the interview, the amount of information provided, and the substance and the complexity of the issues addressed.

Time was saved throughout because the tasks were automated, steps eliminated, and delays avoided. To illustrate, evaluators estimated that to thumb through bundles of documents to locate specific information or support for an issue would take over 15 minutes in the current stand-alone setting. With the application, about 30 seconds was required to locate specific information. Staff also said that the application enabled them to access more information than they could have by relying on memory.

In addition, on-line access allowed staff to immediately review workpapers created at different locations, such as audit sites or regional offices. To meet internal requirements for fulfilling appropriate audit standards, supervisors routinely need to review workpapers that are at

other locations. The on-line access saved time that would have been spent traveling to these separate locations, as well as the time used to fax or mail documents or to transmit information via modems with communications software. Furthermore, staff said that this enhanced access to information would enable them to improve products and be better informed about the jobs' progress.

Time needed to prepare and organize workpapers was also saved. For example, pilot staff needed over 30 minutes to prepare (type or handwrite) a separate table of contents for a bundle of 25 workpapers. In addition, they needed about 8 minutes to assign numbers to these workpapers. However, the DCA eliminates these tasks by automatically creating a comprehensive table of contents and assigning numbers as the workpapers are created.

Product development is also streamlined with the DCA since staff can move text from the workpapers into the report, instead of rekeying it. This saves time and allows staff to focus on higher-level tasks.

Information Access Was Enhanced and Simplified

The application provided a powerful capability that enabled staff to search and locate information by document type, preparer, key word(s), or other key characteristics. This capability greatly enhanced staff's ability to locate specific information. In contrast, when the workpapers were not in the DCA, information evaluators identified was limited to their memory of how and where they had recorded information. Locating the information often involved a time-consuming manual search.

The application also provided on-line access to GAO reports, abstracts, and open recommendations, coupled with key word search and retrieval capability, so that staff could quickly search for and identify information relevant to current assignments. This is a more efficient and faster means to locate information, compared with manually searching through files for reports on relevant topics or asking GAO's Technical Library to search its database of issued reports. For example, an Assistant Director in the RCED pilot group used the GAO report search to respond to a congressional inquiry about recent work on a transportation issue. She was able to tell the requester the titles and the report numbers for recent GAO reports on the issue while the requester was still on the phone.

Communication and Work Group Collaboration Was Enhanced

Staff could communicate and collaborate more easily and extensively with the DCA and the network. With all documents on-line, staff could immediately share their data with colleagues, no matter where they were located, and work together to analyze the information. Without the application and the network, accessing and reviewing workpapers was often difficult and at times infrequent since the documents existed only as hard copies and were often located at regional offices or audit sites. To share information in a stand-alone setting, staff would have had to fax or mail documents from one office to another or travel to a regional office. However, staff who used the DCA and the network said that they provided enhanced, faster, and easier access to information and would enable them to improve products. In addition, they said that they would be better informed and might refine the audit scope and the approach on the basis of the information collected midway through assignments.

The application also streamlined product reviews since supervisors could access, review, and provide comments on-line. In addition, the application kept a continual log of who had accessed and edited the products. Another benefit is that product reviewers could use the on-line workpaper access to retrieve additional information to clarify any outstanding issues or assess whether supporting data had been properly characterized.

The pilot unit staff also said it would have been helpful to have had all units using the DCA application so that the entire job team could enter and share workpapers. While they understood that this technology needed to first be tested in a pilot setting, they often noted the additional benefits that would accrue once all of GAO is using the DCA and the network. These benefits again centered on communication, coordination, and collaboration improvements; better use of time; researching and applying previous job information and avoiding rework; and the ability to be more responsive and better informed. For example, staff said that the workpaper information from previous, related jobs would often be very helpful and avoid duplication of efforts. Currently, when a job ends, the workpapers are filed, shipped to storage, and eventually destroyed. With the DCA application, this information can be stored electronically, accessed, and built on for subsequent, related efforts. As the DCA is implemented throughout GAO, this ease of interaction and information access will continue to expand and support GAO's core group concept.

Conclusions

We achieved our overall objectives of developing, testing, and implementing a mission-critical application, as well as determining the

GAO-wide network configuration that best met user needs. The DCA application and the network provided a technological system for addressing the most critical needs of evaluators in conducting audits—the development of and access to information collected during assignments. The DCA streamlined typical assignment tasks, and the easy and immediate access to assignment information improved communication and work group collaboration.

Pilot Test Laid Groundwork for GAO-Wide Implementation of New Technology

As we anticipated, the network and DCA pilot test introduced significant technological changes in the way staff carry out daily assignments and, inevitably, generated some user resistance. To deal with these challenges, we implemented a comprehensive project planning and management process; expanded the customer and network control facilities to enhance user and technical support; and ensured just-in-time training programs, which included management's unequivocal support for the new technology and work processes.

Comprehensive Plans Developed for Network and DCA Implementation

We recognized that the planning and the management of any project as massive as the network and the DCA rollout would require a highly structured approach. By necessity, the project involved many players:

- five GAO staff offices (OIMC, the Office of Real Property Services, the Training Institute, the Office of the General Counsel, and the Office of Acquisition Management);
- multiple contractors; and
- representatives of the individual divisions, regional locations, and audit sites being added to the network.

As a result, we developed a project planning and management process to define tasks, assign responsibility, develop schedules and budgets, and track results. This approach has proved highly successful even though the project itself has grown to include in excess of 14,000 tasks.

Project Structure

We based the structure of the GAO-wide rollout project on the approach we had found successful in the pilot. We had learned there that once we had established the network infrastructure, staff needed both training and time to master the new tools before they could apply them in new work processes. Therefore, we had provided units with training on basic network concepts and Windows applications just before or concurrently with the installation of their network. Then they had worked for 3 to 6 months in the network environment and had become familiar with Windows and experienced firsthand the communications benefits provided by electronic mail and the network's file transfer capabilities. Next, we had activated the DCA and provided them training on its capabilities, along with management's expectations on how this software would be used in their assignments.

Integrated Project Management

While this process is relatively uncomplicated to describe, it is quite complex when it is applied to introducing technology to over 4,400 staff dispersed at 60 organizational locations. The magnitude of this undertaking required that we use a highly disciplined process to ensure that we clearly defined each task, identified any other tasks upon which they depended or which depended on them, and then managed all tasks closely to ensure their timely completion.

To direct this process, we used two management teams, each of which met weekly. One team directed the network and DCA rollout project, and the other managed the configuration of the network and its tools, modifying them as necessary to resolve technical and budgetary issues. These two teams used the network and its powerful project management software to address all aspects of the rollout of the network and the DCA by dividing tasks into two groups, those related to general project activities (e.g., procurement, application development and testing, communications, and training) and those related to installing the network and the application software at individual work locations and training staff in their uses. The teams then used the software to manage the tasks, track their progress against estimated milestones, and report on their status to management.

This discipline developed a sense of teamwork among project participants. It continually reminded them of where their activities intersected with those of other managers, some of whom they were depending upon and some of whom were depending on them. In addition, by identifying the interdependent project tasks, the teams focused on the importance of managing according to the estimated milestones and kept the project close to its originally projected dates.

Site Preparation and Installation Plans

This structured planning was particularly helpful in managing the complex set of tasks required to install a network at each organizational location. Each location brings a unique mix of a wide variety of elements:

- staff size;
- existing hardware and software;
- type of space: GAO owned, commercial, or host agency;
- permanence of location (anticipated move date if nonpermanent);
- location of current wire closets and other structures carrying the building's electrical system and the capacity of existing electrical systems;
- heating and air-conditioning capacity and hours of operation; and

- presence of a local area network (if present, its conformance to GAO's current standards).

For each location, we identified and analyzed all these elements in a site survey to determine the level of effort and the specific steps that we would need to take to bring in a network. With the survey data in hand, we then ordered the hardware and the software the site required through contracts that we had specifically awarded for that purpose. We also used the survey to develop a detailed design of the proposed cable plant to guide the cabling and installation teams, identifying the location of each network workstation, printer, and server, as well as the location of the wiring closets and the potential connection points for the network. Depending on the location and the type of site, we then selected the appropriate contractor to install the cable plant and delivered the network hardware to the location. When the contractor had completed the installation, we tested the hardware to make sure it conformed to the design standards. Concurrently with these tasks, we employed a separate contractor to make any changes to the location's electrical and air-conditioning support required by the new network.

As the cable plant was being installed, we also prepared the location's end-user hardware and software. The specific number and configuration of server(s) depended upon staff size and the types of applications to be performed at the site. We configured and tested the server(s), and then loaded the software the site required. We also installed network interface cards in each workstation and delivered them to each site.

Finally, another team completed the installation. It connected the server(s), workstations, and printers to the cable plant, and if the location was not in the headquarters building, the team connected the local area network to GAO's wide area network, allowing it to exchange data with other GAO locations. We then verified that all network functions were operating normally and completed the systems integration.

The variables that drive this process would not have been manageable without our project management approach. To illustrate, we had to manage 12 major tasks containing about 86 subtasks and coordinate the efforts of our own staff with a variety of contractor teams, their number ranging from 2 to 4 depending on the situation at a particular site. Given the number of organizational locations covered by the project, this was a challenging undertaking.

Acquisition and Budgeting Issues

As did site preparation and installation, our acquisition process required careful planning and management. In the middle of fiscal year 1994, we received authorization to proceed with the rollout of the network and DCA. We were faced with establishing a procurement vehicle that would meet the multifaceted requirements for this project, everything from network infrastructure hardware to end-user software and the labor services needed to install and maintain the total plant. Our task was complicated by two facts: (1) many of our existing contracts for information technology and services were about to terminate and (2) our procurement efforts would take place during the always hectic year-end buying period.

As we had with the rollout as a whole, we formed a team representing the pertinent offices—General Counsel, Acquisition Management, and OIMC—to improve communication and reduce obstacles. The team defined the key activities required in the balance of fiscal year 1994 and those for fiscal years 1995 and 1996. The team also established some working guidelines:

- use existing contracts and governmentwide agreements wherever possible (such as contracts for cabling and telecommunications);
- use the reprocurement of terminating contracts as the vehicle for meeting our new network requirements wherever possible;
- negotiate directly with software providers for agencywide software; and
- use the mixture of competitive and noncompetitive contracts best suited to our needs.

Working with these guidelines, we were able to undertake and put in place six major procurement activities in fiscal year 1994:

- a labor services replacement contract for various network tasks (e.g., user support and network operations and support);
- a hardware maintenance services replacement contract;
- an operations and maintenance replacement contract for administrative systems, small systems development, and customer support;
- a high-level configuration design and engineering support contract (e.g., testing structures and compatibility testing);
- a contract to install the hardware and the software for the basic network infrastructure; and
- a contract to install the hardware and the software for the DCA.

With these contracts in place, we then worked to ensure that they would provide us with the quality and the timeliness of service that we required.

Our project management approach had demonstrated how tightly interrelated our tasks were and how a slippage by one contractor could roll throughout the project, causing delays in networking numerous units. As a result, we worked closely with the top management of our contractors to understand the stresses that they were under and to guarantee that they were clear about our priorities, schedules, and concerns. While we have experienced some delays, they have been relatively few given the size and the complexity of this project.

Customer and Network Support Enhanced and Expanded

We are well aware that the ability of our network and the DCA to achieve the type of benefits that GAO seeks will depend largely on how well we support users. We also recognize that by establishing the network and its applications, we are creating a new working environment for GAO. If that environment fails or becomes inefficient because of technical problems, it could compromise the performance of our mission until service is restored. As a result, we are expanding our Customer Support Facility and Network Control Center to ensure the expected support and efficient operations.

Customer Support Facility

User support is a complex undertaking. Many users work in locations far from headquarters, and many others are traveling far from their own offices or working at home; however, they all require support in the new interface and applications provided on the network, as well in the use of them in their assignments. To deal with these issues, we have established a two-tier support mechanism. The first tier is at the user's permanent location, where the network focal points and administrators are sources for immediate help and troubleshooting and know how to use the new applications in a typical GAO assignment. For those problems whose resolution requires a level of technical skill beyond that of the local support or for traveling staff, we have established the second tier, the Customer Support Facility, which is staffed weekdays from 6 a.m. to midnight E.S.T. and weekends from 7 a.m. to 7 p.m. E.S.T.; support at other times is available through voice mail and pager service with a guaranteed immediate call-back option.

Within the Customer Support Facility, a caller is provided multiple types of assistance depending on the nature of the problem. The caller is first handled by the Help Desk, which logs the call, identifies the type of problem, and transfers the caller to a support specialist. This specialist is responsible for resolving the problem, if possible, or diagnosing it and

passing it on to the appropriate group for resolution: the Network Operation Team, the Software Operation Team, or the hardware maintenance contractor. Because this approach is designed to deal with the unique nature of each caller's problem, we hope to quickly resolve problems, reduce customers' frustration, and get them back on the job.

Network Control Center

Network control is extremely difficult in an environment as complex as ours. The development of centralized network management support tools is relatively immature. The hardware and the software do not yet exist to monitor every device on the network and identify problems before they interrupt operations. Doing so is a daunting task. Like all networks of any size, ours has thousands of different devices linked to the network infrastructure and thousands more which form the network itself. In addition, these devices come from thousands of different manufacturers, and while they are designed and configured to operate together, the industry is not yet so standardized that the status of each can be determined from a central point.

We have, however, taken the first steps in securing such a capacity. We have procured the dominant industry platform for network management. When this combination of hardware and software is fully implemented, it will allow us to proactively review the status of major devices across the network, determine traffic patterns, and highlight potential trouble spots. While the platform provides a rich set of tools, implementing it will require a significant level of effort. We will need to standardize the network as much as possible, ensuring that each device on it has a unique address that can be identified and monitored centrally. However, we recognize our ability to manage the full network centrally will come only with the continued development of this segment of the information industry.

Comprehensive Training Strategy Developed

The Training Institute has developed a comprehensive program to support the successful implementation of the DCA.

The program will begin with a "DCA Leadership Briefing and Workshop," targeted to the Senior Executive Service leaders and staff managers. This course will provide a framework for understanding the dynamics of organizational change and the skills, the tools, and the techniques for managing change involving new technology. As part of the course, the executives and the managers will lead their units and core groups through the DCA implementation.

In addition, all staff will attend a "DCA Overview Briefing" to learn about the DCA's features and benefits and the impact that we anticipate it will have on GAO's work processes. At these sessions, unit leadership will set expectations for staff to learn about and adapt to the new environment. This overview will also consist of

- a DCA demonstration;
- a briefing on benefits, use of the DCA, organizational implications, and support provided for implementation; and
- group discussions.

Classroom training on the DCA will follow the overview. It will include a 1-day course to teach the basics of the DCA, which will be followed by several specialized training sessions—either on-site workshops or self-paced instruction—to learn additional DCA capabilities. In addition, staff will complete self-assessments a few weeks after training to identify their current skills and any additional training and/or assistance they might need. Finally, once the staff are back on the job, they will have the support of focal points and user groups at their units to reinforce the skills that they have developed in the classroom.

Conclusions

Several best practices were developed from the pilot experience, which GAO used in preparing a detailed plan for GAO-wide implementation of the computer network and the DCA. We have implemented this plan to ensure that the installation process is appropriately carried out and managed, to enhance user and technical support, and to provide the just-in-time training and management support needed for successful implementation.

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