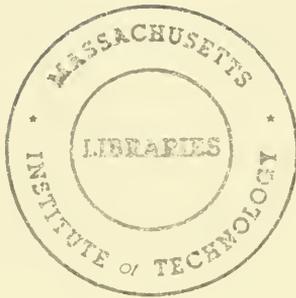


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A CASE STUDY
of
OFFICE WORKSTATION USE

Christine V. Bullen

John L. Bennett

Eric D. Carlson

March 1982

CISR WP #84

Sloan WP No. 1285-82

Center for Information Systems Research

Massachusetts Institute of Technology
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Christine V. Bullen

Center for Information Systems Research
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

John L. Bennett
Eric D. Carlson

IBM Research Laboratory
San Jose, California 95193

ABSTRACT: This paper describes the use of the Office Analysis Methodology to study a specific office environment in order to determine requirements for an advanced office workstation. The research site environment was unique in providing an opportunity to observe a natural growth pattern in the use of advanced technology. Specific workstation requirements were identified and are being implemented. Interesting observations are reported in the following areas: categories of secretarial work, use of existing workstations, influence of a community of users, access to shared services, and impacts on productivity and organizational behavior.

I. MOTIVATION AND STATEMENT OF PROBLEM

In the Spring of 1981 the IBM San Jose Research Laboratory (SJRL) was faced with an operational problem. A variety of typewriters and terminal equipment, installed in offices throughout the Laboratory, had been acquired over a period of time for use by administrative and secretarial workers. As part of planning for an expansion of physical facilities, a committee began investigating how the equipment was actually used in order to make intelligent recommendations about what new equipment should be provided for the administrative support staff in the future.

At the same time, a Computer Science group within the Laboratory was developing an advanced office workstation. It became clear that a study of the work patterns of the administrative support staff in this particular Laboratory could be helpful in understanding the general requirements for an advanced workstation.

After reviewing published methodologies and inviting proposals from academic groups involved with office systems research, the decision was made to work jointly with the MIT Center for Information Systems Research (CISR) and that funding for the study would be shared by administrative and research groups at SJRL. CISR was in the process of conducting research into the nature of office work using the Office Analysis Methodology (OAM) developed at MIT [1]. The CISR research is designed to explore office automation issues in several organizations including samples from manufacturing, high technology, and service industries.

As Zisman [2] observes, much of the previous work directed toward office automation has focused on mechanization of the current straight-forward, paper-producing tasks. The

CISR studies, conducted as part of the CISR research on office automation, encompass the total range of procedures carried out by office workers at all levels – secretarial to top management. The studies seek to identify, through interviews during site visits, procedures that have a high impact on the mission of offices within organizations. Once the procedures are outlined and related to the mission of an organization, then those high impact procedures and tasks that would benefit most from computer-based technology can be identified.

We present here the results of one part of the CISR study conducted at the SJRL. This part focused on existing secretarial tasks performed using existing workstations (Section II). The results (Section III) were used to develop requirements for office workstations for the SJRL (Section IV). Although the results presented here are from a single case study, they do indicate the value of using a systematic methodology such as OAM to study office work. From our study of office environments similar to that found at the SJRL, we believe that the requirements apply generally (Section V) to office workstations in highly automated offices.

II. METHOD

Objectives

Two objectives were chosen for the first phase of the specific study at the SJRL:

- A. Survey the tasks currently performed by the secretarial staff in the SJRL.
- B. Understand the current use of the existing workstations and the role that they play in support of these secretarial tasks.

The objectives of the study were focused initially in order to answer the shorter range operational question of workstation requirements and selection. The interviews were directed toward understanding the existing procedures and the possible effects arising from the acquisition and installation of new office workstations.

While we did look for procedures and tasks which could benefit from additional automated aids, that was not a main focus. The difficult issues of measuring productivity and predicting the impact of change on the organization were not central in considering what equipment would be needed to support existing work. However, in the course of the interviews, factors impacting productivity and organizational behavior were observed.

The Office Analysis Methodology

The Office Analysis Methodology (OAM) was used to guide and structure the study. OAM focuses on 1) understanding how each office operates within the organization with respect to the overall organizational mission, and on 2) understanding how that mission is accomplished. This focus involves conducting a "functional" analysis of the office's operation, expressed in business terms. The procedures being performed and their purposes are identified so that analysts, programmers, and office workers can communicate effectively about requirements.

OAM defines several levels of abstraction as a conceptual framework for gathering data. The MISSION of an office support group (e.g., the secretarial staff) is described in terms of purpose and goal (e.g., support the technical staff by preparing documents, handling phones, and managing office work). A FUNCTION (e.g., document preparation) is the aggregate of all the procedures that INITIATE, MANAGE, and TERMINATE the use of office resources to achieve a business goal (e.g., keying, proof reading, printing for review, and revising text). A RESOURCE is an entity (e.g., a document, a word processor) that is managed to meet a business goal. A PROCEDURE (e.g., an outline of the sequence for printing a photo-composed draft) prescribes the tasks needed to complete an activity. A procedure (or the tasks specified within a procedure) will often involve the manipulation of a

specific OBJECT or set of objects. An OBJECT (e.g., a typed page, an instruction book) is a tangible entity that is a component of a resource or that provides information about the resource.

OAM offers potential benefits by avoiding the following pitfalls often encountered in the use of conventional requirements analysis:

- suboptimizing present procedures as a result of a focus on discrete procedures and tasks taken out of context;
- preserving archaic procedures as a result of a concentration on mechanizing a discrete process without gaining an understanding of the bigger picture.

In addition OAM provides the opportunity to identify which activities are valuable in accomplishing the mission, as opposed to identifying only the easily observable, visible, structured tasks. Through this approach, OAM can help to define productivity and isolate meaningful measures that apply to semi-structured tasks found in the office, the work as it is actually carried out [3].

The OAM is intended to be quite comprehensive. It can be used for descriptive studies (how work is done now in a office) or it can be used for prescriptive studies (how new procedures can be used to better carry out the function of an organization). It includes what to do in a study, recommends interview procedures, and outlines analyst qualities needed. It suggests concentration on the usual path through a process followed by analysis of exceptions and how they are handled.

The best available description of OAM is given by Sirbu et al. [1]. We can only give an outline of the concept here. Figure 1 gives an overview comparison and contrast between

CONVENTIONAL	OAM
look for processes structured enough to be completely automatable	focus on requirements of functions within the organization (not on operational details)
concern with specific procedures instead of functions	oriented around functions and resources which are then supported in procedures
look for a single system approach	functions can be supported by a variety of procedures, alternative system approaches
little attention to behavioral and managerial aspects of system design	concern for decision-making role of office staff at all levels
focus on the need for (low level) change and the technology which can be applied to this end	concern with organizational needs of client group at all levels
how much secretarial time is spent typing	how many hours each by how many people does it take to complete a procedure; how often per week is it repeated; how many procedures are in process at any one time
how many forms are filled out per unit of time	how many resources are in process in a unit of time to carry out a business function

Figure 1. The Office Analysis Methodology permits a focus on functions and procedures important to the mission of the organization. This contrasts with a conventional approach focused on the supporting technology.

conventional requirements analysis and OAM. Figure 1 is not meant to be a comprehensive comparison; it only highlights some key differences.

We began our preparation for the study at San Jose by adapting an interview outline previously developed for use as part of the CISR study at other sites. Figure 2 is a summary of the interview outline.

The Case Study Site

The IBM San Jose Research Laboratory (SJRL) is organized into four major research areas, called Functions,^a each of which is headed by a Functional Manager who reports to the Director of the Laboratory: Computer Science, Physical Science, Storage Systems, and Applied Science. All centralized administrative tasks are combined at a Functional level in Administrative and Technical Services (A&TS). The total population – research and support personnel – is about 600 people.

Within each research Function there are two to three departments ranging in size from 23 to 45 people. The people on the research staff, called Research Staff Members (RSMs), are grouped by research specialty within the departments and are assigned to specific projects. While the research staff is relatively stable, shifting between departments and projects is quite common. In addition, a number of visiting scientists, postdoctoral fellows,

^aThe Use of the term FUNCTION is not identical to the use of the term in OAM. However, both uses relate to a focus on activities needed to achieve mission results.

INTERVIEW OUTLINE

- I. MISSION/FUNCTION
Statement/organization chart

- II. RESOURCES
 - A. People (who, how many, management levels)
 - B. Other resources

- III. MAJOR TASKS/PROCEDURES
 - A. Phases (initiating, managing, terminating)
 - B. Inputs/Outputs
 - C. Sources, destinations, links
 - D. Exceptions (a checklist of exception causes was provided)
 - E. Objects (a checklist of sample objects was provided)
 - F. Databases (a checklist of sample manual and electronic data bases was provided)

 - G. Quantitative measures
 - 1. Number of objects in process at any time
 - 2. Time to accomplish a task
 - 3. Time to accomplish a procedure (set of tasks)
 - 4. Frequency of repetition
 - 5. Number of objects processed per unit time
 - 6. Timing constraints on completion of a task
 - 7. Frequency of exceptions
 - 8. Number of people involved in each step of a procedure
 - 9. Size of databases

 - H. Office Layout/Environment
 - 1. Equipment (what, what used for, likes and dislikes)
 - 2. Comfort, style
 - 3. Training
 - 4. Special needs

Figure 2. The outline structured the Phase 1 interviews such that the information gathered on clerical procedures could be understood in the context of the office and organization mission.

and summer interns report at functional, departmental, or project levels while temporarily at the SJRL.

In this phase of the study, we confined interviews to the secretarial staff working at the Function and Departmental levels. We also included those secretaries working in the Administrative Processing Center giving support to A&TS professionals.

The SJRL provided an intriguing research site. While it is comparable to our other research sites in its basic organizational design and its administrative functions, it is unique in the following ways. First, the SJRL is staffed by technology-oriented, highly skilled professionals who create an environment which is receptive to introduction of new technology. This would be expected in any group working on advanced technology products. However, the innovative attitudes of the RSMs encourage experimentation with new technology even in their routine office activities – drafting papers, preparing presentations, and sending messages to colleagues. In addition, sophisticated technology is available for use by administrative people in a setting without mandate or formal pressure to employ it. This, combined with the supportive access to information from RSMs, results in an unusual situation for studying natural growth patterns in the use of advanced technology. Thus, we could observe actual patterns of use in a technologically sophisticated environment as contrasted with the speculation common with many writers on the "office of the future."

As outlined above, we used the OAM framework to construct a one hour interview.

The categories of those interviewed and the range of people nominally served by each secretary in the category are as follows:^b

<u>Level</u>	<u>Number of Secretaries Interviewed</u>	<u>Number of people Served by each Secretary (Range)</u>
Functional Manager	4	3 to 7
Department Manager	9	23 to 43
Administrative/Other	<u>8</u>	5 to 45
TOTAL	21	

Each secretary was interviewed at the place of work where sample objects (computer-readable and paper copy) could be displayed as needed to serve as an illustration. All secretaries interviewed used a desk-top display terminal capable of showing simultaneously on the screen 24 lines of 80 uppercase and lower case characters. Some had a terminal allowing display of 43 lines at a time. Each terminal had an attached (but movable) keyboard. In addition, each secretary or administrative support person had a communicating typewriter terminal for printing output on letterhead paper. This terminal was also used occasionally as a stand-alone typewriter, and it had magnetic card storage.

The display terminals, which had no stand-alone data entry capability, were attached to a large-scale host computer operating the VM/CMS system. Also attached to the computer, directly and through a network, were many high speed and/or high quality devices used to produce printed output on a variety of paper and pre-printed forms. The network is an IBM

^bThe selection of those interviewed and the range estimate for the number of people served were made from an inspection of the organization chart.

corporate network linking computers in most IBM Laboratories worldwide. The secretaries in the sample were using a variety of software available on the system, including a full-screen editor, a document formatting and printing facility, a message system, and a number of locally-developed macro programs.

III. RESULTS FROM THE INTERVIEWS

Types of Tasks

In our study we focused on resources and objects that resulted in paper copy or that went through a keyboard data-entry phase. We did not address phone handling as a task (except to note approximate percentages of time spent), although we did consider typed lists as support for making phone calls.

The secretarial work at SJRL can be divided into the two categories shown in Figure 3. The "others" initiating secretarial work are professionals, managers, and visitors serving on the staff. The category of "work initiated by others" is the one that generally comes to mind when people describe what the "typical" (actually stereotypical) secretary does. The work is text-oriented – that is, the initiator provides text (handwritten, dictated, rough-typed), and the secretary's role is to provide text output in typewritten or printed form. Completion requires little contact with other resources (documents or people). The tasks require a fixed format which is made standard through policy, tradition, or equipment constraints. The outputs are typically a file specifically designed to be revisable (because the final task result is subject to initiator negotiation) and text-on-paper for initiator review. Examples are notices, letters, and memos (relatively short) and activity reports (relatively long). In the second category,

CATEGORIZATION OF SECRETARIAL WORK

1. Work initiated by "others" secretary is
 - a. told explicitly what to do
(given raw text and a sample letter specifying the format)
 - b. given some discretion
(foil format)
2. Work initiated by the secretaries in response to:
 - a. being told in a general sense to achieve a result
(produce an equipment inventory list)
 - b. being told they are responsible for a result
(making labels used to forward mail to former visitors)
 - c. observing a need and taking responsibility for meeting it
(monitoring department expenditures)

Figure 3. Use of the OAM led to insight on process-initiation as a key discriminator of the type of work done by a secretary.

the levels of self-initiated work reflect increased taking of responsibility and creativity.

Although this category involved keyboard data entry, the data entry is not an end in itself.

Completion generally requires contact with others, and the secretary has flexibility in selecting the format in which the results are presented. The outputs are typically files used by the secretary in carrying out office procedures. Examples are mail logs and reminder files.

There seem to be a series of prerequisites for appearance of secretarial work in the "self-initiated" category. First, powerful tools (or a light work load) must make it possible to get routine work out of the way. Then the secretary must have a willingness to explore

the use of tools in imaginative ways. Third, the professionals served must acknowledge the value of the resulting innovation.

Hiltz and Turoff [4] describe the category of "work initiated by others" well when they observe that secretaries "act as intermediaries between the originators and the recipients of text." They comment on the fact that word processors are typically aimed for one specialized aspect of what the secretary actually does.

There are other non-text kinds of work in the "initiated by others" category (e.g., placing telephone calls). The extent to which a secretary can influence the process used to complete such tasks depends on the precision with which the "order" is given. The initiator may fully describe the task (e.g., specify the exact format) or may leave that to the discretion of the secretary. An instance where the secretary adds value to the output is in the design of overhead projector foils. In this category, there are two breakdowns: those tasks where the value-added is in form only, and those where both form and content are influenced by the secretary. Figure 4 summarizes some examples in each list.

Tasks initiated by secretaries, in order to better accomplish a job, involve a flexible format. Examples include equipment inventory, personal calendars, and budgets. The self-initiated work described in Figure 5 includes use of tools requiring the secretary to do considerable "thinking"; that is, the secretary must add value in order to achieve the result. Again, many more "non-keyboard" tasks could be found in this category when observing a secretary at work (e.g., telephone calls, setting up meetings, planning office moves, furniture and equipment acquisition). Figure 5 lists some examples of self-initiated tasks requiring keyboard data entry.

FORM	FORM & CONTENT
typing a letter	memos announcing a meeting
technical typing (formulas, equations, special characters)	applicant handling speaker announcements
foil layout	shaping notes into sentences and paragraphs
activity reports	 budgets
progress reports	space planning, moves, and telephone assignments
proposals	new staff, visiting pro- fessionals, summer interns;
performance plans	orientation and records
research orders	equipment inventory

Figure 4. Tasks initiated by others but which give evidence of secretarial "value added" and, in some cases, creativity.

FORM AND CONTENT

mail log

distribution lists for reports and memos

equipment inventory

employee home addresses and phone numbers

mail forwarding lists and labels

reminder file based on date

financial monitoring to track budget expenses

Figure 5. Tasks initiated by secretaries in order to support their own work, to accommodate their personal working style, or in response to an environmental need they have observed.

A major result of our interviews is the observation of how time is allocated between categories of work. The secretaries to Function Managers spend less than 50%^c of their time doing structured text entry initiated by others. Secretaries to Department Managers spend from 50% to 90% of their time doing such work, depending on the style of the Department and the style of the individual secretary. The remaining secretaries spend 75% to 95% of their time on this category of tasks.

It is clear that much of the secretarial workload consists of tasks initiated by the secretary. The conventional stereotype is that secretaries only carry out highly structured tasks at the direction of the persons supported. Contrary to the stereotype that "secretaries do not make decisions of any significance on how to spend their time," we found that secretaries to Function Managers typically spend more than half their time working on self-initiated tasks, and Department secretaries spend anywhere from 10% to 50% of their time in such activities.

The Nature of the Documents

In the previous discussion of types of tasks, the variety of documents at the SJRL was also illustrated. Figures 3, 4 and 5 all list specific examples of the documents identified in the course of the study. Because document preparation, storage, retrieval, and printing are major office workstation tasks, we used the OAM "objects" concept to investigate how documents enter into the SJRL secretarial work flow. We categorized documents on the

^cThe time estimates were collected in the interviews and reflect the judgment of those interviewed. The figures were not independently validated. However, the results are consistent within the hierarchy of secretaries, suggesting that these approximations are reasonable. The interview results were supplemented by some direct observation.

basis of frequency as seen by the secretary. Figure 6 shows this classification with another sample of documents, preprinted forms, listed in each frequency category. The study identified over 50 different (in terms of format) documents, about equally divided among the three categories. Document preparation can be either self-initiated or initiated by others, but it is low on the scale of value-added. However, document preparation may be a task associated with a much more significant procedure (e.g., planning for and ordering new office equipment) that may be important to the mission of an office.

The Use of Existing Workstations

Each secretary had access to the display terminal that was connected to the host computer and to the communicating typewriter terminal with printer and magnetic card storage. We were interested in the secretarial preferences for choice of use and the criteria entering into the decision. We expected that these preferences would illustrate characteristics of work style or features deemed useful by the secretaries. Figure 7 shows the results.

To explore this further, we asked the secretarial staff for their opinions about what they liked when using the display terminal. These characteristics are listed in Figure 8. Note that these are really opinions about the display terminal and the services accessed via these terminals. In summary, assuming the host system was delivering normal service, the display terminal was always preferred except when there were "printing" constraints (e.g., a special letterhead was required, the task consisted of addressing a single envelope, or the text was personal and confidential).

These opinions reflect two issues – productivity enhancement and "expectations" for text output quality. The secretaries unanimously felt that the ease with which text could be

A SAMPLE OF DOCUMENTS AND THEIR FREQUENCY OF USE

High Activity	Medium Activity	Less Frequent
travel expense authorization	invention disclosure	work authorization order
purchase order	presentation clearance	award
check request	request for publication	patent disclosure
petty cash	foreign travel approval	verification of foreign seminar attendance
time card	personnel data	
travel plan	an order for manuals	
Manuscript Processing Center work order		

Figure 6. Documents are frequently completed by the secretary in order to support the staff. Additional secretarial time is spent tracking progress and checking for completion.

CRITERIA FOR USE OF DISPLAY TERMINAL AND TYPEWRITER TERMINAL

- 90% preferred use of display terminal at all times unless:
 - observed slow response time due to heavy host usage
 - needed special letterhead on short notice
 - observed host service was temporarily unavailable
- 100% preferred typewriter terminal for:
 - filling out forms
 - short, one-time jobs (envelopes, local, occasional memo)
- Confidential or sensitive text
 - 14% preferred using typewriter terminal start to finish
 - 48% preferred input of text on the display terminal, printing on the typewriter terminal (host-connected)
 - 38% did not do this kind of work

Figure 7. The secretarial staff made a choice in use of the display terminal and the typewriter terminal.

CHARACTERISTICS OF WORK WELL-SUPPORTED AT THE DISPLAY TERMINAL

- Ease of manipulation and correction of text
- Establish standard format for selves and for sharing with others
- Communication features
 - Messages
 - Sending text files to nearby offices, to other locations over a network, to RSM's working at home
- Special printing features
 - Fonts containing special characters, highlighting
 - Graphics
 - Photo-printers providing book text quality
- Access to special features programmed on the host (see Figure 10)

Figure 8. The secretarial staff mentioned a number of things they liked about display terminal use.

manipulated and changed on the display terminal was a major aid in supporting their ability to "get the work out the door". The message and text transmission features saved time and footsteps. They also provided support communications among secretaries and staff which were never before possible when RSMs were working at home or at other IBM locations.

The "expectations" issue is an interesting one. As soon as secretaries began experimenting with sophisticated printing options for both reports and foils, the research staff came to expect the high quality as a matter of course.

As a result of their extensive use of the display terminal and host-based featured, the secretaries also made a number of observations of things they would like to see changed. A first and foremost concern was the lack of formal training. They recalled their first days using the system with some sense of accomplishment, but they did not think it was an efficient way to learn. They also were frustrated; they suspected the system contained a number of additional features that they would find valuable, but they had no easy way to confirm this. The observations are summarized in Figure 9.

The Community of Users

The research staff (RSMs) in the SJRL make extensive use of the VM/CMS system and the display terminals for administrative as well as technical support. The RSMs in the Computer Science Function, in particular, have an understanding of how the underlying system is organized, have a professional interest in adding new capability to the system, and have a personal interest in seeing this new function used. These combine to act as a powerful influence for innovation in how secretarial and administrative work is done.

CHARACTERISTICS OF WORK WITH THE DISPLAY TERMINAL THAT THE SECRETARIES WOULD LIKE CHANGED

- Lack of organized training
 - found themselves re-creating formats that they later discovered already existed
 - no formal way to learn reliably of new features
 - poor documentation of host programs
 - learning curve longer than necessary
- Host unavailability, slow response time
- Printer problems
 - located several hundred feet from the secretarial work area
 - not safe to send personal and confidential text to a "semi-public" output area
 - schedule for loading special letterhead paper stock too restrictive
 - printers relatively close to work area did not have subscript and superscript capability
- Difficult to proof-read successfully the text displayed on the vertical display screen.
- Terminal physically cumbersome; too much area on the desk top, too "massive", too heavy to move conveniently

Figure 9. The secretarial staff discovered in practice a number of things they did not like about use of the display terminal and the host support.

For example, individual staff members will develop a new way to use the computer (e.g. a SHIP macro command for transferring files between local users and over a network). They will tell or show colleagues how the new command makes their job easier. Some colleagues will typically discover additional things that could be done and will add the function to the system. Since staff members are accustomed to doing much of their own secretarial work (due to provision of tools to support this^d), several will discover ways that they can use the system for office activities. Staff members, in the course of enlisting secretarial support for a task, explain how to use the system to get that particular job done. A secretary, typically receptive to a new idea, will make some notes on how to use that feature. Then at lunch, or in the course of an exchange with another secretary, the technique will be passed on. The readiness to accept innovation, coupled with an easily used message system, leads to the spread of such information over the informal network.

Note that this process can operate two ways. Ideas that seem at first to be good, may upon wider use, be discovered to have flaws. For example, a RECEIVE macro command allowed incoming files to overwrite user files that happened to have the same name. The word soon spread to "watch out", and many began using a similar but accident-proof RD (for "read") macro command instead. Thus, the SJRL environment tends to separate the unworkable from the workable.

^dInvestigation of staff member work is part of Phase 2 of this study and is not documented here.

Shared Services

A variety of services available on the host computer are accessed by the secretaries through the terminal. Figure 10 shows examples of these services.

The secretaries consider the computer-based message system to be a significant aid in their work. They use the facility to exchange brief notes, to seek help on special problems in system use, and to exchange techniques by sending special formats to one another. There appears to be a significant use of this in preference to use of the telephone. While the telephone is an instrument for direct and immediate conversation (once the connection is made), the staff is aware of the disruptive nature of a phone call. By using the message system, the exchange can be managed by the recipient on a "when convenient" basis, whereas conventional office etiquette requires that a ringing phone be answered. Computer messages can be duly noted without interrupting the flow of the work in progress.

Messages on the current system are used in two modes. In a direct mode, the name of the recipient and the content of a short message (100 characters) are specified simultaneously. The message can be delivered only when both parties are synchronously online. This is useful for brief notes where the immediacy of exchange is important. No record of these messages is kept on the system. A second mode allows a message to be stored for later reading if the recipient is not currently using the system. If the recipient is online, then a "notice" appears interspersed with whatever work is in progress. This states the source but not the content of the message. The secretary can access the communication via a set of commands and read the content when convenient.

COMPUTER-BASED SUPPORT FOR ROUTINE ACTIVITIES

Looking up numbers in an online telephone directory
Checking the spelling of words in text documents
Calculation (hand calculator function online)
Clock used in connection with a reminder file
Send and receive "soft copy" documents and messages

Figure 10. These activities would normally be carried out manually. The secretarial staff typically prefers to use the computer-based routines.

IV. INTERPRETATION OF THE RESULTS

Requirements for Office Workstations

The primary objective for this part of the CISR/OAM study at the SJRL was to help determine the requirements for administrative workstations. As previously mentioned, all secretaries in the study had "dual" workstations (display terminal and communicating, magnetic-card typewriters). This "dual workstation" configuration was expensive and consumed considerable space (about 15 cubic feet, requiring an entire desk top surface area). In addition, much of the equipment was reaching the end of its useful lifetime, and many terminals had noise and quality problems. Thus, the SJRL administrative management was interested in replacing these workstations. The management, and many secretaries, were aware of CRT word processors and were interested in their possibilities for use at the SJRL.

The results of the first part of the CISR/OAM study described here were used to make recommendations on office workstations for the SJRL and to guide research on office

workstations. As we summarize the requirements derived from the study, we will interpret the study results which led to each requirement (Figure 11).

Two of the study results strongly indicated that an office workstation should conveniently attach to the host (VM/CMS) system. The attachment should be high speed (at least equal to the 1.2 megabit rate of the display terminals), should involve a simple hardware and software protocol, should provide emulation of the display terminal, and should permit file transfer between host system applications and the workstation. First, the study indicated a high utilization of, and dependency of secretaries upon, host system services (e.g., messages, data bases, editors). Any workstation which does not provide access to these services would reduce productivity and incur substantial resistance. To assure transfer of established work patterns, access to the host system should provide the same user interface and functionality as the display terminals, at least as a subset. Second, the study indicated the importance of the community of users. As observed, this community provides training, help, and new applications. If the workstation does not provide access to the shared services, the value of this community of users will be lost.

Adequate host attachment would allow an office workstation to provide the functions of the existing display terminals, but the workstation also needs to provide the functionality of the typewriter workstations. In particular, the study indicated that the typewriter workstations are used for printing, storage of classified, short or personal documents, and for preparation of documents that are short or difficult to prepare with the display terminal (e.g., forms). Support for document preparation would have to include "typewriter emulation" for short documents, such as envelopes. One of the advantages of the current typewriter

RESULTS	RELATED REQUIREMENT
1a. Dependency on host services. b. Community of users.	1. Host attachment with terminal emulation and file transfer.
2. Magnetic card typewriter used for short documents, backup, and printing.	2a. Typewriter emulation. b. High quality printer.
3. Dual workstations used at the same time.	3. Multi-tasking with simple, quick user support for switching between local and host-attached modes.
4. Wide variety of documents.	4. Support for wide variety of formats with prototype templates.
5. Screen, availability, printer, and training problems.	5. Larger screen; local processing, storage; and training programs.

Figure 11. The results from the study indicate specific requirements for an administrative workstation.

workstation is that it can be used in a standalone mode. Many of the secretaries noted this advantage when asked if they could give up their typewriter workstation. In addition, several secretaries noted that the word processors which they had seen did not provide this typewriter capability.

As shown in Figure 6, the secretarial personnel work with a wide variety of documents. Many of these are prepared, stored, printed, and retrieved using the existing workstations. Thus, any new workstation must support these tasks and documents (e.g., letters, memos, numerous forms, research reports, and lists). The file transfer capability of the host

attachment must be integrated with the local support for these documents so that a document that is prepared at the workstation can be processed by the appropriate host applications. For example, it should be possible to format and print documents prepared at a local workstation with existing host applications. It should also be possible to store in host data bases the forms which are filled-in at a workstation, and it should be possible to use the stored content as data inputs to existing accounting applications. A workstation that could support more of the current documents than the existing workstations would be a definite productivity aid, particularly if that support included prototype forms (partially filled-in) serving as templates.

Finally, the problems with the existing workstations that the secretaries listed indicate requirements for a new workstation. Larger screens, smaller packaging, local processing and storage, high-quality printer, and training programs would be considered advantages.

The study results thus indicated both an opportunity and a set of requirements for an administrative workstation. Based on this set of requirements and a review of existing workstations, we were unable to identify an existing product that met the requirements.

Those requirements that seemed the most difficult to meet were:

1. Adequate host system attachment. Most existing workstations do not provide high speed (e.g., 1 megabit or more) connection, full-screen display terminal emulation, or file transfer to host application programs (e.g., editors).

2. Multi-tasking with simple, fast task switch. In those few workstations that do provide multi-tasking, the user must take several actions (e.g., go through several menus, load diskettes) in order to switch tasks. The exceptions are those workstations that permit multiple display windows, one for each task running in the workstation.

3. Typewriter emulation. It was surprising that only in a few CRT word processors can a user insert paper (e.g., an envelope) in the printer and type directly onto the paper without creating a workstation file. In addition, on most workstations it appears difficult to support preprinted forms because of the complicated formats of these forms.

Based on the requirements identified in this study, the administrative management decided not to replace the existing workstations at this time. In addition, a project in the Computer Science Department has begun to develop extensions to the IBM Displaywriter in order to provide a workstation that meets the requirements.

A Comparison With Other Research Sites In The CISR Study

A discussion of the environment at the SJRL and its effect on the natural growth in the use of advanced technology is appropriate here. There appears to be a secretarial self-selection process in practice. First of all, secretarial applicants at IBM are not surprised to be working with computers. Often those interviewed had been urged to apply by friends who knew their capabilities and who knew the demands of the job (heavy workload, tight deadlines, little formal training or aid). For those who are willing to seek aid, the RSMs can be a source of supportive assistance. The SJRL work environment has led to a cadre of secretaries who expect to learn new things and are willing to think creatively.

At another high-technology location surveyed by CISR, a similarly conducive environment was expected. However, there were significant differences. There the load was lighter (one secretary served one or two people), and the secretaries appeared to be less highly motivated. There was some latent staff support for learning new techniques, but the

professionals appeared not as willing to lend assistance when secretaries encountered problems.

A small consulting firm was observed at a third study site. Here the professional and the secretary formed a supportive team, working in close relationship. While the professionals were highly qualified for their jobs, they did not have technical training in the details of the computer system. The secretaries typically worked out a system problem in collaboration with the professional. If the solution was not readily discovered, the professional called the service organization, gleaned what information was available, and then returned to the terminal to work with the secretary. Actually the professionals were no more qualified in operation of the system than the secretaries, but they were typically more aggressive in seeking information from the vendor.

At a fourth location neither the professional staff nor the secretarial staff was familiar with intricacies of system operation. As a result, the system installed there was used only lightly and not very imaginatively.

At all these locations it appears that organizations are evolving through office technology stages in the same way that they move through information system technology stages as described by Gibson and Nolan [5]. Many factors combine, including company tradition, environment, industry sector, growth, and available technology. These all influence where on the curve a company presently falls. Zisman [2] discusses this concept specifically with respect to office automation. Rockart and Flannery [6] describe it in the area of end user computing.

We can see the pattern at our research sites. SJRL is in the second stage ("contagion" or "expansion"). The other sites are still in the first stage ("initiation"), and they are not yet experiencing the enthusiasm that goes along with moving into the second stage.

V. DISCUSSION

Although the observations and list of workstation requirements which came out of this study are not necessarily surprising, they are important. The results of the study were the major inputs into the decision to continue using the current workstations and into the enhancements to be made to the IBM Displaywriter. In addition, the study provided a number of useful insights on administrative functions and the potential for office automation at the SJRL. We conclude with a discussion of these insights.

We were able to identify missions, functions, procedures, and tasks in offices through use of OAM. The results included classes of work considered both typical and less typical in the secretarial world. The SJRL environment provided a good opportunity to observe a natural growth pattern in the use of advanced technology. This gave us an opportunity to "see the future", to get a glimpse of the potential for office automation. Our observation of the workstation features which are used in performing advanced office procedures gives us confidence that our list of workstation requirements is responsive to future secretarial needs.

A number of interesting organizational and behavioral implications of office automation were identified. Perhaps the most significant is the importance of a community of users. Another interesting observation is in the area of user resistance. At the SJRL we did not see a reluctance to use new technology. Obviously the high-technology environment has a significant impact on creating an atmosphere for acceptance. In addition, the secretarial

self-selection process plays a role. There appear to be at least two additional factors which contributed to low resistance. First, the heavy work load resulting from the ratio of support staff to professional staff creates a situation where secretaries are highly motivated to enhance their own ability to get the work done. It is clear to all of them at the SJRL that without the aid supplied through the host system, they would be hopelessly inundated with work. In addition, because the professional staff makes use of the computer-based tools themselves, the early "rough draft" versions of paperwork are seldom directly typed into the system by the secretaries.

The fact that virtually everyone at SJRL has a terminal and that many RSMs do their own text entry raises the issue of professional staff resistance to personal use of keyboards. Although this issue was not directly investigated in this study, some observations were made as a result of the interviews. The professional staff is enthusiastic and positive about the computer support for self entry of documents directly on the system. In at least some of the instances where resistance was indicated, it seemed to be based on a sensitivity or insecurity related to the job in general, not to the computer technology. This is an unusual and no doubt controversial observation. Ideas analogous to this have been put forth by Turkle [7] as she reported the perceptions of data processing professionals when they described their own relationship with computers.

As we stated earlier, we did not focus on productivity measures. However, secretaries stated they have found the time to organize tasks and create procedures for smoothing work flow which they could not even think about before. This has been stimulated both by time saved through computer support and by access to the tools powerful enough to create these procedures. Some tasks in this category include automated distribution lists, reminder files

triggered by a clock, and financial monitoring and analysis systems. Another stated advantage of the existing office automation tools was the ability of the secretaries to take on new tasks, many of which are self-initiated. Here it is not a case of doing "more" of the current tasks or of doing them "faster", but rather the presence of entirely new functions. The most significant example is the message system. The secretaries learned to use the message system to inform each other when they would be temporarily away from their desks or to arrange for one secretary to do tasks (e.g., pick up printed documents) on behalf of several secretaries.

The results of an OAM study generally include more detail on procedures and their relationships to the mission of the organization. Such detail can be used to suggest potential or desirable organizational impacts which can be expected from office automation. Our initial use of the OAM was for gathering information related to the objectives outlined in Section II; thus, we did not go into detail on issues surrounding organizational impacts. However, some observations in this area did result from the interviews. First, the use of terminals by professionals to input their draft documents is an impact of this technology which clearly affects professional work. Secondly, the ability of the secretary to take on more self-initiated tasks in support of the office mission affects the nature of secretarial work. Finally, the ability of anyone to send electronic messages to anyone, unfettered by traditional office etiquette, creates the potential for a significant simplification of office communications.

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