Office Analysis: Methodology and Case Studies

by

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Abstract

The Office Analysis Methodology (OAM) is a structured methodology for understanding the current operations of an office. OAM provides guidance in interviewing techniques and approaches to establishing a positive atmosphere for possible office automation efforts. It is designed to be easy to learn so that people with experience in office work but little experience in analysis can easily perform a study. OAM makes use of an office work model to ease the data gathering process. The product of an OAM study is a document, organized according to a standard format, describing the current operations of the office.

This report contains the original internal memo describing OAM, along with the OAM descriptions of five MIT offices.

Key Words and Phrases: office analysis, systems analysis, office automation, automated office systems, office work, office model, office description

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Preface

When the Office Automation Group was formed in 1979 we recognized that one of our first needs was to develop a library of case studies of offices and office operations against which we could test our ideas about office automation. After conducting a number of such studies we recognized the need to formalize a methodology for office analysis which in turn led to the development of an Office Analysis Methodology (OAM). As we continued our studies, OAM was revised and improved and has gone through numerous changes and revisions, culminating in an Office Analysis and Diagnosis Methodology as described further below.

In response to numerous requests for individual working memos, this report brings together in one place both a description of OAM and five case studies of MIT offices conducted at various stages of our research. While the version of OAM described here has been superceded by our later work, the case studies remain a valuable resource for anyone interested in how offices work.

The case studies were performed over a period of nearly two years. The first study, of the Work Control Center, was undertaken while OAM was still under development so it does not incorporate all of the features described in the final OAM document. The study of the Industrial Liaison Program and the incomplete study of the Office of Sponsored Research show that OAM can be used in offices where the work, at first approach, appears to be unstructured. The Student Loan Office is an example of a more detailed study in an office that incorporated both structured and semi-structured work. The study of the Office of Facilities Management is slightly different from the others in that the emphasis of the study was not on understanding the entire office, but rather on understanding the production of documents. It shows that OAM can be adapted to meet a particular need.

Since these case studies were performed, the offices have all changed. The Industrial Liaison Program has engaged in a massive automation effort which has changed the entire

structure of its procedures. The Student Loan Office has been merged into the Bursar's Office, which, along with changes in Federal Policy regarding student loans, makes the description included here entirely obsolete. Policy changes within MIT along with the normal adjustments to changing internal circumstances have caused the other offices to evolve considerably from the descriptions that are presented here. *These descriptions are presented as examples of the documentation produced by an OAM study and do not describe the current operations of these offices.*

A condensed version of the OAM description in this report was published under the same title in the 1982 Office Automation Conference Digest [13]. The Office Specification Language (OSL), an ideological sibling of OAM, is definitively described in a PhD thesis by Dr. Jay Kunin, *Analysis and Specification of Office Procedures* [6], available as a Laboratory for Computer Science Technical Report [7]. A brief description of OSL was published in the Proceedings of the 1980 National Computer Conference [3]. The experience gained in using OAM in a number of case studies led to further changes, particularly to its extension into the area of problem diagnosis as well as description. This work, along with an evaluation of OAM, is presented in a Master's thesis by Juliet Sutherland, *An Office Analysis and Diagnosis Methodology* [16], available as an MIT LCS Technical Report [17]. A paper, derived from the thesis, describing the evaluation of OAM, has been submitted for publication and is also available as an MIT LCS Technical Memo [18].

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I. OAM:
An Office Analysis Methodology

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1. Introduction

Although offices of one sort or another have existed for hundreds, perhaps thousands, of years, our need to understand what people do in offices has increased dramatically in the forty years since the invention of the computer. In order to take advantage of the power of the computer to mechanize or automate office operations, it is first necessary to achieve a detailed understanding of the functions to be performed. This need has led to the development of a number of methodologies for studying offices and for guiding the design of computer systems to support them.

In this paper we present OAM, a functionally-oriented Office Analysis Methodology developed at MIT to analyze and describe office procedures in a well structured manner. This is an action-oriented paper. The audience that we address is composed of people who are involved in doing office systems analysis—people, especially those with a background in traditional data processing system analysis techniques, who have a practical project at hand. Our goal is to provide guidance and "how-to" information for conducting and documenting these analyses.

The next sections of this chapter will discuss the role that we expect OAM to play in the process of office automation, the style of description that it is intended to help produce, and the ways in which it differs from data processing systems analysis. We will also make an effort to sensitize the reader to the variety of organizational and behavioral issues that play central roles in determining the success of office systems studies.

1.1 Why Study Offices?

With the explosive growth and declining costs of digital communications and distributed computer systems, office operations previously untouched by the computer are being examined to determine how these new technologies might be used to improve them. This "technological push" is complemented by a "market pull" based on the steeply rising costs

and complexity of office operations. The result has been, in part, a renewed interest in understanding the abstract nature of office work and in developing methodologies specifically oriented towards the analysis of office procedures.

Office equipment vendors and system programmers are interested in understanding offices so that they might design systems that are well suited for supporting office work. Managers need to understand office procedures so that they might find ways of restructuring office work to improve its efficiency and effectiveness. Analyzing the operation of an office is often the first step in reorganizing its structure or in the introduction of new equipment. A clear description of office procedures may also serve as a training manual for new employees and as a reference manual for more experienced workers.

While we expect that our methodology will be helpful in all of the cases just listed, we have had two basic goals in its development. First, from a basic research perspective, we are interested in adding to the cumulative understanding of how offices function—what people do in offices, how they do it, and what recurring themes there are in the nature of office work. Second, we recognize that future efforts to improve office operations will lean heavily towards the use of sophisticated computer systems. The success of future office automation efforts will depend in large measure on an ability to easily and precisely describe the functions that must be performed, allowing systems analysts, programmers, and office workers to communicate effectively with each other.

OAM does not directly address the later stages of the automation process. However, the conceptual model of office work that it provides will highlight those aspects of an office most salient to the redesign of office procedures. This model is oriented towards the development of *integrated functional support systems.* By this we mean systems that support in an integrated fashion the whole range of procedures and decisions that, taken as a whole, achieve a particular business goal. Such systems are more sophisticated than the usual word processing center or electronic mail facility; they seek to automate those aspects of office operations that can be automated and to integrate the system's components into an effective and flexible support environment for the office's staff.

1.2 What Kind of Offices?

Offices exist in seemingly infinite variety. The office of a CEO is very different from a payroll office which is certainly not at all like a research laboratory. Given the enormous differences between types of offices, it seems unlikely that one analysis methodology will be equally useful in all situations. For this reason we are developing a taxonomy of offices which will categorize an office according to the *business functions* that it performs. Functions are implemented by a set of *procedures* that can be automated or supported by *applications*. A given application can be used in the implementation of many functions. To complete the hierarchy, applications make use of *generic tools*. For example, a sales office, an alumni office, and an advertising office might have in common the function of persuasion. To accomplish this function, most of these offices make use of such applications as activity tracking and information formatting. The generic tools that might be used in these applications include high quality output and ticklers or alerts. We expect that there will be many functions, which will use a fewer number of applications, which, in turn, will make use of a finite, although potentially quite large, set of generic tools.

Using the taxonomy, we are developing an Office *Automation* Methodology, of which OAM is a part. Once the functions in an office are determined, the taxonomy will suggest, in a general way, which types of automation, in terms of applications and generic tools, will be useful in that office. The taxonomy will further suggest the most appropriate analysis methodology to use in studying each function, as well as what general benefits a particular office might expect to receive from automation. The appropriate analysis methodology, along with knowledge about what information is needed to tune the associated set of applications, is used to determine the specific needs of the office and the form of the automation system that might be introduced. Development of the taxonomy and its related analysis methodologies is underway; OAM is the first methodology that we have worked out in detail, and is the one that will be recommended for process-oriented functions that involve many semi-structured procedures.

When we say that an office procedure is *semi-structured*, what do we mean? We mean not just that some tasks are structured and some are not, but that the procedural structure of the overall task is "loose"; office procedures are not directly "executed" by either people or machines. Steps may have to be interchanged or occasionally omitted, temporary

deviations may be required, and so on. Large doses of creative problem solving and improvisation are required to carry out most office "procedures," as Suchman and Wynn [15] have brought out in their investigations of office work. A semi-structured procedure, then, is really better thought of as stating what is *supposed* to be accomplished, rather than what must actually be done. Thus, the descriptions that our methodology is intended to help produce will express the "plan" or "strategy" to be followed in achieving the business function of the office under study.

OAM is particularly appropriate for studying offices in which the *performance* of procedures is of primary importance, as opposed to the *design* or *monitoring* of office functions. It is not well-suited, for example, for studying an executive's office or a long-range planning office. In addition, OAM, at this stage of its development, does not adequately deal with the "meta-level" tasks associated with *managing* a procedure. This would include, for example, such tasks as monitoring backlog and deciding to schedule additional overtime to reduce it.

Our notion of semi-structured procedures is related to the analysis of business functions developed by Gorry and Scott Morton [2]. In their work on decision support systems for managers, Gorry and Scott Morton classified business functions along two basic dimensions: the nature of their associated managerial orientation—subdivided into operational, tactical, and strategic tasks—and the extent to which there is a well-understood structure for accomplishing them—spanning structured, semi-structured, and unstructured functions. The payroll function, for example, would fall into the structured operational class; it is a production-oriented activity whose structure is well enough understood to be completely automated. Siting a new manufacturing plant, in contrast, is a unstructured strategic problem; while operations research techniques can help with the quantitative aspects of site evaluation, many qualitative and strategic issues are involved as well. Our focus is on office automation, not decision support, and so our taxonomy classifies business functions by the set of procedures or applications that are required to implement them.

1.3 What Kind of Description?

A methods-time-management expert looking at the office might describe it in terms of elemental tasks: shuffling papers, marking forms, making phone calls. The personnel specialist might describe the office in terms of the number of individuals in each job classification: so many secretaries, administrative assistants, purchasing agents or order entry clerks. A political scientist might look at the same office and describe it in terms of power relationships and coalitions. The organizational psychologist will describe the office in terms of support groups and interpersonal relationships. What do *we* mean when we say we want to describe what goes on in an office?

Our purpose in studying an office is to develop a description of the *functions* that it performs in support of the *business goals* of an organization [4]. Thus, our focus is not on individual paper forms, nor on the job descriptions of individual employees; nor are we concerned with preparing minutely detailed flow charts showing the disposition of every type of correspondence handled by the office. Rather, our emphasis is on the functions that the office is to perform—purchasing materials, collecting accounts, planning ad campaigns, and so on. The descriptions of these functions that we want to produce should be at a level of abstraction above the particularities of the current implementation, providing enough detail to adequately describe the way things work now, while not providing so much that a system designer cannot clearly see how to structure a new and different implementation.

Specifications of office procedures can be either *descriptive* or *prescriptive*. A descriptive study specifies how things are currently done. A prescriptive study results in a plan for restructuring office procedures. Our focus here is on *description*; we are interested in techniques for understanding the existing business functions of an office and their current implementation. An analogy to the paradigm of building design is one that we have found useful. The first thing that an architect will do is to develop a site plan and a set of working drawings that detail any existing structures. These drawings form a basis for the new design and provide a starting point for planning the construction process. Similarly, the availability of office procedure descriptions in a standard, comparable format provides the necessary foundation for the process of analysis and reformulation that may ultimately lead to prescriptions for change and automation.

1.4 Relation to Other Work

There are both other reasons and other methodologies for studying offices; how does OAM relate to them? There is a long history of techniques developed in the data processing community for studying office operations with a view towards implementing them on a computer [1, 19]. For the most part, these techniques have been developed for problems that would be classed, in the Gorry and Scott Morton scheme, as *operational* as opposed to *managerial* or *strategic*. Thus, they focus on those tasks that are structured enough to be completely automatable, resulting in a narrow concern with tasks instead of functions, and in a lack of attention to the behavioral and managerial aspects of system design. This is also the source of their notorious tendency to produce inflexible systems that do not "fit" well into the host organization.

OAM differs from such DP-oriented approaches primarily in terms of its orientation around functions and procedures, and its concern for the decision-making role of the office staff in achieving these functions. We feel that these are the key issues in capturing the nature of the semi-structured activities prevalent in offices, without losing sight of the tremendous flexibility that any future support system must display. Another aspect of this difference is that OAM places little emphasis on capturing the minutiae of the present implementation. Most earlier approaches, intended to result in a single highly-structured computer program, placed great emphasis on capturing operational details. We are not trying to directly specify computer systems, but rather the requirements of office functions, which might be implemented via numerous different man-machine systems.

Another distinguishing characteristic of our work is its attention to the organizational issues involved, not only in the conduct of a single study, but in the management of an ongoing office automation effort. In this last area there are strong resemblances between our methodology and the "management support system" philosophy developed by Lodahl and his associates [8]. We are interested, as are they, in identifying the individual needs of the client group and in tailoring the office organization and technology to meet precisely those needs. Where our work differs from theirs is in our emphasis on understanding office *systems* rather than on simply finding ways to effectively utilize such technologies as dictation and word processing. Our focus is on supporting the business functions of the larger organization through the restructuring of office procedures and the use of whatever

technologies are found to be appropriate.

Many examinations of office activity are currently being conducted by internal office automation groups in user organizations. Such studies are generally narrowly focused on establishing the need for change and on identifying the appropriate new technologies to introduce into working offices. A recent research project investigating the state of the art in in-house studies [14] found that they generally take one of three forms. The first is a broad survey of activities in a large number of office settings, which typically concentrates on task measurements, such as hours spent typing, filing, or answering the telephone. Occasionally, it may measure other quantitative aspects of the overall office such as filing requirements, mail volumes or numbers of forms processed.

The second type of user study is of more direct relevance to our interests for it usually involves both the identification of a candidate office for an office automation experiment and a more detailed examination of its tasks and functions. But because these studies are aimed at short-term changes, they usually restrict their investigation to those aspects of office operation that would be most affected by the application of today's limited technology.

Finally, offices are often studied by management teams with the aim of reorganizing and redistributing work loads. These studies generally focus on individual job descriptions without detailed examination of the assumptions underlying the office's fundamental functions and procedures.

1.5 Summary

The research goal of MIT's Office Automation Group is to advance the state of the art in the design and implementation of integrated, functionally-oriented office information systems. Our work has convinced us that in order to reach their full potential such systems must be designed to support the specific business functions of individual offices. One of the major obstacles to this approach is the time and difficulty associated with analyzing current office operations. An analysis methodology can lower the cost of office system implementation by providing strong conceptual and practical guidance to the analyst as he tries to understand an existing office. The *conceptual model* of office work provided by OAM leads naturally to a formal model of the office, and the development of OAM has been

closely linked with our efforts to develop an Office Specification Language (OSL) [3, 5]. (OSL and its relationship to OAM is covered in more detail in section 3.1, page 17.) An unambiguous model of an office's function is the starting point for the process of system design.

Other important benefits derive from the development and use of a formalized methodology. Foremost among these is the improvement in our understanding of office work that will derive from a growing base of comparable studies in a standard format. Another benefit of a standard analysis procedure is the body of experience that will develop around it. Offices are complex and sensitive organizations; the start of an automation project can generate explosive reactions if it is poorly handled. Corporate familiarity with the overall process of analysis and change will help to develop the kind of practised approach and top management support that lead to successful projects. Finally, a good office analyst is hard to find. Such a person will need both a systems perspective and a detailed understanding of office work. He must also have tact, persistence, and sensitivity to people, combined with competence in the new office technologies. A well-defined methodology provides a teachable and learnable set of techniques and sensitivities that can greatly improve the effectiveness of an office automation group.

The technical content of this paper provides at least partial answers to a number of important questions: what information to gather, whom to interview, the kinds of questions to ask, and how to document the results of a study in a clear and concise manner. Additionally, we have tried to organize and present our thoughts about, and experiences with, a number of the organizational and behavioral issues that are an integral part of conducting office analyses.

2. Getting Started

Just as there are several purposes for which one might undertake an analysis of office functions, there are several—not unrelated—ways to get started. Researchers such as ourselves begin by approaching top management and asking for permission to conduct our research. A newly appointed corporate department head may decide to analyze his group's operations with a view to improving its efficiency. An internal office automation consulting group may be charged by top management to seek out candidate departments for the installation of the latest technology. An internal or external consulting group may respond to a request from a manager to assist in solving a perceived problem. Each of these cases is different and raises its own particular problems. These problems concern how the office systems analyst is perceived by various constituencies in the office, how he must go about securing the cooperation of these various constituencies, and how the dynamics of interaction between the analyst and the office's employees might develop.

With few exceptions, office studies are undertaken with the intent of using the knowledge gained to make changes in the existing organization. Even where that is not the original intent, it is generally the result. As a consequence, the office study must be looked upon as simply one step in the process of introducing change. Numerous consequences follow from this observation. Change in the organization may be viewed as helpful or threatening. Change imposes obligations on managers to manage it. Successful change requires the enlistment of support from all who are affected. As we discuss the various issues that the office analyst must face in conducting a study, we will continually confront the implications of these facts.

2.1 Constituencies

The office analyst must establish an appropriate relationship with three constituencies: the personnel in the office being studied, the office manager, and top management. Each of these groups has a different set of concerns or interests in the study.

2.1.1 Office Personnel

Academic researchers, under pressure from their critics, have developed several important ethical principles regarding the conduct of research involving human subjects. These principals center on the need for *informed consent*; they are necessary because research can present a risk of real harm to an individual. According to the principle of informed consent, subjects must be fully informed of such risks before they are asked to become the subjects of a research effort.

An internal consultant gathering information on a company's operations is not the same as a scholar conducting research; the subjects of such an office systems study may perceive the study as posing a significant risk. Reorganization of an office may result in the elimination of slack time or other significant job changes; some individuals may be laid off or transferred to other departments; the study may reveal real or perceived deficiencies in employee performance. Employees may be aware of disruptive changes that occurred elsewhere in their own company or in other organizations following similar studies. Finally, the workplace will be disturbed to some degree by even the most carefully handled study.

No organization can expect to keep the true objectives of an office systems study from its employees, as anyone who has studied informal communication networks in offices can attest. Moreover, where the end results of the process are unclear, the rational but risk-averse individual is likely to treat the entire process with suspicion. The participants in an office study must be fully informed concerning its purposes and potential consequences. If subjects are to talk freely about their work they must perceive themselves to be in a *safe* environment. Accordingly, if consent to the study is to be received, the company must take steps to reduce or eliminate the perceptions of risk. Such measures may take any of several forms:

- Formulation, promulgation and demonstrated adherence to a company policy that ensures that employees displaced by reorganization will be offered other acceptable employment within the corporation.

- A policy of involving office employees in any redesign of jobs that follows from an office study.

- Opportunities to review and correct conclusions reached from any office systems study.

The process of exposing to the office staff the nature and purposes of an office systems study itself presents several issues. The study can be described in a memo originating from top management, from the director of the office, or from the analyst or his organization. It can be elaborated by the analyst in an open forum with the office staff, or individually with each person interviewed. Each method results in different group dynamics depending upon, for example, the underlying respect for or hostility to management at each level.

Presenting the purposes of the study in an open forum eliminates the need to repeat the same explanation to each individual, results in everyone having received an identical description of the study's purposes, and allows opportunities for questions and comments. On the other hand, an open forum setting increases the risk of confrontation by heightening the opportunities for a "we-they" perception, so it is important to stress that active participation from the staff will be encouraged.

2.1.2 The Office Manager

In many cases an office system study will be undertaken on the initiative of the director of an office, for example, as the result of a request to an internal office systems consulting group. Occasionally, the consulting group will approach a particular office and offer its services. Whatever the nature of the contact, several concerns must be addressed.

The analyst and the office manager must share a common perception of the nature and purposes of the study. Shared goals may be arrived at through a process of give and take in which the costs—in terms of time and manpower—and potential benefits of a study are reviewed with the office director. It is the office director who will be faced with the problem of "cleaning up the mess" if an analyst succeeds in antagonizing the office's employees. If the study leads to suggestions for change, the office director will not only be affected by the change, but will be responsible for implementing it. Thus, in accepting the study, the office director must be prepared to accept the responsibilities that may flow from it.

2.1.3 Top Management

As suggested earlier, the relation of the analyst to top management depends in part on the origins of the study: whether it was initiated by top management or by others within the organization. When the study originates outside of the group being studied, it is particularly

important that top management's approval and justification for the project be solicited and communicated to the office being studied. This can often be handled most effectively by creating an explicit charter for the office automation group and having top management make its support for the group clear. More important is the role of top management in establishing those company policies that will serve to reduce the anxieties of office employees concerning the consequences of any office system study.

2.2 Who should Do a Study?

The answer to this question involves two very different sets of criteria: the expertise or skills necessary to conduct an office system study, and the group dynamics that result from the analyst's position within the organization.

The ideal office systems analyst combines the good business sense of an experienced manager with the analytic skills of a data processing systems analyst and the sensitivity of an organizational consultant. Persistence and tact are indispensable qualities. Needless to say, such individuals are hard to find! Because in many instances organizations engaging in an office systems study visualize repeating the process many times throughout the organization, it is often possible to assemble a team that includes members with each of these competencies and encourage them to cross-fertilize each others' skills. Interviews, and especially direct observation, are best conducted by a single analyst; the use of a team could cause a serious disturbance in the normal office routine.

2.2.1 Insiders versus Outsiders

Ideally, the office systems study should be conducted by the office's director with the cooperation of his staff. In practice, the director is likely to have neither the time nor the expertise to conduct the study, and will call on either an internal office systems consulting group or an outside consultant. The use of outsiders to conduct the study can make the problem of conveying the nature and purposes of the study to the office staff more difficult. Thus, where an outside consulting group is taking responsibility for the interviewing, it is especially important that the office director and not the consultant be involved in explaining the purposes of the study to the office staff. On the other hand, an outsider may have more experience or may be able to avoid problems associated with existing intergroup dynamics

(divisions *vs.* corporate staff, line management *vs.* data processing, *etc.*) Outsiders frequently benefit from an aura of prestige which makes it easier for them to operate; just as frequently, however, they can be ostracized by a tightly knit group which is distrustful of outsiders.

2.2.2 Role of Office Staff

One possibility that needs to be carefully considered is the participation of someone from within the office as a member of the interviewing and analysis team. On the positive side, the participation of such a person may facilitate the interpretation of the information collected, and assist in rapidly pinpointing critical components. Other staff members may feel that their interests are being represented by having one of their own participate in the study. Finally, if there is to be a follow-on, such as the introduction of new technology, there is someone within the office who can actively work with systems designers from a well-informed perspective.

On the negative side, too much reliance on one individual from within the office may lead to a biased picture of the office's activities. Where individuals within an office are distrustful or jealous of one another, they may be more reluctant to open up to one of their colleagues than they would be to an outsider. Finally, increasing the size and diversity of the study group can lead to dilution of responsibilities, and to an increase in the time required to bring the study team members to a common understanding.

2.3 Training

Unfortunately, there is little substitute for on-the-job training in the conduct of an office systems study. One can begin by picking very small offices and attempting to analyze them as a "training exercise." Formal training in either systems analysis or organizational behavior provides a useful background. Preparation for a systems analysis should include reading and critiquing office analyses done by others. An additional reason why it is desirable to have several individuals within the organization engaged in conducting office systems studies is the opportunity this provides for mutual discussion and criticism. This paper is itself a start at formalizing some of the knowledge that would allow the development of an effective training program for office systems analysts.

3. Office Analysis

Once the organizational support structure for the office analysis group is in place, and the mandate of the study team has been established, the first issue to be addressed before embarking on a particular office study is where to start. Should one begin at the top of an organization and work down, or start at the bottom and work up? For a number of practical reasons, some of which were discussed in the previous chapter, the starting point of most analysis projects will be a particular office or department that has requested the services of the office automation group. It is important, however, not to limit the scope of the study to the particular office in which it begins. OAM is aimed at understanding how business *functions* are implemented. The current division of an organization into "offices" is not always in perfect accord with the functional structure that we seek to understand. Organizational history and style, space availability, the capabilities of individual managers and workers, and the numbers of people involved, have probably all helped to shape the current structure. It is important to track down all parts of the larger organization that help carry out each function, and to get them involved in the study as well. Thus, the final organizational scope of a functional office analysis must come out of the early stages of the study itself and cannot be legislated in advance.

Our focus on *functional groups*, informal organizational structures usually falling somewhere between departments and single offices, has much in common with the "middle out" approach to system development advocated by Ness [11]. Once the functions of interest have been identified the analysis moves in two directions, first setting them into the context of the larger organization, and then exploring the details of their implementation.

3.1 Definition of the Conceptual Model

Having said that we are primarily interested in identifying business functions and their associated functional groups, it is important to remember that a real office will usually carry out several, usually closely related, functions, each helping to support its basic mission.

Each function will have a variety of procedures associated with its accomplishment. Alternatively, some offices may carry out only a single procedure associated with a larger function that spans several individual offices.

In this somewhat jumbled world, there must be a clear-cut method for distinguishing among these different cases, for identifying functional groups that include more than one office, and for classifying the procedures associated with a given function in a helpful manner. The formal model of office work developed for OSL [3, 5] provides the necessary tool. OSL is a high-level, problem-oriented language for describing offices in a precise and non-ambiguous way. The methodology described here guides the investigation of the functions of an office, while OSL provides a compact, structured means of recording our findings. While our methodology does not depend on the use of OSL for recording office descriptions, it does share many of the concepts and structural assumptions of OSL. For example, OSL is a hierarchical language in which office operations are described at several levels of abstraction. OAM is also based on the idea of gathering information at a number of different levels of abstraction. A key feature of OSL is the notion of a "resource"—a fundamental construct that provides the focus for the activities of an office. The function of a personnel office, to provide a familiar example, is the management of an organization's employees. Here, the employees are the resource, and all of the procedures carried out by the office deal with objects that provide information about this resource, such as job applications, employment histories, skill inventories, and the like. Our methodology is oriented towards the identification of the central functions and resources that define the business goals of an office, as well as the operations of the procedures that implement them.

In short, OAM provides a means of gathering information about office procedures; OSL provides a way of recording that information. Conversely, the development of OSL has helped us to identify some fundamental constructs and abstractions that are commonly found in offices, and has thus provided a conceptual framework for our information-gathering efforts. OSL models business operations in terms of *functions*. A function is an aggregate of all the detailed activities that collectively manage and maintain some *resource* that relates to the business goals of the larger organization. In the example of the personnel office that was used in the first chapter of this paper, the function was personnel management and the function's resources were the employees of the organization.

Functions have three stages: an *initiating* stage, a *managerial* stage, and a *terminating* stage. The *procedures* that implement a function are all classified as belonging to one of these three stages. The names for the stages of a function were chosen to indicate the manner in which they relate to the lifecycle of the resources that the function deals with: creating them, managing and utilizing them, and finally terminating them. Each individual procedure focuses on the manipulation of a specific *object* or set of objects. An object is some tangible or abstract entity in the office, such as an application for employment or a salary review, that is a component of the overall function's resource or that provides information about that resource.

Let's look at a more detailed example. MIT's Office of Sponsored Research (OSP) carries out a single major function from beginning to end—managing research programs funded by means of a grant or contract from an outside sponsor. Here, the resources are "sponsored research programs." Several procedures are involved in managing sponsored research programs. The initiating procedure for a sponsored research program consists of the review and approval of research proposals from within the Institute and the negotiation of the terms of grants or contracts based on these proposals. The proposal is the object of this initiating procedure, though the grant or contract is dealt with as well in its later steps. Both the proposal and the grant or contract are components of a potential resource for the function of managing research programs. Once a research program has been successfully initiated, the OSP is responsible for administering the terms of the grant or contract that funds it, disbursing funds, approving travel and purchase requests, and monitoring expenditures. Again, each of these requirements is satisfied by a specific procedure that processes a particular object: the travel approval procedure deals with travel requests, the expenditure monitoring procedure deals with accounting reports, and so on. On the expiration date of the grant or contract, the OSP must terminate the research program by closing out and auditing its account, and preparing a final report to the sponsor. Archiving the records of the research program is the final step of the terminating procedure.

A university Admissions Office provides a contrasting example, one that demonstrates the value of the functional model. The mission of the Admissions Office is to review applications and admit or reject applicants. But this responsibility does not comprise an entire function—an applicant is not a resource of concern to the goals of the university, students are. An applicant is only a potential resource. Nowhere in the Admissions Office is there to

be found a single procedure that is concerned with what to do with an applicant once he is admitted as a student, or how to deal with his records once he leaves the university. The overall function is that of managing the student body; the Admissions Office carries out only the initiating stage of this function, that of admitting students into the system. If the integral connection of the procedures carried out in the Admissions Office to those performed in the Registrar's Office—which manages students once they are registered—is not recognized when an automation system is designed, then a major area of potential benefit will have been lost.

Although functions, which provide the framework for office procedures, are the top level of the conceptual model and are therefore the initial focus of the analysis methodology, the analysis of the procedures themselves is a major component of OAM. The OSL procedure model is reflected very strongly in both the analysis and the description aspects of OAM. In the OSL model, an office procedure is a description of the history of its object as it moves through a series of states toward a goal, represented by a "done" state in which no further processing is necessary. The object is the focus of analysis of a procedure, and some effort is needed to identify the appropriate objects. Office procedures are fundamentally concerned with information about some real thing or set of things; it is rarely the case that the carrier of the information is itself of inherent interest. In particular, we explicitly reject the idea that forms are the key to understanding office procedures; a form is merely a particular means of capturing, organizing, and transmitting some of the information about an event or entity of interest. The focus should be on the underlying reality, rather than on symbolic artifacts; the information *content* of the form, rather than the form itself, is the key. For example, the university admissions office would be concerned with an *application* object, the set of information about a prospective student obtained from the applicant, his school, his teachers, the College Board, faculty reviewers, admissions office staff, *etc.*; it is this aggregate of information, and not the forms upon which it is recorded, that is the object of the procedure and that should be the focus of any future reorganization or automation effort.

As we have noted, the explicit use of OSL as a documentation language is not a requisite of the OAM techniques. However, we have found that an OSL "skeleton" description, which uses the OSL function and procedure syntax to structure short English descriptions of lower level activities, is very helpful in documenting the intermediate stages of the analysis

process. A number of other aspects of the OSL procedure model inform the analysis methodology, and will be discussed in later sections.

3.2 Overview of the Process

The first step in our analysis procedure is to meet with the office manager in order to identify the office's organizational context, the major functions for which it is responsible, and the resources that each function manages. The analyst should seek to identify the procedures that implement the three stages of each function and the objects that each procedure manipulates. Identification of the office staff members to interview next is the final stage of this initial interview with the manager.

Once the relevant functions and resources have been identified, along with their associated procedures and objects, a detailed examination of the procedures themselves can begin. Many office procedures appear enormously complex to the outside observer. It is our view that this complexity is generally not inherent in the procedures themselves, but in the myriad exceptions to procedures that arise in actual practice. By concentrating on the main or central lines of each procedure, it is possible to arrive at a description that captures the essence of what is going on, but is not overly complex or obscured by detail.

In developing the description of a procedure main line, emphasis must be kept on the intentions underlying each of the steps. This helps to separate the objectives of the procedure from the artifacts of its current implementation. It also provides the information necessary for understanding how an implementation of the procedure might be changed while maintaining the same objectives. If OSL is being used as a tool in the analysis, the initial skeleton can be created at this point, providing a structured format for describing the functions, procedure main lines, and important entities.

Only after the "ideal" procedure or process has been described can one begin collecting information about exceptions to it. Certain kinds of exceptions are common to most offices—missing information, incorrect inputs, absence of key people, classification ambiguity. Classifying exceptions into basic categories is another important technique for imposing order on the unruly world of office operations. Once this is accomplished, the analyst can begin to identify how the basic procedure is modified in order to handle each

category of exception. In addition, there will be certain categories of exceptions that are so common to a particular office that the response to them has become quite routinized and can be seen as an alternative branch of the main procedure. These should be expanded and described in the same way as the primary process. Again, the OSL skeleton, which provides format and structure for the description of procedure variations, exceptions, and other information, can be fleshed out at this time.

At the same time that information is being collected on the individual steps necessary to accomplish each procedure, records should be kept of all of the *databases* used by the office personnel in support of these procedures. These include not only computerized files, but the contents of filing cabinets, individual desk files, index cards, and even "mental lists" or important categories of factual knowledge that must be possessed by persons attempting to carry out the procedures.

The final step of an analysis is to document the information gained, so that it may be shared effectively with others. OAM provides a detailed structure for organizing the results of a study, a structure that we have found to significantly aid the reader in reaching an understanding of the office and its present operation. If a complete OSL description has been produced, the organization and content of the English writeup will follow fairly easily.

For convenience, an outline of the steps just described is provided at the end of this chapter as Exhibit 3-6, page 41. The remainder of this chapter provides detailed discussions on how to carry out each step of the analysis procedure.

3.3 Problems in Understanding Office Operations

A major goal of OAM is to provide guidelines for an office analyst to follow in order to acquire a fundamental understanding of the supposedly logical processes that implement business functions. Yet it is often the case that specific actions or procedures bear no apparent relationship to, or are indeed counterproductive to, the organization's goals. If organizations were populated solely by "rational actors" whose only objective was the efficient accomplishment of business ends, office procedures would be far simpler to understand and describe. The reality, however, is more complex. There are a variety of reasons why actual office procedures may not show a clear linkage to business functions.

Procedures evolve over time, and often they do not keep pace with changing business goals or changing technology. An excellent illustration is provided by the following story from Elting Morrison:

> In the early days of the last war when armaments of all kinds were in short supply, the British, I am told, made use of a venerable field piece that had come down to them from previous generations. The honorable past of this light artillery stretched back, in fact, to the Boer War. In the days of uncertainty after the fall of France, these guns, hitched to trucks, served as useful mobile units in the coast defense. But it was felt that the rapidity of fire could be increased. A time-motion expert was, therefore, called in to suggest ways to simplify the firing procedures. He watched one of the gun crews of five men at practice in the field for some time. Puzzled by certain aspects of the procedures, he took some slow-motion pictures of the soldiers performing the loading, aiming, and firing routines.
>
> When he ran these pictures over once or twice, he noticed something that appeared odd to him. A moment before the firing, two members of the gun crew ceased all activity and came to attention for a three-second interval extending throughout the discharge of the gun. He summoned an old colonel of artillery, showed him the pictures, and pointed out this strange behavior. What, he asked the colonel, did it mean? The colonel, too, was puzzled. He asked to see the pictures again. "Ah," he said when the performance was over, "I have it. They are holding the horses." [10]

The analyst should not expect to find that all steps of a procedure can be tied directly to a current business function. Where a step in the procedure seems particularly puzzling, it may be helpful to identify when the step was introduced, and attempt to correlate it with the objectives then prevailing.

Another complicating factor is that procedures are often organized around the particular skills of individuals. Joe may dislike dealing with people over the phone; Mary may hate doing paper work. Together they divide up pieces of a procedure so that Joe does the paper work and Mary handles the phone calls. The particular division may create a need for communication and control that would not be required if the work had been divided some other way. Indeed, much of the job of managing consists of allocating responsibilities among the available staff so as to take maximum advantage of their individual talents and proclivities.

It is because of such idiosyncrasies that one must be careful in describing office procedures not to identify them too closely with the tasks of particular individuals. Moreover, almost any reimplementation is bound to revise the task distribution.

A more subtle aspect of office procedures—one that is worth close attention—is the relationship between the design of procedures and organizational control [12]. Procedures

may be designed so as to reinforce the control or authority of key individuals in management. The division of functionally related activities between several offices may reflect the outcome of a battle for control among two or more offices and their managers. Information is power; thus the sharing of information between groups or even within groups may be restricted by individuals seeking to aggrandize their position. Procedures may also be designed in ways which reflect either authoritarian or participative approaches to organizational design. These differences may not be related directly to any business purpose.

Offices serve to fulfill affective needs as well as business functions. Indeed the very *function* of an organizational development office may be to initiate measures—social programs, motivation schemes, group activities—whose purpose can only be described in terms of helping fulfill the emotional needs of company employees. Similarly, individual procedures may also have social components, involving activities whose purpose can best be understood in terms of the need to provide for an employee's emotional well-being as opposed to more obvious business related goals such a collecting payments or authorizing disbursements.

Thus, we see that there are a host of reasons why a procedure design may not reflect a clear business purpose. Attempts to explain everything in the office as if it were a reflection purely of rational action aimed at accomplishing a business function are doomed to failure. Awareness of the multiple motives which govern the evolution of office procedures helps the analyst to separate out those parts of office practice which are relevant to the task of describing office functions, and those parts which cannot be explained in functional terms.

3.4 Gathering the Data

This section outlines the process that we have evolved for actually gathering the types of information previously discussed. As with the office procedure descriptions that it is intended to help produce, the process that we describe does not attempt to cover every possible situation. Rather, it should be understood as a plan or a strategy for the office analyst to follow, improvising as necessary to cope with the unique aspects of each individual office.

3.4.1 Meet with the Manager

Once a particular office has been selected as the starting point for a study, the analyst should meet with the office manager. The initial meeting has a number of interrelated goals. Most important, the analyst must seek to gain the manager's support and cooperation. Explaining the basic structure and time-table of the process, clarifying the manager's responsibilities in making the study a success, and negotiating the details of the study plan are all requirements for this discussion.

Once the groundwork has been laid, the analyst should seek to uncover the basic mission of the office, the functions that support it, and the resources with which they are concerned. The manager cannot be expected to think about his office in exactly these terms; instead of asking these questions directly, the analyst should explore the manager's own way of thinking about what goes on. Casting these reflections into the form of functions and resources is a task that requires skill and imagination. The analyst will have ample opportunity during the course of the study to refine his initial model.

Another set of questions revolves around the organizational context of the office. What are the internal organizational structure and the reporting relationships to higher management? What are the key interfaces with other offices? Almost all organizational studies have shown that there is much more horizontal information flow between groups at the managerial level than at the operational. Thus, the manager is the right person to ask for contacts in other offices for further information when functions that cross office boundaries are encountered.

Once the analyst has formed an idea of the functions and organizational context of the office, he should ask the manager to describe the broad outlines of the procedures that deal with them. Questions about the numbers of people involved in each of the procedures and the level of secretarial and clerical support provided to principals are also appropriate at this point. The analyst should be trying only to get a "map of the territory" during this interview. Too much detail before a clear concept of the basics has been achieved only creates confusion.

Finally, the manager should be asked to identify one or two of the key people involved in each of the office's basic procedures. Often an individual will play a role in several procedures. It is advantageous to seek out such people so that information may be

gathered on more than one procedure at a time, while also helping to clarify how they interact. Length of service is another criterion to apply in selecting people to interview. The analyst should ideally find people who have worked in the office between 1 and 2 years. Many activities occur only annually, so at least a year's experience is desirable. But people who have been around too long become so familiar with their work that they tend to do it "without thinking," and so have a difficult time explaining what they do to a person unfamiliar with the details of their work.

Our experience has been that the number of people an analyst must interview ranges anywhere from 5 to 15 people. When a functional group is composed of a large number of people, it is usually true that many of them are carrying out the same activities. Since our goal is to elucidate the abstract procedures that implement each function, the analyst need only interview a representative set of people, noting in the process the actual numbers involved at each step.

A large office presents special problems and the interview with the manager will be slightly different in such an office. A large office is one that has many different types of jobs. Since at least one person must be interviewed for each major activity, an office which has many people doing different activities requires more work on the part of the analyst than an office which has many people doing the same activity. Large offices are usually organized hierarchically with several levels of management.

The initial interview should be with the manager who is responsible for the entire office and should proceed as described above. In identifying the key personnel to interview next, the analyst should keep the organizational context in mind. Managers are always key personnel, and should be interviewed, if only because the analyst should get their approval before interviewing their staff. In addition, there may be staff members who carry out procedures who report to the current interviewee. The method for deciding which of these people to interview is described above.

The analyst should be aware that managers at all levels carry out procedures. These procedures may be different in type from those performed by their staff. A manager usually handles exceptions, creates new procedures, and maintains correct staffing and work loads. These activities and others like them, though fundamentally different from those found elsewhere in the office, can also form procedures and the analyst should watch for them.

The interviews with managers should proceed down the organizational structure until there are no more managers. At each level the analyst should get a clearer picture of the functions and procedures of that part of the office. However, the details of the procedures must be obtained from the professionals who perform them. These people may be found at any level and the analyst should take care not to miss them.

3.4.2 Procedure Description

Having identified a set of procedures, one can then begin to flesh out their details by interviews with the individual staff members who perform them. The questions discussed here should be asked for each procedure individually. The aim of this first round of interviews is to get several different points of view on the structure of each procedure. Each person normally will have a somewhat different picture of how an office procedure is performed, emphasizing his own role and growing rapidly more faulty as the number of intervening people increases. Synthesizing a coherent overall model of how the office functions is the job of the analyst.

As we have pointed out, it is our hypothesis that office procedures are basically simple. The practical significance of this hypothesis is that the most important thing to learn about an office procedure is what happens when everything goes right. Major alternate processing paths, that is, procedure variations that are not based on the occurrence of errors, should also be explored. It may at times be difficult to keep the interview from digressing into typical problems and exceptions, but it has been our experience that until the analyst has a clear picture of what is *supposed* to be happening, additional details are only confusing.

Procedures are composed of a set of *steps*, each triggered by the occurrence of some *event*. In our example of the OSP, the first step of the proposal review procedure would be started by an event consisting of the arrival of a proposal. A step comprises all of the detailed activities that can be done "at once," that is, without waiting for some other event. In the OSP, the first step includes logging the arrival of the proposal, reviewing it for conformance to Institute policy, checking that the estimated budget is reasonable and has been calculated correctly, and sending any questions or corrections back to the proposal's originator. At this point, nothing more can be done with the proposal until a response is received from its originator, and so the step ends, and the procedure is said to be in a

"state," pending the next event. This structure of events, steps, and states, drawn from the OSL procedure model, is basic to the analysis and description of office procedures.

Every procedure has a *control structure* that determines the order in which its steps are performed. The control structure of the "ideal" procedure must be established in order to understand, later on, how problems and exceptions modify it. Most office procedures have a *sequential* control structure, a short sequence of steps that must be performed in a set order. A procedure whose steps are performed over and over again until some specific condition has been achieved is said to have an *iterative* control structure. Some procedures will have a *parallel* control structure, meaning that their component steps can be performed in any order. Parallel control structures are particularly important to recognize, for they identify those procedures that can be speeded up simply by bringing more resources to bear on their execution.

As the structure of the basic procedure begins to emerge, each step should be characterized in greater detail. Exhibit 3-1 lists the most important characteristics that the analyst should be looking for.

- ☐ What event initiates the step?
- ☐ What is done?
- ☐ What terminates the step?
- ☐ Timing constraints
- ☐ Inputs and outputs
- ☐ Sources and destinations
- ☐ Databases and "mental lists" utilized
- ☐ Environment or special equipment

Exhibit 3-1: Characterizing Procedure Steps

The inputs and outputs of each step include both tangible materials, such as forms and files, and information, such as databases that are referenced or updated. It is also important to know *where* inputs come from and outputs go to. These sources and destinations define the communication links that will be a prime concern in any later redesign of the office.

"Mental lists" and implicit policies form another important category of information to watch for. This is information that, though not recorded in written form, is crucial for carrying out a job. Morgan and Root [9] have claimed that such information is part of a "corporate memory," being continually passed on by word of mouth from more experienced employees to newer ones.

Finally, the analyst should note any special features of the work environment that help or hinder the person carrying out a procedure step, and any specialized equipment that is required. The Work Control Center (WCC), a part of MIT's Physical Plant organization, illustrates this point. The WCC operates a "trouble desk" for receiving notifications of high priority maintenance tasks as they come up. At the desk are two telephones for receiving calls, a "trouble log," special telephones providing direct lines to a number of emergency services, a two-way radio for maintaining contact with a roving group of maintainance workers, and other specialized gear. A careful description of this equipment and its physical layout forms a necessary basis for understanding the procedures that are followed in the WCC.

3.4.3 Conducting the Interview

One of the most difficult aspects of interviewing will be to get people to give *breadth-first* instead of *depth-first* descriptions of the procedures that they follow in their work. Our experience is that it is best to approach office systems one level of complexity at a time, both during the study and in the write-up.

It is easy for an informant to digress from outlining the structure of procedures into descriptions of various specific cases and their unique characteristics, getting lost in the familiar details. It takes some tact to stick to a breadth-first pattern of exploration, keeping attention focused on the main line of the procedure and its purposes. The analyst must constantly ask about the *why* of each step, as well as the *what* and and the *how*. In many cases it will be necessary for the interviewer to abstract the main line of the procedure later on from a set of diffuse descriptions.

It is important that the analyst not jump in too eagerly with many questions. This usually has the effect of encouraging people to venture even farther from the basic outline of a procedure's structure. Rather, the analyst should be trying to fit the description into his

evolving functional model of the office. When a hypothesis has been developed about some aspect of this model, the analyst should ask the interviewee to verify it.

Occasionally one will find informants who will repeat how a procedure is *supposed* to work according to the book, rather than the way in which they actually do it. It is thus important to test the information being presented by reference to specific examples. Walking through a typical scenario is a good technique for finding points that have inadvertently been glossed over or explained in an inconsistent fashion.

The best length of time for a single interview is somewhere between 1 and 2 hours, depending on the stamina of the analyst and the interviewee. Much less and there won't be enough time to cover most people's work in sufficient detail. Much more and not only will the analyst risk boring and inconveniencing his subject, but he runs the risk of "information overload," a condition that causes its victims to start forgetting the meaning of their notes.

Ultimately, the best check on the information gathered via interviews is direct observation. While the presence of an observer can alter normal behavior, unobtrusive observation of a staff member performing his normal work routine is an important check on purely verbal descriptions. Direct observation can also help to identify some of the most common exceptions and problem areas.

Observation should be a component of every interview. Reiterating a point made earlier, the analyst should avoid asking directly for an abstract description of an interviewee's job. Rather, he should ask for tangible illustrations of what is done. Ask to see the log book, for example, and have its use explained while it is lying open on the desk for reference. In cases where a real-time process is being handled, such as the "trouble desk" at the WCC where phone calls come in all the time, demonstrations of how the job is done may be unavoidable. The analyst should go with these interruptions, taking the opportunity to observe how the situation is actually handled.

After the interview, the analyst should spend 1 or 2 hours specifically devoted to observation. The key issue here is one of timing—doing the observation on an occasion that is representative. Few general rules can be laid down about the scheduling and duration of this observation period. It depends on the range and frequency of the activities performed in the office; if there are only two or three basic procedures being followed it will take less

time to see a representative cross--section of their operation than it would in a more general purpose office.

It should be recognized that there are some offices in which observation will be of rather little value; offices in which a fairly large number of procedures are handled, each of which is carried out only infrequently and over a long time span. In such offices the technique of corroborating procedure descriptions with more than one member of the office staff assumes special importance.

A principle from physics, the Heisenberg effect, stating that the process of measurement must affect the quantity being measured, applies as well to observation in the office. The analyst should be unobtrusive. He must not appear to be sitting and staring at the subject. It is useful to appear to be simultaneously engaged in some other activity while the observing, such as reading and checking the interview notes. Initially, the analyst should let the flow of the observation build up; asking questions too early will break the pattern of the work. After the normal flow has been reestablished, the analyst can interrupt from time to time with questions as appropriate.

During the course of observation, the analyst should principally be trying to validate the internal model he has built up from the interview. He should be checking to see if what is going on fits into his model, or if there are discrepancies between the model and reality. It may prove necessary to adapt the model as observation continues. Again, this should be done quietly, with questions phrased as hypotheses submitted for validation rather than as frequent short interruptions.

3.4.4 Analyze the Draft Description

Upon completion of a first round of interviews and observation, the analyst should step back from the fray to piece together a draft description of how the office is supposed to work. Even this first draft should follow the description format that is presented in section 3.5. It is important that this process be carried out as soon as possible after completing the initial round of interviews. Otherwise the analyst may find his notes "going cold."

The major point of this exercise is to abstract from the detailed material that has been collected a clear picture of how the office's operations cohere, casting them into the standard terminology of functions, resources, procedures, and objects. Each procedure

should be classified in terms of its relationship to its function's resources: initiating, managing, or terminating. Classifying things this way is a tool to help the analyst check his information for completeness and inconsistency. For example, if a function has been found with procedures for managing and terminating its resources, but not for initiating them, this is a flag that either one stage of the process has been skipped over, or that there is an unexplored interface to another office that also participates in carrying out the function. Any such ambiguities should be noted for further clarification. If OSL is used throughout the analysis procedure, the skeleton that will have been developed at this point will be of great assistance in pointing out such major omissions.

In addition, the analyst should use the draft description to develop a list of possible exceptions and "What if?" questions to be addressed to the informants. For example, if a procedure calls for someone to verify that an account has sufficient funds to cover a purchase request, then one question is "What happens when there are insufficient funds?" Exhibit 3-2 presents a checklist of basic exception categories that we have found useful in conducting our own case studies.

- ☐ Missing personnel needed for a decision
- ☐ Communications not received
- ☐ Lost documents
- ☐ Discovery of erroneous data
- ☐ Non-compliance with procedures
- ☐ Change of applicable rules or laws
- ☐ Reversal of earlier decisions
- ☐ Process behind schedule

Exhibit 3-2: Checklist of Common Office Procedure Exceptions

The fragmented reports of information required in each step should also be consolidated into an overall picture of the databases used in the office. For each database item, the analyst should note in what form it is kept (*e.g.* in a ring binder, as a paper file), how its contents are ordered (by date, account number, *etc.*), how long it is retained, and whether it is archived in some manner. This exercise will turn up additional questions to be answered

in the next round of interviews.

3.4.5 Iterate the Interview Process

The draft description should be circulated to the interviewees before speaking to them a second time. This will help them to feel an important part of the process (which they are), and may also stimulate them to bring up in the second interview important points that the analyst might otherwise overlook. The draft should be sent out as soon as it is completed to keep up the momentum of the study process. The office personnel should be given two or three days to read and react to it before they are interviewed again.

Armed with lists of inconsistencies and "What if?" questions, the analyst should return to the original informants to correct the draft description and to investigate exception handling processes.

During the whole process of ascertaining details and seeking out exceptions it is very important to watch for decision points in the procedures of which the office personnel themselves are not fully aware. In her anthropological studies of office work, Wynn [20] brings out repeatedly that many important decisions are made lower in the formal hierarchy than most people suppose. Often, due to their rank or the daily nature of the decisions, the people who make them do not think about what they are doing as "decision making."

An example, originally discussed by Wynn, illustrates the importance of *ad hoc* decision making. In a billing office, one step of the basic procedure is to call up customers with delinquent accounts and encourage them to send in their payments. Often however, the customer would claim that the payment was late due to an error in the bill. The billing clerk then had to decide whether to let the collection slip to the next billing period and have the slippage reflect on his own performance report for the month; to try to talk the customer into making a partial payment now and settle for having it adjusted later; or to "light a fire" under the customer's representative by calling the representative's supervisor and complaining about the late payment. This problem came up frequently, and was decided on the basis of a detailed knowledge of the customer's past history, the payment procedures followed by the customer's organization, the billing adjustment procedure in the clerk's department, and how close the end of the current billing period was. Yet, due to its very frequency of occurrence, the clerk did not think of this as an important decision-making process. The

operational problems that would be caused by an automated system that did not recognize this decision point, and no longer allowed the clerk much flexibility in handling it, are left to the reader's imagination.

Often it will also be necessary to identify additional personnel to interview in order to get at the details of how some of the paper work is really handled. In the case of complex procedures, it may also be a good idea to identify and interview additional personnel who perform the same or similar activities in order to verify the results of the earlier interviews. This suggestion is not based on a lack of trust in the initial informants, but simply on a recognition of the fact that different people will have different working styles and different perspectives on what is important. These additional interviews will not necessarily have to follow the same two-step procedure that has been described because the analyst will already be "in context."

3.4.6 Quantification

In addition to identifying the structure and flow of office functions, various *quantitative* measures of an office's activity need to be developed. Though quantitative data should be gathered all along, the second round of interviews is the appropriate time to focus in on this aspect. Some of the principal quantitative measures that should be sought are listed in Exhibit 3-3. In addition to these major variables, which are discussed further below, other measures specific to the office and the procedures under study will undoubtedly suggest themselves to the analyst.

There are three basic reasons for collecting quantitative data. The first, and most important within the context of an initial study, is to learn where the most time and effort is spent, and whether there are any serious bottlenecks in the current process. These define the prime areas for future augmentation or reorganization of the office.

It is also necessary to provide a basis for characterizing a potential office support system. OAM is *not* intended to result in a detailed system specification. In fact, we fully expect that, if it is decided to go ahead with a computer-based system after a study has been performed, the system designers would have to go back to the office, both to pick up the low-level details that were left out of the original study, and to work with the office staff in the design of the system's user interfaces. However, unless the broad outlines of a potential design

- ☐ Numbers of objects in process at any time
- ☐ Time and effort spent accomplishing various key phases of a procedure
- ☐ Elapsed time for completion of a procedure
- ☐ Frequency of repetition of a procedure
- ☐ Number of objects processed per unit of time
- ☐ Timing constraints on the completion of a procedure or step
- ☐ Frequency of key exceptions or alternate processing paths
- ☐ Numbers of people involved in each step or procedure
- ☐ Size of critical databases

Exhibit 3-3: Important Quantitative Measures

can be determined from the study's results, it won't have provided the basis for taking the next step in the change process.

The third reason for collecting quantitative information is for use in performing a cost/benefit analysis of any proposed changes that grow out of the study. Unfortunately, the art of analyzing the costs and benefits of office systems is still a dark one; research currently underway by ourselves and by many others is aimed at bringing some illumination to bear on the problem. It is clear, though, that any numbers that help define the cost of operating the office as it presently is will be of use.

The structure that has already been imposed on the office's operations—by conceptualizing them in terms of objects and the procedures that create, manipulate, and terminate them—provides strong guidance in choosing useful measures in all three of the areas just mentioned.

The explicit structuring of office activities into procedures is very helpful in detecting and *understanding* bottlenecks in the current implementation. Procedures also provide an appropriate way to aggregate time and effort levels. How many man-hours, contributed by how many different people, does it take to complete a particular procedure? How often is that procedure repeated in a week? How many instances of that procedure are in process at any given point in time? Questions like these are more useful in pinpointing areas in need of

improvement than are questions about the aggregate amount of time spent in the office on a specific activity, such as the percentage of secretarial time spent on typing.

The numbers of objects in process at any point, timing constraints on their processing, and the rough sizes of any databases are the points that must be known in order to characterize the size and cost of a potential support system. Here again, the level of abstraction introduced by thinking in terms of functions and resources is a help. It is more interesting to know, for example, how many resources are created in a given period of time than to know how many copies of a specific form are filled out. A form is an artifact of the current implementation; the resource it carries information about will have to be dealt with in any future design.

The detailed structure of procedures and objects is of help in the third area, cost/benefit analysis. Knowing the number of people involved in performing each procedure, not just the number of people in the office as a whole, makes it possible to judge the impact of automating individual procedures with greater accuracy. Measuring the time to complete each procedure step, and the frequencies of various types of exceptions, allows the potential benefits of a new approach to be estimated in terms of improvements in these key areas.

3.4.7 Final Review

The last step is to reinterview the office manager. The manager should be given a copy of the revised description of office operations before this final interview so that he may have time to review and comment on it.

There are a number of goals to be achieved in this last interview. The items to discuss with the manager are summarized in Exhibit 3-4. The first of these is to validate the *intentions* behind the various elements of each procedure. The supervisor will usually have a much more functionally-oriented point of view in this regard than anyone else in the office. Additionally, if the manager does not subscribe to the results of the study, it will probably be very difficult to enlist his support for the process of change that will be based on it.

If the analyst has uncovered portions of functions that are handled by other offices, it may be necessary to clarify what happens at the interfaces between the office under study and those other offices. The manager should also be able to identify people in those offices for

- ☐ Review revised description
- ☐ Validate intentions behind each procedure
- ☐ Go over general exception-handling practices
- ☐ Ask about process modifications
- ☐ Clarify what happens at interfaces with other offices

Exhibit 3–4: Summary Questions for the Manager

the analyst to talk to in order to complete his picture of how these larger functional groups operate.

By the nature of his role, the manager should have a much clearer picture of how the more general types of exceptions, such as emergencies or missing personnel, are handled. Compensating for general exceptions usually takes the form of reassigning the roles of office staff temporarily or of setting priorities, deciding, for example, that the remaining personnel should concentrate on one type of work while letting another pile up until the missing person returns.

Process modifications are another form of general exception handling. How are "overload" situations, such as end-of-the-month consolidations, dealt with? Again, the manager usually has to set priorities, ask certain groups of people to work overtime, hire in temporary staff, or ask for the cooperation of personnel in other offices. It is important to know which procedures, if any, typically have these sorts of problems, and how the manager is accustomed to dealing with them.

A final topic to bring up with the manager is that of the types of change in the office's operation that are especially relevant. As just discussed, operational changes are usually an important part of the manager's responsibility, and he may have already given much thought to identifying particularly good or bad aspects of the office's current mode of operation.

3.5 Structuring the Description

A standard write-up format provides a structure that helps the analyst to organize his materials. As might be expected, the structure of our format bears a close relationship to

the structure of a formal OSL specification, making the transition from OSL to English easier. However, even if OSL is not used, the OSL/OAM format helps to structure a description, presenting it in a manner that is easy for the reader to follow and understand.

We believe that the most important contribution of OAM lies in the conceptual model of office operations on which it is based. The thrust of our description format is to present the study results in a way that brings this point of view across to the reader. The final report will be read by a number of people, each with a different purpose in mind. The manager will be interested in gaining a new perspective on the operation of his office. Members of the office staff will be interested in the results of the project that they have participated in. Most especially, other members of the office automation group, including systems analysts and organizational experts, will need to understand the current structure of the office as a basis for their forthcoming contributions to the process of change. The functional understanding that OAM is intended to help the analyst achieve must be conveyed effectively to all of these people.

For reference, a sample description outline, summarizing the structure discussed in more detail below, has been included at the end of this section as Exhibit 3-5, page 40.

Our study format mirrors the structure of the analysis process, opening with a statement of the mission of the office in business terms. This section should answer the question "What is the purpose served by this office?" The rest of the initial section should cover the internal organizational structure of the office, its relationship with other offices that it communicates with, and its reporting relationships to upper management.

The next section should present an overview of the major functions that support the office's mission, describing the model of its operation that the analyst has built up. This section relates the functions to each other, identifies the resources that each function is concerned with, and classifies the procedures followed in the office to initiate, manage, and terminate each resource. Additionally, the terminology that will be used in the rest of the report should be established. The body of the report is taken up with descriptions of the individual procedures.

Each procedure section begins with a brief overview of the procedure's purpose, its role in relation to the lifecycle of the object it manipulates, its relationship to other procedures

both inside and outside the office under study, and a brief description of its inputs and outputs. If it is significant, the physical environment and specialized tools used in performing the procedure should also be described.

The main line of the procedure is described in a separate section. Just as the separation of exception handling from the investigation of the basic procedure is useful in simplifying the analysis activity, such a separation in the description makes for a more understandable presentation. The databases that are accessed or updated by each step of the procedure should be detailed, including descriptions of "mental lists" that the office workers need to learn to perform them. Quantitative information relating to the procedure as a whole, such as frequency of execution and frequency of major alternate processing paths, is also appropriate here. Finally, the types of exceptions that can occur locally to the procedure are classified and their handling detailed.

A discussion of general exception handling activities should come at the end, after all of the relevant procedures have been detailed. This is also the place to discuss any basic flaws in the operation of the office that have been found.

The databases and documents used within the office are presented in separate appendices. As discussed earlier, the description of each database item should include the manner in which it is filed, how long it is kept, and how it is archived.

I. Introduction

A. Mission

B. Organization

C. Overview of functions, resources, procedures, and objects

II. Procedure descriptions

A. For each procedure:

1. Environment

2. Inputs and outputs

3. Core procedure steps

4. Major alternate procedure paths

5. Databases

6. Local exception handling

7. Quantification

III. General exception handling

IV. Collected database descriptions and document samples

Exhibit 3–5: Sample Description Outline

1. Meet with the office manager

   - Organizational context and reporting relationships
   - Functions and resources of the office
   - Identification of conceptual objects and procedures
   - Identification of key personnel

2. Produce initial procedure descriptions

   - Conceptual objects
   - Core procedure steps and major alternate control paths
   - Inputs and outputs
   - Databases
   - Environment and special equipment

3. Develop and analyze a draft description

   - Examine for inconsistency and incompleteness
   - Construct list of exception possibilities

4. Iterate the interview process

   - Circulate draft description
   - Resolve conflicts and ambiguities
   - Investigate exception-handling procedures
   - Watch for *ad hoc* decision making

5. Review the analysis with the manager

   - Validate intentions behind each procedure
   - Clarify what happens at interfaces with other offices
   - General exception handling

6. Finalize the office description

Exhibit 3–6: Structure of the Analysis Procedure

4. Conclusion

In the preceding pages we have attempted to provide a set of guidelines and warnings to those who, for whatever reasons, may undertake the analysis and description of office procedures. Our goal has been to provide a method for quickly gathering the requisite information, while at the same time being sensitive to the complex interpersonal relationships that grow up in office environments. This document represents the interim results of research in progress. We fully expect that our analysis and recommendations will be modified as a result of continuing interaction with users. The authors welcome comments and suggestions on all aspects of both our methodology and this document.

II. The Work Control Center

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July 1980

5. Introduction and Overview

5.1 Introduction

5.1.1 Mission

The Work Control Center (WCC) of MIT's Physical Plant is responsible for monitoring all building operating systems and responding to the maintenance needs of the community. This mission is supported by a variety of procedures. The WCC receives inputs, generally requests for some sort of maintenance in various forms from all over the campus: requests for work by phone, requisitions, alarms through the autocall system, the Facilities Control System (FCS), environmental monitoring system, and a number of other systems. From these inputs WCC generates instructions to the various shops and other departments in Physical Plant. In addition, WCC has a number of administrative procedures, such as managing the petty cash fund. Together, these procedures control all of the maintenance and repair work at MIT, and keep all building operating systems running at their most efficient level.

5.1.2 Organization

5.1.2.1 WCC and management

At the head of Physical Plant is the director, followed by an associate director. Below him are three service managers, managers of mechanical, structural, and electrical services. The supervisor of WCC is under the manager of mechanical services. The individual shop foreman are also under one of the service managers, at the same level as the WCC supervisor. In particular, the Heat & Vent and the Pipe shop are under the same service manager, mechanical services, as the WCC supervisor. In practice, however, WCC acts as a service organization for all of the shops, regardless of which service manager the shop is under. A chart of the organizational structure in Physical Plant is in figure 5-1.

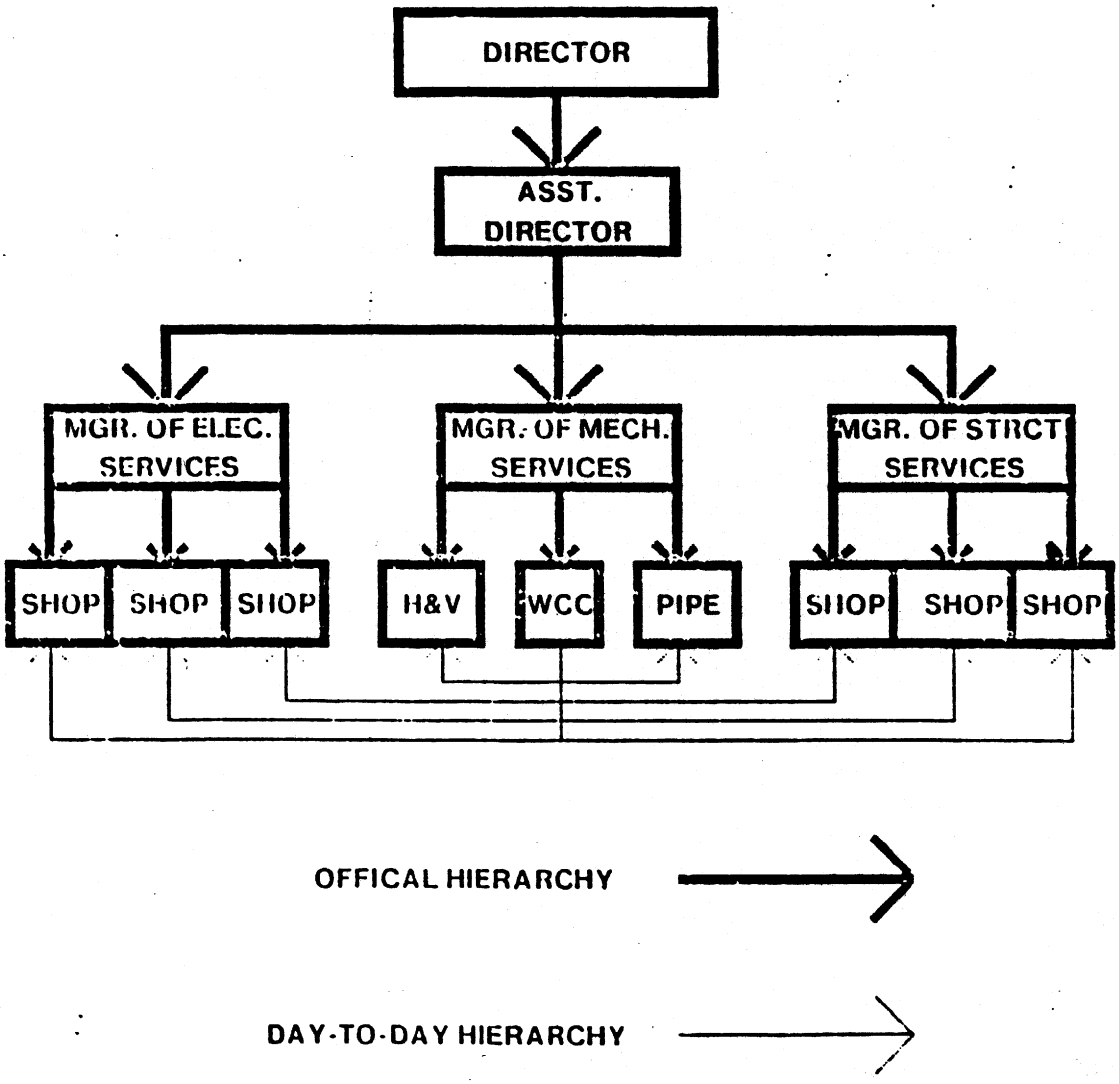


Exhibit 5–1: Physical Plant Organizational Chart

5.1.2.2 WCC and the shops

Currently, individual shop foreman decide how urgent a job is and when it will be done. If WCC feels that a particular job is not being handled fast enough, the supervisor of WCC will consult the shop's supervisor, and if necessary talk with upper management. This might happen if WCC receives repetitive complaints from someone about a problem not being fixed. The supervisor has the right to override any foreman's decision and give particular jobs top priority. Shops dealing with building operations (Heat & Vent and Pipe, and to some extent Electrical) are in almost constant communication with WCC due to the operational nature of those trades. (It is not likely that an emergency will arise involving the Paint shop). Future plans call for WCC to do much more of the scheduling of jobs.

5.1.2.3 Evening and night shifts

The trouble-desk dispatchers and the FCS console operators on the evening and overnight shift are not WCC personnel. These shifts are currently run by telecommunications personnel from a different but duplicate control center. (There is a third control center which serves as a back-up and generally is not used.) The telecommunications department is not under WCC's supervision, as the day shift trouble-desk dispatchers and FCS console operators are. Plans call for the eventual consolidation of all these activities into WCC. In the meantime, the evening shift is manned by rather untrained MIT telephone operators and the night shift is manned by a single, trained dispatcher who also serves as the FCS operator.

5.2 Overview of Procedures

This section provides a brief introduction to the procedures used at WCC to fulfill its mission, and introduces some of the names and abbreviation that will be used throughout the paper. Starting with the next section, each procedure will be dealt with in detail.

The WCC has a regular staff of 5. There is a supervisor and one person for each of the procedures described below. At night, there is only one person to handle both the trouble desk and FCS procedures.

5.2.1 Trouble desk

Here reports of malfunctions from all over the institute as well as an extensive alarm system (the Autocall system) come. The trouble desk must analyze the problem, determine its urgency, and take appropriate action. This desk is also referred to as the communications center, because it maintains a two-way radio and a paging system for keeping in contact with all of the tradesmen, foremen, and supervisors in the field. The desk maintains a log of all trouble calls and passes the individual pages of the log over to the work order processing desk as completed (see figure II-3, page 75.)

5.2.2 FCS desk

In close contact with the trouble desk is the FCS (Facilities Control System) desk. Here all environmental problems are handled -- those dealing with MIT's heat, vent, and air conditioning (HVAC) systems or the hot water system. The FCS is a computer system which controls the HVAC and hot water systems of all major buildings at MIT and helps the desk run those systems at their most economical level. The FCS desk updates the computer's timetables for turning systems on and off, and the temperature to be maintained, according to advance information received on building usage for the coming week. The FCS desk must, like the trouble desk, respond to problems, assign them priorities, and take the necessary action.

5.2.3 WO processing desk

A Work Order (WO) is the main way Physical Plant (PP) passes around information about a repair or maintenance job (see figure II-1, page 73.) Here WOs are prepared and distributed. Copies go to the shop involved, Accounting, and to WCC's own files. The other half of the processing is done when the job is completed. The WO from the shop returns and is matched with a copy kept at WCC filed by a method which depends on the type of WO.

5.2.4 Administrative support desk

WCC handles a variety of odd jobs which don't directly deal with maintaining building operations but need to be done by somebody. Among these are maintaining a petty cash fund, stocking standard office supplies, processing requisitions for special work outside of

PP's maintenance responsibilities, and clearing requests to shut down a subsystem like hot water to some building. The desk also double checks the tradesmen's time cards (labor cards) from and handles the overtime eligibility reports for certain shops.

6. Procedures

6.1 Trouble Desk Monitoring and Dispatching

6.1.1 Environment

The trouble desk has several main pieces of equipment at its disposal. Immediately in front of it is a multi-line telephone for receiving problems, a two-way radio system and a paging system (discussed below), several direct lines to emergency departments (e.g., MIT police, fire department), and the Autocall alarm terminal (a standard Decwriter) which a new Autocall computer system outputs on. Further away are the actual Autocall machines (not normally needed) and many postings of procedures to be followed for special situations.

6.1.2 Trouble calls

The trouble desk receives phone calls reporting problems or malfunctions in institute buildings. These calls come in on what is called the FIXIT line. Typical calls are for broken windows, electrical failure, or a fouled-up toilet. WCC receives approximately 150 calls per day. The dispatcher first decides if the call is an environmental call (one that deals with MIT's HVAC or hot water systems). If so the call is immediately transferred to the FCS desk and the dispatcher is done with that call. Otherwise the dispatcher gets the caller's name, extension, description of the problem, and its location. This information is logged on the trouble log along with the time and date of the call. (see example in figure II-3, page 75)

The dispatcher now decides what action will be taken. His choices are dispatch a mechanic to the scene or, for problems that can wait, have a WO issued. The decision on urgency is based on the dispatcher's background in mechanics, his experience with typical problems the campus has, and with directives from supervisors. If the problem is not serious, the dispatcher will mark "WO" in the disposition column of the trouble log and is done with the call.

For urgent cases, the trouble desk has at its disposal a Maintenance on Demand (MOD) squad consisting of two Heat and Vent mechanics and one plumber, 24 hours a day. The dispatcher maintains a listing of jobs waiting for attention from the MOD squad called the MOD log. The log is a queue: new problems are added to the bottom of the list and when a MOD mechanic finishes a job he calls the desk and gets the next job. The MOD log is divided into two sections, an east list and a west list, corresponding to sides of the campus. The purpose is to cut down on the running around any one mechanic has to do, by giving a job to the MOD mechanic when he calls in from the same side of the campus as he was just working on whenever possible. The dispatcher can always push very urgent cases to the top of the list or, for an emergency like a broken water main, pull the mechanics off of their current job and send them to the emergency site. The trouble log will be marked "MOD" under the disposition column and the dispatcher is done with that call.

For problems that appear urgent but are outside the scope of the MOD squad's capabilities, such as an electrical problem, the dispatcher will contact the foreman of the appropriate shop, usually by two-way radio. The dispatcher will indicate on the trouble log who was contacted. The foreman will generally advise the trouble desk what action was taken within an hour, and will confirm the action by sending a blue-slip (explained later) over to WCC. Less than 20% of all trouble calls need referring to a shop foreman. This procedure is still followed at night; but there are rarely any such problems reported then. If the problem is not serious, the dispatcher will mark "WO" in the disposition column of the trouble log and is done with the call.

6.1.3 Autocall alarm system

The autocall system monitors most of the main buildings for such things as fire, waterflow, intrusion, HVAC systems, etc. Alarms are originally received on the autocall machines. They simply print the alarm number as it comes in. Charts near the machines translate the number into location and problem. However, a new autocall computer system, tied to the FCS computer, translates the autocall alarm number into location, problem, and important instructions automatically and writes them in English on a printing terminal, so the autocall machines are rarely referred to unless the computer terminal is broken.

About 15 alarms will be triggered on an average day. Each alarm normally print five times, but an alarm is considered valid after 2 prints by the dispatcher. All alarms are logged on the

daily autocall log, a sheet kept on a clipboard near the autocall terminal. The autocall log indicates the alarm number, time, location and type of alarm, the operator, and the time reset. The trouble desk will call the people necessary to respond to the alarm, as indicated on the alarm print-out. For some alarms, such as a fire, special instructions are posted on the walls near the autocall machines. They have information such as who to call and in what order when this building is on fire. The trouble desk makes use of a number of special direct lines as well as the radio and paging system to respond to emergencies, generally fire or intrusion alarms. Emergency alarms would be (in decreasing order of importance) fire or waterflow, intrusion or tampering, and an HVAC alarm. When an alarm prints for a sixth time, it means all clear and the time of reset is also recorded. The printout from the autocall computer terminal prints on each of the terminals, one in each of the three complete control centers. Only one of these is saved, the printout from the telecommunications control center. They are kept in boxes in the basement of WCC.

Should the same autocall alarm come in persistently (4 or more times in a shift) a special report will be prepared the next day by the dispatchers involved. It will detail who was dispatched and what the mechanic found. A copy of the MOD dispatch log will be included as evidence of who was sent and the findings. The report will go to the manager of mechanical operations, who will generally delegate it to a particular foreman to have resolved. The manager wants to be informed of special problems in his departments so he can follow-up on them. He also wants to hear about the problem from his own staff first, so he is familiar with the situation if someone complains directly to the top.

6.1.4 Finished trouble logs

As each sheet of the trouble log gets filled, it is handed over the the WO processing desk. This happens about fifty times a day, as each sheet of the log holds information on four calls.

6.1.5 Communications handling

The trouble desk serves as a communications center for most of WCC. Someone may stop by and ask to have someone else (who carries a radio or page) paged, or leave a message. A typical message would be from a foreman to a tradesman to call the shop. The MOD mechanics call in when they complete a job and ask for the next assignment from the

MOD log. The desk will relay information between people in the field. The WCC also serves as a switchboard for all of PP, since the number in the phone book for PP rings in WCC. Approximately 20% of WCC staff's time is spent answering random phone calls not having anything to do with WCC itself.

Each tradesman carries a one-way pager that is permanently assigned to that person. To page someone, the dispatcher looks up that persons number from a list on the desk and punches the number into the pager. The dispatcher then gives the message. A special group of pagers, for the fire response group, can be set off all at once. Key workers, mainly shop foremen and supervisors, carry two-way radios. These are signed out each day on the radio sign-out log, indicating radio number, name, and the time the radio was signed out and returned. These all will operate on the same channel.

6.1.6 Problems at the trouble desk

The trouble desk has two main problems. The first occurs when someone takes a message for the dispatcher and it is incomplete or incorrect. Whenever the dispatcher is busy (with another call, on break, or handling an alarm) someone else in WCC will answer the phone and take down the information on a form called a blue slip. The blue slip is used to relay information about a trouble call or a WO within WCC or between WCC and the shops. It has spaces for the caller's name, extension, problem, and location, plus some other spaces useful when preparing a WO (explained later). (See example in figure II-2, page 74.) The message taker will put the completed blue slip on the trouble desk. If the slip is incomplete, the remedy is either to talk to the person who took the message (if known, perhaps by handwriting) or to call back the person who called WCC. There is a fairly standard set of questions to be asked when handling a trouble call, but sometimes something gets missed. However, even in the busiest of times it is standard procedure to get the callers extension.

The second problem is trying to get hold of a shop foreman when the problem seems urgent but falls outside of MOD duties. The remedy is to keep trying, or ask the WCC supervisor. A related problem is the foreman, once contacted, not checking back with WCC to advise what action has been taken. Should someone later ask the trouble desk what happened on such a call, the dispatcher will look up on the trouble log the name of the foreman contacted. Serious problems with getting hold of a shop supervisor are handled by

contacting the supervisor's boss (by phone). Problems typically referred to a supervisor are repeat calls or a question of how to handle an unusual situation.

6.2 Facilities Control System

6.2.1 Environment

The FCS desk's main piece of equipment is a video display terminal. With this the operator can display, analyze, or change the environmental status of any building under FCS control. Next to it is an alarm box which buzzes and flashes for certain alarms (discussed below). A separate printing terminal makes a permanent record of all alarms. The desk also has a multi-line phone and a microphone for both the two-way radio system and the one-way pager. A log of all incoming calls or alarms is kept, called the FCS trouble log. It is the same form as the trouble log used at the trouble desk, and the same information is kept (caller's name, extension, problem and location, time, disposition).

6.2.2 FCS trouble calls

When a call comes in to the FCS desk or a blue slip is handed over (a message that was taken for the operator while he was away or busy), the operator will first log the call on the FCS trouble log. For buildings that are on the FCS system, the FCS operator will then query the FCS computer to see what the status of equipment in that building is. The display indicates which fans are on, which are supposed to be on according to schedules, what the temperature at various points in the system are and what they were set to be. If something is off when it should be on, or if a temperature is set wrong, the problem can usually be fixed right from the terminal, as it has control over all the fans and temperature sensors in buildings on the FCS system. If the problem can't be fixed from the terminal, the FCS operator will have the trouble desk dispatch a MOD mechanic to investigate. The number of calls that come in varies by season, with 15 calls per day an average.

A typical problem would be a complaint that room 26-100 is too hot. After querying the system, the operator finds that the fan is off and is supposed to be off. He simply turns the fan on. However, if the fan was off and was supposed to be on, this would require a MOD mechanic to investigate. If the operator has a MOD mechanic dispatched, he will mark his log sheet "MOD" under disposition. If he is able to solve the problem from the terminal, he

will indicate "completed" and the time completed in the disposition column.

6.2.3 FCS alarms

Alternatively, the FCS system will signal trouble via its own sensors. A buzzer will go off and a light will come on on a panel indicating type of trouble (critical, emergency, non-critical). A non-critical alarm might be when the computer attempts to start a fan but it won't start. A critical alarm might be a temperature in some system that was too high. Again, the operator will query the computer for the specific building and if he can't fix the problem with the computer he will have the trouble desk dispatch a MOD mechanic. A printing terminal records each FCS system alarm that comes in, and the printout from the terminal is from time to time collected and filed. In addition, all valid alarms are logged on the FCS trouble log as if the problem had been called in, with the time, description of alarm, disposition, etc. There are approximately 150 alarms per day, mainly non-critical alarms.

In practice, the operator usually is aware of particular software bugs or alarms with conservative limits that cause alarms to go off for no reason. These are only investigated if in the opinion of the FCS operator they really are alarms, and are not normally logged. When a software bug is found, the operator will use a WO form to describe the bug to the computer department. The WO is not processed like a regular WO, it is just sent to the computer department. In addition, many of the FCS sensors are duplicated by autocall alarms. The systems are completely independent. Generally the FCS system responds much faster, because of its more conservative limits.

Sometimes the operator might just notice something is wrong. He would query the system and then in most cases have a WO issued (fill out a blue slip and give it to the WO processing desk). When the FCS operator originates a WO himself in this way, he receives a copy of the WO back, which is kept in a notebook. This is solely for the operator's own use, as an aid in remembering which problems have been reported already and which have not.

6.2.4 Adjusting FCS system schedules

When not handling problems or alarms, the operator adjusts schedules for the FCS system according to information he receives from the MIT schedules office. A schedule is simply a timetable for the FCS system, specifying for each subsystem (fan, heater, etc.) the

times it is to be on and the temperature it is to maintain. The information from the scheduling office indicates how and when the various rooms are being used, so the FCS operator can set the FCS schedules accordingly. For example, if a lecture hall normally empty on a Friday night is being used for a special program, he will update the schedule for that area to maintain proper environment.

6.2.5 FCS communications

The FCS desk has access to both radio systems. While only the trouble desk will dispatch MOD mechanics (mainly because that is where the log is and they don't want to constantly be shuffling it around), the FCS operator will use the two-way radio to discuss a situation with a MOD mechanic on the scene. The FCS desk uses the one-way paging system to help the trouble desk pass on messages.

6.2.6 Problems at the FCS desk

The FCS desk's main problem comes with scheduling information. If they don't receive it from the schedules office, they call that office and find out what happened to it. If the scheduling information is inconsistent or impossible (a fairly common occurrence) either the FCS operator will make his best guess or else he will check back with the schedules office. The FCS desk does not share the problem of incomplete blue-slips as it is policy that only the FCS operator will answer an environmental call. If he is busy or unavailable, just the extension is taken and he will call back. Finally, certain flukes in the software can cause an FCS command to be read but not executed. There is no way of knowing without consulting the terminal, so it is standard procedure to follow up on all commands given. However, if this isn't done when the desk is very busy, the malfunction probably won't be caught until someone calls complaining that it is too hot or cold.

6.3 Work Order Processing Desk

6.3.1 Environment

The WO desk is near both the trouble desk and FCS desk. The desk has an electric typewriter, several in-out bins, a time-clock (for dating WOs), and lists of account and job numbers used in filling out WOs. On a nearby wall is are several bins, one for each shop. These bins are used to hold the WO active file. The desk also has a multi-line telephone to aid the FCS and trouble desk in answering the phone.

6.3.2 Flavors of WOs

Every time work is to be performed by one of PP's shops, referred to as a job, a WO is created. There is a job number associated with every job. Two types of WOs used, depending on the type of job. The first, with a blank job number field, is called a standing WO because the WO desk will assign a job number from a master list of routine jobs, and every time the same job is performed, the same job number will be used. The second is a printed WO and has a unique serial number printed on it in the job number area. These are used for expensive or long or otherwise unique jobs which do not already have accounts (and money) allocated to them.

6.3.3 Creating new WOs

The desk receives requests via blue slips, trouble logs, MOD slips (from MOD mechanics after finishing a job, indicating the job's status, see figure II-4, page 76), and janitor slips (slips from janitors who have noticed something that needs fixing). The blue slips are thrown away as soon as the WO is prepared, the last three are scanned to see which require WOs, and then are filed when the WO is prepared. Approximately 80 WOs are created each day. Trouble and FCS logs have "WO" marked in the disposition column, MOD slips have "Job incomplete" checked, and all janitor slips require WOs. The trouble logs have two copies. The white copies of both FCS log and trouble desk logs are filed together by day in a notebook. The yellow copies of the FCS are kept in a separate file, the yellow from the trouble desk are thrown out. The yellow copies FCS logs are kept separately to speed up investigating a "I called four days ago and its still freezing in here" call. (See example MOD slip in figure II-4, page 76.)

To prepare a WO, the WO typist first must decide if the job will fit one of the standing job numbers or if it will require a printed job number. Besides a unique type of job, the following conditions will automatically require using a printed number WO:

1. All housing calls
2. Any job costing over $200 or requiring over eight man-hours of time, as estimated by the submitter (usually a shop foreman)
3. Any insurance claims: fire, explosion, or flood
4. If a foreman wants to keep track of a job (generally comes in to office on a blue slip and has "PRINTED NO." written on top)

The difference between printed and standing WOs from the accounting point of view is that printed WOs are individually itemized each month, and do not have a special allocation for them in PP's budget. Standing numbers cover work that has an annual budget for doing a particular job in a particular building, and all work done under that job number is lumped together and totalled by the month. For example, $1000 might be allotted to replacing fan belts in building 26 for the year. The actual amount spent in a year on a standing number job is determined from the labor cards turned in by the tradesmen (explained later) to the Accounting department. The WCC has set the $200/8 hour rule so as to cover most routine maintenance work and not clog up the accounting system, while tracking the major work individually. Approximately 80% of all WOs are of the standing number type.

In practice, the decision on which type of WO to use is already made before it gets to the WO desk. When a foreman wants a printed WO typed he will mark the top of the blue-slip "printed" or "PN". The FCS operator goes over his own logs and makes blue-slips for necessary Wos. Almost all trouble calls that come in either are for very small jobs or else would be referred to a foreman in the first place, who would then send a blue-slip to WCC. The same is true for MOD slips. Rarely does the WO-typist have to make the decision.

When a WO is prepared, the source of that WO is filed or disposed of (FCS and trouble logs first get a check mark in the "WO issued" column"). Copies of a prepared WO are distributed as follows:

Standing WO	Printed WO
pink: active file white&yellow: shop	gold:active file pink&blue: shop white:accounting yellow:WCC permanent file

The active file is organized by shop and then by date. The printed WO copy that goes to the computer opens an account for that job. The standing WOs do not need this since they are already allotted a certain amount of money to perform regular jobs. An exception to the above distribution is the pipe shop. They also get the active file copy for historical reasons.

6.3.4 Completed WO processing

The second step in processing occurs when the WOs return from the shop after completion. The shop will return one of its copies (standing-white, printed-pink). These are matched against the active file copy. The active copy is pulled so that WCC has an up to date file on which WOs each shop is working on. For standing WOs, the white is filed in the WO permanent file and the pink discarded. For printed WOs, the gold is filed in the permanent file and the pink is sent to the accounting department to close out the job.

6.3.5 Problems at the WO desk

The WO-typist desk has two main problems. Of the many different WO sources, the MOD slips and janitor slips turned in each day are very often incomplete. Generally, these are filed away without any action taken on the theory that the problem will somehow be reported to WCC again. Trouble logs and blue-slips are hardly ever a problem. If a problem does arise, the remedy is to check back with the originator, make a good guess, or, as before, wait for the problem to come up again.

The second problem is failure of the shops to return their copies of completed WOs. There is no official deadline, but when something in the active file gets too old (about two weeks), the foreman will be contacted. This might be noticed in the course of other procedures (e.g., checking up on a particular WO, pulling a completed WO). A particular problem is the pipe shop, since WCC retains no active file copy. WCC won't know if a pipe shop job is taking too long until someone else asks them what a job's status is, and then WCC relies on two foremen who handle scheduling to find out if it's done or not. If the

foreman says the job was completed but has misplaced his copy, WCC gets the foreman's signature on the WCC copy of the WO and then proceeds with its procedure as if it were completed.

6.4 Administrative Support Procedures

An administrative office on the side of the control center handles various reports and procedures. Here most of the permanent files and other logs are kept. Everyone in the WCC knows everyone else's job (new employees are taught at least the basics of the other jobs, and pick up the rest as they go along) and consequently someone at the administrative support desk gives the FCS operator and trouble desk dispatcher their breaks. They also take care of other miscellaneous jobs that need doing, such as getting a certain key for someone.

6.4.1 Labor Cards

Labor cards are filled out each day by all hourly employees. They list each job number they worked on that day and how many hours. In most cases the individual shop foremen are responsible for the approving and sending their labor cards directly to Accounting. However, for the day shift H&V and pipe shop and for the 2nd and 3rd shift H&V, pipe, and electric shop, labor cards are also checked over by the administrative support desk before going upstairs to Accounting. There are about 60 cards per day to check. (This is a holdover from a period during which time these shops were responsible for a large number of mistakes in their labor cards. Since WCC is very familiar with job and account numbers in use, they were more likely to catch these mistake.)

Cards are given a quick scan for accuracy -- fields that should be empty are empty and numbers make sense. Job numbers and account numbers must be correct. Printed number jobs are often looked up in the WO permanent file to check accuracy. The staff is generally familiar with standing job numbers and so they don't check them with actual WOs. Job descriptions are filled in if the worker left them blank. The number of hours spent on different jobs during the day must equal the total number of hours worked that day, and the foreman must have signed the cards. The cards are in pencil and the WCC staff just erases mistakes and writes in correct information. On the average, 25% of the cards will be

incorrect or incomplete.

The cards are then sent up to the Accounting office. Even after this checking, a few cards out of the several hundred will be returned due to a mismatch of job numbers or similar reason. WCC staff then must search through back files of WOs to find the correct information. This doesn't happen too often, but can take some time when it does.

The labor card log, a day-by-day checklist of all cards received, is maintained. If an employee is sick, a status change report (SCR) is sent to WCC along with his labor card by his shop. Administrative support desk staff will note that an SCR was received on that date in the log book. Employees calling in at times other than regular business hours call the WCC instead. WCC will then fill out the SCR, make an entry into the labor card log indicating that the employee was sick, and pass the SCR to the employee's shop foreman. SCRs received from a foreman are sent on the the payroll department after logging. Note that Heat & Vent and Pipe shop foreman send WCC the SCRs, just as only those shops send labor cards to WCC. Other shops send their SCRs directly to the payroll office.

6.4.2 Overtime lists.

WCC also handles overtime situations for H&V and the structural shops (metal, carpenter, lock). These shops incur by far the largest share of overtime in PP, and WCC serves as an impartial coordinator. When a foreman of a particular shop feels that overtime will be necessary, he will call the WCC and tell him what type of work is being done and how many men he will need. WCC staff then begins filling out an overtime incident report. It describes the problem and reason for overtime. WCC staff then begins calling people in order from the overtime eligibility list. The list ranks each tradesman in a shop who wants overtime work in order of number of overtime hours worked in the past, and also indicates special skills they have (all of the workers a qualified for "general duty" overtime work). On the average there are five instances that require the WCC to call in mechanics a week.

The WCC will start with the tradesman who has worked the least number of overtime hours and has the necessary skill. The overtime incident report lists each person called and his answer. The calling continues until enough men agree to come in. If not enough people will work, the foreman either goes on with out extra help or calls in supervisors. However, this has never been a problem since the overtime wage is very high. The overtime eligibility

list is then updated each week to reflect the latest number of hours each employee worked or could have worked, with the man who has worked or could have worked the least going to the top of the list. It should be noted that employee's "eligibility hours" are added to if he was called, not just if he actually came. In other words, everyone that WCC tried to contact, even if the tradesman was not home, has the number of overtime hours actually worked by the mechanics who came in added to the number of hours they "worked." The only exception to this is if the tradesman was sick as evidenced by a status change report, or if the person was on vacation.

The reason for the complex procedures for obtaining overtime mechanics is simply the amount of money to be made. Mechanics get very upset if they feel that they should have been given overtime work that someone else got, so WCC has this system to show exactly who was called. Because so much money is to be paid by PP, overtime is a very touchy business among upper management (the directors and service managers). A copy of the overtime report goes to Accounting for checking against labor cards.

A shop does not have to go through this procedure to keep a tradesman who was already working an extra hour or so to finish up a particular project. The foreman must submit, however, a report indicating who worked on what and for how long at the end of each day. These hours are included in an employee's eligibility hours. WCC will receive an average of 15 reports from foreman in the summer, and five in the winter. The extra summer overtime is due to the air-conditioning.

All shops in PP other than H&V and the structural shops handle overtime situations themselves. The other shops have very little overtime, and have their own systems for deciding who gets the overtime work. They do not involve the WCC at all.

6.4.3 Shutdown requests

6.4.3.1 Handling system shutdowns

Whenever anybody wants to do work that requires shutting down some system (water, heat, etc.) in a building, that person must fill out a shutdown request and send it to WCC. Usual reasons for a shutdown are testing or repair work. The request describes what is being shutdown, when, where, and for how long. When WCC receives the request someone

from the administrative support desk will go to the foreman of the shop involved to discuss it. The foreman will indicate how long the job will take and which rooms will be involved. When WCC staff and the foreman have agreement, WCC staff calls everyone on a shutdown-notification list that is maintained for that area. Normally, these people will cooperate with the shutdown request. Sometimes, as in the case of animal labs, they will agree but request more time so that they can move all the animals out of the area. WCC processes an average of ten shutdown requests per week.

When all people on the list have been notified, the shutdown request is signed and copies of the shutdown request along with the corresponding WO are distributed to the necessary shops. The system being shut down will be indicated on a large board hanging in the WCC. In emergency situations, like a broken steam valve in a hazardous area, the shop is allowed to shutdown the equipment first and then call the people on the list to let them know what happened.

6.4.3.2 Maintaining the shutdown lists

Once a year, the administrative support desk sends out forms to all department heads asking for the names of people to be included on the shutdown-notification list. If there is a change in personnel during the year, the departments are supposed to send WCC a note advising them of the change. The list has alternate names to call in case someone is unavailable.

6.4.4 Requisitions

Sometimes, departments want PP to do some work that is outside of the scope of normal PP building services, and have the work charged to the department's account. To do this the requester will fill out a lab requisition describing the work and will send this to the WCC. (This is the same form as that used for ordering supplies.) The clerk at the administrative support desk will prepare a printed number WO to do the work indicated on the requisition. The requisition's pre-printed serial number (requisition number) will be lightly crossed out and the WO number will be written above it. The WO will have the requisition number typed on it, so the WO and requisition will be completely cross-referenced. The WO is then handled as any other printed WO. The requisition is filed by month and then by requisition number at WCC. Approximately 30 requisitions per week are processed.

Often a requisition must be sent elsewhere for approval before WCC can begin processing it. For example, all requisition numbers starting with a seven or an eight indicate a requisition from a sponsored research program, and those with estimated costs above $200 must go to the Office of Sponsored Programs for approval before the WO can be typed. A log book is used to keep track of requisitions that have come in and are out for approval. When a requisition is received that requires further approval, a log entry is made on a spiral notebook indicating requisition number, account number, date received at WCC, and where sent.

6.4.5 Ordering supplies

WCC keeps general office supplies for many offices in PP as well as for itself. Supplies must be reordered from time to time. This is done on the standard Lab Requisition form used all over MIT. A copy of the order is filed at WCC in sequence with the regular requisitions received. WCC staff have to go to their supply area several times a day. Whenever someone notices that the stock of some items is low, they simply type out an order for those items. One of the staff members then takes the requisition over to Lab Supplies and picks up what was needed. It is not generally necessary to check the file of previous requisitions before ordering, as the items are picked up shortly after they are ordered.

6.4.6 Petty cash

The administrative support desk is responsible for maintaining a petty cash fund for use by WCC and the shops. Most of the expenses are either for travel allowances or for safety shoes. To receive reimbursement, a person would need a receipt and a safety shoe reimbursement card approved by the safety office and the supervisor for safety shoes, a transportation slip for transportation, or a receipt for miscellaneous expenses. In all cases a petty cash voucher is put in the petty cash envelope. When ever WCC accumulates over $100 in vouchers (about every two weeks) a transaction itemization is prepared and send to Accounting along with the vouchers for reimbursement.

6.4.7 Other procedures

The payroll for the WCC is made out once a week by the supervisor. This involves filling out a sheet with the employees' names and the number of hours they worked. A weekly Preventive Maintenance (PM) status report is prepared. PM job orders are generated from a computer program. The Information Processing Service runs the program and sends the job orders to WCC. The report details the number of hours of PM to be worked this week, the number of hours done last week, and the number of hours of work not done last week. The report is filed at WCC; a summary of the report goes to the service managers of PP. The actual printout is sent to the foreman who schedules PM work. When a PM job is completed, a copy of the PM work order is sent to WCC, which is filed by PM number and building.

6.4.8 Exception handling for administrative-support desk

The administrative support desk faces several types of exceptions with incomplete or incorrect information. Often the labor cards from those shops WCC checks are missing. The desk can tell if a card is missing by checking the labor card log (a day-by-day checklist of all cards received). Normally the desk will let it go for a few days, then call the appropriate foreman.

The overtime lists can have incorrect information on them. Occasionally an employee will charge that he should have been called for overtime work and wasn't. The remedy is to get the overtime report that shows exactly who was called and what the response was. If the employee is right, the overtime eligibility list will be corrected. The desk also can have missing information when preparing the weekly update on overtime eligibility lists. The foremen are supposed to turn in a daily report of all overtime occurrences. The missing information will probably go unnoticed unless an employee complains about not being called in for overtime work. No attempt is made to verify the overtime information from the foremen. Finally, shutdown requests also are often turned in with missing information. The remedy is to call the foreman back and get the needed information.

6.5 Special Procedures for the Evening and Night Shifts

While the basic procedures are the same 24 hours a day, there are some differences in procedures on the evening and night shifts. First, only one log is used for both the trouble-desk and the FCS desk. Secondly, the night shift operator types up all of his own WOs from his shift and the evening shift before. Finally, the night shift operator must issue a special set of commands at regular times on the FCS system. These commands cause the printing of the environmental status in certain buildings on the FCS computer room printer, located in building 42. This is not used by WCC, but by other parts of PP to monitor environmental trends in the buildings.

The late shifts also face a special set of problems. Many of these occur because they are in a remote monitoring station. The evening and night shifts operate in a duplicate control center on the seventh floor of the same building as the main control center. Sometimes some information, like a new bug in the FCS computer software or a new procedure to be followed, does not get upstairs for some time. There is also a problem of misplacement of documents (WOs, logs) in transit from the seventh to the first floor, where the main WCC is located.

7. General Exception Handling

7.1 Main problem at WCC

First, a general assumption for all of WCC: If some document gets fouled up such that WCC can not do its job (that is, get something fixed), someone will (sooner or later) call back and the system can start over. There is also one major problem which affects all of WCC: the inability to stop duplicate calls on the same problem. For example, if two students share an office and they get to the office at different times in the morning, they both might notice that it was unusually cold and both might call WCC. The trouble desk would probably be on a new log sheet by the time the second call came in, and unless the dispatcher specifically remembered already getting the call, or if someone else was watching the trouble desk, a second WO would be generated. This is complicated by the fact that there are several different inputs to the WO creation system. A janitor might report a problem on a janitor slip and then someone might call in the problem next morning. If the dispatcher or WO typist notices the duplication, the duplicate entry can be stopped. However, with the number of WOs prepared in a day, many duplicates go through unnoticed.

7.2 General exception handling procedures

Besides the specific exception handling procedures discussed with each procedure, there are some general rules that are followed. In the case of a missing document, the general rule is to put off working on that document until it is found, and go on to the next task. If the document is present but incomplete or incorrect, the procedure is to get hold of the originator and correct it. If a key WCC employee is missing, someone else will just fill the job, as everyone knows everyone else's job.

7.3 Supervisor's role

The WCC supervisor's role is to handle problems of the same type as the rest of the staff, but at a much higher level of complexity. For example, shutdown requests are normally handled by the administrative support desk, but when a shutdown will involve a large number of people, the supervisor will clear the shutdown request himself. The supervisor is generally sent a letter from a higher source in PP directing him to take care of the shutdown. An example of this would be a request to shutdown air conditioning service to a main computer area for two weeks (effectively shutting down the computers themselves).

A similar situation exists for the trouble desk: repeat calls can be handled by the regular staff, but when there has been a long delay in getting the work done or a large number of calls for the same problem, the supervisor himself will look into the problem. The supervisor usually gets a blue-slip from a WCC staff member describing the repeat-call problem, but he may also simply be told by a foreman or the trouble-desk dispatcher, from a letter sent to him by the original caller, or by direct phone call from the source of the problem. In fact, the supervisor has made it known to the top directors of the groups or buildings at MIT that they should call him directly when there is a serious problem not being taken care of. Normally the action he takes is to call the appropriate shop foreman and out the status of the job.

The supervisor also handles the coordination of new PP policies. An example was the emergency temperature regulations: this involved the supervisor meeting with a top administrator from each group or building to discuss the requirements and how the group could meet them. When ever a major new policy is instituted, the WCC supervisor will receive a letter from PP's directors explaining the new policy and what they want him to do.

The supervisor also has several smaller responsibilities. He oversees the PM program and the fire prevention program (inspection and testing of the fire hoses and extinguishers on campus) and handles directly any problems resulting from them. The supervisor approves the petty cash itemization and also the PM status report when prepared by one of his staff.

The supervisor steps in is because these larger-scale problems often involve top-level directors or administrators from all over the campus and politics comes into play. The supervisor of WCC has more experience in these situations and can better "keep the peace" between PP and the rest of MIT.

8. Summary: Applications to an Office Specification Language

8.1 Styles of Case Studies

This paper has described the procedures and databases used at WCC using a structured, english style. However, there exist several other methods for describing an office, using a defined model of an office. This section will attempt to describe the WCC using the framework of an one such model, an Office Specification Language (OSL). OSL looks for a *basic office mission*. It strips away the implementation details and separates exception--handling routines from the main routines. What is left is a set of procedures built out of simple, generic activities that fulfill the office's mission. These procedures operate on *abstract data objects*. OSL provides a framework for describing these objects and the environment in which they are acted upon.

This section is in no way meant to be a complete, formal description of WCC using these models of office procedures. Rather, it will summarize the observations made on the procedures and databases used at WCC using the framework provided by OSL. At the same time, this example will demonstrate the power of these models for dealing with office functions.[1]

8.2 The Basic Office Mission

There are hundreds of different missions an office could be designed to serve, and for each mission there are hundreds of different ways of carrying out that mission. However, many offices are, at their most basic level, performing the same function. There may be differences in the implementation of these functions, i.e. in the specific data object being

[1]The particular model used here is based on the ongoing research into an Office Specification Language by Mr. Jay Kunin at MIT's Laboratory for Computer Science.

acted upon, or the type of forms used in the office. For example, consider two different offices whose mission is to *schedule* objects. One such office might be found in a television station, whose mission was to schedule TV programs and commercials. An airline might have another scheduling office, to assign pilots to flights. However, when the basic functions of these offices are analyzed, their structure will be similar.

The WCC exemplifies a "dispatch" office. The procedures used at WCC are much the same as those used by a dispatch office in say, the repair department of a department store, though some details are unique. It receives requests for action to be taken, usually repair work. WCC determines the urgency of the request and issues the appropriate instructions. This involves calling for a MOD mechanic or issuing a WO. WCC keeps track of dispatches it has made through the WO active file. The fact that Physical Plant uses two types of WOs, standing and printed number, while the repair shop might not, is a low-level implementation difference.

Not every procedure in an office will fit in with this basic function, nor does every procedure need to. For example, WCC has procedures, such as the maintaining of the petty cash fund, which have very little to do with being a dispatch office. Many offices have procedures that have been done in that office for historical reasons. This does not invalidate the idea of a basic office function.

8.3 The Abstract Data Object

The style of this case study is a *functional* one. It concentrates on the procedures an office goes through to achieve it's task, instead of following the jobs of individual employees or the flow of documents through the office. It is therefore natural to look for the entities that are the focus of the office procedures and the environment around which they are organized -- what OSL terms the *abstract data object*. There are many types of objects: person, document, file. Some object types are built out of others, for example, file is an aggregation of documents. Most offices can be shown to center their activities around a particular data object.

WCC has a particular object which is the focus of most of its procedures: the Work Order. Almost every function at WCC either prepares data for, updates data in, or accesses data

from the WO file. The logs prepared at the trouble desk and the FCS desk are inputs to the WO creation procedure. The WO desk's fundamental task is to manage the collection of active WOs. As inputs are received (logs, MOD slips, blue slips, janitor's slips), an instance of the fundamental data object (a new WO) is created and added to the active file. The desk tracks the active WO, hopefully notifying the supervisor if a WO remains in the active file too long. The quantity of WOs makes this difficult to do, and so in practice very little tracking of WOs is done. When the WO returns from the shop, that object is deleted from the file and archived. Of course, there are many other low-level objects in use at WCC, as listed in the section on databases. However, the idea of the WO as a central data object for WCC removes the details from the picture and allows the basic function of the office to be seen more clearly.

Appendix I. Database

WCC generally keeps all documents forever. When the space allotted to a document in the WCC office is full, the file is placed in cartons and sent to the basement storage area. Unless otherwise stated, all files below are kept permanently. Included with each entry is the section and page number where a full description of the document can be found.

Trouble-desk log — White copies filed with the white copies from the FCS log by date after the WO typist has gone through them. Yellow copies are discarded. (6.1.2, page 49)

FCS log — Yellow copy kept in separate notebook by date White copy filed chronologically with trouble-desk log. (6.2.1, page 53)

Autocall alarm log — Filed chronologically. (6.1.3, page 51)

Autocall/FCS computer printout — Stored in boxes by date. Only one of the three copies of each report are kept, the others are thrown out. Boxes are kept for approximately six months. (Autocall: 6.1.3, page 50. FCS: 6.2.3, page 54)

FCS copy of WOs — Copies of WOs created by the FCS monitorer are kept in a small binder by date. (6.2.3, page 54)

WO active file — Filed by shop and then by date. Short term only, just until job is completed. (6.3.3, page 58)

WO permanent file — Filed by shop, then by month, then by building. Officially kept for seven years, but no one ever remembers throwing one out. (6.3.3, page 58)

MOD slips — After the morning lookover by the WO-typist, they are filed by date. (6.3.3, page 56)

Janitor slips — After the morning lookover by the WO-typist, they are returned to the janitorial services department. (6.3.3 - page 56)

Labor card log — Kept in a small binder. This is relatively new, but it is expected that they will be filed away forever by shop and then by date. (6.4.1, page 60)

Overtime eligibility lists — Kept in binders by shop and then by date. (6.4.2, page 60)

Overtime reports	Filed by date. (6.4.2, page 60)
Shutdown requests	Kept in a 3-ring binder, by date. (6.4.3.1 - page 61)
Requisitions	Kept seven years (forever in practice) by requisition number and date. (6.4.4, page 62)
Requisition log	It is a small notebook, kept on the administrative-support desk. (6.4.4, page 63)
Petty cash	Work sheets for balancing the petty cash fund each time it is turned in for reimbursement are kept in a 3-ring notebook. (6.4.6, page 63)
WCC requisitions	These are filed together with the regular requisitions. (6.4.5, page 63)
Shutdown Notification lists	Maintained in a notebook. Old list filed (by year) when a new list is created. (6.4.3.1, page 62)
PM work orders	Filed by PM job number and by building. (6.4.7 - page 64)
PM summary reports	Filed chronologically. When file is full (approximately once a year) it is archived in boxes in the basement. (6.4.7, page 64)

Appendix II. Sample Documents

PHYSICAL PLANT DEPT.
MASS. INSTITUTE of TECHNOLOGY

WORK ORDER

JOB NO.	REQ. NO.	DATE ISSUED	DATE REQD.	1ST ACCT. & SYST. CODE	%	OBJ. CODE
065493						
JOB LOCATION	PHONE EXT.	REQUESTED/REPORTED BY:		2ND ACCT. & SYST. CODE	%	OBJ. CODE

PR. NO.	SOURCE	ESTIMATED: HOURS	COST	APPROVALS Supt. / Adm. Off. / Dir.

Work Order Class and Priority

Emerg. 1 2 Routine 3 4 Project 5

Copies to:

Description of Material or Service:

ESTIMATES

Trade Code	Labor Hours	Material Dollars	Total Est. Job Cost	Estimated By

FORM PP-5

KEY PUNCH COPY

Exhibit II–1: Work Order

Reported By_____ Ext. No._____ Date:_____

Req./Job No._____ Account No._____ Trade Code_____

To: Check Shop(s)

- ☐ Carpenter
- ☐ Plumber
- ☐ Electric
- ☐ Locksmith
- ☐ Paint
- ☐ Metal/Shade/Glass
- ☐ Heat and Vent
- ☐ Movers/Trucking
- ☐ Stockroom
- ☐ Other_____

Location_____

Confirmation ☐Yes ☐No

Exhibit II-2: Blue Slip

OPERATIONS CONTROL CENTER
TROUBLE CALL & DISPATCH LOG

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF PHYSICAL PLANT

DATE_____
PAGE_____

TIME	SOURCE	LOCATION	PROBLEM	DIAGNOSIS/ACTION	PR	W/O	SHOP	TIME REPT	TIME COMP	OPERATOR

PRIORITY CODE
1—IMMEDIATELY
2—2 HOURS
3—WITHIN 24 HOURS
4—WORK ORDER

Exhibit II-3: FCS/Trouble Log

TROUBLE CALL

LOCATION: _____

PROBLEM: _____

_____

_____

ACTION TAKEN:

_____

_____

_____

STATUS:

☐ Complete

☐ Incomplete

TIME: _____

SIGNED: _____

DATED: _____

Exhibit II-4: MOD slip

III. The Industrial Liason Office

Craig L. Zarmer
Jay S. Kunin

October 1980

9. Introduction

9.1 Mission

The mission of the Industrial Liaison Office (ILO) is to promote interaction and technology transfer between MIT and industry, subject to a constraint that it make money for MIT. The Industrial Liaison Program (ILP) is one of the programs used by the ILO to carry out its mission.[2] Several functions are used to carry out this mission, corresponding to the various resources the ILO must manage. One function is concerned with managing ILP members: recruiting new ones, servicing them, recording activity about them, billing them, and terminating them. Others deal with managing symposia and seminars, the publications library, ILO employees, and so on. Together, these functions effect the duties of the office.

Before proceeding, a brief, non-technical description of the ILP as it would be explained to a member company or participating faculty would be helpful. MIT's Industrial Liaison Program exists to facilitate access to the research and staff resources of MIT by member companies. Companies pay a membership fee of approximately $30,000 per year. The ILP provides the following services for its members:

- Arrangement of company visits to MIT or faculty visits to a company
- Access to various publications: working papers, technical memos, laboratory periodic reports, and most other MIT publications
- Production of the annual Directory of Current Research ("Directory"), a listing and brief description of all of the research projects in progress at MIT
- Organization of symposia and seminars on varying topics

The ILP currently has approximately 200 members throughout the world, of which 70% are

[2]The ILO is also responsible for a similar program, the Associates Program, designed for smaller companies. It is not being covered in this study.

American.

Faculty participating in the ILP benefit through opportunities to meet with members of the business world, to keep up to date with industrial research, and perhaps to initiate new consulting or sponsored research arrangements. The ILO also "pays" faculty who participate in the ILP (*i.e.*, meet with a company, submit a paper, speak at a symposium) through *revenue sharing points*. Each activity represents a certain number of points; at the end of the year, the points are totaled and a dollar equivalent is set. The money received by the faculty is to be used for professional development. The term revenue sharing comes from the fact that a percentage of the ILP's revenue is shared among the participating faculty.

9.2 Organization

At the head of the ILO is the Director. The next level consists of 11 Industrial Liaison Officers ("officers"). Officers are assigned in several ways. First, some officers are responsible for a subject area, such as chemistry; many companies are assigned to a particular officer based on subject area, and that officer is personally responsible for attending to all of those companies' needs. Other officers are assigned a geographical area, such as Europe or Japan, instead of a subject area, and all companies from that area regardless of subject are handled by that officer.

Each officer is also assigned one or two laboratories or research centers. Any tasks dealing particularly with faculty, such as evaluating papers for inclusion in the publications list, or checking up on those who haven't returned a listing for the Directory, are handled by the officer for that center. Several officers also supervise one of the support functions, such as symposia and seminars.

Finally, two of the officers are titled "Assistant Director"; in addition to their officer's duties, they fill in for the Director.

A few support functions are not supervised by an officer. The accounting and personnel matters are handled by the Assistant Director for Administration, who reports to the Director. The publications functions are also managed by a supervisor who reports to the Director. In addition, there are a number of assistants who work on special projects, such as the

Directory.

In this report, the various *roles* in the office are distinguished from each other, regardless of the fact that one person may fill several roles and vice-versa. For example, reference will be made both to an officer and to the symposium and seminar coordinator, even though they are the same person. Also, references to offices such as the accounting office do not necessarily mean that a separate physical office exists for the accounting procedures. Figure 9-1 depicts two views of the organizational structure. One shows the way in which people have been assigned to roles, the other presents the functional view that will be used throughout this paper.

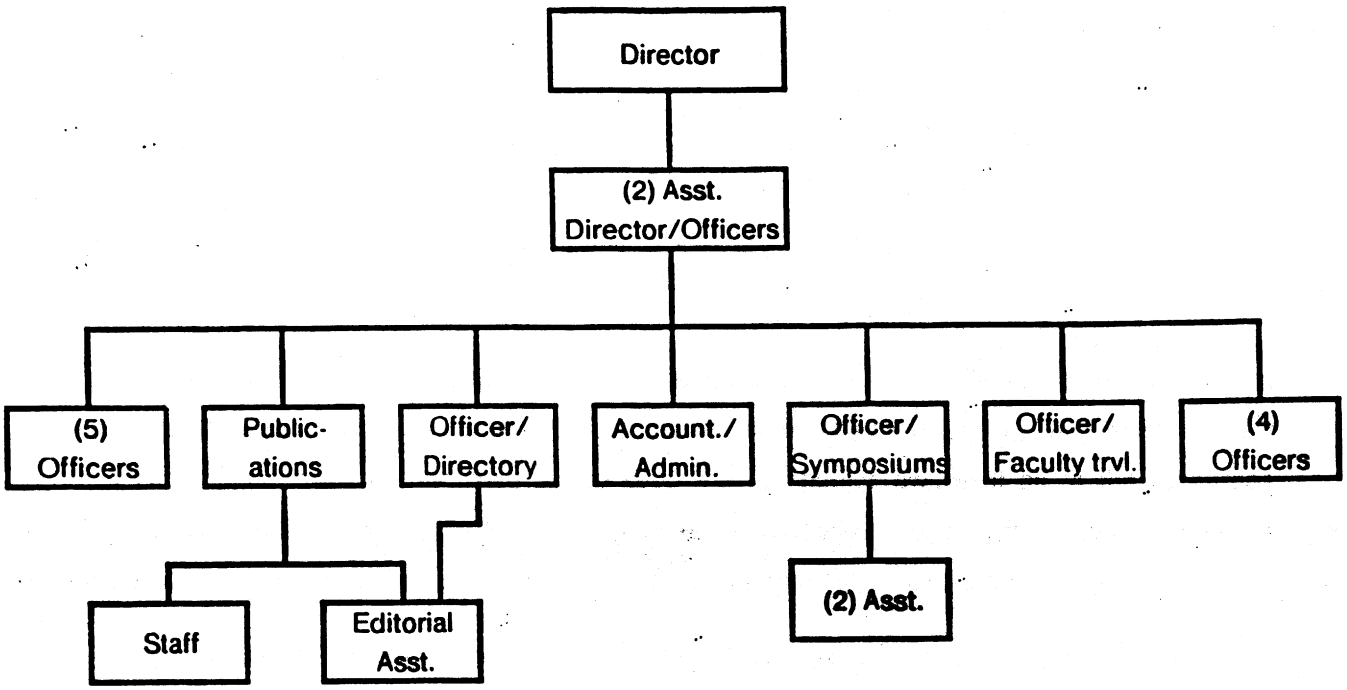
9.3 Overview of functions

9.3.1 Managing members

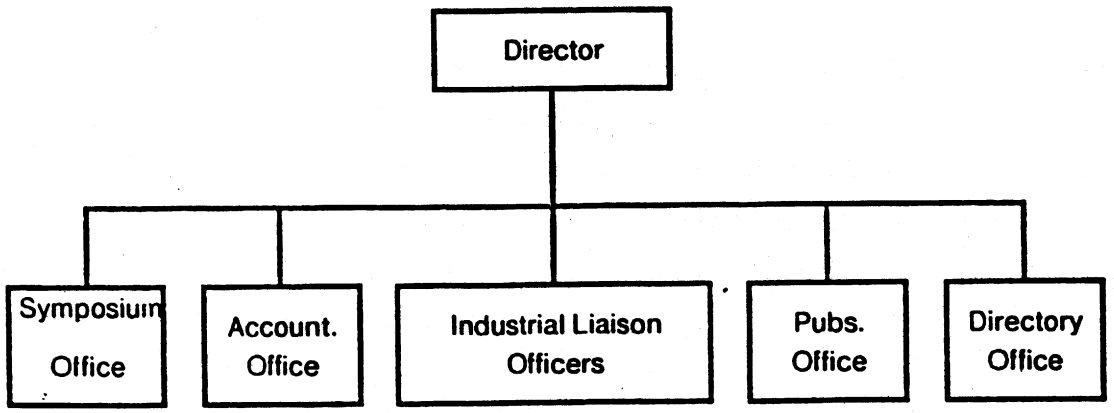
Managing member companies is the most important function of the ILO, and also the one that consumes the most time. The initiating procedure begins with a lead for a prospective member of the ILP, and its goal is to turn the lead into a member company. The exact steps taken in soliciting a company vary. Usually, when a new lead develops, it is first cleared with the Development Office. If approved, the Director will send a brochure along with a letter explaining the ILP and offering to have an officer come out and meet with the company. After that visit, if the company is still the Director will usually have the officer who handles that subject area arrange a visit to MIT. The company might also be invited to attend an upcoming symposium or seminar. When the company decides to join the ILP, the Director prepares a formal agreement letter, and chooses an officer to service the company.

Several procedures are followed for servicing member companies. Each company has a particular officer who handles all of the company's needs. The most common services an officer provides for his companies are:

- arranging of company visits to MIT
- arranging faculty visits to the companies
- arranging telephone conversations between faculty and companies
- handling any other reasonable request from the company.



Actual organizational structure



Functional organizational structure

Exhibit 9-1: Industrial Liaison Program organizational structure

Besides acting as a liaison between companies and MIT, officers actively try to get companies to make the most of their membership. They will usually visit each of their companies once a year, in order to keep the companies aware of all of the resources available to them through the ILP. At the same time, they add to their mental database of companies, noting what kinds of projects and interests the company has.

Each officer produces quarterly summaries of all activity for his companies. There is also a procedure for invoicing companies for their membership fees. A terminating procedure is invoked when a company wishes to leave the ILP. The records are updated to show the last payment and that the company is no longer a member. Most records are kept permanently, some are archived in boxes with the MIT archives.

9.3.2 Point earning

The accounting office manages revenue sharing point information for faculty and other point earners. Each year, the point database starts empty. The first time that a faculty member earns points in a year, the accounting office creates a page for him in the faculty book. Thereafter, all points earned by the professor are recorded on his page in the book. At the end of the year, the accounting office computes totals, credits each point earner appropriately, and archives the faculty book.

9.3.3 Publications

The publications office is responsible for managing the library of papers, and distributing them to ILP members. The publications office routes each paper as it is received to the officer in charge of the author's research center. The officer reviews it and returns it with his recommendation. If the paper might be useful to a number of companies, he will recommend listing the paper in the Monthly List of Publications (MLOP), a booklet containing abstracts of selected papers contributed by the faculty. Approximately 100 papers are listed each month. Most approved papers are listed in the monthly list of publications; all papers received are cataloged and stored, awaiting requests.

Another procedure is paper distribution. Most requests come in on the order form included with the monthly list. The publications office must also handle other types of requests, such as phone calls or letters asking for "something about computer science."

The publications office will call faculty, send letters, or ask officers when necessary to get information or papers.

Four months after being listed in the Monthly List of Publications, papers are transferred to boxes, stored in the ILO, where they are kept for five years. From there, the boxes are taken to the MIT archives for permanent storage. Papers can be retrieved from the archives, but a considerable amount of time is involved.

9.3.4 Symposia and seminars

This office organizes the symposia and seminars run for the ILP. Topics are chosen at a meeting of all officers; this group produces an ordered list of eight or nine topics, each with an officer in charge. The chosen officer negotiates with members of the faculty to find a chairman of the symposium. The faculty chairman becomes responsible for determining the program and lining up individual speakers. The officer along with the S&S office handles the mechanics of putting on a symposium—arranging for rooms, audio-visual equipment, preparing a program, registration, and other details.

9.3.5 Directory of current research

The Directory office gathers the information for and sees to the printing of the annual Directory. Each year information forms are sent around to faculty. The forms ask if current research projects are still underway, and ask about any new projects. The information is checked over by the officer that handles that research center. The text of the Directory is stored on a computer, and each year the Directory office updates last year's Directory according to the forms received. After proofreading, the Directory is printed and mailed.

9.3.6 Staff

This function, run by the accounting office, manages information about staff members. There are several similar sets of procedures, corresponding to the different grades of employees (staff, student, and support staff.) In general, they consist of a procedure to hire a new employee, one for completing the payroll, and one for handling employees when they terminate.

9.3.7 Budgeting

This function, also run by the accounting office, prepares and manages the budget for the ILO. A new budget is prepared each year by the Director. During the year, the office orders supplies, processes vouchers, and approves invoices. Once a month, a statement of all financial activity comes from the MIT accounting office, and is verified by the ILO accounting office. At the end of the year, reports are made, some for MIT executives such as the president and some for the ILO's own interest, and the records are archived.

10. Managing ILP members

This is the most important function in the ILO, and also the one that takes the most time. The Director, the officers, the publications office, and the accounting office all participate directly in this function. The environment is fairly simple. Officers work in a typical business office, and have at least partial use of a secretary. The accounting office consists of the Assistant Director for Administration and a half-time secretary. The accounting office has a terminal to a time sharing computer service. The computer is currently used only to maintain basic membership data about the member companies, such as the next billing date. Future plans call for much more information to be stored, such as revenue sharing data, and the eventual purchase of a dedicated computer.

Officers maintain an *tickler file* in addition to a appointment book. While the details of its structure vary from officer to officer, it is usually a chronological file of reminders. Officers make extensive use of the tickler file, as they tend to have a large number of "call-me-in-a-month" items to remember. Each officer maintains a "company file" for the companies he represents. This file contains visit summaries, agendas, and the like, after they have returned from the accounting office, as well as any other correspondence with the companies. Documents are kept in the file for two to three years, and then archived in boxes.

10.1 Initiation: Soliciting new members

Soliciting new members is mainly the job of the Director. He will often have officers help him by arranging visits with the faculty. Only the Director can sign agreements or letters for the ILO.

10.1.1 Developing new leads

The first step in getting new companies into the ILP is developing new leads. Both internal and external information is used. Published lists of companies, such as the Fortune 500, are searched. The Office of Resource Development often comes up with suggestions. Companies that come up over luncheon with a current ILP member are checked. However, the most common and most successful leads come from word-of-mouth between an ILP company and another company. Here the ILP already has the company's interest and a good recommendation on the ILP's usefulness. While all leads are looked into, the ILO has more leads from direct contact by interested companies than they can handle.

Prospective members must first be cleared with the Office of Resource Development in order to prevent soliciting companies who have recently made big donations. An "information request form" is prepared, giving the name of the company and the reason for checking. The form returns to the ILO with an approval or a reason for disapproval. If approved, the Director or one of the officers will put together an introductory package on the ILP, including a personal letter and some brochures. The nature of the letter depends on how the lead was developed (primarily whether the ILO is making the first contact or the company called the ILP first.) The letter will usually offer to have an officer visit the company to explain the ILP in detail and answer any questions.

10.1.2 Courting a prospective member

If the company is still interested after hearing from the ILO, the company will be invited to come to MIT and meet with some of the faculty. If an appropriate seminar or symposium is coming up soon, they will be invited to it. The Director will usually have the officer who serves companies of the prospective member's type make the arrangements, as he is more familiar with the faculty who would interest the company. The basic procedure that is used to service current ILP members is followed to arrange visits for prospective members, with the following differences:

- an additional criterion is used in choosing faculty members: that they be very pro-ILP. Usually MIT's president or another high-ranking official is included on the agenda.

- the Director himself, whenever possible, will greet the visitors and guide them through the day.

Generally, either the company joins at this point or informs the ILO that it isn't interested. Sometimes a company wants to join, but must wait until the next budget period. When a year has passed with no contact with the company for the last six months or so, then the prospect is considered lost and no further contact will be initiated from the ILO. On the average, 60 new leads are pursued per year, and 30 of those become ILP members.

When a company is ready to join, it signs an agreement letter. A "financial status card" is created for the company and information about the agreement (the date, annual fee, billing frequency) and the company itself are entered on the card. A program is run on the computer system to add the company to the computer files. Twice each month, an updated list of member companies is prepared and sent to all ILO and senior MIT staff (MIT President, VPs, deans, *etc.*) In addition, the responsibility list, indicating the companies each officer is responsible for, is updated and distributed to the ILO staff and other designated offices at MIT.

10.2 Servicing ILP members

The majority of the ILO's resources is spent servicing current ILP members. There are several procedures followed. As one of the main purposes of the ILP is to aid interaction between faculty and member companies, most of an officer's time is spent arranging meetings between MIT and the company. Beyond that, there is a rather unstructured, catch-all procedure to respond to any other request a company might make. Most of the procedures that follow vary somewhat from one officer to another. For example, one officer might always make a phone call whereas another sends a note. Other variations are more substantial, such as not filling out a "required" form.

10.2.1 Arranging company visits to MIT

The procedure is initiated by a phone call or letter requesting a visit. The officer determines the date and, as narrowly as possible, the topics the company is interested in. The company may have some particular professors in mind or a specific research project listed in the Directory. Otherwise, the officers will chose the appropriate faculty to meet with himself. Criteria used when making a selection include:

- Relative seniority or importance of the faculty member compared with that of the company visitor. Position in the company/school and eminence in the field are the major guides.

- Importance of the company itself. This can be high if the company has been dissatisfied with the ILP.

- Officer's previous experience with a particular faculty member.

The officers will try to arrange a meeting with the chosen faculty members. A professor may be unavailable, or might just refuse to meet with the visitor. Sometimes the company asks the professors to sign a secrecy or non-disclosure agreement and they may refuse. If a chosen professor is unavailable, the meeting might be arranged with a staff member or graduate student.

When the schedule is resolved, a visit agenda is prepared. Luncheon at the Faculty Club is almost always included. (No reservations are necessary unless a very large party is being entertained.) The agenda is sent to all the faculty involved and to the visitor. The visitor's package includes directions and other information. Forgetful professors are sent a reminder note shortly before the meeting date.

During the visit, the officer greets the visitors and guides them to their appointments. Usually he stays with them and often takes notes through the meeting. At the end of the day he sees them off. He corrects the visit agenda if any last minute substitutions were made, and signs it. A "company visit summary sheet" is prepared by the officer, listing names of the visitors and the faculty visited. The sheet is mainly for revenue sharing point distribution. The sheet and agenda are sent to the accounting department for recording, and then returned to the officer. A few officers do not fill out the summary sheet, but just send the agenda to the accounting office. Approximately 700 visits requiring 2000 individual meetings are arranged each year by the ILO.

10.2.2 Arranging faculty visits to a company

The faculty travel (FT) supervisor maintains for the officers information on the travel plans of the faculty. Four times a year, a card is prepared asking for a faculty member's travel plans for the next few months. MIT's Graphic Arts Department duplicates and distributes this card to every faculty member. Typically, two or three trips will be noted on each card.

As the cards are returned, they are filed in order of the earliest trip on each card. 1100 cards are mailed each time, and approximately 250 are returned to the ILO.

Approximately once per week, the card file is inspected, and cards with trips four to six weeks away are pulled (these should be the first few cards in the file). A "faculty travel alert" form is prepared, giving the professor's name, trip dates, destination, and the research projects he is in charge of. The travel alert is copied and sent to all officers. If there are more trips on the travel card, it is returned to the travel card file according to the next trip's date.

Officers must decide if a visit to any of their companies would be possible and desirable on this trip. The research interests of the professor must match the interests of the company, and the company must be located near the professor's destination or on his way. The officer notes his suggestions on the travel alert and returns it to the FT supervisor.

The FT supervisor chooses one to three companies to pursue further. Typically he will only receive two or three suggestions. The officer representing the company becomes the trip coordinator (the FT supervisor chooses one officer if more than one company is involved). He contacts the professor and gets specific dates and times available for visiting companies. He also gets the professor's preferences on companies to visit.

Only when the professor has agreed to a meeting with a company is the company called. The officers serving the companies chosen call them and determine if they would like to meet with the professor. A time is chosen, and the trip coordinator is informed. The trip coordinator makes sure that meeting times do not conflict. The trip coordinator prepares a "faculty visit itinerary" form, listing the dates and times of all of the professor's visits on the trip. This form goes to the accounting office before the trip begins. The coordinator sends to the professor before he leaves several blank "visit reports", one for each company being visited. This form asks for the professor's feelings about the company, the arrangements, and who else might benefit from meeting with this company. Upon his return the professor must also fill out and return a travel expense form if he incurred any extra expenses in going to meet with the company.

The visit reports along with the travel expense vouchers are sent by the faculty member to the FT supervisor. The FT supervisor approves the travel voucher and sends it along with

the visit reports to accounting. The FT supervisor verifies the voucher for legitimacy (i.e. was this a trip the ILO should pay for) and reasonableness of the expenses. Accounting doesn't need the reports, but requiring them before processing travel vouchers helps ensure that they are turned in.

Approximately 90% of all trips arranged follow this method. Other possibilities are a faculty member calling an officer directly and informing him of his travel plans, or a company calling and asking specifically for a faculty member to come and visit. However, most faculty who would take the time to call the ILO would have taken the time to fill out the travel plan card. Altogether, approximately 350 trips are handled each year.

10.2.3 Arranging telephone conversations

This procedure is very similar to arranging company visits to MIT. It is an increasingly popular alternative to actual visits, especially when there are scheduling or financial constraints. A company may contact its officer asking to speak to a particular professor or just to someone in a particular field. As with actual visits, the Directory is often used by companies to find research projects with interests similar to the company's, and the officers will try to make an appointment with the professor heading that project.

The officer makes an appointment with the chosen professor and confirms the date and time with the company. A "telephone conversation form" is prepared by the officer and sent to the accounting office for recording of revenue sharing information. This form lists the date, the name of faculty member, the company representative spoken with, and, optionally the subject of the conversation. In practice, the officer will often just write a memo to the accounting office about the call, instead of filling out the telephone conversation form. The accounting office saves all telephone conversation forms or memos in a binder kept in the accounting office.

10.2.4 Other forms of service

Officers will handle any reasonable request from a company. While most of the requests are for arranging visits or telephone calls, others may involve finding special information on a subject or research project, making hotel reservations, and the like. Officers also perform other services on their own initiative, such as sending out papers that were not included in

the monthly list of publications. Officers visit their companies on a regular basis. The main purposes of such visits are to keep the company's interest in the ILP and to inform them of the resources available to them. At the same time, officers learn of new trends or interests of their companies. When officers visit their companies, they fill out an "officers visit summary", giving the name of the company and the people visited with. It is forwarded along with the officer's travel voucher, if any, to the accounting office, which records the activity in the company book (see next section).

10.3 Recording company activity

The accounting office maintains a book, called the "company book" that records all visits by the company to MIT or faculty to the company. The book is a series of pages, one for each company. At the beginning of the year, the book starts empty. When the accounting office receives a company visit summary, an officer's visit summary, or a faculty visit itinerary, the book is searched for a page for the company involved; if no page exists a new one is created for it. The date as well as the names of the faculty members and company employees involved are entered on the page.

10.4 Activity summaries

Each quarter, a summary of all activity by a company is produced on the "quarterly activity summary" form. Each officer prepares a summary for his own companies. The information comes not only from the officer's own company file, but from other offices in the ILO as well: accounting, publications, and S&S. Although procedures will vary among officers (or their secretaries), the procedure is basically the same. Company visits to MIT, faculty visits to the company, and ILO visits to the company are recorded based on the forms in the company file. The information is then checked against the company book in the accounting office. Records of telephone conversations, which are not usually noted in the officer's company file, are also obtained from the telephone conversation form binder in the accounting office. The S&S office maintains information on attendance at ILP symposia or seminars. The publications office supplies monthly summary sheets about requests processed by that office. Finally, the company file contains copies of publications request forms, which indicate any papers the officers sent unsolicited to the company. The

completed summaries are sent to the Director for evaluation, a copy going to the company file.

At the end of the year, the activity of each company recorded in the company book is summarized by the accounting office and given to the officer in charge of the company. For some companies, the officer will forward this summary on to the company. The company books and copies of all summaries are archived.

10.5 Billing companies

Program members are billed at varying intervals by the accounting office; some are billed annually, others semi-annually, and a few quarterly. Each month, a computer program produces a list of companies to be billed, and the amount due. For each such company, an invoice is typed and mailed. The creation of the invoice is logged in the invoice log, a notebook with spaces for the company name, date of invoice, amount, period covered, and date invoice sent.

When the payment is received (usually about two or three months later), the corresponding invoice log entry is completed. The company's financial status card is updated by entering the date and amount on the card. A cash voucher is created and attached to the check. The cash voucher indicates the account number the check is to be deposited in. The check and voucher go to the MIT cashier's office.

Once a week, a program is run on the computer to account for all payments received during the week. For each such payment, the company file is updated to reflect the amount paid, next due date, and next payment amount. After all updating is done, the computer generates a financial status report of all companies, listing officers in charge, last payment date and amount, next payment date and amount, annual fee, amount paid in current fiscal year, and billing frequency. The report is kept in a binder in the accounting office.

10.6 Mailing lists

The publications office maintains comprehensive mailing information for the ILO. The publications office uses the computer system operated by the Office of Administrative Information Systems (OAIS) to maintain its mailing lists. When a company first joins the ILP

and whenever a change in mailing information occurs, the officer who services the company sends a form to the publications office containing name, address, a list of possible interest areas, and a list of periodicals to be sent automatically. The publications office transfers the information to a coding sheet, and then to punch cards. The cards are sent to the OAIS, which updates the information in the computer.

The publications office has time reserved on the OAIS system twice a week. Programs can be run to generate mailing labels for mass mailings, such as the brochure for the upcoming symposium series. Other programs can be run to generate labels for specific publications, and distribution lists of the publications that a company automatically receives and the company personnel on the mailing list.

10.7 Termination: Companies leaving the ILP

Companies leave the ILP for various reasons: a change in the economy, new management, and budget cuts are common. Sometimes a company will make this known just by not paying the bill. When a payment is overdue by several months, the officer will be notified by the accounting office and he will check with the company. Other times the company is more direct and simply calls the ILO. Occasionally, a company that has been a long-standing member will have a sudden business crisis. In such cases, the ILO may waive the membership fee for a year or two, while allowing them to continue with full membership privileges. Such a decision is made by the Director, considering the likelihood of the company recovering and how long the company had been with the program.

Each year, about six companies leave the ILP. When an officer determines that a company is terminating, he informs the accounting, publication, and Director's offices by memo. The accounting office runs a program to update the financial status file, setting the company's next payment amount to zero. The financial status card is also updated to show the date dropped from the ILP. The publications office updates its mailing information. The monthly list of members, also prepared by the publications office, will reflect the company's dropping from the ILP.

10.8 Exception handling

The largest problem in managing information about a member company stems from the lack of a central information location in the ILO, and it is made more difficult because not all forms that should be filled out are filled out. The process of producing the quarterly summary routinely elicits visits noted in the officer's company file but not in the company book, or in the book but not in the officer's file. The officer may not have created the form in the first place, it may have been lost somewhere between his office and accounting, or it may just have been returned without recording by the accounting office. The company book in the accounting office will be corrected; the officer's file is usually left as is.

11. Other Functions

In addition to managing member companies, the ILO has a number of "support" functions. For each of these functions, the main-line procedures are described, followed by a description of any exceptions that are particular to that function. The next chapter describes general exception handling.

11.1 Managing point earnings

Revenue sharing point management is divided between two offices in the ILO. Most points are recorded by the accounting office, while the publications office maintains information about points earned through submitting papers. At the end of the year, the publications office sends to accounting its list of points earned by each professor. The accounting office then adds these points in with its own totals.

11.1.1 General point-accounting

The accounting office records all activities that earn revenue sharing points for a professor. The "faculty book" logs points earned by a faculty member[3]. The faculty book consists of pages, one for each professor. The page is further divided into sections, one for each way a point can be earned:

- Visits to a company
- Visits from a company
- Participation in a symposium or seminar
- Telephone conversations

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[3]Certain other people can earn points. A reference to "faculty members" or "professors" includes all people authorized to earn points.

- Research briefings (similar to visits from a company, seldom used)

- Review of papers (also seldom used)

The book starts each year completely empty.

Whenever a faculty member earns revenue sharing points, some type of form will be initiated by the officer and sent to the accounting department. A form may contain several individual point earnings. For example, the faculty visit itinerary form may list three or four separate visits made on a trip. Approximately 50 forms are received per week, containing some 200 point-earning entries. Currently there is a distinct form for every way points can be earned; plans call for the integration of these into a single form. The possible point-recording forms are: telephone conversation, faculty visit itinerary, company visit summary, the program from a seminar or symposium, or the receipt of a paper in the publications office. Other forms are often received with these, such as the company visit agenda with the company visit summary, but these are not required or needed by the accounting office. Note that the form received is the same one used in the "manage member company" function to record company activity.

The first step upon receipt of such a form is to verify that the named faculty member is a valid point-earner. If the name is not recognized, the institute phone book is consulted. If the name exists but the person is not a legal point earner (for example, a graduate student or a research scientist), the points are awarded to the supervising professor instead. The accounting office calls the officer to find out who the supervising professor is. If the name does not exist at all, the officer is called or the form is returned to him.

When the professor's name is verified, the faculty book is searched for his page; if none exists, one is created. The number of points are entered into the appropriate part of the page, depending on the way in which points were earned (telephone conversations, visits to a company, etc.) When the accounting office has recorded the information, the form is returned to the officer who sent it.

Every July, the end of the fiscal year for the program, all of the points earned by each faculty member are totaled and entered on his page in the faculty book. The totals from the publication office are added in for each point earner. Next, 10% of the gross income (total of all membership payments received from companies, as shown on the invoice log) of the ILP

is divided by the total points earned by all point-earners to arrive at a dollar value for each point. The total dollar value of each professor's points is computed, and a journal voucher is prepared and sent to MIT's accounting office to transfer that much money to the professor's department's account. A statement for each point-earner is prepared and sent to him.

Summaries and analyses of company activity and points earned are made each year, and sent to each department head and dean. These analyses include:

- The top 40 point earners
- Totals by school and departments
- Percentage of member companies having at least 1 on-campus visit, 2 on-campus visits to different departments, 5 visits to different departments.

Most of these are only for the curiosity of the ILO staff, others are for annual reports. After all summaries have been prepared, the year's company and faculty pages are archived along with their summaries.

There are no major problems associated with managing revenue sharing points. If a form is not turned in, then the points are not awarded. Should a form arrive after the points had been totaled for the year, the points are just credited to the next year. Forms that are incomplete or incorrect (*e.g.*, the person is not a valid point earner) are returned to the sender.

11.1.2 Publications office point management

The publications office uses a file of 3x5 cards, one per professor, to maintain point information. Each paper submitted by a professor is listed on his card, a new card being created for the first submission by that professor of the year. The publications office sends a letter of acknowledgment to the professor, informing him that the paper was received. The letter states that each paper receives one point, divided equally among the co-authors who are elgible point earners. At the end of the year, the office prepares a list of the total points earned by each professor and sends the list to the accounting office.

11.2 Budget

11.2.1 Making the budget

The budget is created once per year. Basically, the budget starts with last year's budget, and adds for inflation. In addition, the budget is increased if enough new companies (generally 15) have joined the ILP to warrant the hiring of a new officer and half-time secretary. The prepared budget is sent to the Director for approval, and then to the Vice President for Resource Development and the MIT budget office.

11.2.2 Travel vouchers

The accounting office processes the travel expense vouchers for faculty who visited a company and for officer travel. Approximately 15 vouchers are processed each week. The travel voucher is the standard form used all over MIT. Vouchers are verified, checking for arithmetic mistakes, reasonableness of charges, and accuracy to receipts (attached to voucher). These steps are followed even if the FT supervisor has already approved the voucher. One copy of the voucher is kept by the accounting office, the others are sent on to MIT's accounting office for payment. Other forms are normally received with the voucher, such as visit summaries, but these are not necessary for the approval of the voucher.

11.2.3 Ordering supplies

When the ILO needs supplies not stocked by the MIT Office of Laboratory Supplies, the accounting or publications office prepares a requisition form. One copy is kept, the rest are sent to the MIT purchasing office, which prepares a purchase order and sends a copy back to the ILP accounting office. The invoice generally goes to the purchasing office, which forwards it to the ILP accounting office for approval. The accounting office confirms that the ordered material has arrived from memory), approves it, and sends it to the Accounts Payable office, keeping a copy of the invoice. The publications office orders supplies for itself at least weekly, and orders large amounts of mailing materials every few months. The accounting office orders supplies for the rest of the ILO, once or twice a month.

Occasionally material is purchased without a purchase order. In this case, a yellow "request for payment" form is filled out and sent with the bill to the MIT accounting office.

Office supplies are obtained once per week from the MIT lab supply room. This is done with the same requisition used for outside purchases. Someone from the ILO takes the form to lab supplies and picks up the order.

11.2.4 Checking the MIT accounting statement

Once a month, the MIT accounting office sends a consolidated statement to the ILO, detailing all activity in its various accounts. The accounting, publications, and symposium and seminar offices compare the statement with their own records—payroll, purchase orders, and company payments. Two or three errors are usually found each month, and they are resolved via a memo to the MIT accounting office.

11.3 Managing ILO staff

11.3.1 Hiring new employees

The procedure followed for hiring new employees depends on the type of job. For secretarial and clerical help, the accounting office fills out a "personnel requisition" form and sends it to the Personnel Office. The Personnel Office is responsible for upholding MIT's affirmative action/serious search program for secretarial job openings. They do the initial screening of applicants, and refer qualified people to the ILO. The accounting office supervisor interviews the applicant. The supervisor whom the secretary or clerk will be working for interviews those applicants who pass the accounting supervisor, and has the final say in hiring decisions. A form is sent from the Personnel Office to accounting for each applicant referred to the ILO. The accounting office returns this form with a "hired" or "rejected" notation, and indicates the starting date and wages for the hired applicant.

The procedure is considerably more complex for hiring staff members, such as officers. Most of the extra steps are to satisfy MIT's affirmative action/serious search program. All of the steps for hiring secretarial help are followed. In addition, a letter is sent to the staff subgroup of the Academic Council, explaining the need for the employee and the plan of search to be followed. The Personnel Office usually places want-ads in various newspapers. The accounting office supplements this search by writing to MIT alumni and contacting various professional and minority-interest groups. When the ILO has selected an applicant, a letter is sent to the staff subgroup of the Academic Council to provide the following

information: the number of applications received, categorized by sex, race, and ethnic background; a brief summary of each applicant; and detail on the chosen applicant. The group informs the ILO of their decision by memo. If approved, a memo is sent by the accounting office to the Personnel Office, giving the starting dates and salary.

New students on the hourly payroll complete a "personnel action" form, which is sent to the Payroll Office. This will generate a time card for the new employee. Until the new card arrives, the students fill out student payroll vouchers.

11.3.2 Payroll

There are three different payroll systems in use at the ILO. Officers and other staff are paid based on an annual salary, and paid monthly. Secretaries and other clerks are on a support staff hourly payroll and are paid biweekly. Students on an hourly payroll, using time cards, and are paid weekly.

For the staff payroll, the accounting office receives from the Payroll Office a form listing names along with salaries and the account number(s) that the salaries are charged to. This form indicates the information as used last month; corrections, additions, and deletions are made on the form. (The form was only intended to be used for account number changes, but it is common practice to note other kinds of changes, such as resignations, on the form, as a back-up to other forms.) The form is signed and returned to the Payroll Office, with copy kept in the accounting office files.

For the support staff payroll, the accounting office receives two listings, the bi-weekly adjustment report and the "DINDI." The number of hours worked is entered on the adjustment report, and it is then returned to the Payroll Office. The DINDI is verified for salary and account numbers, corrected if necessary, and returned to the Payroll Office. Copies of both forms are kept in the accounting office.

Student payroll is completed via time cards. Each week, the accounting office receives from the Payroll Office a list of names and account numbers, and a time card for each person on the list. The supervisor approves the number of hours entered by the student, fills in vouchers for new employees, and returns the time cards to the accounting office for approval. The accounting office enters the hours worked on the payroll form, sends the timecards to the Student Personnel Office and the vouchers to the Student Employment

Office.

11.3.3 Termination of employees

For professional and support staff, two forms are filled out by the accounting office. One just lists name, termination date, and other basic information. It is sent to several offices throughout the institute: Payroll, Health and Benefits, Personnel, and Keys. A longer form, which includes such information as reason for leaving and recommendation for rehiring, goes to the Personnel Office. In addition, the resignation is noted on the next set of payroll sheets. For student employees, a personnel action form is used, indicating on the form that this is a termination rather than a new hiring.

11.4 Publications

The publications office maintains the library of papers for the ILO, responds to requests for papers and information, and mails periodic publications such as annual reports according to the mailing list information. The staff consists of a supervisor, a full time assistant, a half-time secretary, and several part-time employees, generally students. The office has a large storage area with vertical shelves for storing current papers. The office makes use of OAIS to maintain mailing list information. Mailing lists for various categories can be obtained by submitting the proper cards to the computer service. Procedures exist to add new papers to the collection, respond to requests for information, and archive older papers.

11.4.1 Adding new papers

The publications office receives papers volunteered to the ILO by MIT faculty. Over 200 papers are received in this manner each month. Other papers or periodical publications are received because the publications office is on many departmental mailing lists. Each paper is logged in upon receipt, and assigned an acquisition number. The number is of the form <month>-<year>-<serial number>, the serial number being sequentially assigned within each month. The author, name, acquisition number, and reviewing officer's initials are entered into the log. A publications review form is attached to the paper, and the package is routed to the officer who handles that research center. (A list of centers each officer is responsible for is maintained in the publications office.)

The officer decides whether the paper should be publicized in the ILO's Monthly List Of Publications (MLOP), or maintained on file for specific requests (called "single file" papers). He notes on the publications review form his decision, a Directory project number, and if accepted, an abstract and approximate number of copies to make, and returns it to the publications office. The pubs office supervisor makes the final decision on whether or not to list paper in the MLOP. There might be too many papers one month, or the paper might be too long, too outdated, or a bad copy. New entries in the acquisition log are passed around to all officers each month so that they are aware of all papers, not just the ones they personally reviewed.

All papers are listed on the bibliography card for the research project to which they pertain. The card catalog entries are made by photo-copying the acquisition log entry and filing in the card catalog. The catalog indexes papers both by author and by subject. MLOP-accepted papers are given an extra number on the card-catalog entry, of the form <month> - <serial number> - <year>. MLOP papers are sent to a printer to be copied, the single-file papers are filed.

The latest four months' worth of papers are kept out on trays. After four months the papers are stored in boxes. Post-1975 papers are stored in the ILO, pre-1975 papers are in the MIT archives. The dates and quantities of initial orders and reorders of MLOP papers are entered in the MLOP initial order log . A reordering slip, which is a photocopy of the entry in the reorder log, is placed five papers from last copy of each paper, listing dates reordered and dates the new order was reshelved. When the slip comes to the top, the item is reordered. The reorder is listed in a log taped to the shelves.

11.4.2 Request for publications

Most requests come to the publications office on the order form included with each MLOP. Processing these requests is straightforward—just get that paper from the storage shelves and mail. (Filling orders, typing labels, and mailing is all done in batches.) Another common request is a letter or phone call asking for information on a particular Directory project number by letter or by phone. The bibliography card for that project is copied and sent to the company, which can then request specific acquisition numbers. Single-file papers are copied as needed, MLOP papers should already be printed. Finally, some requests come on a publications request form, mainly from officers sending unsolicited

publications to their companies, and are filled like other requests. All requests are filed after processing by type (MLOP, letters, or publication request form).

If a bibliography card for a project is blank, the requesting company is so informed and the publications office sends an information request form to the principal investigator. The form asks the professor to send any related papers, or to indicate that the papers will be available on some date, or that the project has been completed or not begun. The request from the company is attached to the card, and publications are sent to the company when papers are received from the professor.

Sometimes requests come to the publications office asking for "something about research in chemistry." These are forwarded to the officer responsible for that company. Another type of request is for papers or reports without an order number (either the MLOP number or the bibliography card number). These are looked up in the card catalogue and filled as usual if the paper is in the publications office files.

While 90% of all requests received can be processed in a straightforward manner, the remaining 10% are extremely difficult to satisfy and take up a substantial amount of the office's time. While this task has been traditionally handled by the students, the problems of lack of continuity and difficulty in receiving returned phone calls has necessitated the hiring of a part-time permanent staff member to handle such requests. To avoid the blank bibliography card situation, the staff goes through all bibliography cards three or four times per year and sends information request forms to those with empty cards.

Thesis requests are handled differently. Companies are supposed to order these directly from MIT's Microreproduction Laboratory using a supplied thesis request form or a letter. Many requests still come to the publications office, which orders these from the Microreproduction Laboratory on the same form that the company is supposed to use.

Once a month, the publications office prepares a summary of all requests for papers, by company. This involves going through the MLOP order cards as well as requests received by letter. The summaries are sent to the officer who services that company. In a typical month, 1000 requests will be processed.

11.4.3 Exception handling

One problem the publications office faces is an officer not returning a paper sent to him for review. The publications office could track down such papers through the acquisition log, but the time involved would not be worth it. The paper is usually not detected until a request for that paper comes in, in which case the publications office calls the officer involved. Another problem is keeping track of all requests in progress in the office. As most of the work of filling requests is done by part-time students, occasionally a student will be in the middle of filling a long request when he has to leave. The request will get buried and might not be found for several weeks, when it will be processed as normal.

11.5 Symposia and Seminars

The S&S office is responsible for coordinating the various symposia and seminars run each year. The two are virtually the same, symposia being longer and of broader scope than seminars. The procedure outlined is that of symposia; seminars follow a similar pattern. The S&S function is mainly run by two staff members, with little day to day supervision by the officer in charge of S&S.

The ILO generally has a fall and a spring symposia series. Twice a year, all of the officers meet to decide on a set of topics to be covered. Sources of topics include faculty members who have offered to run symposia, and general officer knowledge of business trends and company interests. The staff meeting produces a list of eight or nine topics to hold symposia on, ranked in order of preference, and tentative dates.

A major constraint on the dates of symposia is the availability of suitable meeting rooms. Before the staff meeting, the S&S supervisor will check with Office of the Dean for Student Affairs, which handles reservations for major rooms on campus, to get an idea of room availability. After the meeting, when symposia chairmen have been selected, final dates will be selected by the S&S supervisor from those listed by the Dean's office as being free. An application form is submitted by the S&S office to the Dean's office for specific rooms and dates. Generally, the ILO carries enough importance that it will get the rooms it asked for if they were listed as being free, and win any conflicts with other groups requesting the rooms.

An officer is selected at the staff meeting to supervise each symposium. The supervising

officer of a symposium first selects a faculty chairman. This is usually the professor who offered to do it. The chairman is responsible for the basic organization of the symposium. All reports (agenda, abstracts, etc.) are to be turned in to the supervising officer, and he is responsible for making sure that they are turned in on time. The officer also serves as a point of contact between the S&S office and the chairman, as faculty members are often hard to reach. The officer supervisor usually looks over the submitted information, edits it if necessary, and forwards it to the S&S office.

The office sends at the start of each series a memo to the faculty chairman and another memo to the officer supervising the symposium, reminding them what and when information is expected. The memo to the supervising officer includes a checklist of material he should receive:

1. An abstract of the whole symposium
2. A list of speakers an abstract on each talk
3. The program design, including exact timing of the symposium
4. Any unusual audio-visual requirements of the speakers
5. Copies of any slides, recent papers, and so on that are to be handed out to the audience.

When the topics and chairmen have been lined up, the S&S office prepares a series announcement. It lists the dates, topics, brief abstract, and chairmen of each symposium in the series. The brochure also includes a reply card to allow recipients to ask for more information on individual symposia. The publications office supplies the mailing labels for the series announcements from the OAIS computer system. Many companies don't send the reply card, but call the S&S office instead. In this case, the S&S office just fills out a card similar to the one in the announcement.

When the program design, list of speakers, and abstracts on individual talks have are turned in, the symposium program is created. Mailing labels are typed (by hand) based on the responses on the reply cards. Anywhere from 50 to 250 companies may request more information on a symposium. The officer, along with the S&S office if necessary, get after faculty chairmen who are behind in turning in the list of speakers, abstracts, etc. Often the officer and the S&S coordinator end up doing as much of the work as the chairman.

Three card files are maintained for every symposium. One contains the returned registration cards (included in the back of the symposium information booklet), sorted alphabetically by last name. If the reply is by phone, as half of them typically are, a registration card is created and filed with those received by mail. The second file (referred to as the "company file") contains a card for each company attending, and lists the name of each person attending from that company. As registrations are received, the name is first added to the company's card in the company file, adding a new card if necessary. Then the card is filed in the alphabetical file. As many as five sets of card files may be active at any given time. The third file contains copies of reports, memos, orders and other documents pertaining to the symposium. If a registration comes in very early, before a set of card files have been started for that symposium, it is held in the document file for that symposium until the card files are started.

Approximately two weeks before the symposium, orders are sent out to the dining service and, if necessary, to MIT's audio-visual office for extra equipment. Orders are made on the standard intra-MIT requisition form. Dining service orders include coffee breaks and luncheon.

Attendance lists and name tags are generated from the alphabetical card file. Two weeks before the meeting, a reminder is sent to the supervising officer, asking for copies of papers, viewgraphs, or even copies of the presentation itself. These will be duplicated and given to each person attending the symposium.

After each symposium, the attendance lists are used to update the attendance log and statistical summaries. A company attendance log records every person who attended a symposium or seminar, organized by company. After each series, a summary is made, detailing the total attendance for the series and for each symposium, the cost of each symposium, and the average cost.

There can be many variations on the basic symposium procedure. For example, once a special symposium was held, the "Senior Executive Meeting." Besides the regular arrangements, a series of dinner parties was held. Each party had one or two faculty members and a group of company visitors. The S&S office had to line up professors, try to get visitors with the party of their choice, and arrange for dining facilities all over town. This is by no means typical. However, the ILO would like to try out other new ideas more often.

An individual seminar is handled much like a symposium. The main difference is that seminars do not, as a rule, form a series. Instead, they are initiated whenever convenient, often on the spur of the moment. Another main difference is scale; while a symposium generally lasts one day and often several, a seminar usually only lasts half a day, with a much narrower subject. There is usually only one or two speakers, and a smaller audience than for symposia.

The main problem the S&S office faces is people not turning required information in on time. Most of these are supposed to be turned in by the faculty chairman, but a delay might also be due to the supervising officer. In either case, the remedy is simply to call the officer supervisor, and if necessary, call the chairman. Late reports do not alter the procedures, they just back up the process.

Another exception is a company visitor who just shows up at a symposium without having been registered previously. The S&S staff make out a badge card and add his name to the attendance lists. The office doesn't really care if a few extra people just show up, but they do want to keep an accurate attendance count for their cost analyses.

11.6 Directory of Current Research

This office has a single procedure for putting out the annual Directory. The staff consists of the officer in charge of the Directory and a Directory coordinator. The office sends out an introductory letter and Directory information requests to professors, one for each project they have. The Directory office make use of last years' annotated ILO version of the Directory, which lists each professor and the projects he has, in addition to the usual information. The Directory information request form includes a copy of last years' listing, and asks if the project is continuing or if there are any changes. In addition, each professor gets three blank forms, to list any new projects that started.

The Directory log lists every faculty member, organized alphabetically within departments. It has spaces for recording the important dates in the processing of a Directory listing: the date the Directory information sheets were sent to the professor and the date received, the date sent to the officer for editing and the date returned, and when the listing was entered into the computer. A second log records the number of information request forms received

each day from a professor. The Directory log is passed around regularly to officers, so they can remind forgetful professors about turning in the sheets.

When a sheet arrives, it is first examined by the Directory coordinator. Generally, editing is only necessary for new entries, as the continuing projects usually don't change their listing much. After initial editing, the sheet is sent to the officer in charge of that department or laboratory for technical editing. The Directory numbers are in the form <last digit of year> - <department or center number> - <serial number>. The officer assigns the department number, the Directory office assigns the serial number. Projects generally keep the same serial number every year, although sometimes they are renumbered to allow for new entries.

The office makes use of a computer system for editing the text of the Directory. Last year's text file is updated with information from the information request sheets. A sample copy of the Directory is printed by the computer and proofread by the coordinator. Last-minute projects are also entered at this time. When the final copy of the Directory is ready, local printing companies are asked to bid for the printing job. The finished product is delivered to MIT's Graphic Arts for bulk mailing.

11.7 Miscellaneous procedures

As with any office, the ILO has a number of odd jobs or other little projects that need doing. For example, since the publications office is the only function that employs students, it is often used as a source of labor for odd jobs (*e.g.*, moving desks, courier service). The accounting office handles just about anything not specifically stated as being part of some other office. For instance, when a new officer was hired, the accounting office arranged to have MIT's word processing service prepare letters to all of the affected companies informing them of the change. The Directory coordinator also works on other brochures that need updating and maintains a particular shelf of brochures from various departments, obtaining more from the departments when they run low.

12. Exception handling

12.1 General exception handling

The ILO has a very small number of exceptions that occur with any frequency. If a form is incomplete, it is returned to the sender. If a form was not submitted in time (S&S), the person who was supposed to send it is called. Officers each have a back-up officer to cover for them when they are away.

12.2 The Director's role

There are several situations where the Director would be likely to step in. Most of these involve a company that is upset with the ILP in some way. The problem may be referred to the Director by one of the officers, or the company might call the Director itself. The company may feel that it is not getting enough out of the ILP to justify the membership fee, or that the officer representing the company is not doing enough for the company. The Director will look over the activity of the company by examining the quarterly summary reports, and discuss the problem with the officer servicing that company.

The situation can become considerably more complex when the company is involved with MIT in a number of ways, and the entire relationship is at stake. For example, a company might be part of the Electrical Engineering & Computer Science department's cooperative program, be sponsoring several research projects, and be a member of the ILP. A company's dissatisfaction with one program may jeopardize them all, and the Director is often asked by senior MIT staff to step in and straighten out the relationship.

The Director attempts to head off potential problems before the company itself complains. Each quarter, the Director goes over the activity summaries of all companies. A company that has few or no visits to or from MIT, paper requests, or visits by an officer for two or more consecutive quarters can be expected to balk when the membership bill comes around. The Director checks to see that officers are visiting their companies, that unsolicited papers

have been sent, and that every attempt has been made to arrange visits both to and from MIT, particularly for companies whose activity is dropping off.

The Director provides other services to MIT because he is so familiar with the "moods" of various companies. For example, a professor may be ready to approach some companies for support of a research project. The professor will often talk to the Director first, who may be able to tell them both the names of companies and the people within the companies who might be interested in supporting such a project. He may also be aware of trends in management, such as "I don't want to see another MIT energy proposal." Such information is routinely gathered by the Director in the course of visits, phone conversations, and so on.

Appendix III. Outline of functions

The following is a summary of the functions, their objects, and the procedures used to carry out the functions. Where appropriate, an event or time interval that indicates when the procedure is to be begun is given.

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Function: Manage member companies
        Object: A member company
        Initiating: Soliciting new members
        Procedures
                Arrange visit to MIT
                Arrange faculty visit to company
                Arrange telephone calls
                Other forms of service
                Update mailing lists
                Record company activity
                4 times per year: Make quarterly summary
                Every December: Make annual summary of
                        company activity
                Every 6 months: Invoice companies
        Termination: Company leaves ILP


Function Manage point-earnings
        Object: Faculty-book
        Init: (first point-notice of the year):
                Create new page and record points
        Procedure:
                Record points
        Term: Every July: Total and pay points


Function: Manage staff
        Object: Ilo employees
        Init: Hire employee
        Procedure:
                Every week: Prepare payroll
        Term: Process resignations


Function: Symposium and Seminars
        Object: Symposium
        Init: twice per year: Get topics
        Procedure:
                Run a symposium
        Term: Prepare summaries, archive records


Function: DCR
        Object:
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        Init, body procedures, and term: Once peryear: Make DCR

Function: Manage Library
        Object: Papers
        Init: Receive papers
        Procedure:
                Retrieve and send paper
        Term: 4 months after Init: Archive papers

Function: Manage Budget
        Object: The budget
        Init: Once per year: Make budget
        Procedures
                Once per month: Verify MIT-accounting statement
                Order supplies
                Process travel vouchers
        Term: End of fiscal year: Make reports, archive
```

Appendix IV. Database

The following lists each major database in use at the ILO. The lists includes not only physical files, but other important sources of information. Unless otherwise noted, all databases are kept permanently. *Archiving* generally means placing into boxes and storing in the MIT archives. The index to the paper gives page number references to these and other topics.

IV.1 Databases maintained by each officer

These descriptions are very general, as the specifics often vary from officer to officer.

Ticker file	A supplement to the desk calendar. Consists of notes and reminders, filed chronologically.
Company file	One for each company. Contains visit reports, agendas, and other official ILO forms, along with any other correspondence between the ILO and the company. Generally kept two to three years, then archived.

IV.2 ILO-wide databases

Company book	Contains all of the *company pages*, which contain information on activity by a particular company.
Faculty book	Similar to the company book, it contains a page for each faculty member who has earned any points in any given year.
Computer	The computer maintains information on annual fee, billing frequency, next amount due, and so forth. The data exists in printed form, updated once a week, as the financial status report.
Cash voucher	Filed chronologically.
Request for payments	Filed chronologically
Requisitions	Accounting office requisitions filed chronoligically, in accounting office. Publications office requisitions filed by type of expense and

chronologically within those catagories, in the publications office.

Accounting company file
Contains the agreement letter signed when the company joined the ILP, and the financial status card.

Invoice log — Tracks all invoices for company fees: when created, received, and amount billed.

Bibliography cards — Filed by Directory project number: <year> - <department number> - <serial number within department>

Acquisition log — A log of all papers received by the pubs. office, chronologically.

Card catalogue — Contains copies of the acquisition log entries, arranged by subject and by author.

MLOP initial order log
Records all orders, initial and reorders, of MLOP papers.

MLOP order cards — Contains all MLOP order cards since the last monthly summary. After the fiscal year, they are discarded.

Publications letter requests
Contains all orders other than MLOP order cards since the last monthly summary. They are discarded after a few months.

Pubslications request forms
Filled chronologically, discarded after the end of the fiscal year.

Directory log — Tracks the flow of Directory information requests

S&S card files — Contains registration information for a particular symposium or seminar, arranged both by individual attendees and by company.

IV.3 General databases

Directory — The Directory of Current Research is used throughout the ILO to obtain information on research at MIT.

MIT Directory — Used by accounting, among others, to verify that the person receiving revenue sharing points is a valid point earner (by making sure he is of the appropriate title.)

IV. The Office of Sponsored Research

Sandor R. Schoichet

October 1980

This description of OSP functions and procedures has not been compiled as a factually comprehensive portrayal of this office's activities. Information presented has been simplified to emphasize procedural operations for a limited number of administrative situations.

Director, Office of Sponsored Programs

13. The Office of Sponsored Programs

The research work that is performed at MIT is largely supported by contracts and grants received from outside agencies, both governmental and private. The Office of Sponsored Programs (OSP) represents the interests of the Institute during the formalization of research grants and contracts, and assumes responsibility for administering their terms.

13.1 Mission

There are three basic aspects to the mission of the OSP. They are responsible for aiding the academic staff of the Institute in obtaining outside (*i.e.* non-tuition based) funds to support their research work. In pursuing these funds, they are responsible for ensuring that both the proposed research itself and the terms of the grants and contracts conform to the policy guidelines of MIT. And, finally, after a grant or contract has been signed, OSP is responsible for administering its terms, disbursing the funds, and closing it out upon completion.

13.2 Organization

The Director of the OSP has three Research Coordinators (RCs) and 14 Assistant Directors (ADs) who all report directly to him, creating a very flat organizational structure.[4] Each of the ADs is assigned responsibility for handling the contracts and grants of a particular group of departments, laboratories, or research centers. The RCs act as senior consultants within the office, and are specialized by account classes (*i.e.*, contracts, grants, and gifts and funds).

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[4] I would like to thank Carol VanAken, Research Coordinator, and Joe Connolly, Assistant Director, for the hours that they spent going over this report with me.

13.3 Overview of Functions

There is one basic function performed by the OSP: administration of sponsored research programs. A variety of other subsidiary functions are also handled; these will be listed briefly in the next section, and will not be discussed further in this report.

13.3.1 Administration of Sponsored Research Programs

There are three major steps to be performed by the OSP during the lifetime of a sponsored research program: review and approval of the budgetary and policy aspects of a research proposal, negotiation and approval of the contract or grant, and administration of the grant or contract. Each of these steps will be briefly outlined below, and discussed in greater detail in the next chapter.

Proposal Review

The first step that must be performed is for the OSP to review and approve or reject any proposed research that will require outside funding. This review is concerned both with the conformance of the proposal to MIT research policy and with its likely reception by the proposed sponsor. Any problems with the proposal are resolved through a process of negotiation between OSP and the principal investigator. Once approved, the proposal is sent out to the intended sponsor.

Grant or Contract Negotiation

If the reaction of the sponsor to a proposed research program is favorable, the actual terms of a grant or contract must be negotiated. During this process, the OSP acts as an intermediary between the sponsor and the principal investigator, again representing the interests of the Institute as a whole.

Program Administration

If a grant or contract acceptable to all parties is finalized, it must then be administered. A research program is an entity in the MIT accounting system, and the OSP is responsible for overseeing the disbursement of funds that are allocated to it, seeing that required reports are written and submitted to the sponsor, and so forth. When the program terminates, either by being completed, running out of funds, or any other reason, the OSP closes it out of the

MIT accounts and prepares a final report for the sponsor.

13.3.2 Other Functions

Several functions subsidiary to the administration of sponsored research programs are also managed by the staff of the OSP. Each of the three RCs acts as an AD for a small set of special programs:

- New projects not yet associated with a particular lab or department are handled in the same way as normal projects except that the initial approval cycle is somewhat abbreviated.

- Student loan accounts are reviewed for the Financial Aid Office because of the similarity of this process to that of reviewing the monthly consolidated financial statements for sponsored research projects.

- The administration of gifts,funds, and endowed professorships is handled just as is the administration of grants or contracts, except that they are assigned account numbers from a special set of series maintained by the RC who handles them.

Each AD also has a few special projects for which he is responsible, such as keeping track of MIT vehicles purchased on research funds or renegotiating standard contracts with major sponsors yearly.

There is a separate Subcontracts section of OSP that is responsible for negotiating and reviewing all research project subcontracts, a process that essentially duplicates the negotiation and administration stages of sponsored research contracts; In addition, there is a Security Records section which processes security clearances and keeps track of restricted materials in use at MIT.

14. Procedures

Now that an overview of the activities performed at the OSP has been given, this chapter will detail the procedures followed in the present office to achieve each step of the sponsored research program administration function.

14.1 Proposal Review

OSP's formal participation in a program is initiated by the receipt of a Research Proposal (Proposal) and an associated Research Proposal Summary (RPS)[5] which has already been approved by the Principal Investigator (PI), and the appropriate Department or Laboratory Head. If the Proposal is from an academic Department then it must also have been signed by the Dean of the appropriate school; if it is from an interdepartmental laboratory or research center, then it must have been signed by the officer that the laboratory or center reports to, either the Provost or the V.P. for Research. At OSP, a control clerk assigns the RPS a control number taken in sequence from the RPS Log and enters into the Log the date of receipt, the name of the PI, his department or laboratory, the intended sponsor, the present OSP control number if the Proposal is a renewal or modification of an existing program or Proposal, the Proposal's title, and the name of the AD who handles Proposals from that department or laboratory. The RPS Log provides a convenient basis for answering questions which may arise from time to time, such as the volume of work of a particular type handled by OSP during a certain period. A Xerox copy of the RPS is placed in the RPS File, a loose-leaf binder that is ordered by control number. The RPS File provides more information than the RPS Log, including any notes that the AD may have made on the RPS form, and is kept for recovery if something should get lost. The control clerk also sends out copies of the RPS to several other offices: if the RPS indicates that animal space will be needed, a copy is sent to Veterinary Services to ensure that they are aware of the PI's plans;

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[5] See appendix VI, page 129, for a copy of the RPS form.

the Planning Office gets copies of all RPS forms as part of an effort to keep track of research activities at MIT; and the office of the Director of Information Processing Services receives a copy if computer services other than those that can be provided within MIT will be needed. The Proposal and the RPS are then sent on to the appropriate AD's secretary who creates a Proposal folder to hold them.

The AD reviews the Proposal and the RPS from a fiscal and policy viewpoint for completeness, correctness, and reasonableness, looking especially for standard considerations that have been ignored and for interactions with other research projects. The basis for this review is a set of MIT Policy and Procedure manuals that detail the requirements that Proposals must meet. Additionally, each of the major agencies and sponsors with which MIT regularly does business provides OSP with manuals stating general requirements and restrictions on the type of research projects that they are willing to fund. The AD also recalculates the budget presented in the RPS and checks the dollar figures involved against the activities described in the Proposal on a common sense basis.

Unusual aspects of the Proposal or problems with it must be cleared up to the satisfaction of the AD before he signs the RPS. This is accomplished via phone or personal conversations with the PI and the various other signatories and affected individuals. For example, if more than $25,000 had been budgeted for computer services or if any computer equipment was being purchased, the AD would call the Director of Information Processing Services to see that he had been consulted by the PI and agreed that the budget and/or purchases were reasonable.

Before the AD is satisfied with the Proposal he may have to negotiate with the PI and other signatories to have changes made in it. If the changes are minor, the AD may make them himself in the current copy of the Proposal. Larger or more substantive changes may require the Proposal and RPS to be rewritten, and to go through the entire new proposal cycle again.

At this point the AD either decides that the Proposal is basically reasonable and signs the RPS or decides that it is a poor idea and refuses to sign it. If the AD thinks the Proposal is reasonable, he will write a short note in support of it and staple copies to both the Proposal and to the RPS. The AD may sign the RPS even if there are still some open problems with it that could not be resolved at the departmental or laboratory level. For example, the

Proposal might give the sponsor proprietary rights to the results of the research. This violates MIT policy guidelines and the AD is not authorized to make such exceptions on his own. The AD would include write-ups of such issues in the Proposal folder. If the AD decided to reject the Proposal, a written note explaining the reasons for his decision would also be included in the folder.

If the Proposal is for an amount in excess of $75,000, the RC sends the Proposal folder to the Director for signature on the RPS form. If the Proposal is for more than $250,000, the RC also includes the V.P. for Financial Operations on the Proposal folder's routing slip for signature on the RPS. Finally, the Director will sign the cover page of the Proposal if the sponsor requires the signature of an authorized official; otherwise, the RC will sign the Proposal's cover page. The Proposal folder is then returned to the AD who officially submits a copy of the Proposal to the sponsor by mail, and places the Proposal folder back in the Proposal file.

It is extremely rare for a Proposal to be rejected by OSP. Out of a volume of approximately 4,900 Proposals processed by OSP each year, the AD I interviewed could remember 1 that was not approved.

14.2 Grant or Contract Negotiation

Following submission of the proposal most sponsors send an acknowlegement of receipt back to OSP, where it is filed in the Proposal folder. Typically there ensues a six month period during which the sponsor agency is processing the Proposal. There is no formal system to keep track of the progress of Proposals during this time. Instead, the usual informal contacts between the PI and the technical monitor at the sponsoring agency, and the natural interest of the PI in timely processing of his Proposal are relied upon to ensure that the sponsor takes action on Proposals. Inquiries about the status of Proposal processing are dealt with by the AD on an *ad hoc* basis, usually by calling the sponsor several times in an effort to get them to discover what is going on.

While in the process of considering the award of a grant or contract, the sponsor may have questions about the Proposal or take issue with various aspects of it. The AD is responsible for mediating negotiations between the sponsor and MIT to resolve any issues

that might arise with regard to either the Proposal itself, or with regard to framing a grant or contract that is acceptable to MIT. This entails consulting as the AD decides is appropriate with the PI, the RC, and possibly other offices within MIT (*e.g.*, the Patent Office if the sponsor is unhappy with MIT's standard patent clause), reviewing and approving any modifications to the original Proposal, and handling all formal correspondence between the sponsor and MIT. Copies of all correspondence with the sponsor are filed in the Proposal folder by the AD, along with notes of phone conversations and written opinions from other sources that have been consulted. This second round of negotiations is handled similarly to the initial round; minor changes to the Proposal are handled by mailing updates to the sponsor, while more substantial changes would cause the AD to decide that a new Proposal must be written and resubmitted via the original procedure.

If all goes well, a grant or contract is eventually received at OSP from the sponsor. The AD's secretary places it in the Proposal folder, thereby transforming it into a Contract folder. Contract folders containing unsigned contracts or grants are not filed, but are held temporarily by the AD's secretary until processing is complete. The AD reviews the grant or contract, producing a checklist, modeled on a standard Grant/Contract Checklist, that highlights important or unusual features (*e.g.*, total budget, publication restrictions, reporting requirements). The checklist is sent to the PI along with a copy of the grant or contract. The PI must sign the checklist and return it to the AD before the contract or grant can be approved. The negotiations that began between the sponsor, the AD, and the PI after submission of the Proposal may continue after receipt of the grant or contract at OSP. Changes at this point, however, generally result in revisions to the grant or contract which the sponsor mails to the AD. When the AD feels the grant or contract is acceptable he will sign it. The Contract folder is then routed to both the RC and the Director for signature, after which it is returned to the AD.

The acceptance rate for Proposals varies from approximately 50% to better than 90% depending on the laboratory involved and the mix of academic to research funding for its faculty.

14.3 Program Administration

When a grant or contract has been signed by the AD, the RC, and the Director, its terms go into effect. The account administration process starts when the AD fills out an Account Action Notice (referred to as an 001 form),[6] assigning the project an account number and providing a complete financial summary of it for the section of the Accounting Office (AO) that handles sponsored research accounts.[7] Account numbers are assigned sequentially for research grants and contracts. A messenger clerk distributes labeled copies of the multipart 001 form to the AO, keypunch (where it becomes direct input for MIT's unified accounting system), the PI, and the PI's Department or Laboratory Head. Copies are also filed in the Contract folder and, for initiating 001s (*i.e.*, those that create new account numbers, not those that modify aspects of existing accounts), in the OSP Master File, a loose-leaf binder that is kept by account number.

ADs receive monthly reports from the AO providing consolidated financial statements for all of their active accounts. The AD reviews these reports for alarming spending patterns (*e.g.*, an imminent budget overrun) or other deficiencies. If appropriate, the AD will call individual PIs to discuss such issues. Additionally, monthly meetings are held with the larger departments and laboratories to discuss any more general problems that the AD has caught and to go over progress on correcting earlier problems. For smaller research groups these discussions are handled by telephone.

The AD has responsibility for ensuring that all equipment purchases follow the terms of the appropriate grant or contract. All equipment requisitions written against sponsored accounts are sent to OSP by the Purchasing Office for the AD's approval. Contracts, in particular, often require the AD to notify the sponsor in writing of any equipment purchases and to wait for an approval notice to be sent. In this case, copies of both the request and the sponsor's reply would be filed in the Contract folder by the AD. Similarly, all foreign travel requests, and domestic travel requests over a certain dollar limit, must be cleared with the AD over the phone by the Travel Section of the Comptroller's Accounting Office.

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[6] See appendix VI, page 130, for a copy of the 001 form.

[7] See Kunin & Hammer, *Case Studies of Office Procedures: I*, OAM-001, January 1979, chapter 7, Sponsored Accounting Office, for details on the handling of 001 forms in the AO.

If the PI requests changes in the original terms of the grant or contract, the AD will again act as his intermediary with the sponsor. The PI must submit change requests to the AD, who will review them in the same way that the original Proposal was reviewed. If the AD approves the change request he will sign and forward it to the sponsor. The sponsor's processing of the change request also follows the same process as the original Proposal. Under their "Prior Approval Programs," the NIH and the NSF have authorized delegates in OSP to handle such change approvals locally, rather than requiring correspondence with Washington. When a change to a contract or grant is approved, the AD informs the AO by filling out a new 001 form, which is distributed as before.

On an account's termination date, the AO runs an audit of the account and sends a copy to the AD. If there was a budget underrun, the AD fills out a new 001 decreasing the total budget to match the funds actually spent. If there was an overrun, the AD may be asked to assist in the negotiating process that will get someone within MIT to pick up the difference (*e.g.*, the PI from one of his unrestricted accounts, or the PI's department or laboratory head from some type of "miscellaneous" account). When the account has been "zeroed out," final reports must go to the sponsor from the PI and the Patent, Property, and Accounting Offices. A copy of the transmittal letter for the PI's final report and copies of all the other final reports are included in the Contract File.

15. General Exception Handling

OSP personnel make use of a small set of standard methods for handling such general exceptions as may occur during any stage in the life of a Sponsored Research Program. These exceptions fall into three basic classes: (1) Missing personnel; (2) Communications not received; and (3) Reversal of earlier decisions.

Personnel may be missing for any of a wide variety of reasons including vacations, illness, etc. To handle such situations there are both formally and informally designated back-up personnel. Informally, the ADs and RCs know who else within the office has experience related to their ongoing projects. If, for any reason, they are unable to come to work they will inform their back-up of any outstanding issues and of how long they anticipate being gone. If they will be gone for long periods of time (*e.g.*, serious illness or job termination) the Director will designate a replacement. The replacement will carry on with the same authority as the missing AD or RC unless the return of the missing individual is imminent, in which case the replacement will simply delay any necessary actions until their return. For official decisions such as financial approvals, there is a formal system of back-ups based on the organizational hierarchy.

Nonreceipt of expected communications is usually noticed when an impatient PI calls the AD to check on the progress of his project. Otherwise the AD simply relies on memory to notice when something has become overdue. The AD handles such situations by making phone calls to the expected originator to find out what has happened. Usually the problem turns out to be a delay in generating the document, in which case the AD informs the relevant parties. If a document has actually been lost, the situation is easily rectified by requesting that it be regenerated and resent, and again the relevant parties are notified of the delay.

The complex approval process for both Proposals and for Grants and Contracts reflects OSP's policy of not reversing an approval decision. Denials, however, may be reversed after

continued discussion. This is handled by simply continuing a process that was suspended previously. If the PI decides to withdraw a Proposal, the proposal process is suspended, and a phone call is made to the Sponsor if appropriate. If there is an abnormal contract termination resulting from cancellation or resignation on the part of the PI, the AD requests the AO to run an audit of the account and then handles it as if it were a normal account closing.

Appendix V. Database

OSP-wide Files

Research Proposal Summary Log:
Contains identifying information from all RPS forms received.
Provides control numbers.

Research Proposal Summary File:
Contains Xerox copies of all RPS forms received.
Filed by control number.
Individual copies kept for one year and then tossed.

Master File:
Contains copies of all initiating 001 forms submitted to the AO.
Filed by account number.
Individual forms kept two years and then tossed.

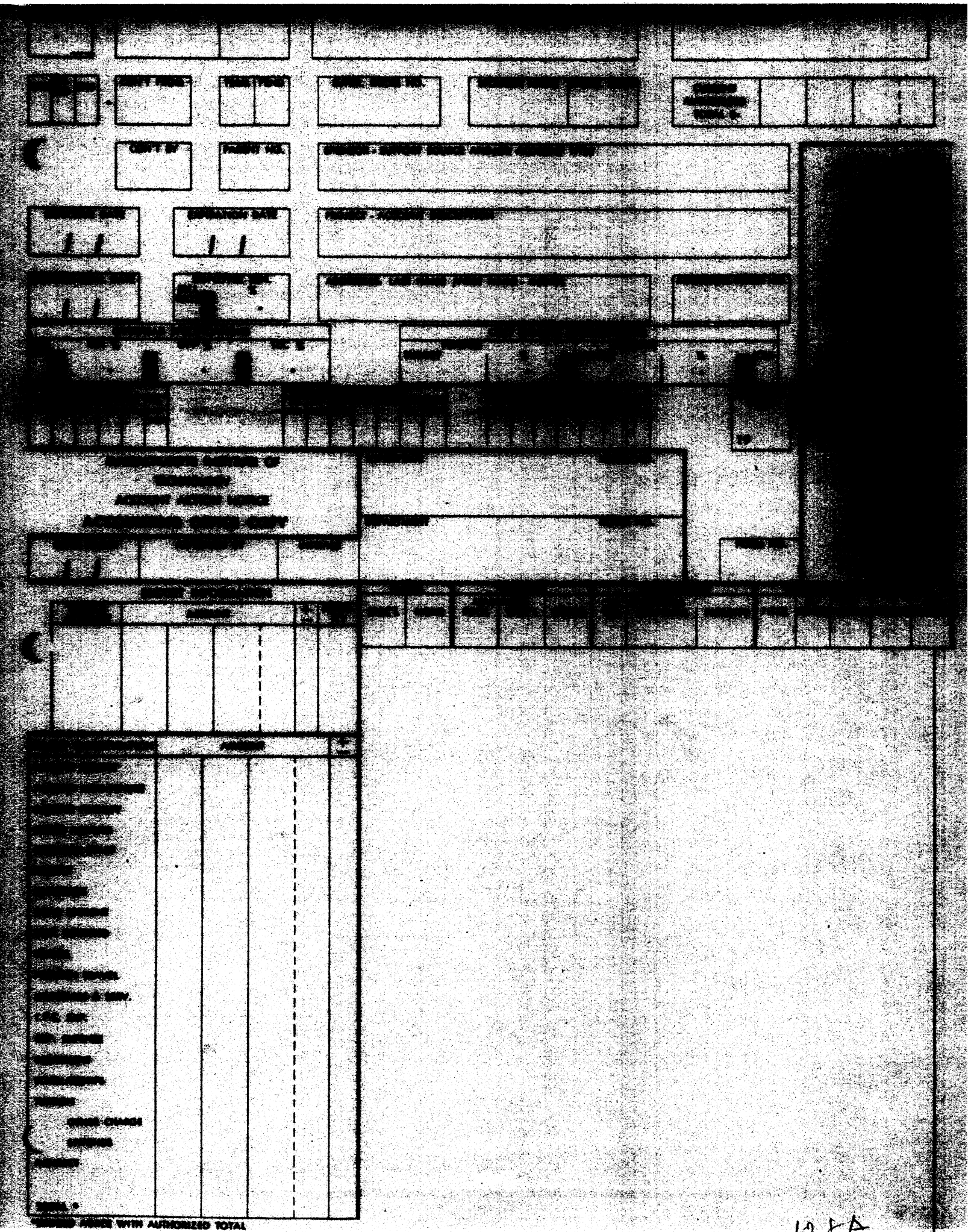
Files maintained individually by all ADs in identical format

Proposal File:
Contains the proposal, the RPS, transmittal letters, and all correspondence for each pending or rejected proposal.
Filed alphabetically by PI.
Accepted Proposals are moved to the Contract File.
Rejected Proposals are kept one year and then tossed.

Contract File:
Contains the Proposal folder augmented by the grant or contract, negotiation notes, and 001 forms for each account; Copies of all final reports (transmittal letter only for the PI's final report) included on closing.
Filed alphabetically by PI.
Kept for the life of the account, then microfilmed and archived.

Appendix VI. Sample Documents

The next two pages, in order, provide copies of the Research Proposal Summary (RPS) form, and the Account Action Notice (001) form.



CONT'T BY

PARENT NO.

EXPIRATION DATE

/ /

/ /

ACCOUNT ACTION NOTICE

ACCOUNTING OFFICE COPY

AMOUNT

AMOUNT

OFFICE CHARGE

TOTAL *

*[illegible] WITH AUTHORIZED TOTAL

128A

FORM NO. CO-001 9/70

MASSACHUSETTS INSTITUTE OF TECHNOLOGY – RESEARCH PROPOSAL SUMMARY

Department, Lab, or Center _____ Sub-Unit _____ Dept. No. _____

Title of Proposal _____

_____

For Submission to _____

Attention of _____

Date by which this proposal must ☐ be postmarked or ☐ arrive at sponsor _____ No. of copies to sponsor _____

New Project ☐ Renewal ☐

Present M.I.T. Account No. _____

Period Proposed _____

Total Dollar Amount this Proposal _____

First year amount _____

Mark boxes if applicable:

Response to RFP ☐

Sponsor expecting to receive proposal ☐

Sponsor expected to accept proposal ☐

Revised budget (indicate change below) ☐

BUDGETED PERSONNEL

Faculty

Name (if known)	% of time

	Total Head Count	Total Man-mos	New People to be hired
Faculty			
Other Acad			
Grad Stud			
DSR Staff			
Other			

COMPUTER services required? Yes ☐ No ☐ If yes:

Specific Machine	Facility	Total hours	Total Cost

Use of human subjects: Yes ☐ No ☐ If yes:
Date of approval of protocol by MIT committee _____ Protocol No. _____

Are recombinant DNA experiments involved? Yes ☐ No ☐ If yes:
Date of approval by the Committee on Assessment of Biohazards _____

FIRST PERIOD BUDGET

(mos.)

Sal & Wages _____

Benefits _____

Overhead (___%) _____

Equipment _____

Mat and serv _____

Travel _____

Subcontracts _____

Other _____

TOTAL: _____

Cost-Sharing (_____)
Total from Sponsor _____

Use of animals? Yes ☐ No ☐ If yes: Species _____ Number _____
Is space available for animals? Yes ☐ No ☐

Give room numbers of spaces to be used for this research: _____
Do you foresee submitting a Space Change Request or the need for rented space for this project? Yes ☐ No ☐

Underrecovery of indirect cost? Yes ☐ No ☐ If yes, what dollar amount? _____

BRIEF SUMMARY AND SPECIAL INFORMATION

TECHNICAL APPROVAL

Supervisor _____ Date _____

Dept. or Lab Head _____ Date _____

Dean, Provost or V.P. _____ Date _____

Final Review _____ Date _____

FISCAL APPROVAL

OSP _____ Date _____

_____ Date _____

V.P. for Financial Operations _____ Date _____

Added Information: _____

V. The Student Loan Office

Juliet B. Sutherland

May 1981

The Student Loan Office no longer exists at MIT. Its procedures and functions, with significant changes, have been incorporated into the Bursar's Office. This description in no way reflects current operations.

16. Introduction

16.1 Mission

The Student Load Office (SLO) is responsible for the maintenance, billing, and collection of student loans. The SLO does not award loans to students; that is handled by the Financial Aid Office. However, once the loan has been approved, the SLO is responsible for all other activities concerning the loans.

16.2 Organization

The SLO is part of the Office of Student Financial Affairs. This office in turn reports to the Vice President for Financial Affairs.

The SLO is divided into three parts internally. Each of these parts has a manager who reports to the director of the SLO. The three parts do not have official names, but can be characterized as accounting, collection, and maintenance. The accounting section consists of one half time person. The collection section consists of the manager, two full time collectors, and one and one half full time support people. The maintenance section consists of the manager and a clerical staff of three and a half full time people. In addition, there is a half time person in charge of administration, and there is the director.

16.3 Overview of Functions

In the process of carrying out its mission the SLO performs four basic functions which may be characterized as Student Loan, Collection, Yearly Reports, and Accounting.

16.3.1 Student Loan

The Student Loan procedure starts when a loan is awarded to a student by the Financial Aid office. The clerical staff types the terms of the loan on a standard loan note, makes sure that the student signs it, then reviews the student's status annually until the student leaves MIT. When the student leaves, a collector conducts an exit interview with the student to explain the repayment terms, obtain a mailing address, and discuss any questions or problems that he might have. The student then has a 9 month grace period during which no payments need be made. Starting with the tenth month after graduation, the SLO bills the borrower in monthly installments until the loan is repaid in full. The installments are figured on a ten year repayment schedule but the SLO is currently undergoing revisions on the lengths of grace periods and repayment periods.

16.3.2 Collection

The Collection procedure starts when a borrower falls behind in his payments. The borrower is sent letters at intervals of 15, 30, 60, and 90 days asking for payment. In addition, after 30 days the collectors start calling the person to determine the problem. If the borrower does not start repayment after 90 days the account is turned over to an outside agency. The collectors can help the borrower to start repayment by setting up a different repayment schedule, recommending that the borrower apply for a hardship deferment, or by suggesting one of several other arrangements.

16.3.3 Reports

Since the SLO deals with the government, it must generate a variety of reports in addition to reports for the MIT administration and its own internal reports. Various government reports are generated monthly, quarterly, and yearly. Internal reports are generated monthly, and reports for the MIT administration are generated yearly. All reports serve basically the same purpose--to show where the money for loans came from, where it went, and how much. The exact details of the reports do vary.

16.3.4 Accounting

Since the SLO deals with money there is an accounting function. The books are closed and balanced twice each month. At the end of each fiscal year the accountant does a final, detailed adjustment and balancing of the books.

16.4 Other Notes

As with any office, the SLO is constantly changing. However, some of the procedures are changing drastically and deserve mention. In particular the details of the collection procedures are changing due both to new government regulations and to a continuing automation effort. It was particularly hard to establish what aspects of the procedure were current. Other changes are noted in the procedures that are affected.

17. General Information About the SLO

This chapter contains information about the SLO that is relevant to all procedures. Those aspects of the environment that affect most of the SLO staff, the most common databases, and the various types of loans are described in detail.

17.1 Environment

The physical organization of the SLO reflects the logical organization. The director has a separate office, the collectors and their manager each have a cubicle, as does the accountant. The support person for the collectors has a desk near the word processor. The clerical staff and their manager have desks behind a front counter. Everyone in the office shares the use of certain facilities, including a terminal that connects to the Registrar's database and a terminal that is used for credit inquiries. There is a vault that holds the folders for individual students, as well as some of the material that is archived.

The SLO makes use of two computer systems and, in a less direct sense, they are a part of the environment. The SLO has its own accounting package (SLS), which runs on an IBM machine owned and managed by the Administrative Computing Services Office. The SLO also has its own word processor. Since these systems are important parts of various procedures, a more detailed description follows.

The accounting system is run in batch mode once every two weeks by the accountant and generates reports that are used by everyone in the SLO. Entries to this system are made via special forms. The accountant collects these forms every day and sends them, at least once every two weeks, to Administrative Computing Services to be keypunched. Input to the SLS also comes in the form of tapes sent from the Institute Cash Control system of the Accounts Receivable Office and from the Registrar's Office. The cards and the tape are used to update the SLS when it is run.

The word processor (WP), a WPS 8 made by DEC, is an interactive system used to

generate form letters, and to store information about delinquent accounts that can be retrieved to create various lists. The WP is run by the collector's full time support person. The WP must be told when to generate which letters and to whom they must be sent. For some letters the WP can use lists that are already stored in it and for other letters the name, address, and other relevant information must be entered by hand. At this time there is no connection between the SLS and the WP so that all information that must go from the accounting system to the word processor must also be entered into the WP by hand. There are plans to automate this connection in the future.

The SLO has a vault in which it keeps the borrower's folders. The folders are kept in two rows of filing cabinets which fill the room. Other archived material, such as old bills or reports, is kept in, and on top of, the filing cabinets. The vault is open during the day but is locked when the SLO is closed.

17.2 Databases

There are several databases that are used by nearly everyone in the SLO. The most important of these is the Student Loan Status Report, which has about 11,000 entries and lists all the accounts with names, amounts owed, active or inactive status of the loan, delinquency, class, expected date of graduation, and other specialized information. There are six copies of the Status Report, one shared by the clerical staff, one for each of the collectors, one for the director and one for the accountant. Future plans call for the Status Report to be produced on microfiche. When that happens, each person will have a copy. The Status Report is generated by the SLS twice each month. Various people in the SLO use other reports generated by the SLS, but these are all extracts of information from the Status Report organized in different ways.

Another important database is the Registrar's database. This is a listing of all information known to the Registrar's Office about each registered student. Along with standard information such as name, id number, course, units, etc., the Registrar's database shows financial aid information. The Registrar's database is available interactively for queries and updates. The SLO also receives several written reports of information extracted from this database.

The other database used by most people in the SLO is a file of folders, one for each type of loan for each borrower. This file is kept in the vault. The folders are filed in alphabetical order by name. Folders for people who have completed repayment are filed in a separate filing cabinet. Each person takes the folders that he needs and returns them as quickly as possible. Folders used by the clerical staff are usually put back into the vault the same day. The collection staff often takes longer to get folders back to the vault.

17.3 Loans

The SLO is primarily concerned with student loans. A student loan is a loan which is made to a student to help pay for his education. These loans are typically made at interest rates that are much lower than those for other loans and the loans are usually awarded and administered by the school, rather than by a bank. To get the money from a loan, once it has been awarded to a student, the student must sign a loan note. This document is the contract between the student and the agency giving the loan, and by signing it the student makes a legal commitment to the terms of that contract. If, as happens in the case of a foreign student, the student is required to have a cosigner, then both of the signers are responsible for the repayment of the loan. At MIT, the money from a student loan usually goes directly to the Student Accounts Office to cover tuition and housing expenses. If the student lives off campus, then he is given a check for the amount of the loan less tuition and other such expenses. As long as the student is in school, or is working for such groups as the Peace Corps or VISTA, he does not have to pay back the loan. Repayment starts 9 months after these deferments end. When he does start repayment, the payments are spread out over 10 years. If the borrower returns to school or becomes eligible for some other deferment, the payments stop again until he is finished.

17.4 Loan Types

The SLO handles several types of loans. The three principal types are National Direct Student Loans (NDSL), Federally Insured Student Loans (FISL), and MIT Technology Loans. Each of these sources of loans has different rules and standards, typically requiring different types of reports and different collection procedures. Since the different rules make sense given the type of loan, some further explanation is warranted.

The money for NDSL loans comes directly from the US government. The SLO must show due diligence in collection. Loans of this type are sent, if necessary, first to an outside agency to collect, and if that fails are then turned over to the government

The FISL program is run by the government and insures the interest on loans given to students by other sources. Money for this type of loan typically comes from MIT, from banks, or from other outside sources. The government requires that the SLO send it bills for the interest on, and maintenance of, these loans as well as monthly, quarterly, and yearly reports. These loans must be turned over to the government for collection and cannot be sent to an outside collection agency.

Historically, there were many funds that had been given to MIT by alumni and companies to be used for student loans. About 10 years ago all of these funds were merged to support the MIT Technology II loan program, known for short as the Tech fund. Reports on the status of loans from this program go to the MIT administration and the policies concerning it are set by a policy committee consisting of people from the SLO, the Financial Aid Office, and other interested parties. The accounting reports still show the various funds within the Tech fund.

The proportion of loans from each of these sources is as follows: about 50% from NDSL, about 20% from FISL, and about 30% from the Technology Fund.

18. Student Loans

These are the procedures that implement the function for which the SLO exists. In some ways all of the other procedures exist solely to supplement this one. All of these procedures, except for the Exit Interview Procedure, are carried out by the clerical staff. The collection staff, the accountant, and the director all perform parts of the Exit Interview Procedure.

18.1 Environment

The environment is fairly simple. Each member of the clerical staff has a desk with a typewriter and an adding machine. There is a terminal, shared by everyone in the SLO, used to access the Registrar's database, a microfiche reader shared by the clerical staff, and a front counter which separates the clerical staff from the general public. The environment for the collectors is somewhat different and is described later.

18.2 Databases

The clerical staff use several databases, including the Registrar's database, a file of folders, one for each type of loan for each student, which are kept in the vault, an alphabetical file of loan notes waiting to be signed which is kept in files under the front counter, and the Loan Status Report.

18.3 Initiation of Loans

The Financial Aid Office awards loans to students. At the time that the loan is awarded, the student is told to go to the SLO to sign his loan note. If the student fails to do this the Financial Aid Office will send the student reminders and under some circumstances the Student Accounts Office will also start sending the student notices. Eventually, if the student still has not signed the note, the SLO will take action as described below.

18.4 Loan Notes

The loan note is the physical entity which most directly instantiates a loan. The SLO must prepare the loan notes, have them available for the student to sign, make changes to the notes as changes are made to the loans, and keep the loan notes until the borrower has paid back the full amount of the loan. A slight variation on these procedures occurs for short term loans.

18.4.1 New Loans

Each month the SLO receives a list of all financial awards to students for the current year. This list is used twice each year to prepare loan notes for the students who show on this list as having been awarded a loan. The list is checked against the folders to see which students on the list have had previous NDSL loans. If the student has had a previous NDSL loan, the loan note is retrieved from the student's folder (the folder is left in the vault) and the amount of the loan is added to the note. If the student has never had a NDSL loan or if the loan is of any other type, a new loan note is prepared. The loan notes are filed in alphabetical order in files under the front desk. Approximately 5000 such loan notes are prepared each year, 2500 each semester.

When the student comes in to sign a loan note, a clerk gets the note from the file and gives it to the student to sign. If more than one signature is needed the student takes the note and returns it when he has all signatures. At the end of each day all of the signed loans are marked as such in the Registrar's database. When the note is signed, it is held with all other signed notes until the books are closed for that two week period, in case there are changes to the loan. When the books are closed, the signed notes are used to be sure that the amount that appears in the SLS and the actual amount signed for agree. After the books are closed the note is returned to the student's file. If the student has no file for that type of loan, a new file is made. The SLO is the only office authorized to mark loans as signed in the Registrar's database.

If the student never comes in to sign the note it is usually because he graduated early, or had money from somewhere else and so did not need the loan. At the end of each term, the clerical staff compiles a list of students who have not signed their loan notes by listing the names on the notes that are still under the front counter. This list is sent to Student

Accounts asking if the student owes money to MIT. If the student does owe money then a card is sent to the student reminding him to sign. If the student still does not sign the note, Student Accounts is informed and they attempt to collect the money from the student. If the student does sign the note then the money eventually (possibly after several more steps performed by the student) gets to Student Accounts and is used to pay the student's bill. If the student does not owe money, the Financial Aid Office is informed of the situation and is asked to cancel the loan. When the cancellation happens it is treated like any other cancellation where the student never signed the loan note (see procedure below).

18.4.2 Changes to Loans

Each week the SLO receives a report, generated from the Registrar's database, which shows the changes that have been made during the past week to any of the loans. These changes include new loans, changes in amount or cancellation of signed or unsigned loans, and loans which have been entered into the database as signed. Approximately 60 changes are received each week, of which perhaps 20 require action, although the number varies with the time of year. More changes happen at the beginning of each semester and the number tapers off as the semester progresses. Changes may also be caught when the note is marked as signed in the Registrar's database. The person entering the fact that the loan has been signed checks to be sure that the loan information in the database is the same as what is on the loan note. If the loan has been canceled, in part or in full, the student is sent a form and the change is treated like changes from the weekly list. The following procedures are carried out for each type of change:

- New Loans. The procedure described above is used.

- Addition to amount of loans. If the student has already signed the loan note, no matter where it is in later processing, the loan note is retrieved, changed, and filed under the front desk to be signed again and then go through the entire process again. If the loan note has not yet been signed, it is retrieved from the front desk file, changed, and filed back there again.

- Reduction of amount of loans. This is known as either a reduction or a partial cancellation. If the student has not signed the note, the change is made and the note is filed back under the counter. If the student has signed the note, the loan note is retrieved from later processing and the change is made. The student is sent a form letter and a copy of the loan note to verify the partial cancellation.

- Cancellation of loans. If the student has not signed the loan note, the loan note is retrieved from under the front counter and the loan is crossed off the note. If there are other loans on the note (this happens only if the student has had a previous NDSL loan) the loan note is put back into the student's folder. If there are no other loans on the note, the note is destroyed. In either case, the cancellation must be marked in the Registrar's database, the student must be sent a copy of the canceled note, and Student Accounts must be notified that the loan has been canceled.

- Signed loans. The list of signed loans is checked against the pile of signed loan notes to make sure that all of the signed loan notes have been recorded in the Registrar's database.

18.4.3 Short term loans

Short term loans are loans that the student must pay back in the near future. They are usually used to help students through brief periods when they are short of cash or to give students advances on their long term loans. With the exception of how they are started, short term loans are handled the same way as other loans. Approximately 30 short term loans are started each month, although the number varies somewhat with the season. Students are more likely to be short of cash during January and at the end of semesters than other times.

A student will come to the SLO with a voucher from the Financial Aid Office showing the amount of the loan. This is the first notice that the SLO has that this short term loan has been granted. The clerk checks to make sure that the student has no delinquent short term loans and if he does not, types up a loan note. The student signs the note, then takes a copy to Student Accounts for the next step involved in getting his money. The short term loans are recorded in a log and get entered into the SLS. When the short term loans appear in the Loan Status Report, the student's address, taken from the Registrar's database, and the repayment terms are also added to the SLS system. From this point on the short term loan is treated like any other loan, unless it becomes delinquent.

18.5 Maintenance

The SLO receives a list, called the Tuition Report, from the Registrar's office each month that shows the names, id number, course, year, and units, for all registered students. This list is compared by hand with the Status Report. Name changes are noted, to eventually be

put into the SLO system, and a list is made of students who have loans and who are no longer registered. This list is double checked against the Registrar's database to be sure that the students are really not at MIT. The folders of the remaining students on the list are checked to see if the student had an exit interview. If the student did have an exit interview then the repayment terms are entered into the SLS and the status of the account is changed to show that it has entered the grace period. A list of those students who have not had interviews is given to the collectors to take care of. The number of students on this final list varies with the time of year but averages about 10 per week.

18.6 Exit Interview

When each student who has a loan leaves MIT, he or she must have an exit interview. This interview is used to explain to the student his or her rights and responsibilities, to obtain one or more addresses where the student can be reached, and to explain the repayment terms. The exit interviews are performed by the collectors, the collector supervisor, and the administrative staff.

Each semester the SLS generates a list of students who have petitioned for a degree. This list is generated from a list that the SLO receives from Student Accounts, who get it from the Registrar's Office. The list is checked, by a SLS program, for students who have loans to repay and the names of these students are entered into the WP. The WP prints letters asking the students to make an appointment to come in to the SLO for an exit interview. These letters are sent to the students along with cards asking the student for the three best times for the interview. The student returns the card with his selections. The collection support person schedules the students based on their selections and sends each student a note telling him when his interview is. If the student does not return the card, a second letter is sent saying that the student will be withdrawn from the degree list if he does not make an appointment. Approximately one third of the students on the degree list receive the second letter. If the student still does not make an appointment, he is withdrawn from the degree list. As yet this has never happened. If the student is continuing on for graduate study at MIT he does not have to come in for an interview but must tell the SLO that he is staying. The June degree list typically has about 500 to 600 people who must be interviewed and the September and February lists typically have about 200 people each.

At the same time as the above procedure, before the exit interviews actually happen, a special program is run on the SLS to extract the names of those students who are expected to graduate at the end of the current semester. The SLS generates repayment terms and disclosure forms for these people. The forms are put into the student's folder. Note that the forms are not generated for those who actually are graduating but for those who are expected to graduate. Even if the student is not graduating at this time, the forms are put into his folder so that when the student actually does graduate the forms are there. Usually if the graduation date changes and the SLO knows about it, the new expected graduation date is entered into the SLS so that forms will be generated again at the appropriate time. If, at the appropriate time, more forms are generated, and they are different from the old forms, the old forms are destroyed. However the SLO does not always have a new expected graduation date, so that when the student actually does graduate no forms may be generated. If for some reason the student has no forms, the interviewer must fill out the forms by hand at the exit interview.

Each exit interview takes about 15 minutes. The interviewer explains and gets signatures on, the following forms

- The Repayment Schedule. This form lists the loans that the student is repaying, the interest and the monthly payments for all the loans taken together. The student gets the copy and the original is kept in the student's folder.

- A Disclosure of Finance Charges for each loan. This form shows the detail of the finance charges for each loan. It is the truth in lending form that is required by law for all loans. The student gets the copy, the original is kept in the student's folder.

- A Loan Information Form. This is a form, filled out by the student, which gives general information about the student. It is kept in the student's folder.

The interviewer explains that the student has a grace period before he must start paying back the loan and tells the student what happens if payments are made during the grace period and if that might help him. The interviewer also explains that it is written in the loan contract that the student must inform the SLO of any changes of address that may occur while he is repaying the loan. If the student is going on to graduate school or qualifies for any other special deferments the interviewer explains what deferment forms must be filled out and where to send them. The interviewer also does some basic financial counseling.

For example, if the borrower is planning to pay back the loans more quickly than is required, the interviewer might explain which ones are best paid off first.

Students who do not come to the scheduled interview are called to see if another interview can be scheduled. Approximately 9 out of 10 students who graduate in June do come in for the interview. Students who graduate in September and February have often already left the campus and were just finishing off a degree. These students are less likely to come in for the interview. The students who do not have an interview are mailed the appropriate forms and information. When the forms are returned signed, the interviewer mails the student his copy (if he did not already take it) and puts the other copies in the student's folder.

Copies of all of the forms mentioned in this section, as well as a check list that is sent to students who do their forms by mail, are included in the appendix of this report.

18.7 Billing

After the exit interview, the billing procedure starts. It involves activating the account, entering the repayment terms into the SLS, warning the student of the end of the grace period, and billing the borrower until he has paid in full.

During the grace period each borrower receives three letters. These letters are required by the government for NDSL loans and are sent to all borrowers regardless of the type of loan that they have. The first letter reiterates the repayment terms and reminds the student that he must inform the SLO of any change of address. The second letter is sent after 7 months and warns the borrower that the grace period is ending and his loan is coming due. The third letter is sent after 8 months and tells the borrower that the grace period will be over in 30 days and a bill is coming. These letters are generated on the WP. Letters are sent twice each month, with about half of the total letters being sent each time. The number of letters sent each month varies depending on the month, that is, how long ago a class graduated. Some months there will be no letters and other months there may be as many as 800.

Each month the clerical staff goes through the Status Report by hand looking for loans, short or long term, which need to be activated. These could be loans which are at the end of

their grace period and for which there is no deferment, loans for which a deferment has ended, and new short term loans. The status of these accounts is changed in the SLS to show that they have entered repayment. The monthly check also looks for obvious errors with any account.

Active accounts are billed monthly and quarterly. Only older accounts are billed quarterly, newer accounts are billed monthly. The bills are generated by the SLS. Approximately 5000 bills are sent out each month. Before the bills are sent they are reviewed to check for obvious errors. Bills with obvious mistakes are removed, as are bills for students who have written or called to change an address or question the amount of a bill. Mistakes and changed addresses are corrected and then the bills are sent. Bills about which there is a question are kept until the question is answered, then corrected as necessary and sent. Approximately 100 bills require special handling each month.

A return envelope is provided with the bill so that the borrowers send their checks to a bank where they are handled through a lockbox system. The bank makes a daily tape of all transactions on MIT's accounts and sends that to the Accounts Receivable Office. A copy of the parts of this tape that are relevant to the SLO is eventually given to the accountant and is used to update the SLS. Every third day or so the bank sends the SLO copies of the bills that have been returned and whose payment has cleared the bank. The bank also sends back any envelopes which have changes of address on them. The bills and envelopes are checked for changes of address, overpayment, and comments from the borrower. If either of the first two is present the account is adjusted accordingly. Approximately one quarter to one third of all the bills returned require this type of special handling. The bill also has a space on the back for the person to check if he is eligible for any type of deferment. The bills are examined for these checks and processed as follows. If the student is still at MIT, the Registrar's database is checked to verify the claim, and if true, the account is made inactive again. If the student is eligible for any other type of deferment, the appropriate forms are sent and billing continues until the forms are returned.

When the bills are sent out, copies are kept on a shelf so as to be able to answer questions. These copies are thrown away when a new bill is sent. The copies that are returned from the bank are kept in boxes in the vault for two years, then destroyed. These transactions are also recorded on the computer tape that comes from Accounts Receivable

and the tapes are kept indefinitely in the vault.

Occasionally a person will send payment directly to the SLO or will come in to pay the bill in person. If the person does not send the bill with the check then the clerk must look in the Status Report and try to figure out how to apply the payment. The payment is recorded in a log, a deposit slip is filled out, and the check, deposit slip and log sheets are sent to the Cashier's Office. A receipt is sent to the borrower if requested. Cash payments are handled through the cash box. Once every week or two the receipts and money in the cash box are balanced and are sent to the Cashier's Office.

18.8 Paid in Full

The SLS generates a list twice each month of accounts that have been paid in full. Typically a person will have more than one loan to pay so if the person is still paying on other loans nothing happens. However, if the person has paid off all loans then a letter is generated by the WP saying so. The letter and the canceled loan note are sent to the person. Approximately 10 to 20 people are paid in full each month. When a person is totally paid in full, his folders are pulled out of the general file and kept in a separate filing cabinet in the vault in alphabetical order for two to three years. They are then destroyed. If a person requests the canceled loan note for a loan that he has finished paying but he still has other loans to pay, he is sent that canceled loan note. The paid in full procedure is supposed to happen every time the books are closed but usually happens once every few months.

18.9 Other Related Activities

The SLO handles other activities related to Student Loans. Some of these are necessary to the maintenance of their records and others are not related so directly to the Student Loans.

The SLO is constantly receiving questions and updates on the status of various loans. These questions and updates take several forms

- Change of Address. The SLO gets letters and phone calls from borrowers informing them of changes of address. The new addresses need to be entered into the SLS (via keypunch forms). Other sources of new addresses are the collectors and the receipts from the lock box account.

- Prepayment or Overpayment. A borrower may decide to pay ahead a few months so as not to have to pay then. The account needs to be adjusted and any bills for these accounts that may be generated need to be removed from those that are to be mailed. Alternatively a borrower may want to pay off a part of the account but still get bills to pay as usual. Again, adjustments need to happen. These adjustments are recorded in the Status Report and are entered into the SLS via keypunch.

- Questions. Borrowers may call or write with questions about their accounts. These questions need to be answered. Copies of all correspondence are put into the student's folder. Any questions about delinquent accounts are referred to the collectors. Questions are only answered if the borrower inquires; information about the status of the loans is not given to anyone else. The only exception is if two people signed the loan, in which case questions from either of the signers will be answered.

- Deferment Forms. The SLO receives deferment forms from borrowers who have left MIT but who have continued to be students elsewhere or who are eligible for some other type of deferment. The accounts are marked as deferred and if they were active are made inactive again. The date when the deferment ends is also entered into the system. As usual, the changes are made via keypunch.

The SLO sometimes gets requests for credit references. The credit agency sends a form for the SLO to fill out. The student's accounts are checked. If the account is all right then the form is filled out and returned. If the account is delinquent then the form and request go to the collectors. In any week the SLO may get as many as ten such requests or they may get none.

19. Collection

The collection procedure has several variations, the usual collection procedure, foreign students, skip tracing, and short term loans. The purpose of this procedure is to get borrowers who are behind in their payments to pay the money that they owe. The procedure consists primarily of notifying borrowers that they are behind on their payments, and working with these borrowers to find ways to bring their accounts up to date again. There used to be a fair amount of leeway in the time constraints on this procedure that the collectors could use at their discretion to help the borrowers. However, the government, which backs most of the loans, has recently started requiring that loans which are more that 90 days delinquent be turned over to outside collection.

There are approximately 2000 loans that are delinquent at any time. Since there are approximately 5000 accounts that are in repayment and since it usually takes about 10 years for an account to be paid off, most of the accounts become delinquent at some point during repayment simply due to the inevitable problems that life brings to the borrowers.

19.1 Environment

The collectors each have a cubicle with a desk, telephone, typewriter, adding machine, and a microfiche reader. The full time support person for the collectors has a desk near the terminal and printer for the WP. The computer part of the WP is in another room. The part time support person is one of the clerical staff who sits behind the front counter. This person is responsible for helping with skip tracing.

19.2 Databases

The collectors make very heavy use of the Status Report and of the file of folders, to check names, addresses, repayment terms, and other items of interest. They also use the various delinquency reports and the lists generated by the WP to know who to keep in

contact with. For skip tracing the collectors use a lot of databases, most of which are listed in the appendix.

19.3 Collecting

Twice each month a list of the accounts that are delinquent is generated by the SLS. This list is actually two lists, one ordered by name, the other ordered by how long the account has been delinquent. These lists are used to send standard form letters to the borrower as follows. When the person misses a payment, a letter is sent 15 days after the bill was due reminding the person to pay. If he still does not pay, a letter is sent after 30 days, then 60 days, then 90 days. Each letter is worded more strongly than the last. The letter at 60 days warns the person that his loans have been accelerated, that is, the full amount of all his loans is now due, and says that if he does not pay, all of his student loans from MIT will be turned over to an outside collection agency. The 90 day letter informs the person that this has been done. If, at any time, the borrower pays the total amount that he owes to date, the account stops being delinquent. The only other way for the borrower to stop this process is to call one of the collectors and explain why he could not pay. If he shows willingness to work on repayment and if his situation is really bad enough to justify it, the collectors can suspend this process in various ways (described below) to give him time to get started again.

The letters to the borrowers are generated by the WP. The names and addresses of borrowers that are not already in the WP are entered from the lists generated by the SLS. Letters are sent twice a month, with half of the total letters for the month being sent each time. Approximately 200 15- and 30-day notices are sent each month and about 150 60- and 90-day letters.

Possibly when an account becomes one month delinquent, and certainly when it becomes two months delinquent, the collectors start calling. They make every effort to reach the person and to find out what has happened, since if they know that something is wrong they can often explain options that the borrower may not have been aware of. Each time a collector contacts a borrower, the contact must be recorded on a Borrower Contact form (see appendix). This form shows how and when the contact was made, or attempted, and what the results, if any, were. These forms are kept in the person's folder to provide a

history. They are also used to show the government auditors that every effort has been made to collect.

The information from the Borrower Contact forms is also entered into the WP including what, if any, terms were agreed on and when a collector should look at the account again for any reason. This information can be accessed by date and is used to make tickle lists for the collectors. The collectors usually ask for one of these lists, tailored to a specific purpose, each day.

19.3.1 FISL Variation

A variation on this procedure is carried out for FISL loans. When the account becomes 30 days delinquent, the U.S. Department of Education (DoE) office in Boston is sent special 30 day notices (see appendix) with the name of the borrower already filled in. The DoE sends these notices to the borrowers. If the student does not respond to these letters another form, a 48-hour notice saying that the borrower has 48 hours to pay before the account is turned over for collection, is sent to the DoE which sends it on to the borrower. The collectors make one last effort to contact the borrower but if nothing is heard from him, the loan must be turned over to the government for collection. When the loan is turned over, the loan note is sent to the DoE and the loan is deleted from the Status Report. No more record of the loan is kept although a copy of the loan note does appear in the borrower's file. At the same time, final demand letters are generated for all of the other loans that the borrower has and the usual final demand procedure is followed (see below). The government reimburses the SLO for the FISL loans. To be reimbursed the SLO must send a form for each such loan to the government. A check is eventually sent to the SLO and the amount is posted to the borrowers account. This whole procedure is new and there are no figures yet for it, since the collectors are still going back through the books to catch all FISL loans to which it applies.

The letters are sent to the DoE once each month, less often if there are no names to report. The collectors also keep a list of all people who were sent the FISL 30-day notice. This list is used to keep track of the other steps in the process. The borrowers can stop the process at any time by contacting the collectors. The DoE only sends the letters that the SLO gives it to send. Thus if a borrower contacts one of the collectors and starts working out ways to repay, his name will not be sent to the DoE and the process will have stopped.

19.3.2 Extensions, Deferments, and Cancellations

When a borrower falls behind in his payments it is usually because he is having trouble with his finances. The collectors have several options that they may use to help the borrower get back to a sounder financial situation so that he can meet his payments. These options range from short term extensions to, in cases of total disability or death, total cancellation of the loan.

Before granting any extension, deferment, or cancellation, the collector checks to be sure that what the borrower has said is true. The methods for this vary from case to case but usually include a credit check of some sort, either through the TRW terminal or through a request to a credit bureau.

If the problem sounds like one that can be resolved in less than six months the collector may give the borrower an extension. Although there is much variation from case to case, this usually means that the borrower need only pay the interest. Extensions are granted for a three month period and may be renewed once.

If the problem will take more than six months to resolve, and if it is severe enough to warrant it, the collector may give the borrower a hardship deferment. The borrower must file the hardship deferment form with the SLO and must also send the collector a copy of his most recent income tax forms and a complete financial statement. When all of this material has arrived the collectors as a group decide whether or not to give the deferment. If granted, the deferment is good for six months and can be renewed for an additional six months.

In the most drastic cases, such as complete disability or death, the director can decide to cancel a loan. For NDSL loans, the loss is absorbed by the government. The SLO can collect the amount of the loan plus 90 days interest from the government if the loan was from the FISL program. If the loan was funded by MIT then the MIT loan funds absorb the loss.

The above options may seem impossible to use with the government being so strict about 90 day time limits, but in fact the collectors can use these options if they show due diligence. Also most of the new rules do not apply to loans that became active before the rules went into effect. Due diligence for government loans means that the collectors must have either been in contact with the borrower at least once every 30 days or there must be a deferment

or extension. These requirements, coupled with keeping track of borrowers who have deferments produce the following statistics. Each collector makes approximately 130 contacts in each two week period with borrowers for whom new terms have been set. Each collector follows up on about 20 hardship deferments in each two week period. And finally, each collector makes about 60 contacts in each two week period with borrowers for whom no terms have yet been set.

19.3.3 Outside Collection

If a loan must be turned over for outside collection, the borrower is sent a final demand letter informing him of the fact and telling him that he has 10 days in which to pay off the loan completely before this happens. When one loan must be turned over for outside collection, all of the borrower's other loans are also turned over. This is a very drastic step so before a final demand letter is sent, the collector discusses it with the collector supervisor to be sure that it really must be sent.

If the borrower pays off what he owes on all of his loans within the 10 day limit, the loans are treated like any other loan that has been paid in full and they do not go to outside collection. About 80% of the borrowers who receive the final demand letter are able to pay back their loans by the end of the 10 days. Those who do not pay are sent to an outside collection agency.

The SLO uses two outside collection agencies. Loans that are being sent out for the first time all go to one agency. The collector fills out a form giving the name, address, phone number, and amount owed. These forms are sent to the agency by the collector supervisor about once per month. The agency is not sent any other material although the SLO will provide copies of some documents on request. The collection agency works on collecting the loan until either the loan is paid in full, in which case it is treated like any other paid in full loan, or the SLO asks for the loan back. The SLO requests loans back only when no progress has been made by the collection agency. Periodically the collector supervisor asks the agency to check its books and to report on the complete history of any loans for which no payment is being received. When the SLO requests the return of loans or when, as sometimes happens, the agency determines that the loan is uncollectable, the SLO then sends these loans on to a second collection agency. If the loan was a NDSL loan, the SLO also has the option of returning the loan to the government for collection.

Approximately 175 accounts are with outside collection agencies at any time. The first collection agency charges one third of the amount recovered as its fee. The second agency charges one half of the amount recovered. These charges are standard for the industry. The SLO currently pays for the cost of outside collection but that will probably change. Some government loans already have clauses that make the borrower responsible for outside collection costs, and it seems likely that most future loans will also have such clauses.

The collection agencies send a report to the SLO once each month showing the amount of money collected and the amount deducted for their fees. The remaining amount is sent as a check. The amounts sent for each account are credited to that borrower's account.

19.4 Foreign Students

Foreign students present several special problems. They are required to pay the loan in US dollars and sometimes they simply cannot. Their country may not let them send money out of the country, or the salaries in their home country may be so low compared to the loan payments that they cannot pay. The collectors make every effort to help the foreign borrowers who want to pay work out ways that they can get the money, or at least part of the money, to the US. In special cases such as these, the collectors try at least to get the students to pay enough to cover the interest, if not the principal. The collectors also encourage the foreign students who are remaining in the US for the year that is allowed for job training after they graduate to use the money that they earn to pay back at least part of the loan. The collectors keep a file of information on countries which have currency restrictions or which present other problems for borrowers. The file includes information on techniques that have worked for that country in the past.

Almost all contact with the foreign borrowers after they return to their home countries is conducted by letter. This poses several problems in that it is often harder to keep track of these students, and the mails in their countries may or may not be reliable. Also once a foreign borrower is lost, it is much harder to find him again. Almost all such cases have to be written off as never paying. Even if the SLO knows where to find a foreign student, if he chooses not to pay there is very little that they can do since they do not deal with collection agencies in any other country except Canada. A result of all this is a new policy that foreign

students must have cosigners on their loans who live in the US. These people will be easier to track down and the SLO hopes to have to write off fewer accounts in the future.

Several techniques have been developed to help with these problems. The SLO sends a letter to every foreign student when he returns home saying that he has a debt and stating the amount. The borrower can give this letter to his government to help persuade them to let him send money out of the country. For foreign borrowers where repayment is impossible, the collectors encourage the borrower to pay for the education of another student from his country, either in his home country or in the US. Where repayment is possible, the SLO deals with foreign credit bureaus to check borrower's stories as to why they cannot pay. Finally, since so many loans to foreign students do end up being written off, MIT has set up a special fund that absorbs these losses. All of the loans to foreign students come from the Tech Fund since the government will not let foreign students have NDSL or FISL loans.

19.5 Skip Tracing

Another part of the collection process is tracing people for whom the SLO does not have a current address. This part of the procedure is very much an art. The collectors are reasonably familiar with the names of their lost people and they are constantly on the watch for them. They will use such resources as the phone books, Who's Who, alumni magazines, parent's addresses, and technical journals to try to find the people. Skip tracing is very time consuming so that there is a constant backlog of skips to trace. Whenever they have any spare time, the collectors spend it doing skip traces. In addition, in everything they do, at home or at work, they are constantly looking for leads.

Recently much of the fairly straight forward skip tracing has been turned over to one of the support staff. The procedure is somewhat as follows. The person checks with the Registrar's Office to see if the student is still at MIT. If not, the next step is to check with the Alumni Office. The Alumni Office makes a microfiche listing of the names, phone numbers and addresses, home, former, and parents, of all people who have received degrees from MIT. This list appears once each month with an additional update once every two weeks. If the borrower does not appear on this list or if the information seems out of date, the next step is to check with the Alumni Office directly to see if they have any more recent

information. If this fails, the next step is to check with the person's department, since many borrowers maintain contact with their departments long after they leave MIT. These methods usually suffice to find about three quarters of the recently delinquent borrowers.

An alternate procedure, used primarily with borrowers who have been delinquent for a long time, would be to check the borrower's folder to see if there has been a pattern to his movements. Sometimes, from information in the folder, educated guesses can be made as to what school the borrower is currently at or what city he is in. From there it is a matter of using phone books and tracking down leads. Another procedure might start with the borrower's parents, asking them for information as to where he might be. Or alternatively, some of the loan applications, available on request from the Financial Aid Office, show a friend or relative who can be contacted to try to trace the borrower.

The collection part of the SLO has existed for only five years so there are many borrowers on the books who have been delinquent and lost for long periods of time. In addition, the government has only just started being so strict about the 90-day time limit, so that many people were lost as the collectors were trying to work with them. These people are slowly being tracked down, and as they are found new terms are worked out that will pay off their accounts by the end of the term of the loan. The collectors are strict with these people and will turn them over for outside collection if they do not cooperate.

19.6 Short Term Loans

These loans are somewhat different in that when they become delinquent the students are still at MIT. The short term loans follow the same regular procedure as the long term loans except that they are not turned over to outside agencies. Instead, the SLO has certain powers that it can use to try to force the student to pay. The SLO has the following options

- The SLO denies short term loans to anyone who has a delinquent short term loan. In a few cases where a real emergency exists, or there are extenuating circumstances, as determined by a collector, the collector may choose not to deny the short term loan.

- The SLO withholds registration stickers for MIT students who have delinquent accounts. This method works well with the students who intended to pay but forgot. It has no force with some students who do not care if they get their registration stickers.

- The SLO has recently acquired the jurisdiction to withdraw students from MIT if they are delinquent. This power is used only in the more serious cases. However the SLO hopes that word will get around that they are doing this and that students will be better about paying off their loans.

- The SLO has another new power to withhold diplomas from those who are on the degree list who have delinquent accounts. This power is used only in the most serious cases.

The collectors can also choose to use one of these options with a borrower who is delinquent on a long term loan who comes back to MIT as a student.

If a student has not finished paying off a short term loan at the time he graduates, one of two things can happen. If he will be paying off long term loans, the student is informed at his exit interview that the remaining amount on the short term loan is due immediately. If he still does not pay, his first few payments on the long term loan will go only to the interest with the remaining portion going to the short term loan until it is paid off. This will put the former student behind in his payments and cause his long term account to become delinquent. The collectors will catch the account after awhile, see what happened, then try to contact the person to tell him what happened and to work out ways to bring him up to date. If the student will not be paying off a long term loan after graduation, the collectors try to collect on it, although this is difficult since they have very little information about the borrower. These loans can also be turned over for outside collection if necessary. Most of the students who still owe on short term loans also owe on long term loans so that not many short term loans get turned over for outside collection.

20. Other Functions

There are three other types of procedures that are handled by the SLO. There is an accounting procedure, a generation of reports procedure, and some miscellaneous other activities.

20.1 Accounting

The accounting procedure is reasonably straight forward. The accountant closes the books twice each month. And at the end of the fiscal year the accountant does a final, detailed adjustment and balancing of the books. Most of the work in keeping the books is done by the SLS. The accountant runs the SLS and does any checking that may be necessary to find out what went wrong when the books do not balance.

The SLS gets input from the clerical staff and the collectors via keypunch forms and punched cards, as well as from the transaction tape showing cash receipts that is sent from the Accounting Office. The SLS system is run twice each month to create a new set of books and various reports.

As part of the accounting function various automated procedures are performed once each year. These procedures are

- Audit Confirmation Letters. In June, at the end of the fiscal year, 100 letters are generated on a random basis and are sent to the outside auditors. Each letter show the balance still due for a certain account. The auditors send these letters to the borrowers whose accounts were chosen and ask for a response as to whether the figures are correct.

- Paid in Full. At the end of each fiscal year the SLS is purged of all accounts that have become paid in full during the previous year. Dummy accounts that result from the merging of several accounts are also purged.

- Interest Letters. At the end of each calendar year, letters are generated showing the total amount of interest that each borrower who is repaying a

loan has payed during the last year. The letters are required by law and are used by the borrowers for tax purposes.

- ID changes. Twice each year the SLS system is updated for changes in student identification numbers. These changes are obtained from students, former students, and from the Registrar's Office.

20.2 Reports

The SLO sends reports to the government and the MIT administration. In addition they generate a few internal reports for their own use. The accountant and the director generate all reports.

20.2.1 Monthly Reports

There are two monthly reports. The first is the Lender's Manifest Report which goes to the government. It shows information about all FISL loans including how many accounts have started repayment, how many were paid in full, how many loans were disbursed, and the amounts for all of these categories. The report is generated by the SLS. The accountant checks it to be sure that it looks correct. The other report is an internal report called the Gap Report. It shows fund by fund how much money is available and how much has been spent. This report is generated by hand.

20.2.2 Quarterly Reports

Each quarter a bill must be sent to the government for payment on all FISL loans. This bill covers the interest on the loans and an allowance for managing the loans. This bill is generated by hand from information compiled from the Monthly Fund Information List.

20.2.3 Yearly Reports

There are quite a few yearly reports, all due at different times. The first report is to the NDSL program. It is a cumulative report showing numbers from the time that NDSL started at MIT. It shows the number of borrowers, and how payments have been made, by repayment, by cancellation, or by being turned over to the government for collection. It also shows numbers for loans which have delinquent or default status. Part of this report is generated by hand, part by a special program from SLS. It is generated based on a fiscal

year that ends at the end of June and the report is due at the end of October.

Another yearly report is the report made to the FISL program. This report shows how much money has been spent and how much collected. It is generated by hand and by a special program from SLS. The report is based on a fiscal year that ends at the end of September and the report is due at the end of November.

Yet another set of yearly reports are the schedules that are generated for the MIT Treasurer's report. One of these is the C11 schedule which shows for all accounts the balances, how the money was disbursed, what income was generated, etc. The other report is the C9 schedule which shows the same information but only for accounts that came from MIT's endowment. Both are generated at the end of MIT's fiscal year.

20.3 Miscellaneous Procedures

Since the SLO has a cash box for cash payments of loans, the Registrar's Office has students pay for their transcripts at the SLO. This is much easier for the students than going all the way across campus to the Cashier's Office and then back again.

21. Exception Handling

The only major exceptions to these procedures occur when personnel are missing. For the most part if a few people are out for a few days the office proceeds as normal. Most of the work in this office can usually keep for a few days. The only urgent work is to deal with phone calls and with students who come into the office for various reasons. One potential source of trouble is that only two people currently know how to run the WP so that if both of them were not available for a week or two there would be problems. There are plans to train additional people to use the WP. The computer systems are fairly reliable and have not yet caused major problems. At worst, there are sometimes problems with the SLS because of bad cards or what not. This happens perhaps two or three times a year. If the situation is bad enough sometimes the bills are sent a little late and the date that the payments are due is extended by a few days.

Appendix VII. Databases

This appendix contains descriptions of each major database used in the SLO. These databases include computer generated reports, physical files, computerized databases, and any other important sources of information used in the SLO.

VII.1 General Databases

These are sources of information used by most people in the SLO.

Status Report — A complete listing of all accounts showing the name of the borrower, class, date (or expected date) of graduation, course, degree, type of loan, amount of loan, status of loan, and any other relevant information. This report is generated by the SLS twice each month and a copy is placed in each section of the office. There are plans to put this report on microfiche.

Registrar's Database — This database is maintained by the Registrar's office. It contains information about each student, including name, address, year, course, etc. The SLO uses it to see if a student is registered, if the student has been given a loan, and to mark that a student has signed a loan note. It is available interactively through a terminal.

Folders File — This file is kept in the vault and contains one folder for each type of loan that a borrower has. The folders contain the loan note, copies of all correspondence, copies of borrower contact forms, and any other material relevant to the loan. The folders are stored until two years after all accounts for that borrower are paid in full.

VII.2 Collector's Databases

The collectors use several databases that are not used by the rest of the SLO. In addition to those included on this list, the collectors use every source of information that they can think of for doing skip traces. The major sources of skip trace information are included but it would be impossible to give an exhaustive list.

Delinquent Report This report is generated from the Status Report and appears twice each month. It shows information about each account that is delinquent. The accounts are ordered alphabetically by the name of the borrower. This report has entries for about 2000 accounts. It is archived on tape in the vault for several years.

Aging Report This report shows the delinquent accounts ordered by length of delinquency and within that by name. This report also includes addresses for each borrower as well as grand totals for each fund.

Selective Aging Report
This report is different each month. It contains information about specific sets of delinquent accounts as requested by the collectors. Each collector gets the report.

Delinquent Short Term Accounts
This is version of the Selective Aging Report which shows only short term accounts.

Country File This is a card file ordered by country of information about countries with currency restrictions or other problems for foreign students who are trying to pay back loans.

Tickler File Each collector maintains a tickler file of some sort. The details vary from person to person.

MIT Student Report
A listing, produced by the Registrar's Office, of every person who has ever been a student at MIT. Includes name, Id number, degree, and last date of attendance. Comes in two flavors, ordered by name or by id number.

TRW Credit The SLO has a terminal that connects to the TRW credit system that the collectors can use for credit checks.

Alumni List The alumni office sends out a list each month with the name, address, work address, former address, and parent's address, of each person who received a degree from MIT. An update to this list appears once a month also. The list is distributed on microfiche.

Cole's Crossreference Directory
A directory made for most cities that has two sections. One shows the address of each phone number, the other shows the name of all people who live at a given address.

R.L. Polk Directory A directory made for most cities which shows who lives at each address, what they do, how many children there are, etc. There is also a service where subscribers can call in for that information for cities that they do not have directories for.

The collectors also keep telephone books for most metropolitan areas as well as Boston area phone books for the last few years. They also use MIT student directories, MIT phone books, alumni directories, and all the resources of the main MIT library.

VII.3 SLS Reports

This section lists all reports that are generated by the SLS that have not already been described.

Control Totals — Used for accounting purposes. Shows the current balances in various accounts. These balances are compared with the ones for the previous report to check that the correct tape is in use.

Detailed Transaction Report
Shows all processing that was done by SLS. Used for resolving questions and problems with accounts.

Monthly Fund Information Listing
Lists for each source of funds for loans how many loans are active or inactive, and the total number of accounts. Used by the accountant and the director for government reports and internal management reports.

Lender's Manifest — Generated for government report of same name.

General Ledger Entries
Used to make monthly journal entries into the MIT accounting system.

Social Security Number Changes
Generated twice each year. Shows old and new numbers. Used by the accountant as a crossreference.

Fund Table — Lists funds by account number and name. Shows how much money each fund has. Not used very much except to know what is on the books and in case of major changes.

Address Listing — Generated once each month. Lists the addresses of all borrowers.

Paid in Full — Shows all accounts that have become paid in full since the last run.

VII.4 Other Reports

This section lists all of the other reports and lists used by people in the SLO.

Tuition Report — A list generated by the Registrar's Office once each month which shows all students who have paid their tuition and therefore are registered

students. It lists the name, id number, course, year, and units for each such student.

VII.5 Logs

This section lists all of the logs that are used in the SLO.

Short Term Loan Log
: This is a log of all short term loans. The loans are recorded as the students bring them in. The information in the log is entered into the SLS via keypunch.

Cash Receipts Log
: This log shows the payments made by borrowers directly to the SLO. The name, check number, and amount are entered in the log. A copy of this log goes to the Cashier's Office. The information in this log is entered into the SLS via keypunch.

Appendix VIII. Selected Forms

The next few pages, in order, provide copies of the

1. Exit Interview form,
2. Disclosure of Finance Charges form,
3. Loan Information form,
4. Request for Deferment form,
5. Borrower contact form,
6. First Delinquent Warning letter,

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LOAN OFFICE E19-225
77 Massachusetts Avenue
Cambridge, Massachusetts 02139

EXIT INTERVIEW

REPAYMENT SCHEDULE

Date _____

Name _____ I.D. No. _____

Permanent Address _____ Phone _____

Foreign National _____ Visa Type _____ Permanent Resident _____ Permanent Resident No. _____

Degree _____ Termination Date _____ Course _____ Class Year _____

Schedule of Loans

Loan Fund	(S) (U)	Number of Payments	Date First Installment Due	Number of Payments Annually	Monthly Payment Principal and Interest	Annual % Rate	Unpaid Principal Balance	Finance Charges
						%		
						%		
						%		
						%		
						%		
						%		
						%		
TOTALS								

*When paid according to this schedule.

(S) SUBSIDIZED LOAN. No interest charge for in-school and grace period.

(U) UNSUBSIDIZED LOAN. Interest accrues from 1st of month after date of signing. Repayment Schedule does not reflect in-school and grace period charges. Monthly bills will be sent during the grace period to inform you of the dolla amount accruing.

REPAYMENT OF ALL ACCRUED INTEREST IS DUE IN FULL _____

GRACE PERIOD EXPIRES _____ DEFERMENT is granted annually: Your deferment forms are due each _____

_____ SHORT TERM LOANS must be paid according to the terms of the loan. (list amounts and due dates) _____

EDUCATIONAL LOANS NOT HELD BY M.I.T.

Lender _____ Monthly Payment _____ Unpaid Balance _____

M.I.T. Representative _____ Borrower Signature _____

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LOAN OFFICE E19-225
77 Massachusetts Avenue
Cambridge, Massachusetts 02139

DISCLOSURE OF FINANCE CHARGES

_____ Loan

1. For purpose of the repayment agreement, the FINANCE CHARGE begins to accrue _____, ___, _____. (month, day, year)

2. Amount Financed (Unpaid principal balance (s)) $_____

3. FINANCE CHARGE (interest to be paid during repayment period) $_____

4. Number and amount of payments: _____ payments at $_____
   Final payment of $_____
   Total of payments $_____

5. Due date of payments: commencing _____, ___, _____ (month, day, year) and the same date of each month thereafter.

6. ANNUAL PERCENTAGE RATE _____%.

7. Delinquency and Default Charges: Reasonable attorney's fees, and other charges necessary for the collection of any amount not paid when due, may be charged. Any obligation of the U.S. Commissioner of Education to pay interest shall terminate upon default by the borrower (as defined by Regulations of the U.S. Commissioner of Education).

8. Acceleration of Maturity Date by Prepayment: The maker may, at his option, and without penalty, prepay all or any part of the principal plus the accrued interest at any time. In the event of such prepayment, the maker shall be entitled to a rebate of unearned interest computed by the actuarial method.

_____ _____
Date Signature - Lender's Representative

The maker acknowledges receipt of an exact copy of this statement.

_____ _____
Date Signature - Maker

_____
Address

_____

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Student Loan Office E19-225
77 Massachusetts Avenue
Cambridge, Massachusetts 02139

LOAN INFORMATION

Date_____

Name_____ I.D. No._____

Term Address_____ Phone_____

Permanent Address_____ Phone_____

Parents Name_____ Phone_____

Address_____

Name and address of closest relative that could forward mail_____

_____

Degree_____ Termination Date_____ Course_____

Foreign National_____ Visa Type_____ Perm. Resident_____ No._____

Secondary schools or colleges attended other than M.I.T._____

_____

FUTURE PLANS

1. Occupation_____
2. Work for whom_____
3. Will you be eligible to apply for a deferment due to the following:
   (a) Graduate School_____
   (expected termination)_____
   (b) Military, Peace Corps, VISTA Service_____
   (expected termination)_____
4. Other(explain)_____

Please list any educational loans other than those administered by M.I.T. you may have with banks, state agencies, private lending institutions, or other schools.

Lender	Amount Outstanding	Monthly Payment

All students having loans with M.I.T. must report to the Student Loan Office for an Exit Interview on termination of at least half-time student status at the Institute.

All terminating foreign students must also report to the Foreign Student Office

Failure to comply with the above could adversely affect your standing on the degree list.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF EDUCATION
WASHINGTON, D.C. 20202

BUREAU OF THE BUDGET NO. 51-R730
APPROVAL EXPIRES: 9/30/71

REQUEST FOR DEFERMENT OF REPAYMENT BECAUSE OF ARMED FORCES, STUDENT, PEACE CORPS, OR VISTA STATUS

(For Loans Insured or Guaranteed under the Provisions of the Higher Education Act of 1965, Title IV, Part B, P.L. 89-329)

LENDING INSTITUTION ACTION

☐ APPROVED ☐ DISAPPROVED | DATE

NAME OF OFFICIAL

INSTRUCTIONS: File form with the lending institution from which loan was obtained (1) When first repayment installment is due following borrower's re-enrollment in at least full-time student status, or entrance into Armed Forces, Peace Corps, or full-time VISTA Status, and (2) Report any change of status IMMEDIATELY to the lending institution, and (3) File a report of status AT LEAST ONCE ANNUALLY.

PART I - REQUEST FOR SUSPENSION OF PAYMENT *(To be completed by borrower)*

NAME OF BORROWER

ADDRESS *(Number, Street, City, State, ZIP Code)*

SOCIAL SECURITY NUMBER

MILITARY SERVICE NUMBER

NAME AND ADDRESS OF LENDING INSTITUTION *(Include ZIP code)*
Massachusetts Institute of Technology
77 Massachusetts Ave., Rm E19-225
Cambridge, Mass. 02139

I CERTIFY that I am

☐ A MEMBER OF THE ARMED FORCES ON ACTIVE DUTY

☐ IN PEACE CORPS VOLUNTEER SERVICE

☐ IN FULL-TIME SERVICE IN VOLUNTEERS IN SERVICE TO AMERICA *(VISTA)*

☐ PURSUING A FULL-TIME COURSE OF STUDY IN AN INSTITUTION OF POST-SECONDARY EDUCATION

FOR THE PERIOD OF → FROM *(Month and year)* | TO *(Month and year)*

I claim exemption from payment of principal on my insured or guaranteed student loan during the period indicated above. I agree to notify the lending institution immediately upon termination of my claimed status.

SIGNATURE OF BORROWER | DATE

PART II - CERTIFICATION OF STATUS

To be completed by the registrar of the educational institution or military commanding officer, Peace Corps volunteers will forward to DIVISION OF VOLUNTEER SUPPORT, Peace Corps, Washington, D.C. 20525, for completion of Part II and forwarding to lending institution. VISTA members will forward form to: DIVISION OF FIELD OPERATIONS, VISTA, Washington, D.C., 20506. Note: NO DEFERMENT ACTION IS POSSIBLE UNTIL THIS FORM REACHES THE LENDING INSTITUTION. Lender retains form.

I CERTIFY that the information stated in Part I is true and correct. Person named above is:

☐ ENROLLED AS A FULL-TIME STUDENT

☐ IN ARMED FORCES

☐ IN PEACE CORPS VOLUNTEER SERVICE

☐ IN FULL-TIME SERVICE IN VOLUNTEERS IN SERVICE TO AMERICA *(VISTA)*

NAME OF INSTITUTION OF POST-SECONDARY EDUCATION, MILITARY ORGANIZATION, PEACE CORPS HEADQUARTERS, OR VISTA HEADQUARTERS | OFFICIAL SEAL OR STAMP

ADDRESS *(City, State, ZIP Code)*

SIGNATURE *(Registrar, Commanding Officer, Peace Corps Officer, or VISTA officer)* | DATE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Student Loan Office

BORROWER CONTACT

Date _____

Name _____ ☐ In Person

I.D. No. _____ ☐ Telephone

Status Change: Yes ☐ No ☐ ☐ Third Party (Who) _____
Current Status _____
Changed To _____

Past Due? $_____ Months _____ Action by us to date _____

Remarks: _____

Address Change:

_____

_____

_____

_____
Interviewer

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

REGIONAL OFFICE
REGION I
OFFICE OF STUDENT FINANCIAL ASSISTANCE
POST OFFICE BOX 8370
BOSTON, MASSACHUSETTS 02114

OFFICE OF EDUCATION

TELEPHONE NO
(617) 223-645

_____

SSN: _____

LID: _____

WARNING

The _____ has notified this office that your Guaranteed Student Loan is delinquent.

This is to inform you that if your delinquency should persist, by STATUTE your account will be declared IN DEFAULT and will be referred to the Federal Government for further collection activity.

In order to avoid this, you must contact the above captioned lender IMMEDIATELY. Your lender's telephone number is ( )_____.

Sincerely yours,

Gary J. Caramanis
Director of Claims & Collections
Office of Student Financial Assistance

PC-1

VI. The Office of Facilities Management

Juliet B. Sutherland
Sandor R. Schoichet
Michael M. Hammer

September 1981

22. Introduction

The Office of Facilities Management Services (OFMS) has three primary responsibilities. The first responsibility is to maintain current and historical information about all of MIT's physical facilities. In concert with that responsibility is the maintenance and operation of the INSITE system, a computer based system for managing the use of space and facilities. INSITE is used by a number of other organizations, known collectively as the Consortium, and the OFMS is also responsible for transferring the INSITE technology and facilities management expertise to consortium members. The third responsibility is to inventory and tag all of MIT's movable equipment, provide information about that equipment via the INSITE system; provide for the disposition of MIT excess and the acquisition of government surplus equipment for the MIT community; and the temporary storage of idle equipment and surplus materials.

22.1 Internal Organization

The OFMS is organized into four parts, INSITE space accounting, INSITE Consortium, property management, and the warehouse. For more details see the organization chart in Figure 1.

22.2 Management Goals for Automation

The OFMS has been growing very rapidly in size over the last few years. The goal of automation is to reduce the growth in the number of personnel needed to maintain the current and projected levels of activity. The areas that have experienced the most growth, and which are projected to grow still more, are the property management area, and the INSITE Consortium area.

Secondary goals include upgrading the quality of the documents that are sent to the Consortium members, and possibly reducing the amount of paper that needs to be stored in

the office.

22.3 The INSITE System

INSITE is a large computer-based system that is used for the management of space and equipment. It runs in batch mode on an IBM computer taking input from CMS files. The current costs of running INSITE are approximately $125,000 to $150,000 per year. The OFMS uses the INSITE system to manage space and equipment at MIT and also provides it to other organizations. In managing facilities at MIT, the INSITE system can be queried to answer specific questions about the use of *space*. Information about *equipment* is usually obtained from reports produced using INSITE. These reports are massive and expensive to produce so that they are seldom up to date.

Due to the cost of running INSITE, the OFMS is considering, sometime in the future, buying a mainframe of their own on which to run and maintain the system.

22.4 Overview of Functions

The primary functions of the OFMS correspond to the primary responsibilities. These functions can be broken down in units that include: dealing with the INSITE Consortium, improving and maintaining INSITE, running INSITE and maintaining its database (both for space and for equipment) for MIT, acquiring and disposing of surplus equipment, reporting to the government and other research sponsors on the status of equipment used for research, and other miscellaneous functions.

22.4.1 The INSITE Consortium

The OFMS is constantly adding new members to the Consortium. Since the members pay an annual fee based on the cost of services provided by the OFMS, this part of the function is akin to a sales effort. MIT does not make money from the Consortium. The purpose is rather to transfer technology: the OFMS expects to get new ideas from the members for improvements in space and equipment management at MIT, and for additional features for INSITE.

When a new organization joins the Consortium, it receives the latest version of INSITE

with documentation. The members of the Consortium receive the following from OFMS each year: the opportunity to attend training courses at MIT in the use of INSITE, an annual workshop and conference on facilities management, at least two visits from OFMS staff each year, a new contract, a new fee computed to cover the expenses incurred in supporting that member, and the opportunity to have questions answered by OFMS staff through phone calls or letters. In addition, there is an INSITE newsletter which appears four times each year, for which non-INSITE subscribers must pay.

22.4.2 Improving and Maintaining INSITE

The OFMS developed INSITE and is responsible for improving and maintaining it. The newest version represents a large change from the previous version and while the programming effort to produce the new version is largely finished, the work of completely documenting the system and fixing bugs remains.

22.4.3 Managing Space and Equipment at MIT

The OFMS is responsible for managing all space and equipment at MIT. Managing space consists of making sure that all information about space, such as the size of rooms, the use of rooms, the department to which the space belongs, whether MIT owns it or not, etc., is entered into the INSITE system. The OFMS then produces reports that are used by many offices. In addition, the OFMS staff who are associated with this function answer questions from all over the Institute concerning space. The OFMS also maintains historical records about buildings and the space in them and has produced reports of various types showing how space usage has changed with time.

Managing equipment at MIT also consists, at one level, of making sure that all information about the equipment is in the INSITE database. However, since equipment moves around, is bought and sold, and generally changes more quickly than space, the process is more complex than maintaining space data. As equipment is purchased, the property staff of the OFMS enter information about it into INSITE. This involves a great deal of paper work and communication with the Purchasing Office and the Accounts Payable Office, all of which are described in the section below that elaborates the details of this process. This process accounts for equipment that has been purchased since 1978. The older equipment is being inventoried for addition to the database by physically going through the Institute and tagging

it. This process, detailed below, is expected to take at least another two years.

Another part of the equipment management function is reporting to the organizations that sponsor research at MIT what has become of equipment purchased with funds from those organizations. There are two types of reports, yearly financial reports that must be made to government agencies concerning equipment purchased, and reports concerning the disposition of equipment after a contract terminates. The termination reports are one step in the Office of Sponsored Programs (OSP) procedure to terminate a contract and involve quite a bit of interaction with the OSP, as may be seen in the detailed description of this procedure.

Equipment management also includes the acquisition and disposition of excess and surplus government property. Most of the work here is involved in the acquisition of excess property. The various government agencies and contractors circulate lists of excess property that can be acquired by other agencies or non-profit contractors. The equipment is made available on a first come, first served basis. Obviously the more equipment that can be acquired this way the better, since MIT is getting the equipment without paying for it. Surplus property that is owned by MIT is also traded between departments, and if no one wants it, may be sold.

The motive behind keeping track of property at MIT, other than good business practice, is that MIT is reimbursed by the government for the use of MIT property in research sponsored by the government. In the past the amount of reimbursement was negotiated by MIT and the government, since MIT had no real figures. Now that OFMS is keeping track of equipment, MIT can show how much equipment is really used and be reimbursed for the proper amount. It is interesting that this amount is over three times as much as under the previous system.

22.4.4 Other Functions

The OFMS has several other duties. One of these is to manage a warehouse for the short term storage of equipment that departments cannot, for one reason or another, keep themselves. Another is doing the administration for the Society of Property Administrators (SPA), an organization founded by people from MIT a few years ago. The administration consists mainly of organizing an annual conference, maintaining membership lists, and billing members for membership fees. Other duties of the OFMS include running the silver

recovery program, which recovers silver from photographic materials, and answering questions about the use of government commodity codes, which are assigned by the government to all goods and services and which must be used on all government contracts.

23. The Consortium

The OFMS responsibilities for the Consortium of users of the INSITE system consist of recruiting new members, and maintaining the current members, which includes administrative work as well as teaching and user support.

23.1 New Members

The OFMS receives approximately 100 requests each year for information about the INSITE system. These requests are answered by sending a cover letter along with standard information about the capabilities of the system and the support that is provided. The letter is made up of standard paragraphs that are put together to fit the situation. The enclosed information does not change. Currently these letters are typed by hand.

If a prospective customer indicates further interest, the OFMS will send a person to give a presentation about the system. Approximately 25 presentations are given each year. The presentation lasts about 2 hours, is given to a small group of people, and makes use of standard transparencies, mostly made from reports generated by INSITE. The person giving the presentation answers questions and spends the rest of the day talking with people from various offices in the prospective organization.

If the organization is still interested, the OFMS prepares a proposal. The 8-page proposal has a standard form, in which only the details such as the cost, the organization, and so forth, change. There are a few options that the organization can choose to purchase, and the proposal varies slightly depending on which are taken. Currently the proposal is prepared by adding the name of the organization to previously typed pages, and retyping those pages that are affected by the options. The issue in this case is not so much the time involved in preparing the proposal but the quality of the result. The current process does not produce a result of as high quality as the person in charge of these proposals would like. The names of the organizations do not fit well into the spaces provide on the previously

typed pages, resulting in the presence of white space where none should be, and making it obvious that the document has been prepared in this manner.

23.2 Current Members

Current members receive support from the OFMS in the form of personal visits by OFMS staff members at least twice each year, training courses offered at MIT, a quarterly newsletter, an annual conference, and access to OFMS staff to answer questions. Dealing with current members also includes revising the proposal each year, and billing the members for the cost of the support to be provided them.

23.2.1 Visits

Each Consortium member is visited at least twice each year by one or more staff members from the OFMS. The purpose of these visits is to see how the organization is using INSITE, to make suggestions as to how it could be better used, and to note interesting applications that could be used at MIT or by other Consortium members. The visits range in length from a half day to two days.

A careful account is kept of which organizations have been visited most recently to be sure that each organization is visited at reasonable intervals. Since there are usually several Consortium members in a city, visits are usually arranged so that the staff can visit several members on the same trip. Scheduling all this is somewhat difficult.

23.2.2 Training Courses

The OFMS offers training courses to users of INSITE. A course is taught when a need for one is perceived, usually 4-6 times per year. The courses are held at MIT, last for 5 days, and are taught primarily by two people, although in the past most of the staff members were involved.

Running a course includes the following steps.

- Preparing a course announcement and sending it to approximately 90 people on a course mailing list.

- Sending confirmations to those people who register for the course.

- Preparing an agenda, collecting local information such as hotels and maps, and sending these items to the students.

- Reserving a room and making arrangements to have appropriate audiovisual equipment in the room, as well as a telephone.

- Ordering food.

- Preparing handouts and homework, approximately 100 pages, for the students. This usually involves making slight changes to handouts from previous courses.

- Setting up accounts for the students to use INSITE and preparing a sample database.

After the course is finished, the students are asked to fill out evaluation forms so that the course can be improved.

Future plans for the course include arranging the material so that it can be presented in smaller, self-contained, chunks. Eventually parts of the course may be taught at the location of the people who need it. In addition, the teachers would like to revise the course to take advantage of the latest teaching hardware. Another project is to make a notebook that will have all of the student's material in one place. Currently the students are given the INSITE manual and a number of handouts with no particular organization.

23.2.3 Applications Support

The OFMS provides two forms of applications support. The first is the user's manual. It is approximately 300 pages long and was originally written in January of 1980. The original version was written and stored on a Multics system but that version does not have the changes that have been made since then. The manual is currently being retyped once each year to make the changes that have accumulated in that time. These changes are usually fairly small.

The other form of applications support is answering questions. Most of the staff who are involved in any way with the Consortium participate in this activity. The questions can come as telephone calls or as letters. The responses can take the same forms. The questions range from specific ones about the syntax of a particular command, to questions about whether INSITE can be used for some fairly general purpose.

Each contact with a Consortium member is accounted for through the use of a contact note. This note gives the organization contacted, the medium of the contact, the nature of the contact (applications or systems), and has space for descriptive notes. At the end of each week, a summary sheet of the number of contacts with each member is prepared and this sheet, along with two charts showing the same data organized in other ways, is reviewed by a committee at the beginning of the following week. This committee is composed of high level management of the office.

23.2.4 Newsletter

The OFMS sends out a quarterly newsletter about INSITE. The newsletter goes to anyone who will pay the subscription, not just to Consortium members. The steps involved in preparing the newsletter include: collecting the articles, sending them to the Engineering Word Processing Center, proofreading the result, cutting and pasting to make the pages look right, then sending the whole thing to Graphic Arts to be copied. Since the staff members who write the articles are often late in doing so, there often is not time to send the articles back to word processing after the revisions are made, so that parts of the articles must often be typed, and right justified, by hand. The current system is rather laborious, largely because the word processing center takes so long to return the materials sent for processing. In addition, the word processing is expensive, and the results are not of sufficiently high quality since the justification is done by inserting spaces, leaving too much white space in a line.

23.2.5 Proposal Extensions

Once a year, each Consortium member is sent a three page proposal extension that continues Consortium membership for one more year. The extension document is the same for all members, varying only in the name of the organization, the fee, and the options chosen. The fee is recalculated each year based on the cost of servicing that member in previous years. The calculation takes into account the number of visits made by OFMS staff, the number of staff contacts, the distance (for travel and phone) of the organization from MIT, and possibly other factors as well.

23.2.6 Billing

The OFMS sends quarterly invoices to each Consortium member. The invoices follow a standard format that varies only in the name and the amount. Each invoice is typed by hand, and then copied. Three copies are sent to Accounts Receivable, one is kept for the records, and another copy is kept to be used as a working copy in preparing the next invoice.

24. INSITE Development and Maintenance

The latest version of the INSITE system has been completed and released. This version is very different from previous versions and is not expected to change dramatically again in the next 5 years. The programming staff is now involved in fixing bugs and adding features to the system. The major portion of their effort, however, will soon be going into documenting the system. The documentation takes two forms. The first is the documentation at the module level, mostly specification of module interfaces. The second is narrative documentation of the workings of each module and group of modules.

Most of the module descriptions were written as INSITE was written. These descriptions are maintained on Multics, total approximately 700-800 pages, and cover about 350 modules or entry points. The module descriptions are not complete since system documentation slipped a bit towards the end of the project. In addition, changes have been made since INSITE was released that are not reflected in the documentation.

The bulk of the narrative descriptions remain to be written. This project will be starting sometime around August and will be a major effort that is expected to produce substantially more written material than the module descriptions.

In addition to the above documentation, when a sufficient changes have been made to INSITE, a new copy is sent to each of the Consortium members. This new copy is accompanied by a new version of the users manual. As the programmers make the changes that will go into the next release, they document them. These change notes are currently maintained on line (Multics) as they occur and when a release is ready they are edited and typed by hand.

25. Space and Equipment Management at MIT

The OFMS uses INSITE to keep track of space and equipment at MIT. This chapter will be broken into sections dealing with space management at MIT, data entry on equipment at MIT, and the management of MIT equipment.

25.1 Space Management

OFMS does not actually allocate or deallocate space, rather they maintain a database of information about space usage, which is used by many offices around MIT. The OFMS runs INSITE to do this.

25.1.1 Collection and Entry of Space Information

The information about space is collected by a facilities auditor who actually visits each space annually. The auditor gathers information about the size, use, and ownership of the space. Also, floor plans are updated by the auditor. The information is then given to the INSITE space database manager who enters it into the database by putting it into CMS files, then running INSITE. There is additional information that needs to be entered when a building is built. Information gathered and entered into INSITE in this way reflects only the current usage of the space. One version or another of INSITE has been in use since approximately 1970 so that information gathered since then is reasonably accurate. OFMS also maintains historical information about buildings and space usage going back to the founding of the Institute. The historical information was found to be incomplete and inaccurate so an effort was made earlier this year to research this information. More complete and more accurate data now exist, and have been organized in a way that is meaningful.

25.1.2 Space Usage Reports

The OFMS produces several standard INSITE reports on the usage of space at MIT. In addition, the database manager knows how to query the database to get answers to specific questions and who will do so on request. The standard reports are produced on a semi-annual basis.

Specific inquiries come from all over the Institute and range from questions about which department has what space, to the historical use of a certain building. INSITE is queried or other sources are checked, and the answers are returned to the person who requested them.

INSITE Space Accounting Historical Reports. These are reports generated by INSITE each year that show space data for that year. They are kept on paper for a year then microfilmed.

The Building Data Academic Facilities Report (BDAF). This non-INSITE report changes very little from year to year, is about 300 pages long, and provides numerous data about each MIT building.

The Gross Area Books. There are two of these books, 40 and 20 pages long respectively. The books contain calculations on the gross area of each building at MIT, broken down by floor. These calculations are presented as columns of figures. The figures are computed by hand from scaled floor plans or original construction drawings.

All of the above reports are used by Physical Plant, space planners, and numerous other academic and administrative offices.

25.2 MIT Equipment Management

Managing equipment at MIT consists of maintaining a database of information about equipment at MIT (using INSITE), acquiring and disposing of surplus equipment, and reporting to research sponsors on the use of equipment purchased with sponsored research funds.

OFMS produces a book of Property Procedures, intended to document all of the procedures involved in collecting data about equipment at MIT. While most of the property

staff of the OFMS have a copy of this notebook, only one notebook is completely current. Periodically, when enough changes have occurred, or additions have been made, the notebook is retyped and new copies are distributed. The notebook does not yet cover all of the property procedures, and it is an ongoing project to make the notebook complete.

25.2.1 Inventory of Old Equipment

Since the OFMS has only been keeping equipment records since 1978, and since the old records are incomplete, a thorough inventory is being done of all equipment that was purchased before July 1, 1978. Eventually this information will be added to INSITE. This inventory is expected to take at least another two years. After that, only annual inventories will need to be done and they will be much quicker since equipment that is being inventoried now is being tagged with bar codes labels that can be read by scanners. The scanners will produce computer-readable lists which will be used to maintain the INSITE database.

The inventory is conducted by having a property inventory auditor visit each room in the Institute to look for property that has not already been marked with a bar code label. A line of a form is filled out for each such item. This line shows who owns the equipment, under what account number it was purchased, what the item is, the bar code assigned to it, etc. About 10% of the equipment has the old MIT property number (assigned between 1972 and 1978), in which case all information about the piece of equipment is already available to the property group. Otherwise the property inventory auditor will have to get what information he can from the site, then check through the old property records, and possibly the records from the Accounting Office as well, to find all of the information. As the sheets are completed they are numbered, logged, and given to the INSITE property assistant database manager who checks for standard usage of the names of equipment, then enters the information into CMS files for entry into INSITE. All of the forms are stored. It is estimated that there are about 150,000 items to be inventoried, requiring about 14,000 forms. There is often a time lag involved in getting the information into the INSITE property reports, so that requests for information about the status of certain pieces of equipment are usually answered by going back through the inventory forms.

A standard nomenclature list is maintained in a CMS file, with hard copies made when enough changes have occurred. This list is kept so that all of the data collectors, property inventory auditors and others who are involved in identifying pieces of equipment will use

the same names for the same equipment. A list of sponsor codes is also maintained. New entries are made as new sponsors are found and new lists are printed as needed, either when many changes have occurred or a new data collector joins the staff.

25.2.2 New Equipment

The government requires that MIT be able to account for all purchases made under government contract by location, value and user. Government auditors check periodically that MIT procedures are sufficient to meet this requirement. The OFMS also needs to be able to document what MIT equipment is being used for government research so that MIT can collect its use allowance on that equipment. The inventory of old equipment is being done for these reasons and to continue to meet these requirements. New equipment is handled as follows.

As new equipment is purchased, it is tagged and entered into INSITE. The procedure for doing this is as follows. All purchase orders that are generated at MIT have object codes that indicate what type of thing is being purchased. Certain of the object codes indicate that equipment, of one type or another, is being purchased. Purchases of equipment, as well as certain other items such as precious metals, are of interest to the OFMS. The object codes are assigned by the person requesting the purchase. The rules, however, about what equipment gets which code, and what constitutes equipment, are somewhat complex and dependent upon whose money is being used to buy the equipment. For these reasons, mistakes are often made in the assignment of object codes. All purchase orders are sent to the OFMS where they are examined to be sure that the object code is correct. About 8,000 purchase orders are reviewed each month. When a mistake in the object code is found, a change order is filled out and sent to the Purchasing Office, the Accounting Office, the person who ordered the equipment, possibly the OSP (see below), and a copy is stapled to the purchase order. The purchase orders that have object codes of interest to the OFMS (e.g. equipment, precious metals) are pulled and put into an active pending file and filed by PO number. The other PO's are not retained.

When the Accounts Payable Office receives invoices for items with object codes of interest to the OFMS, about 500-600 per month, they are sent to the OFMS where the object code has to be approved before the Accounting Office will pay the vendor. In order to verify that the correct object code has been used, the purchase order needs to be retrieved to see

what changes were made to it. After the invoices are reviewed and approved, copies are made. The originals are sent back to the Accounting Office and the copies are put into a holding basket. The data collectors use the matched invoices and purchase orders to fill out the data sheets on the purchases.[8] If all of the necessary information is not present on the purchase order or the invoice, as often happens, then the data collector must go to the Purchasing or Accounting Offices to find it. This is very time consuming. After the data sheets are prepared, the data collectors put a tag on the piece of equipment. The paperwork is then given to the database manager to enter the information into INSITE and then filed by account number. When enough paper has accumulated[9] it is all microfilmed.

The old records are used frequently to retrieve information about equipment that has already been purchased. One example of how this might happen is that when a new piece of equipment that enhances the value of an existing piece of equipment is purchased, the purchase is not regarded as a new piece of equipment, but rather as a part that enhances the value of the old piece. Instead of generating a new form and entry in the database for the new piece of equipment, the information on the old piece must be changed. To do this the the microfilm records and standard equipment reports (see below) must be checked to find the value and other information about the old piece of equipment and a change form must be generated to make the appropriate change in the INSITE database.

About 1000 new items are tagged each month, that being about 1.5 items per invoice. About 8%, of the 8000 monthly PO's are of interest. The OFMS receives all PO's because of the problems with the object codes. Where the item is being purchased with MIT money then changes made to the object code on the purchase order or invoice by the OFMS are final. If the equipment is being purchased under a government contract then the OSP has to approve the change. In that case a change order is sent to OSP and a log is kept so as to know if OSP has responded to a particular order.[10] Approximately 75-80 change orders are sent to the OSP each month. About 90% of the incorrect object codes are caught from the

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[8]This data sheet includes the same information as is gathered by the data collectors doing old equipment inventory, although the forms are different.

[9]"Enough paper" is defined to be enough to fill the filing cabinet. This happens about every 3 or 4 months.

[10]Some OSP officers are more prompt about responding than others.

purchase orders, the rest are caught from the invoices. About 100 change orders are generated each month.

25.2.3 Change of Department

When a piece of equipment changes ownership within the Institute, a form is filled out showing the change and giving the information necessary to identify the departments, accounts, and piece of equipment. These forms are given to the INSITE property database manger who checks for reasonable data and then enters the change into a CMS file for entry into INSITE. Approximately 100 changes are handled each month.

25.2.4 Excess and Surplus Property

The OFMS receives information from various government sources about excess equipment that MIT researchers who have government contracts can obtain for little or no cost. This information comes in the form of lists of excess equipment that are produced at various intervals. The OFMS receives these lists, and distributes some of them to MIT researchers who have asked to be on the mailing list for a particular excess property list. The researchers check these lists for equipment that they can use and reply to the OFMS as soon as possible with the list and item numbers of this equipment. The person at the OFMS who is responsible for this operation then calls the government contractor that produces the list and puts a freeze on those items of equipment. Excess equipment is distributed on a first come first served basis; a freeze means that no one else can take that equipment for about two weeks. The researcher must then send the OFMS a technical justification of why he needs the equipment. The OFMS fills out the appropriate forms and sends them, along with the justification, to the contractor responsible for the equipment. After the equipment is frozen, the OFMS sends the paperwork to the agency responsible for the equipment, which then sends it to the contractor that actually has the equipment. If all goes well, the equipment is shipped to MIT and the OFMS is notified when it arrives. The OFMS person who is responsible for this operation processes the shipping documents, matches them with the forms from his file, then gives the information to the people who handle new equipment so that they can add it to their records, just like any other piece of new equipment.

Although other excess property lists are received, only the following ones are distributed: ADP, Lincoln Lab, DOE, Kitt Peak. Each of these reports has a separate mailing list and

arrives at a different frequency.

Report	mailing list	pages received	time interval
ADP	16	28 pages	once a week
Lincoln Lab	19	40 +	2-3 days
DOE	22	40 +	every day
Kitt Peak	3	?	once a month?

Approximately 5-6 requests for freezes are made each day, often resulting in twice that number of calls being made. Transfer orders, the paperwork to request that frozen surplus equipment be transferred to MIT, require processing at the rate of approximately 2 or 3 per day.

This operation is obviously quite valuable to MIT but it is not advertised in any way, since the OFMS currently does not have the resources to handle more people making requests on a regular basis. The biggest problems in this operation are the time required to copy and distribute the equipment lists and the time required to receive a justification letter from the researcher.

Departments at MIT have surplus equipment that they do not want. The OFMS is responsible for disposing of this equipment. What happens to the equipment depends on who has title to it. If the government has title to the equipment then the standard government excess equipment procedures are followed. This happens about once a month. If MIT has title to the equipment (approximately 250 cases per year) then the specific needs file, kept in a CMS file, is consulted to see if anyone has requested the equipment. If the equipment has not been requested then an ad is placed in Tech Talk and made available for transfer for two weeks. If the equipment is still not requested, then it is sent to the Equipment Exchange and made available for sale to the MIT community. It will be held in the warehouse for 30-45 days, then sold to used equipment or scrap dealers. If at any time the equipment is requested by another authorized person at MIT, then the change of ownership is entered into INSITE and the equipment is considered transferred. A department can request that certain equipment not go through this process but be sold directly, in which case a notice of the sale is sent to a list of potential buyers both within and outside the Institute. The sale takes place by sealed bid.

Surplus equipment is stored in the surplus equipment warehouse until it is disposed of.

Records are kept of what is in the warehouse and how long it has been there. The warehouse is open to the MIT community three days a week for several hours and equipment in the warehouse can be requested for transfer or can be bought with personal funds. For this reason, the warehouse keeps a cash box and some accounting is done.

25.2.5 Stolen Property

Each month the OFMS gets a report from the Campus Patrol saying what MIT property has been stolen during the previous month. In addition, the OFMS receives letters from departments reporting stolen property. An entry has to be made into INSITE (via the usual form and CMS file) showing that the item has been stolen. Since the item is now gone, the OFMS must correlate with the property records to try to get the serial numbers. Of about 30-40 items handled each month, they are able to identify about 90%. If the item belonged to the government then the appropriate government agency has to be notified and given the serial number of the item. In the case of DOE equipment, the FBI must also be notified.

25.2.6 Sponsored Research Equipment Reports

There are two types of equipment reports. When a research contract ends, part of the termination process involves reporting to the sponsoring organization what will happen to the equipment that was purchased with funds from the contract. The other type of equipment report applies only to contracts from government agencies. It is a financial report showing how much money was spent on equipment for that contract.

When a contract terminates, the OFMS must send a final inventory letter to the sponsoring organization showing what equipment was acquired under the contract and recommend how it will be disposed of. All government sponsored contracts that expire require final inventories. The list of equipment acquired is obtained by checking the property records and the monthly accounting statements (where these disagree, the difficulty must be resolved). The actual contract is checked in the OSP to see how the equipment is to be disposed of.[11] The list of equipment is then sent to the department with a request that they verify that the equipment exists and send the room number that it is in. If the department is

[11] MIT usually receives title to the equipment.

to keep the equipment, they are also requested to send a justification of their future need of it. When all this has been done, a cover letter of a fairly standard format listing all of the equipment acquired, if any, is written[12]. The letter is then sent to the sponsor for review and action. This whole procedure is a part of the contract termination procedure of the sponsor.

Many sponsors, both government and private, require that MIT send interim inventories at regular intervals and that equipment purchased under contract with them be marked with property stickers belonging to their organizations, as well as MIT's stickers.

The financial reports are sent once each year to the government agencies that sponsor research at MIT. The DOE, however, requires financial reports twice each year. Each agency requires the reports at a different time of year, and each agency has its own form for the reports. The INSITE system generates the information needed to compile these reports. A cover letter is written and sent with each group of forms to the individual agency.

In order to know when a contract begins, is extended, terminates, purchases equipment, or has other action of interest to the OFMS, all of the OSP 001 forms are sent to the OFMS. The OFMS receives about 900 of these forms each month, all of which are screened for activities of interest. When a form of interest is found, a copy is made and put into a file by contract or account number. If the contract is starting, a new file is made. The original 001 forms are then returned to the OSP.

Additional forms are written concerning all equipment that costs over $1000 and all computer equipment. These acquisition forms, 1342's, are the same for all government agencies. They are sent to the appropriate sponsoring agency and copies are kept in the contract's file. Approximately 3 to 4 of these are handled each month.

25.2.7 MIT Equipment Reports

INSITE is used to generate a number of standard reports showing information about MIT equipment. In addition, various ad hoc reports are produced on request from people around the Institute. In some cases the department or other unit requesting the report is charged

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[12]The cover letter usually cites the specific paragraphs in the contract that specify the disposition of the equipment.

for the cost of producing it. The standard reports include the fiscal year reports, the list of equipment by department, and others. Most of the standard reports are run on an as-needed basis, but since the reports are very expensive to produce[13] the need must be quite great. Since the reports are seldom up to date, information about recently purchased or inventoried equipment must be obtained either from the forms used to record the transaction or from the CMS files.

[13]The reports are expensive because they require a lot of computer time to generate and a lot of paper to print. The most recent department listing filled three computer paper boxes.

26. Other Functions

The OFMS has several miscellaneous responsibilities that do not fit into the other functions. These include running a warehouse for the short term storage of equipment, running a program to recover silver from photographic materials, teaching a summer course about facilities management, doing the administrative work for the Society of Property Administrators, and serving as a reference for the Institute concerning the proper use of government commodity codes.

26.1 The Warehouse

The OFMS manages a warehouse that is used for short term storage of equipment. Equipment is accepted for storage for six month terms. When a researcher wants to store some equipment, he calls the OFMS person responsible for the warehouse, who makes sure that he is not just dumping useless equipment, and that he has a good reason for needing to store it. If this is the case, then the researcher is given permission to store his equipment in the warehouse. The equipment is brought to the warehouse and tagged. The tags show who is storing the equipment and when it was stored. When the equipment has been in the warehouse for six months or so, a reminder is sent to the person responsible for the equipment saying that it is only supposed to be stored in the warehouse for six months and that time is now past. If there is a good reason why the equipment should stay longer, then the time limit is extended. Since space is not a problem in this warehouse, and since the incoming equipment is being stored for good reason, equipment is not thrown out of the warehouse if the time limit is exceeded. The users of the warehouse are fairly responsible and one notice is enough to remind them to either remove their equipment or explain why it should remain in the warehouse.

26.2 Silver Recovery

The OFMS is responsible for coordinating the new silver recovery program at MIT. The materials used in developing photographic plates are collected and a special machine is used to recover the silver. The OFMS maintains a mailing list of people who belong to the program, and keeps track of who should be credited with how much of the value of the recovered silver.

26.3 Summer Course

The OFMS teaches a course each summer on Facilities Management. The course lasts 2 days and costs $650. In preparation for the course, speakers are found, both from within the OFMS and from outside it. Notices are sent to about 100 editors who will use them without charge to the OFMS. A brochure is developed and sent to about 30,000 people on a mailing list purchased from an outside company. A response rate of about .1% is expected from the mailing. These 30-40 people are sent letters confirming their acceptance to the course, along with local information about hotels, etc. From the time that they are accepted to attend the course to the end of the course, about 3 or 4 letters, concerned with various details or answering questions, will be sent to each attendee. In the past, all of these details, except the selection of speakers, were handled by the Summer Session Office, but now the OFMS must handle them. A workbook, of about 200 pages, is prepared for use during the course. At present this workbook is typed by hand each year. When the course is finished, a questionnaire is provided each attendee to see how to improve the course.

26.4 Commodity Codes

The OFMS serves as a resource within MIT for those who need to know exactly what the government commodity codes are and how to use them prior to acquisition. The government has assigned code numbers to all possible items. The list of codes fills 52 manuals. The person within OFMS who is responsible for sending government agencies reports about equipment is also responsible for responding to inquiries about these codes. He receives about 5 calls each day concerning these codes.

26.5 The SPA

The OFMS does all of the administrative work for the Society of Property Administrators. This work includes maintaining the membership lists, collecting membership fees, running an annual conference, and answering requests for information. The SPA is a new organization and its membership is growing quickly. In September, 1980 there were 160 members, by April, 1981 there were 260 members.

26.5.1 The SPA Membership

Managing the members includes maintaining the membership lists. This is done by means of a card file where each card show the member's name, the number of people from that organization, the address of the organization, and the date that the member joined the SPA. The membership list is revised once each month and sent to the Board of Advisors. The members are also billed for their membership fees. This involves simple bookkeeping. About 30 membership renewal notices are sent each month. Requests for information about the SPA are answered by sending standard information with a cover letter. There are about 5 requests each month, with more around the time of a conference.

26.5.2 SPA Annual Conference

Running the annual conference is much like running the summer session course. Speakers are chosen, notices are sent to about 100 editors who will not charge to put them in their publications, a brochure is developed, the brochure is sent to about 6,000 people on a mailing list maintained by the OFMS, the responses are acknowledged, local information is sent, invoices are sent for conference fees, the conference is held, and a questionnaire is sent. The questionnaire, in a slightly different form, is also sent to all members of the SPA who did not attend the conference. The bulk of the correspondence involved with the conference is with the speakers. There are usually about 12-15 speakers who get 4-5 letters each.

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