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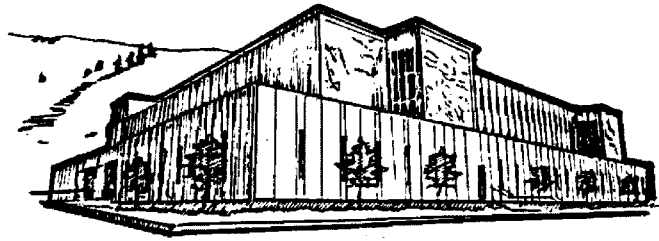
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University of
Montana

AN INFORMATION SYSTEMS PLAN FOR THE
UNIVERSITY OF MONTANA
OFFICE OF RESEARCH ADMINISTRATION

By

Rohn Wood

B.A. University of Wisconsin

Presented in partial fulfillment of the requirements

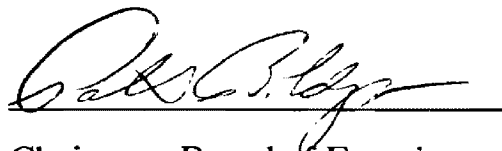
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University of Montana

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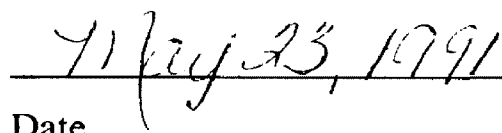
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Table of Contents

CHAPTER I PROBLEM DOMAIN	1
Introduction	1
Recommendation Overview	4
Justification and Summary	5
CHAPTER II BACKGROUND	7
Political and Policy Background	7
Structural Background	8
Technical Background	9
Summary	11
CHAPTER III OVERVIEW OF THE INFORMATION PROCESSING CYCLE	12
Introduction	12
Evaluation	12
Distribution	13
Alternative Methods of Evaluation and Distribution	14
Summary	15
CHAPTER IV AN INFORMATION MANAGEMENT SYSTEM FOR RESEARCH ADMINISTRATION	16
Introduction	16
Integration of Needs under an Information Management System	17
Issues Review	17
Associated Perceived Needs	18
Recommended Technologies	19
Introduction	19
Building Upon Proven Technologies CD-ROM	20
Building Upon Established Resources: PC-based Databases	22
Optimizing a Standing Investment: BBS	22
Introduction	22
Services	23
Summary	24
The Role of the User	25
Introduction	25
Discussion	26
Summary	27
CHAPTER V IMPLEMENTATION STRATEGY	30
Introduction	30
Process Overview	30
Discussion	31
Phase One Narrative	31
Phase Two Narrative	32
Phase Three Narrative	32
CHAPTER VI METHODOLOGY	35
Introduction	35
Iterative Systems Development Cycle	36
Iterative Systems Model	38
CHAPTER VII RESOURCES AND COSTS	39

Introduction	39
CD-ROM Workstation	40
Hardware	40
Software and Subscriptions	40
BBS	41
Upgrading Faculty Hardware and Software	41
Upgrading Office Hardware and Software	42
CHAPTER VIII CONCLUSION	43
APPENDIX ONE DOCUMENT.TXT	49
NSF Electronic Proposal Submission	49
1. Purpose of the EPS	49
2. Brief History	49
3. Characteristics of EPS	50
4. Recent Changes and Current Status	51
5. Participation	52
5.1 Requirements	52
5.2 Establishment of an FTP Account at NSF.	52
5.3 Obtaining the EPS Software.	53
5.4 Preparing the Proposal.	54
5.5 Submitting the proposal	54
APPENDIX TWO NSF ELECTRONIC PROPOSAL MEMORANDUM ...	56
APPENDIX THREE INTERNET DESCRIPTION AND SERVICES	60
INTERNET	60
INTERNET Resources	60
Computational Resources	60
Library Catalogs	61
Data Archives	62
Networks and Email Gateways	63
BIBLIOGRAPHY	65

CHAPTER I

PROBLEM DOMAIN

Introduction

The vitality of American research and scholarship underlies a healthy economy and a sustaining intellectual tradition. While Congress and other public and private institutions have assumed responsibility for "nurturing creativity and exploration in science,"¹ a principle and sustaining mission of universities and colleges is the creation of an environment within which such teaching, research creative scholarship, and service to a community can flourish.² Since World War II independent support of research activities has been beyond the financial wherewithal of all but the most well endowed institutions with the result that the majority of public universities providing graduate level education depend upon public and private support to pursue and maintain their research agendas.³ The quality of the research environment in the face of such constraints, therefore, has increasingly depended upon the ability of colleges and universities to identify and solicit private and public support for sponsored program research activities.

Responsibility for coordinating the acquisition, evaluation, and distribution of sponsored program support data at the University of Montana (UM) has traditionally fallen to the Grants Coordinator, housed in the Office of Research Administration, under the direction of the Associate Provost for Research and Economic Development. Relying primarily upon print media, the coordinator is called upon to read, evaluate, and hand mark for reproduction and distribution to the UM research community, a growing volume of research support data. Given the importance of

sponsored program support to the UM, the rapid and continuing advances in data processing technologies, and the ever growing volume of research support data received by the office, the efficacy of this essentially pre-information age approach must be called into question. A clear need exists to enable the coordinator to provide UM researchers with the means to access and thoroughly evaluate sponsored program support data in a timely fashion using the most current and appropriate technology available.

The urgency of the problem extends beyond merely enhancing the ability of the coordinator to process data, it underlies establishing a competitive sponsored programs information system to carry the UM into the next century. The development and application of such systems has clearly become a priority throughout the nation. Electronic submission and processing of proposals has become a priority for both the national Science Foundation (NSF) and the National Institutes of Health (NIH), key sponsors of numerous UM research programs. In an electronic document distributed by NSF entitled, *NSF Electronic Proposal Submission*, Larry Edwards of NSF indicates that (see appendix one for complete body of document)

[t]he Electronic Proposal Submission (EPS) Project is the initial phase of the transition of NSF's proposal processing from paper-based to electronic. This goal cannot be achieved without similar changes in the universities' processing and submission of proposals to NSF. This project focuses, then, on converting the paper processing within NSF as well as facilitating, insofar as possible, the analogous process at participating universities.⁴

In a subsequent memo distributed electronically and received at the Office of Research Administration on May 9, 1991, Edwards briefly outlined the background and future development of NSF's electronic proposal submission (EPS) information

system (see appendix two for the complete message text). Briefly summarizing, NSF envisions completely eliminating paper proposals as a means of both reducing the cost and increasing the efficiency of the submission and review process.

...the real benefits of EPS will not be apparent until much more of the vision is implemented. The current project is just the start of a long-term revolution in how we process proposals as well as other university submissions, e.g., the 98A. The vision is more than an NSF "electronic proposal folder" for it includes processing at the universities.

The first step is a new definition of a proposal. NSF is developing, with NIH, a representation of an electronic proposal that is a combination of data and compound text. The data are the elements in the various boxes on the NSF (and NIH) forms, as well as information like Budget Justification and Results from Prior NSF Support. They are normally simple text and can be entered and stored in the universities' and NSF's information systems.

The "proposal" then would no longer be any paper presentation but the set of data and compound text submitted to NSF. The implementation of this representation of a proposal will facilitate and require a new "view" of the proposal.⁵

To enhance the capacity of the UM to realize this new definition of the proposal and compete effectively in this "revolution," this report recommends a vigorous technical upgrade of the information systems resource at the disposal of the UM Grants Coordinator in particular, and the UM research community in general. The fundamental predicate of this report is derived largely from the work of Beasley, who insists that

[a]utomated management information systems and reporting systems are no longer a luxury for offices of sponsored program activity; rather, they are required for effective and efficient administration.⁶

In recognition that transitions to intensive use of technology are not without costs underlies the organizational philosophy espoused here which is derived from the work of Tien and McClure who argue that information systems impose upon the organization the need to reexamine and redesign tasks.

[B]ased upon the goals of the function being performed -- both immediate, medium, and long term (how is/can the data be used to satisfy the various time-dependent goals and objectives of the organization).⁷

Consistent with these antecedents, the information system plan recommended in this report is intended to enhance the flow of sponsored program support data throughout the University of Montana research community and the ability of the community to access the information flow by: (1) expanding the concept and application of information technologies in the daily operations of the UM Grants Coordinator; (2) expanding access to these information technologies to the UM research community at large; and (3) enhancing the Office of Research Administration's human resource and the UM research community's ability to understand, plan for, implement and utilize the information technology resource.

Recommendation Overview

Implementing this plan would involve (1) designating a central location where faculty and students can access and evaluate sponsored program news and support data in a variety of print and electronic formats and mediums using (as appropriate) state of the art information technologies; (2) developing electronic dial-in services to provide the UM research community with 24 hour access to the resources and personnel of the Office of Research Administration; (3) enhancing electronic dial-out services available to the coordinator to access the growing number of national and international information services specializing in research support data and services.

To these ends the research center would maintain: (1) a library of print materials and publications currently subscribed to by the Office of Research Administration and an index of other on-campus resources; (2) a CD-ROM workstation for searching CD-ROM versions of the US Federal Register, ORYX Grants OnLine

database, and the Catalog of Federal Domestic Assistance; (3) an electronic bulletin board service (BBS) to provide the UM research community with electronic mail (email) services as well as access to an online version of the GO compiled daily, computer software to enhance productive use of personal computers, institutional data frequently required by proposals, research and proposal development information such as budget templates for spreadsheets, etc.

Justification and Summary

The discussions and recommendations provided in this report are based upon a ten month examination of the (1) human and technical processes associated with the acquisition, evaluation, and distribution of sponsored program support data by the UM Grants Coordinator; (2) a review of Sponsored Program Administration literature, current developments in information management systems, and the growing trend toward the distribution of sponsored program data in electronic, machine readable formats; (3) numerous interviews with UM faculty, research personnel, deans, chairs, and administrators; and (4) extensive use and review of the growing network of information services available via INTERNET.

In summary, developing a centralized technical base for the acquisition, evaluation, and distribution of research support data can assist the UM in (1) realizing a more efficient and effective throughput of its data resources; (2) more effective utilization of the UM Grants Coordinator's time by providing a system for more concise evaluation of sponsored program support data by the UM research community thus freeing the coordinator to concentrate upon activities associated with proposal development and strategic planning with faculty; (3) developing a flexible entry level technological platform for taking accessing, evaluating, and distributing

the growing volume of data distributed electronically; and (4) providing members of the UM research community with the tools to communicate and exchange data among themselves--within and without the organization--in a timely and organized manner in support of research development activities and opportunities. As is clearly evidenced in transmissions from the National Science Foundation's Larry Edwards, the wave of the future in information is a "sine-wave," and the institutions which shall fare best are those which learn how to ride the sine wave of information to its source.

¹U.S. Congress, Office of Technology Assessment, *The Regulatory Environment For Science: A Technical Memorandum*, OTA-TM-SET-34 (Washington, DC: U.S. Government Printing Office, February 1986): iii.

²Anthony A. Hickey and Kendall W. King, "A Model for Integrating Research Administration and Graduate School Operations at a Regional Comprehensive University," *Research Management Review*, Vol. 2, No. 1 (Spring 1988): 38.

³Kenneth L. Beasley and Associates, *The Administration of Sponsored Programs*, (San Francisco: Jossey-Bass Publishers, 1982): 1.

⁴Edwards, Lee., *NSF Electronic Proposal Submission, Document.txt*, NNSC.NSF.GOV, (Last revised on February 14, 1991).

⁵Larry Edwards. *Your procedures for handling electronic proposals*, Note.nsf.gov id aa29937, (NeXT-1.0 (From Sendmail 5.52)/NeXT-2.0), (May 9, 1991, 10:41 EDT).

⁶Kenneth L. Beasley and Associates, *The Administration of Sponsored Programs* (San Francisco: Jossey-Bass Publishers, 1982): 77.

⁷James M. Tien and James A. McClure, "Enhancing the Effectiveness of Computers in Public Organizations," *Public Administration Review* 46, (Nov. 86): 555.

CHAPTER II

BACKGROUND

Political and Policy Background

During his address before the 1990 Dean's Retreat, UM President George Dennison declared that it was his goal to double sponsored program activity at the UM during the next four years to \$16 million from the then present volume of approximately \$8 million.¹ In response to the President's remarks, Raymond C. Murray, Associate Provost for Research and Economic Development and Dean of the Graduate School expressed guarded optimism over the ability of the UM to easily attain the President's goal, but felt that the University was very likely already operating at its full research capacity.² Murray, whose responsibilities as Associate Provost include direction of the Office of Research Administration (institutional center for UM sponsored program administration and support), felt that generating the additional sponsored program activity would require a vigorous reappraisal of the UM's research priorities and policies. In the weeks that followed the Dean's Retreat, deans, directors, and chairpersons expressed the belief that the responsibility for meeting the President's goal lie largely with the research community, and that it was unreasonable to suppose that "Ray's shop" could affect the increase alone. There was, however, almost universal agreement for the need to update and enhance the structural ability of the Office of Research Administration to provide the research community with the service it would require to meet the President's goals.

Structural Background

There is little doubt among staff of the Office of Research Administration of the necessity to update and enhance the structural capacity of the office to provide administrative services and support. A shared perception of office staff is that the office has clearly reached the limits of its ability to accommodate the administrative and service demands of the research community. One issue that figures prominently in this perception is the effect of workloads upon service delivery; this is particularly evident in the emergence of two coping strategies adopted by office staff, one of which provides continued service delivery through increased workloads, and the other which compromises service delivery rather than add to workloads. In the former case, some office staff regularly work dozens of uncompensated hours each month to stay abreast of the demands associated with sponsored program administration. In the latter case, staff compensate by cutting back on the breadth of the services they provided. In general cutback strategies are service specific rather than across the board.

The net effect of these strategies has been a lowering of quality of overall service provided by the Office of Research Administration. Understandably, there is little enthusiasm for the President's goal of doubling sponsored program activity unless it entails a concomitant expansion or restructuring of the office. However, it is realized that such expansion is unlikely to include the addition of either professional or clerical staff; thus restructuring has become the focus of staff efforts through job reclassification and the more effective use of information system technologies and strategies.

Technical Background

If access to and use of state of the art information systems technology is a valid indicator of the relative competitive advantage of a research office in providing its clients with administrative and data services, the UM Office of Research Administration cannot be considered a serious competitor. It is acknowledged, however, that this evaluation is not for a lack of want or effort on behalf of the office staff. Since at least 1988 efforts have been underway to assess office needs and to develop information system based strategies to address these needs. Several personal computers purchased in the 1980s have been put into service as word processing and database platforms, and preliminary efforts have been made to establish a telecommunications platform capability with tentative exploration of the National Science Foundation's (NSF) INTERNET system to obtain data on NSF programs and research opportunities. However, these efforts and applications remain largely discrete and premised upon individual initiative rather than upon a plan developed from a systematic review of office need and the state of the art in PC technology specific to research administration need. Failure to develop an office plan is largely the result of (1) time constraints imposed by the overwhelming administrative demands placed upon the office, and (2) the overall impact of PCs and information systems technology. In general, the staff have simply been unprepared in terms of their understanding of the technology to put it to effective and efficient use.

Initial efforts to use computers in the office began in the mid 80's when staff, working in concert with UM computer services and student aides, implemented several databases on the campus mainframes. Two of these, the Proposal database and the Faculty interests database were eventually moved to office PCs from the

mainframe. The proposal database, the primary system for tracking and accounting all university sponsored program activities, survived the transition, although by early 1991 had outgrown its original PC database platform. The Faculty Interests database, on the other hand, did not survive the transition from mainframe to PC. For several years the interest's database had been considered of limited usefulness to coordinators, particularly as a mainframe package. This limitation was perceived to be related to the idiosyncrasies and inconvenience of the mainframe environment. However, attempting to recreate the package on a PC revealed that the failure lie in the serviceability of the concept within the constraints imposed by the day to day working environment.

As originally conceived the Interests database was to be used by the Grants Coordinator as he or she reviewed incoming sponsored program information. The database would reveal matches between sponsor and faculty interests to guide the routing of sponsored program information throughout the campus. Overall, the concept was well conceived and indeed is used by a number of universities; yet within the constraints described, it was impractical. The process simply required too much time and (in its various implementations) failed to achieve the robustness required to ensure that the time invested in its use and maintenance was well spent, particularly as the volume of data flowing into the office increased. Two realizations were to eventually emerge as a result of the office's experience with the Interest's database: first was the need to reassess the role of the Grants Coordinator in processing the data; and second, was the need to redefine the data evaluation and distribution. As a result of the latter, emphasis was to change from seeking a technical means of enhancing the ability of the coordinator to evaluate data, to seeking an

effective means of distributing data to faculty for their evaluation. As it stood, the faculty interests database was a roadblock to effective evaluation of sponsored program opportunity data, and a bottleneck to its efficient distribution.

Summary

Through the lens of the President's goal of doubling sponsored program research at the UM it can be observed that existing administrative service and support systems are severely taxed and require either infusions of personnel or technical resources coupled with strategic planning. Since the infusion of additional personnel is unlikely, efforts have been concentrated upon enhancing office use of PC-based information management systems. A closer review of these efforts is provided in the following section.

¹Ray Murray, personal communication, 1991.

²Ibid.

CHAPTER III

OVERVIEW OF INFORMATION PROCESSING CYCLE

Introduction

The following discussions provide a more comprehensive look at the process of sponsored program data processing and the role of the Grants Coordinator in that process. These examinations are then used as the basis for a review of various alternatives for enhancing research data throughout.

Evaluation

Current processing of sponsored program support data at the UM begins with the coordinator performing a preliminary assessment and review of support data to determine the most likely recipient(s) of data. To ensure a reasonable degree of precision in the assessment and review process the coordinator requires a database of faculty research interests. This database can be acquired either through on the job experience or through technical means (e.g., computer based). Neither approach is wholly satisfactory. Developing familiarity with researchers' interests on-the-job is time consuming and can be inconsistent with regards to coverage due to arbitration by the coordinator's interests, social skills, familiarity with the campus, and length of tenure. At best a gregarious coordinator with far-ranging interests will acquire a considerable "feel" for and understanding of faculty interests and capabilities. At worst a reclusive coordinator with narrowly defined interests may develop only a passing acquaintance with the research community sharing his or her

interests. Regardless of the orientation of the coordinator an additional problem with the on-the-job approach is that benefit of the coordinator's knowledge is generally due to job turnover.

Technical implementations of databases, despite their promise have yielded uneven results. Throughout the past ten years coordinators have undertaken development of various computer based *Faculty Research Interests Databases*.¹ While these databases have been conceived to assist the coordinator in evaluating data they have also held the potential to preserve the personal knowledge-base lost whenever the coordinator's position turns over; however, in practice they have fallen far short of realizing this potential. Key failings of this particular technical approach are (1) it is extremely time consuming to develop and maintain a database, thus precluding opportunities for substantive one-on-one contact with faculty; (2) it seldom achieves the degree of precision imagined when development efforts are undertaken; and (3) the databases tend to fail to "capture" the coordinator's knowledge as they are generally not maintained past the tenure of the coordinator responsible for its development. Each of the last three coordinators, for example, have to one degree or another abandoned their predecessors database and begun anew.

Distribution

There is no practicable means of effectively distributing all research support data that is received by the Office of Research Administration. Current distribution methods involve the photocopying of all relevant materials identified by the coordinator to be of potential faculty interest for distribution via campus mail. Expansion of the distribution net as currently implemented would require either (1) improved evaluation methods to identify more recipients, and increased photocopying charges

(not to mention increased utilization of the campus mail facility), or (2) utilization of the "shotgun" method of data distribution--sending out photocopies of data to as many faculty as possible using the barest of criteria for establishing a match, e.g., send any Department of Education Program announcement to all School of Education Faculty (this approach was advocated due to concern that any given piece of information is likely to be received by only one individual whose subsequent use of and use for the data is largely unknown). Neither of these is seen as workable because they exacerbate an already labor and time intensive activity.

Alternative Methods of Evaluation and Distribution

Discussions of alternative strategies for enhancing the distribution process have assumed a "coordinator-centered" process as currently exists. Three alternatives suggested during the course of investigation included: (1) hiring additional Grants Coordinators to ensure a closer working relationship with each School and Division; (2) designating individuals within each subunit to serve as a coordinator, allowing them to subscribe to all the appropriate sources of funding support information, etc; or (3) increasing the frequency with which the GO is distributed from two months to one month or two weeks.

Each example has its disadvantages: Options 1 and 2 relieve the coordinator of some workload and improve the accuracy of evaluating and subsequent distribution costs, but incur the expense of additional personnel and resources. Option 3 represents the most tenable solution but shares the disadvantage of the other approaches in that it treats the problem in terms of discrete steps. Failings of each approach are (1) reliance upon the coordinator as the key for evaluation and distribution, and thus

overlook the need to free the coordinator's time for proposal development support and planning, and (2) each fails to ensure that the knowledge acquired by the coordinator is not lost when due to job turn-over.

Summary

In summary, observation that the Grants Coordinator's time is increasingly spent evaluating incoming sponsored program support data. The result of this can go one of two ways: (a) the coordinator spends more time attempting to keep up with incoming data, or (b) the coordinator spends less time reviewing data and more time working with faculty. Previous efforts undertaken by coordinators to resolve this dilemma have been largely ineffective primarily because they have not addressed a basic flaw in the office data processing cycle--determining who is best qualified to evaluate sponsored program support data. The defacto assumption in the data processing cycle has long been that responsibility for evaluation of incoming data currently rests with the coordinator, *but are coordinators the most qualified individuals for this task?* This report contends that they are not, that research faculty are the most qualified, and that the task of the coordinator should be to ensure that the systems are put in place to ensure that the faculty have the most complete and timely access to sponsored program data that can be reasonably provided. The following section begins a discussion of a plan that will begin to build the capacity of the coordinator to ensure this goal.

¹Ken Hubbard, personal communication, 1990

CHAPTER IV

AN INFORMATION MANAGEMENT SYSTEM FOR RESEARCH ADMINISTRATION

Introduction

The principle justifications for, and primary considerations underlying the development of an information management system are to (1) enhance and integrate the discrete processes associated with the acquisition, evaluation and distribution of sponsored program support data; (2) develop a technical base to position the UM to compete effectively for public and private research support; (3) develop the technical skills of faculty to efficiently and effectively use PCs in support of their research efforts; and (4) enhance and capitalize upon the substantial base of installed PCs at the UM. The key to successfully realizing the implicit goals of these considerations is in realizing that the system must provide these capabilities within certain constraints. First, the system must not rely upon the coordinator as the principle evaluator, but must provide the means to shift this responsibility to the researcher. Second, the system cannot ignore existing the institutional technological base, but must build upon it and provide the means to enhance that base. Third, the system must be consistent with long range strategies emerging from the ongoing work of the UM Computer Users Advisory Committee (CUAC), particularly with regards to CUAC's commitment to networking. And finally, the system must be consistent and sensitive to the advancing state of the art in research information system technologies.

Integration of Needs under an Information Management System

The following discussion outlines six issues that must be addressed as part of the overall enhancement of the flow of sponsored program data and services. This section reviews the issues, and the needs that underlie these issues; the following section summarizes the role of the recommended technologies in meeting these needs.

Issues Review

- Issue One Data Evaluation**--moved from the strict purview of the coordinator to the research community, thus enhancing the accuracy of data evaluation, and freeing the coordinator's time for activities of greater primary importance to the institution;
- Issue Two Data distribution**--reduce the institutional material and human resources involved with distributing and exchanging resource related data;
- Issue Three Data processing**--ensure that whatever physical manipulation and evaluation of data occurs is maximized for its useful impact upon the research community, i.e., handling data once, instead of several times during the distribution process;
- Issue Four Human resources**--free office personnel from labor intensive, non-human oriented tasks that can be handed over to an information management system, e.g. locating Office of Research Administration data resources;

- Issue Five** **Office resources**--enhance the accessibility of the Office of Research Administration's considerable research resources and expertise to the UM research community;
- Issue Six** **Connectivity**--keep the research community in touch with one another, with the office and with developments which affect their productivity.

Associated Perceived Needs

Some of the specific needs from which these issues arise include (note item numbers correlate with above):

1. Perceptions that Research opportunity data are not always distributed in a timely fashion given the often short notice of announcements;
2. The strong likelihood that the population served by the distribution of any given piece of data is restricted by considerations of reproduction cost and the relative acquired expertise of the coordinator with regards to faculty research interests. More comprehensive coverage is required to ensure that all faculty with potential interest in any given data are made aware of the existence of the data;
3. Limitations of the data evaluation process relative to the familiarity of the coordinator with faculty research interests;
4. Problems associated with locating current institutional resource data during the preparation of proposals, e.g., student and faculty demographics, institutional capability, programs and services, etc.; and the concomitant demands placed upon departments repeatedly providing the same infor-

mation. Consolidation and regular updating of this information would result in a more consistent representation of the UM in proposals and reduced expenditures of time on behalf of faculty and department personnel;

5. Perceptions that to access the personnel of the Office of Research Administration is difficult; perceptions due, in part, to the informal structure and habits of the UM; such as faculty's tendency to make appointments through "walk-ins" which disrupt the activities of the Office of Research Administration and make ineffective use of faculty and office personnel's time; and;
6. Faculty interest in the development of a BBS as the equivalent of a "local BITNET," i.e., an electronic forum for the exchange of ideas, information, problems, and data.

Recommended Technologies

Introduction

Several overlapping and interdependent needs have emerged from the preceding discussions that can be addressed with an information system administered out of the Office of Research Administration. The technical resources recommended to meet the specific needs of data acquisition, evaluation and distribution include: a CD-ROM workstation, an electronic BBS and various PC-based databases. Each of these shall be briefly addressed. An in-depth discussion of the merits of instituting a BBS has been included in recognition of the unique problems associated with operating a BBS. The three sections that follow each examine the advantages of techni-

cal approaches to the problems of distributing information.

Building Upon Proven Technologies CD-ROM

Although slow to start, CD-ROM has established itself as the platform of choice for the distribution of specialized information databases. Though beyond the scope of this paper, it is apparent that the commitment of the federal government to develop extensive CD-ROM databases has helped drive the market for these mass storage devices. This commitment, for example, is clearly evident in the US Department of Agriculture distribution of the AGRICOLA database on CD-ROM and the recently announced availability of the Photographic Collection of the US Department of Agriculture containing 66,000 photographs from the department archives to be distributed on two eight inch laser discs. Of more specific interest to our discussion is the distribution of the US Federal Register on CD-ROM, delivered via express mail once a week and containing the full text of the current week's Federal Register plus text of the previous six month's Federal Registers.

One of the country's leading private suppliers of online information, DIALOG, has begun distribution of specialized databases on CD-ROM. Among these is ORYX Grants OnLine, a CD-ROM database distributed quarterly containing 16,000 plus sponsored program opportunities listings similar to the data available on the State University of New York (SUNY) Sponsored Program Information Network (SPIN)

To underscore this discussion the advantages of the CD-ROM ORYX database are outlined below in comparison with the SPIN service currently utilized by the office. It is envisioned that the CD-ROM ORYX database could eventually replace the SPIN service.

- **Unlimited searches**--currently a one year subscription to SPIN with 100 online searches costs \$1200 exclusive of searches in excess of 100 (at \$7 each), printing and postage and handling of search results. The essentially cost free nature of conducting searches with ORYX allows the office to offer access to the database to faculty. With SPIN such access was neither logistically nor financially feasible.
- **Instant review of search results**--SPIN searches are largely "blind," that is, the actual text result of a search is not seen until a week later when the SPIN materials are received at the UM. Often the material received is not satisfactory and remains unused. With SPIN there is simply no effective means of screening the material prior to incurring printing, postage and handling charges. ORYX data can be reviewed instantly for suitability.
- **Faculty access**--As mentioned, offering faculty access to SPIN is not feasible, however, offering access to the CD-ROM workstation is entirely feasible and indeed represents the sort of hands-on review of sponsored program data that this paper argues for. If the success of the Mansfield Library's CD-ROM workstations is any indicator, we can expect heavy faculty and graduate student use of the system.
- **Flexibility**--SPIN provides access to only one database; a CD-ROM workstation provides a technical platform to access a variety of databases. As mentioned earlier, the US Federal Register is also available on CD-ROM and can be accessed by faculty and graduate students.
- **Ease of Use**--SPIN is complex. Training coordinators to use it can take several days. Additional training must also be provided in the basics of PC-based tele-

communications, as SPIN is accessed via a PC equipped with a modem and telecommunication software. In brief, there is nothing simple or easy about using SPIN. A CD-ROM workstation on the other hand is essentially a discrete technology and easy to use.

Building Upon Established Resources: PC-based Databases

Not all information is currently available on CD-ROM. The Catalog of Federal Domestic Assistance (CFDA), one of the most heavily used federal program references in the office, is not yet available on CD-ROM but is available on floppy disks which can be installed upon a conventional hard disk and searched in a manner similar to that used for CD-ROMs.² Additional databases that can be made available have been constructed from or can be constructed from databases currently in use by the office, specifically the Proposal Database used to track sponsored program activity at the UM, and the Faculty Interests database currently undergoing redesign.

Optimizing a Standing Investment: BBS

Introduction

The potential for inter-institutional connectivity inherent in the UM's large installed PC base has remained substantially untapped. This problem has been recognized by the UM Computer Users Advisory Committee (CUAC) which in its March 1990 report, forwarded various recommendations to consolidate the UM computer and data resource base through a local-area network, thus allowing faculty the ability to easily communicate with one another and access the campus mainframes via their PCs.³ Realization of the envisioned campus-wide network, however, according to the CUAC's report and ex-chairman of the committee, Dr. Jerry

Esmay, "is at least two million dollars and two years away."⁴ One of the principal disadvantages of the CUAC's strategy is the network cost associated with installing literally miles of wiring to physically connect each and every PC to one another. Although this report does not argue against the ultimate networking of UM PCs, it does recognize that the realization of such a network is still some years away while a growing need exists to connect faculty into an electronic network now. A BBS provides this capability without infringing upon the goals and objectives of the CUACs report and indeed, in terms of user acceptance, the proposed system would very likely speed acceptance of and demand for a more robust and integrated network of the type proposed by the CUAC.

Services

Widely used by nearly every agency of the Federal Government,⁵ BBSs are recognized to provide a variety of services and allow agencies to "[do] more with the same or fewer resources."⁶ Standard BBS capabilities include: (1) posting of announcements and bulletins; (2) the transfer of text program and other data files to and from the BBS; (3) sending and receiving email and participating in advanced message conferencing; as well as (4) administering surveys and questionnaires. Specific to the issues previously summarized it is possible to develop an integrated environment to:

1. Enhance the ability of the Office of Research Administration to obtain and distribute research opportunity data in accordance with the time-sensitive nature of the data;
2. Increase the faculty population served by the distribution of research opportunity data;

3. Enhance the effectiveness of data evaluation by involving the research personnel directly in the process;
4. Enhance access to the personnel and resources of the Research Administration Office through email;
5. Expand the scope of the resource data we are able to make available; and
6. Provide access to the connectivity benefits of such an email service to the UM research community at large.

These services in effect represent tasks currently performed by the Office of Research Administration in conjunction with other organizational subunits or technologies. In this respect the first five items concentrate upon enhancing, expanding or reducing services through integration. Only item six represents the creation of a new task or service, yet one that is integral with the electronic environment used to integrate items one through five.

Summary

A BBS provides a non-limiting short term solution toward (1) providing a system to integrate PCs into the process of obtaining data and distributing the information they produce with the UM at large, (2) providing faculty with a tool to become familiar with process and procedures of networking, (3) providing the technological platform required by the Office of Research Administration to participate in the growing trend toward the exchange of research support data electronically, a service not likely to be addressed specifically by CUACs envisioned network strategy. Unfortunately, this recommendation is not made without reservation and must be qualified. BBSs are extremely time consuming to implement and maintain. Consid-

eration of a BBS will require either the hiring of an information specialist to coordinate its operation, the hiring of student interns from Computer Sciences, or training of office staff in BBS operation.

The Role of the User

Introduction

A celebrated quote in the popular computing press states that

the problem with personal computers is that they are so personal, and what started out as a passionate embrace of a new technology has turned into a half nelson--with [the user] on the losing end.⁷

Developing and relying upon a technical base is not without its drawbacks and difficulties, particularly in the areas of training and user acceptance. Technical constraints, user expertise, user acceptance can and do limit the use and usability of the recommended information system in the public organization..

Though joked about, the ineffective, inefficient and inappropriate use of PCs plagues nearly all organizations and costs them money in the form of lost time and data. A quick survey of PC users at the University of Montana (arguably the largest single user of PCs in Western Montana) reveals chronic complaints ranging from catastrophic losses of office data due to hard disk failure, to the inability to format a table under Word Perfect, to problems transferring files across various computing platforms, e.g., moving a text file from an Apple Macintosh computer to an IBM PC. Given the widespread use of computers on campus and the considerable organizational data resource entrusted to them, the losses in productivity that such complaints represent can be seen to be considerable and serious.

An example more directly related to the needs of the Office of Research Administration and the research community at large can be drawn from the recent experiences in organizing an EPA research institute consortia proposal submitted by Dr. Jerry Bromenshenk. Participants from around the country, were asked to submit information packets comprised of proposals, budgets and CV's in both hardcopy and disk based formats. Unfortunately, the request for IBM compatible unformatted ASCII files was interpreted in almost as many ways as there were proposers. Some disks came in formatted for use in Apple Macintosh computers. Consequently, almost two full days were spent reentering data, or attempting to transfer data from the Apple Macintosh format to IBM format.

Such problems are perhaps an inevitable side effect of information age technology; however, that does not mean they should be tolerated. A need clearly exist to realize the responsibility of keeping faculty and researchers abreast of new developments in technology, as well as to encourage them to post their questions and concerns about technology, or, as in the previous examples, the requirements of the office. Developing a centralized information management resource would be well-suited to meeting this need.

Discussion

Consideration of these issues should not be by-passed with the assumption that they will work themselves out--they represent very real areas of policy concern. Davies and Hale suggest that when PC's begin to transcend the role of merely automating tasks and begin to transform organizational processes, users begin to question what precisely is being reorganized--people or processes.⁸ While no adequate means exists for alleviating these apprehensions, adoption of the information

system technologies requires greater attention to developing and maintaining support and user groups to facilitate the user's transition to not only a new tool, but also to using the tool to perform old tasks in a new way.

The long-term potential of an integrated data resource base must be viewed against practical short-term considerations. Despite the ability of the system to meet several articulated needs and provide services and benefits not specifically requested, its immediate and widespread use should not be expected. Not all users will adapt to the new process immediately, some may never adapt, but even for those that do the benefits will be proportional to their needs, technical proficiency and their willingness to participate in the use of the technology. Another factor will be the total number of participants across the organization as a whole--a small core of dedicated users is not optimal, hence the need to consider an ongoing process of promoting and supporting the concept through workshops, demonstrations, etc. Finally, building acceptance for a process is more than building acceptance for the idea, it is also a matter of building the technical base and the proficiency to utilize it. A key aspect to bear in mind is that the objective of building the user's technical proficiency is an ongoing process, particularly with regards to new users. This again has two sides, skilled users may result in a more useful and effective system, but as Johnson and King point out, skilled users also make greater demands upon the system in terms of services and capacity.⁹

Summary

While assessing the potential user base is helpful in terms of determining the cost-effectiveness of automating a task, it loses currency when considering transforming a process. As we have seen with PC use, the process of utilizing the technol-

ogy is a negotiation between the cognitive perceptions of the user and institutional technological imperatives; learning how to use a PC has essentially become an institutional imperative, particularly in institutions that are attempting to maintain or increase levels of service delivery with constant or declining resource base. Perhaps adapting to new processes perceived to be institutional imperatives is more likely when seen as necessary to remaining in the loop, users will ultimately become involved although but it must be anticipated that their involvement will be a function of access to and familiarity with the required technology.

Lastly, developing an integrated research information system can be seen as a means of maximizing the UM's investment in PCs, and as a short-term means of realizing the objective outlined by the Computer Users Advisory Committee to network campus PCs. Maximizing the return on PCs is particularly important when one considers that on the average a PC will cost an organization an estimated \$20,000 in technology, training, and service when factored over the useful life of the machine.¹⁰

¹David Stroebel, personal communication, 1990.

²The Catalog, compiled by the Office of Management and Budget, contains the full text of federal program announcements, a deadlines index, and a program index and thus represents an enormous resource for planning research activities and for cross-referencing programs by CFDA as they are often listed in other publications.

³Jerry Esmay, "Computer Users Advisory Committee (CUAC) Annual Report," May 23, 1990.

⁴Esmay, personal communication, 1990.

⁵Although no official list of government BBSs is available, an unofficial listing compiled by the U.S. Department of Agriculture lists more than 50 BBS operated by agencies. The July-August issue of CRS (Congressional Research Service states, "A growing number of government agencies are making data available on CD-ROM, as well as through electronic bulletin boards" (Stephen B. Gould, "Computing and Telecommunications in the Federal Government," CRS Review 11, (July-August 1990): 12-15).

⁶Stephen B. Gould, "Computing and Telecommunicating in the Federal Government," CRS Review, (July-August 1990): 12.

⁷Peter H. Lewis, "Group Dynamics: When the Going Gets Tough The Tough Go To Meetings," PC/Computing, (October 1988): 108.

⁸Thomas R. Davies and William M. Hale, "Implementing a Policy and Planning Process for Managing State Use of Information Technology Resources," Public Administration Review 46, (Nov 1986): 520.

⁹Kenneth L. Kraemer and John Leslie King, "Computing and Public Organizations," Public Administration Review 46 (November 1986): pp 493.

¹⁰David P. Norton and Ronald L. Evans, "Keeping Pace With Technology," Personal Computing, (January 1989): 207.

CHAPTER V

IMPLEMENTATION STRATEGY

Introduction

This section outlines a three phase program to upgrade and augment current office PC-based technologies to a level consistent with the requirements of the proposed information system. An overview of the program phases is provided followed by discussion of pertinent implementation goals for each phase.

Process Overview

Phase One

- Consolidate and catalog sponsored programs newsletters, periodicals, reports, books, manuals, etc. maintained by the Office of Research Administration and survey related holdings of UM subunits.
- Summarize holdings in *GO* and announce access policy.

Phase Two

- Thoroughly review the CD-ROM marketplace to identify potential CD-ROM databases. Request sample printouts and ASCII file dumps as these will be the principle secondary data distribution methods utilized.
- Order Hardware and Software.
- Configure and implement CD-ROM workstation and databases.
- Provide demonstrations and training in use of CD-ROM workstations.
- Summarize holdings in *GO* and announce access policy.

Phase Three

- **Prototype an electronic BBS and telecommunications platform to establish feasibility of offering (1) email; (2) dial-in services to provide 24 hour access to the information resources and personnel (via email) of the Office of Research Administration. ; (3) dial-out services to provide access to the wide variety of national and international information services via INTERNET, BITNET, and BBSs specializing in research support data.**
- **Provide training and demonstration in use of BBS services.**
- **Develop software platform for accessing and utilizing NSF's STIS and Electronic Proposal Submission/Review service.**

Discussion

Phase One Narrative

A considerable amount of sponsored program information received by the office is in print form. This is unlikely to change in the near future, although the principle reference, The US Federal Register, is now available on CD-ROM. Until such time as all commonly used references are available in electronic format, the office will continue to accumulate a considerable number of paper-based references. Presently, this resource is reviewed only by the coordinator and then copied for limited distribution, shelved or filed. It is difficult to assess if the resources would be of interest to faculty. Certainly, however, little interest is likely if the faculty are not aware of the breadth of reference material the office possesses.

Presently, lists are maintained of the titles currently received, the contents of file drawers, etc. These will be updated and revised to indicate the major subject areas covered for faster cross-referencing by faculty using the materials. Toward developing a comprehensive listing of all sponsored program reference materials

held on campus, and perceived need for information, a survey will be constructed and distributed to deans, directors, chair-persons, and faculty. The returned surveys will form the basis of a campus reference to be held in the Research Center, and to guide the acquisitions of additional information sources.

Phase Two Narrative

The CD-ROM workstations are the heart of the overall information system plan, providing the coordinator and faculty alike with unprecedented ease of access to research support materials, the ability to search for data by keyword, sponsor, deadline, etc., and then print out only those data which are pertinent to the search. Currently, the coordinator has no comparable system to access research support data. The State University of New York (SUNY) Sponsored Program Information Network (SPIN) described earlier has been used by the office to perform similarly structured searches, but offers no feasible means to review the data before it is printed by the SPIN staff and mailed to the University for further evaluation.

Installation of a CD-ROM will entail designating a suitable location in the office for a PC, CD-ROM drive, and printer. The newly annexed room would provide a suitable location.

Phase Three Narrative

Implementing a BBS requires a considerable investment of human resources, however, the potential afforded by the system is equally considerable. Fortunately, a BBS can be configured to offer as many or as few services as is perceived to be prudent given resource constraints. A minimally configured BBS can be used to provide just bulletin posting and email, the equivalent of an online GO with a mailbox attached. A sophisticated system can provide file transfer services, and a highly

sophisticated system can provide users with remote access to the CD-ROM workstations. Each successive increase in system sophistication requiring commensurate increases in human expertise and organizational resources. I recommend that the office implement a minimal system to begin with, offering bulletins and email, and then allow both user and operator sophistication, interests and familiarity to dictate expansions and enhancements.

Development of a software platform to effectively utilize INTERNET will require a commitment by the coordinator to use the service. Unfortunately there are no shortcuts to learning either the intricacies of the UNIX operating system used by the UM mainframes that provide the INTERNET connection, or the INTERNET FTP (File Transfer Protocol), TELNET and email systems. The benefits, however, are considerable. The National Science Foundation Network (NSFNET) recently brought the Science and Technology Information Service (STIS) online specifically to augment the distribution of NSF information. Some of the publications currently available on STIS via INTERNET include: the NSF Bulletin, the Guide to Programs, grants booklet -- including forms, program announcements, press releases, NSF telephone book, reports of the National Science Foundation, descriptions of research projects funded by NSF -- with abstracts, and analytical reports and news from the International Programs Division.

The office currently receives many of these publications in paper form. The advantage of using the STIS are:

STIS makes it possible to search through thousands of pages of text in seconds. A query can retrieve sections of the NSF Bulletin, the Guide to Programs, an evaluation report or analytic study, a particular program announcement, a list of projects funded by NSF, and even a listing in the NSF telephone directory.¹

In addition,

STIS contains reports prepared by NSF's Division of International Programs (INT), on basic science and technology trends, developments, policies, and resource allocations in selected foreign countries. It also has topical news items and country profiles.²

Additional services available via INTERNET include access to the computational resource available at any of the nations super computing facilities, plus numerous other public and private computer research centers; library catalogs, including the Library of Congress; data archives; and network and email gateways (see appendix three for partial listings).

¹National Science Foundation Office of Information Science and Information-Analysis Japan Section of the International Programs Division, Science and Technology Information System (STIS) Manual.

²Ibid.

CHAPTER VI

METHODOLOGY

Introduction

The recommendations of this report assume a high degree of user involvement in the design and implementation in conjunction with the services of an individual with demonstrated skills in the field of information systems. It is recognized that occasional users of information systems seldom possess the technical skills related to information system development, or the time to acquire them. Information systems development is simply not part of their job description, nor should it be; however, as has been evident, occasional users have needs and ideas regarding the usefulness of PCs in satisfying those needs. When unskilled users conspire to attempt to develop systems on their own, the result is generally an unworkable system, a frustrated user, and a considerable investment of organizational time and resources. The needs of the user cannot be debated, nor can the value of the organizational resources. The solution to these problems has historically been the involvement of an information specialist to interview the user, observe his or her tasks, and then leave to develop a system which meets the perceived needs of the user, based upon the specialist's limited concept of the user's task. The results, predictably, have been systems that have been as unworkable as those designed solely by the users.

Research in the public sector has demonstrated repeatedly that attention to the process of information system development is as critical to the success of an infor-

mation system as the components of the system. Of the two development strategies, the Iterative Systems Development Cycle (ISDC) and the Systems Development Life Cycle (SDLC), the former is currently favored in the public sector.¹

Iterative Systems Development Cycle

The process of involving the user in the iterative development of prototypes is the strength of ISDC. First, ISDC advocates the rapid development of prototypes to involve users in the process of reconciling and modifying their needs with the limitation or capabilities of the computing platform. Second, implicit in the notion of rapidly generated prototypes is an iterative process of development. As prototypes are developed and used, not only are weakness in their design discovered and corrected, but users are able to adjust their conceptualization of their needs in terms of their growing understanding of the capabilities of the computing platform. The user's understanding of their information needs tend to evolve along with the evolution of the system and is not fully formed until they have used the system for sometime.²

Roles for end users in ISDC design include roles in or as:

- **Consultation**--reactions to design concepts and proposals;
- **Members of the systems design team**--interacting with the analysts and designers one on one;
- **Participative Design**--places the users in the role of the design team with the analysts and designers in place as consultants--this approach seems to be resulting in better communication, less resistance to new systems, more productivity, job satisfaction, and a more efficient development process.³

Specific related advantages of the ISDC include:

- The iterative systems avoids destructive rigidity. The prototyping approach allows rapid low cost and low risk development that is flexible and responsive to changing environmental factors.
- The iterative systems approach mandates user involvement to enhance later acceptance of the system, and more consistent and accurate usage.
- The iterative systems approach use of prototypes ensures that the organizational goals and strategic issues are incorporated into the systems planning process.⁴

Even though the SDLC was not chosen, brief mention should made of the perceived weaknesses of this system in terms of the proposed project. First, SDLC requires an approach to system development on a unit by unit basis to ensure that specific unit data processing needs are met. This approach often results in a poorly designed system, duplication of effort, lack of data sharing capabilities, and loss of utility for upper level management decision makers. Organization of the system requires a top-down approach with management supervising, requiring only subgroup cooperation, versus participation. In terms of iterative development, SDLC precludes feedback cycles to return to previous phases of the development cycle, resulting in a "freezing" of the system specifications early on in the development process. Rubin also notes that under SDLC, too many assumptions are made of the users in terms of their ability to identify their needs precisely within the context of an as yet unrealized system.⁵

Iterative Systems Model

Systems Planning and Evaluation	Perception of need Develop information system plan Feasibility analyses
Preliminary System Analyses	Analyze existing system Establish information requirements Establish initial prototype specs
Preliminary System Design	Design process logic Input-output & manual procedures
Initial Prototype Implementation	Develop prototype program and procedures Construct dbase Delivery to users
Prototype Cycle	Evaluation Analysis Design Implementation
Operation and Maintenance	Operate system Post audit evaluation

¹Barry M. Rubin, "Information Systems for Public Management: Design and Implementation," Public Administration Review 46, (November 1986): 550.

²Ibid., 542.

³Ibid., 543.

⁴Ibid., 550.

⁵Ibid., 543.

CHAPTER VII

RESOURCES AND COSTS

Introduction

Briefly summarized, the information system plan advocated here calls for the following hardware purchases: one new computer system, one hard drive, and one CD-ROM player. The new computer system should be installed in the Program Assistant's work area. The assistant's computer will receive a hard disk upgrade (from 40 mb to 80 mb) and be moved to the coordinator's work area. The coordinator's present machine will not be upgraded and will be moved to the secretary's position. The secretary's present computer will be fitted with a CD-ROM drive and used as a workstation for use by the coordinator and faculty to search CD-ROM versions of the Federal Register (distributed weekly), and ORYX's Grants OnDisc, a SPIN-like database service of private and federal grant opportunities (distributed bimonthly).

It should be noted that the CD-ROM drive price is offered at a discount when purchased in conjunction with a subscription to the Grants OnDisc. Additional savings can be realized if the subscription to the CD-ROM services allow discontinuation of subscriptions to the SPIN database service and the Federal Register (total \$1540.00, not inclusive of printing, mailing, and additional search charges levied by the SPIN service). The difference in cost between CD-ROM subscription and present paper-based subscriptions total an additional \$710 per year.

The initial start-up cost, including hardware and software for the CD-ROM workstation totals \$4,422. Yearly recurrent costs thereafter total \$848 at 1991 pricing. Total start-up costs for a BBS total \$1,050. Total cost for implementing both systems: \$5,472.00.

CD-ROM Workstation

Hardware

Item	Description	Cost	Notes
Computer	Zenith-386 SX Model 80	2399.00	
Hard disk drive	Micropolis 125 mega-byte	525.00	
CD-ROM Drive	Hitachi CD-ROM Drive (Model CDR-1530S)	650.00	
	EQUIPMENT TOTAL	3,574.00	

Software and Subscriptions

CD-ROM Database <i>Federal Register</i>	One Year subscription, updated weekly	1400.00	recurrent cost
CD-ROM Database <i>Grants OnDisc</i>	One year subscription, updated bimonthly	850.00	
Floppy Disks Database <i>Catalog of Federal Domestic Assistance</i>	One year subscription, updated yearly	100.00	recurrent cost
	SUBSCRIPTION TOTAL	2,350.00	yearly recurrent cost
	GRAND TOTAL	5,924.00	

BBS

Upgrading Faculty Hardware and Software

Hardware

Issues and cost associated with facilitating faculty access to the BBS unequipped with PCs is beyond the scope of this report. One approach to facilitating access to the BBS is to ensure that a departmental computer be equipped to access the system and be made available to the faculty. For faculty equipped with PCs, requirements are: a modem (approximately \$60-100) and access to a telephone line. All or most faculty have the latter, and some PCs are already equipped with modems and telecommunications software. Additional support costs could be incurred dependent upon problems arising from configuring PCs with the modem. Normally such configuration is a straightforward procedure, however, this cannot be taken for granted.

Software

Telecommunications software is required to arbitrate the connection between the users PC and the BBS host PC. Software costs run approximately \$35-150 per PC. Fortunately, the vast majority of telecommunications software is *freely* distributed through the shareware concept, meaning that payment is not made until the user decides to make payment. Site licenses are available, and are recommended to ensure that shareware authors are properly compensated. However, the software can be readily acquired at no cost. Additionally, most modem packages will include a copy of one of the popular shareware packages.

Cost

Total cost for upgrading faculty resources can be anticipated to run from \$0 to \$150 per PC depending upon the software and hardware chosen. Costs associated with skill upgrading cannot be projected, but should be considered vis-a-vis incorporating the training in new faculty orientation, and through regular workshops to hold the line on incurring ad hoc training expenses.

Upgrading Office Hardware and Software

Introduction

A BBS adequate to meet the long-term system needs of the UM research community will require an adequately powered PC to serve as a dedicated BBS host. As the BBS will be run utilizing an existing office PC, only the cost of a modem and software must be calculated. Total cost: \$1,050.

Hardware

2400 baud modem w/MNP5 error correction @ \$150.00

Software

Fortunately, BBS software is widely available as *Shareware*; shareware is a high quality low-cost alternative to commercial software. Shareware programs are typically distributed via BBS and may be freely downloaded and used. If after a set period of time the program proves satisfactory, a registration fee is paid to the program's author. In exchange for the registration fee, the author then provides support, upgrades, printed manuals, etc. Overall, the concept works well, and is widely used. As shareware is not freeware and must be registered if used, the software needs of the BBS will cost approximately \$900.00.

CHAPTER VIII

CONCLUSION

This report has outlined the need and method for a four phase information system plan to enable the UM Grants Coordinator to more efficiently and effectively meet the information needs of the UM Research Community and to enhance the capacity of the UM to compete effectively for research support from public and private donors. The four phase plan outlines the establishment of a Research Information Center to enhance the flow of sponsored program support data throughout the UM research community by: (1) expanding the application of information technologies in the daily operations of the Grants Coordinator; (2) extending access to these expanded information technologies to the UM research community at large; and (3) enhancing the Office of Research Administration's staff's ability to understand, plan for, implement and utilize the information technology resource.

Implementing this plan would involve (1) designating a central location for research support data on the UM campus where faculty and students can access sponsored program news and support data in a variety of print and electronic formats; (2) developing dial-in services (BBS) to provide the UM research community with 24 hour access to the resources and personnel of the Office of Research Administration; and (3) utilizing the National Science Foundation's INTERNET, NSFNET, and Science and Technology Information Services (STIS) to access a wide and growing variety of national and international information services specializing in research support.

To these ends the research center would maintain: (1) a library of print materials and publications currently subscribed to by the Office of Research Administration and an index of other on-campus resources; (2) a CD-ROM workstation for searching CD-ROM versions of the US Federal Register, ORYX Grants OnLine database, and the Catalog of Federal Domestic Assistance; and (3) an electronic bulletin board service (BBS) to provide the UM research community with email services as well as access to an online version of the GO compiled daily; computer software to enhance productive use of personal computers; institutional data frequently required by proposals; research and proposal development information such as budget templates for spreadsheets, etc. In addition, a software platform for more effective use of INTERNET would be developed as a demonstration project and to enhance the Grants Coordinator's ability to use INTERNET efficiently.

The four phase plan is intended to be incremental and thus allow the office the flexibility to implement as much or as little as is feasible. The total cost of a fully implemented plan is slightly more than \$5,500, exclusive of personnel costs. The time frame for the complete installation of all the required technology once on-site, assuming a full implementation, is three to six months. Development of staff expertise in the operation and maintenance of the information system is somewhat more problematic, depending upon the degree of implementation, learning curves, etc.

In brief, the plan is premised upon the observation that the Grants Coordinator's time is increasingly spent evaluating incoming sponsored program support data. The result of this can go one of two ways: (a) the coordinator spends more time attempting to keep up with incoming data, or (b) the coordinator spends less time reviewing data and more time working with faculty. As discussions and interviews

with deans and chairs earlier this year revealed, the former case results in the perception that the Office of Research Administration is out of touch and waits for the faculty to come to it (the relative merit of these perceptions is beyond the scope of this report). In the latter case the results are more tangible--the cost effectiveness of the data resource is compromised, the office spends money upon the acquisition of data that is not exploited to its fullest potential.

Previous efforts undertaken by coordinators to resolve this dilemma have been largely ineffective primarily because they have not addressed a basic flaw in the office data processing cycle--determining who is best qualified to evaluate sponsored program support data. The defacto assumption in the data processing cycle has long been that responsibility for evaluation of incoming data rests with the coordinator, *but is the coordinator the most qualified individual for this task?* This report contends that he or she is not, that research faculty are the most qualified, and that the task of the coordinator should be to ensure that the systems are put in place to provide faculty with the most complete and timely access to sponsored program data possible. The plan advocated by this report would begin to build the capacity of the coordinator to ensure this goal.

This report attempts to answer the question posed by the Associate Provost for Research and Economic Development, "Where does this office want to be in two years in terms of information systems?"¹ In response, this plan has indicated that the office should strive to develop the technical systems and expertise required:

- To ensure that sponsored program support data can be obtained in the format most conducive to redistribution and thus reduce redundant data entry and tedious hand-evaluation; and

- To utilize (a) state of the art information retrieval systems, and (b) the envisioned campus network recommended by CUAC as a means of providing faculty with the means to quickly locate, acquire and evaluate data pertinent to their research interests.

The buzz words, "state of the art," should not arouse undue suspicion. However, this report has indicated that they should serve to temper expectations with an understanding that state of the art technology is useless without the expertise and willingness to apply it. The issue underlying the use of the words, however, is that the public and private sector information vendors have chosen and are committed to utilizing state of the art information systems to distribute a wide variety of sponsored program support data. The National Science Foundation has just come online with STIS, the Science and Technology Information System, accessible via INTERNET using FTP or TELNET. If these terms sound foreign to the reader then the point is made, for currently only one individual in the Office of Research Administration is familiar with either the terms, STIS, or the procedures for obtaining program information, RFPs, or submitting proposals electronically to NSF.

This is a case for concern because NSF has indicated its desire to move towards complete electronic transmission and submission of data as the following notice received electronically from NSF demonstrates.

In an effort to cut printing and mailing costs and to offer the public faster access to NSF publications, the Foundation recently introduced the Science and Technology Information System (STIS), our new electronic publishing system. Many subscribers to the Bulletin now go online to access and print out each issue. It would be very helpful if these subscribers would return the last page of the mailed Bulletin, indicating that they no longer need to receive the printed material.²

While it may seem that the day when NSF completely discontinues paper distribution of data is still far off, the groundwork is being established now, and now is the time for the Office of Research Administration and the UM to begin building the systems, acquiring the expertise and determining the technical criteria required for evaluating future job applicants.

This last issue can be used to serve as an example of the considerations that need to be made. Criteria guiding the selection of the last grants coordinator included determining whether or not the applicants were familiar with Word Perfect, a word processing package in use in the office. No inquiry was made regarding the familiarity of the applicant with information systems, INTERNET, telecommunications, even though these are the more salient skills required to position the UM to begin to compete effectively for sponsored program support. Indeed, knowledge of Word Perfect, as it turned out, was superfluous to the demands of the coordinator position, as Lotus Development Corporation's Manuscript word processing package has been used instead due to its flexibility in producing the Office's monthly research newsletter, *GO*.

Unfortunately, no single strategy will enable the Office of Research Administration to catch-up with the state of the art. Meeting the challenge of the information age, and meeting the challenge of President Dennison's goal of doubling sponsored program activity at the UM over the next four years will require vision and dedication. It will also require time and capital and a reconsideration of office hiring policy. The choices facing the office are simple: keep up and remain competitive, or fall behind those institutions which are forging ahead with implementation of information systems. To implement the latter choice is simple enough to

accomplish. To implement the former will require obtaining the technology, building the expertise of the office staff and creating an awareness of the potential of the technology to not only automate tasks, but to transform processes. The plan recommended in this paper is neither complex nor prohibitively expensive. The technology recommended (CD-ROM workstations, telecommunications hardware) is already in wide use throughout the research community in various implementations. The greatest challenge and key to the success of the plan is the participation of the staff of the Office of Research Administration, Deans, and department chairs in creating an atmosphere of support and optimism.

¹Ray Murray, personal communication, 1991.

²OLPA, NSF, "Announcements," Bulletin, Volume 18, No. 9, (May 1991).

APPENDIX ONE

DOCUMENT.TXT

NSF Electronic Proposal Submission

(Last revised on February 14, 1991)

This document describes the NSF Electronic Proposal Submission (EPS) project. A second document, Software, describes the procedures for preparing a proposal using the EPS software. Section 5.3, below, describes how to obtain this second document.

This document contains the following sections.

1. Purpose of EPS
2. Brief History
3. Characteristics of EPS
4. Recent Changes and Current Status
5. Participation
 - 5.1 Requirements
 - 5.2 Establishment of an FTP Account at NSF.
 - 5.3 Obtaining the Software.
 - 5.4 Preparing the Proposal.
 - 5.5 Submitting the proposal

We have tried to be complete, if not concise. If you have any questions and/or suggestions, please contact Larry Edwards (ledwards@nsf.gov (Internet), ledwards@nsf (Bitnet), or, as a last resort, 202-357-7439).

1. Purpose of the EPS

The Electronic Proposal Submission (EPS) Project is the initial phase of the transition of NSF's proposal processing from paper-based to electronic. This goal cannot be achieved without similar changes in the universities' processing and submission of proposals to NSF. This project focuses, then, on converting the paper processing within NSF as well as facilitating, insofar as possible, the analogous process at participating universities.

2. Brief History

In the last few years, NSF has actively pursued the goal of introducing new electronic communications technology into the proposal submission, review, and award

processes. The first formal project was EXPRES, EXPerimental Research in Electronic Submission, an NSF funded research and development project to create a prototype of a next generation information technology environment to support NSF and its scientific/engineering constituency in the creation, submission, and review of research proposals.

As part of the EXPRES project Carnegie-Mellon University prepared a set of PostScript-based proposal generation tools to facilitate the preparation of NSF proposals. This effort soon became known as PS-EXPRES. Many proposals are created by word processors which can output high quality text and graphics much of which is printed on PostScript compatible laser printers. PostScript, a trademark of Adobe Systems Inc., was chosen as the file format for the electronic proposal because it is widely supported and handles text and graphics easily. Thus the electronic proposal submission can be printed directly on a laser printer when it arrives at NSF and the submitter knows that what NSF prints is the same as what was printed at the submitting institution.

The PS-EXPRES software provided a means of creating the NSF forms and combining them with the institution created proposal text (including graphics). It runs on UNIX, VMS, Macintosh, and PC operating systems. Proposal templates for some common document processors were also created. The document, document.txt and the printable version, document.ps, available via anonymous ftp (see below), describe the software in detail.

Recently, we changed the name of the project from PS-EXPRES to Electronic Proposal Submission (EPS) to emphasize our focus on the creation and electronic submission of proposals, as opposed to other documents.

Finally, NSF has been working with NIH to coordinate EPS and the recently started NIH EGAD (Electronic Grant Application Development) project. We all understand how valuable it would be to all concerned if the EGAD and EPS procedures and software were similar.

3. Characteristics of EPS

Proposal Transmission

The only paper that needs to be sent to NSF is a single copy of the cover sheet. The EPS office provides all paper copies of the proposal required by NSF.

Proposals are deemed received on the date they are ftp'd to the EPS host computer. The actual submission takes only a few minutes.

Assignment of the Proposal to a Program

The routing of the printed version of an electronically submitted proposal is somewhat different from that of a hard copy submission. It is, therefore, important that the information in the "FOR CONSIDERATION BY NSF ORGANIZATION UNIT" block on the cover sheet be provided to ensure proper routing.

4. Recent Changes and Current Status

NSF has, to date, received about 200 electronic proposals. Each of these electronic submissions was accompanied by the submission of one paper copy, the signed original, of the entire proposal. After a recent reinterpretation of NSF policy we now need to receive only the cover sheet in paper copy. It can be faxed (202-357-7663). We are investigating the possibility of eliminating the paper copy entirely.

The 200 or so electronically submitted proposals came from individual researchers as well as from sponsored research offices. While this was appropriate for the first stage of the EPS project, it is no longer tenable for NSF to accept submissions from individual researchers. In the procedures described below you will see that we now accept proposals only from the official approving office of the university, i.e., the office of the Authorized Institutional Representative (AIR).

In the past we have provided the PS-EXPRES (now EPS) software on diskettes. We will not do this any more. The software will be available only via anonymous ftp (Section 5.3). We assume that since the AIR's office must be able to use ftp to submit the proposal (Section 5.5), the same office can obtain the software via ftp and distribute it within the campus.

The currently available proposal submission software, Version 3.0, is consistent with the current version of the NSF Grants for Research and Education in Science and Engineering (GRESE), 90-77, released in September, 1990. In particular, version 3.0 contains the changes to the Form 1225 & Cover Sheet. Also the Lobbying Certification has been added. (The Lobbying certification is required for any proposal over \$100,000.)

There are many possible fonts available among the text editors capable of PostScript output. While we appreciate the aesthetic value of many fonts, we must restrict the fonts to those we can print. Currently we have the following fonts available:

Symbol Helvetica, -Bold, -Oblique, -BoldOblique, -NarrowRoman Helvetica Condensed -Medium, -Bold, -Oblique, -BoldOblique Times-Roman, -Bold, -Italic, -BoldItalic Courier, -Bold, -Oblique, -BoldOblique NewCenturySchlbk-Roman, -Bold, -Italic, -BoldItalic Palatino-Roman, -Bold, -Italic, -BoldItalic ITC Bookman-Light, -LightItalic, -Demi, -DemiItalic ITC ZapfChancery Medium Italic ITC Avant Garde Gothic-Book, -BookOblique, -demi, -demioblique

For any other font, e.g., a special graphics font or a TeX font, the requisite font information must be included in the submission. We accept only what we can print.

A continuing problem in printing the submission is the lack of adherence to Adobe's "Conforming PostScript" standard. That is, many word processors output PostScript; but it is tailored for that word processor's environment. A good example is that most PostScript created in the Mac environment is non-conforming. The result is that we often have difficulty printing the submission. NSF is now working with Adobe to develop solutions to this problem.

5. Participation

5.1 Requirements

University EPS Contact Person

A person within the Authorized Institutional Representative's (AIR) office must be designated the EPS contact person at the institution. This person, presumably a research administrator (RA), should be reasonably computer literate or have access to system support. All proposals from the university must be transmitted by this person (or from his/her office) to NSF. Internet Access

The proposal will be transmitted from the AIR's office over the Internet to an NSF host computer. Thus the university must be on the Internet and the AIR's office must have access to an Internet host computer. Many AIR's offices do not know if their university is on the Internet. To find out, the first place to ask is the university's computer and/or network support center. The National Network Service Center, the support center for the NSFNet (617-873-3400), may know if the university is already on the Internet. They also can explain how to get on the Internet. (If you call and get a recording, be sure to leave your full mailing address and they will send you an information packet.)

Internet Capabilities

The RA must have an email address for general communication with the EPS office and have access to the TCP/IP file transfer protocol (ftp) software for retrieval of software and transmission of proposals to NSF Internet hosts. It will be useful for the RA to be on the EPS mailing list. To join the list the RA should so request via email to nsfprops@nsf.gov. PostScript Printing Capability

The institution must have the capability to produce the proposal in PostScript output form. Many text processing software packages can produce PostScript output. The EPS software provides the capability to create the NSF forms and combine them with the proposal body. The institution must also have access to a PostScript laser printer to print copies for its own use.

5.2 Establishment of an FTP Account at NSF.

The RA requests the NSF EPS office (nsfprops@nsf.gov or 202-357-7439) to establish an ftp account for the AIR's office. The EPS office will give the RA the name of and a password for the account.

5.3 Obtaining the EPS Software.

The software is available in source and executable form via anonymous ftp as follows.

Note. Throughout the this document, dialogues with your computer are written as your entry in bold-face following your computer's last response, e.g.

```
login: userid
ftp> n3.nsf.gov (If unsuccessful, try 128.150.195.43 in place of n3.nsf.gov)
ftp> Name: anonymous
ftp> Password: anythingyoulike
ftp> prompt
ftp> ascii
ftp> cd common
ftp> mget *
ftp> cd ..
```

(There will be a lot of back-talk from ftp besides the "ftp>" prompts shown.)

This will retrieve the common files everyone needs. In particular, the file, Software.txt and the printable version, Software.ps, describe the procedures for preparing a proposal using the EPS software.

We provide the executables for PC's. To retrieve them type:

```
ftp> binary
ftp> cd pc
ftp> mget *
ftp> cd ..
ftp> ascii
```

For Mac's we provide the files necessary to build the executables. To retrieve them type:

```
ftp> cd mac
ftp> mget *
ftp> cd ..
```

We assume that anyone with a UNIX or VMS system can build the executables from the source code in the src directory. The document install.txt in the src directory describes this process for UNIX as well as for VMS systems. The src directory contains:

Install.txt: Instructions for building executables.
 C-Programs and Header files: *.c and *.h
 UNIX-specific files: Makefile

VMS-specific files: `compile.com`, `descrip.mms`

Macintosh-specific files: `*.r`, `nsfforms.make`, `nsfmenus.c`, `window.c`, `nsfwndw.h`

PC-specific files: `*.mak`

To retrieve these files type

```
ftp> cd src
ftp> mget *
ftp> cd ..
```

The following directories contain document processor templates for proposals:

```
scribe
tex
latex
troff
```

For example, to retrieve the `tex` template, type

```
ftp> cd tex
ftp> mget *
ftp> cd ..
```

To exit ftp type:

```
ftp> quit
```

5.4 Preparing the Proposal.

As stated in the beginning paragraph, the document, `Software.txt` (or its printable version, `Software.ps`) describe the procedures for the preparation of a proposal using the EPS software. As mentioned above it is important to provide the information in the "FOR CONSIDERATION BY NSF ORGANIZATION UNIT" block on the cover sheet.

5.5 Submitting the proposal

As explained above only the AIR or his/her designee may submit proposals electronically. In the following process you may substitute any name in place of "Your-ProposalName". However, it would facilitate our procedures if you used the PI's last name. The "xx" in "submitxx" and the password were obtained in section 5.2 above.

```
ftp> n3.nsf.gov (If unsuccessful, try 128.150.195.43 in place of n3.nsf.gov)
```

```
ftp> Name: submitxx  
ftp> Password: password  
ftp> put YourProposalName  
ftp> quit
```

Once the transfer succeeds, notify us by emailing to nsfprops@nsf.gov. Then fax (202-357-7663) a single signed copy of the cover sheet. We will print the proposal, check it for completeness, and take the printed version to the normal NSF proposal receiving office to have it logged into the system as though it had been received in hard copy, i.e., it will be issued a proposal number and sent to the appropriate NSF division. We will email you the proposal number as acknowledgement.

APPENDIX TWO

NSF ELECTRONIC PROPOSAL MEMORANDUM

From ledwards@n2.nsf.gov Thu May 9 09:25:10 1991
Received: from n2 by Note.nsf.gov id aa29937; 9 May 91 10:41 EDT
Received: by n2.nsf.gov (NeXT-1.0 (From Sendmail 5.52)/NeXT-2.0)
id AA00454; Thu, 9 May 91 10:40:23 EDT
Date: Thu, 9 May 91 10:40:23 EDT
From: ledwards@n2.nsf.gov
Message-Id: <9105091440.AA00454@n2.nsf.gov >
Received: by NeXT Mailer (1.62)
To: Linda Cornell <lcornell@milton.u.washington.edu>
Subject: Re: Your procedures for handling electronic proposals
Cc: eps@note.nsf.gov
Status: RO

Linda,

You have asked several good questions. I thought others might be interested in the answer and so have sent this reply to the eps mailing list.

Right now all I do is print the proposal and then take it to the NSF Proposal Processing Unit (where the paper proposals arrive) and ask a clerk there to log it in the usual fashion. From that point on the proposal is handled as though it had arrived as a paper copy. The only real difference NSF program staff will notice is that some proposal data will already be in the computer system when they first go to enter the proposal data. We plan to increase the data we capture from the electronic proposal upon arrival. For example, we will, some day, capture the PI's resumes and make them available online to program managers. The proposal summary and budget will also be captured in the not-too-distant future. We will have to develop systems to manage these processes. Right now we are in the middle of a transition of our central information system to an IBM mainframe. Once the current processes are ported over, we will add new processes, like expanding the proposal data captured.

However, the proposal will still be printed upon arrival at NSF for a long time to come. Our goal is to minimize the number of proposal copies printed and eliminate the storage of paper copies. But we don't see the possibility of reading and reviewing proposals online for several years. The technology simply is not good enough. I have a PostScript previewer on my NeXT work station and have looked at several proposals on the screen. The resolution isn't high enough and there is very limited ability to move around the document. Very few people would want to read a complex document on a screen. Now, there are some NSF staff who don't really need to see the entire proposal to do their jobs. We will be able to provide those people with

the information they need without printing another copy of the proposal. But program managers and reviewers will continue to want to read paper copies for quite some time.

Larry

Begin forwarded message:

From: Linda Cornell <lcornell@milton.u.washington.edu>
Subject: Your procedures for handling electronic proposals

To: Larry Edwards <ledwards@nsf.gov>
Date: Tue, 7 May 91 9:29:40 PDT
X-Mailer: Pine [version 0.9.703]

Hi there,

We were wondering how you currently handle electronic proposals on your end, and what you see as being future handling procedures.

Are you printing them and processing the hard copies per usual? Are you trying to look at them on PostScript readers? Will you be trying to eliminate all hardcopy? What are you doing about storing the electronic proposals now, and what technologies and procedures are you anticipating using in the future? What benefits and obstacles do you anticipate in the short and long term?

We thought if we understood a little more about what you are trying to accomplish on your end, it would help us design and implement some short term processes and guide the development of our long term solutions!!

Any help would be appreciated!! Thanks much!

Linda Cornell
 University of Washington

P.S. Any luck on that information about getting MS-Word 5.0 on the PC to print PostScript without having to send that postscrp.ini file to the printer first?!

From ledwards@n2.nsf.gov Thu May 9 10:26:28 1991
 Received: from n2 by Note.nsf.gov id aa03851; 9 May 91 11:50 EDT
 Received: by n2.nsf.gov (NeXT-1.0 (From Sendmail 5.52)/NeXT-2.0)
 id AA00526; Thu, 9 May 91 11:50:15 EDT
 Date: Thu, 9 May 91 11:50:15 EDT
 From: ledwards@n2.nsf.gov
 Message-Id: <9105091550.AA00526@n2.nsf.gov >
 Received: by NeXT Mailer (1.62)

To: eps@note.nsf.gov
Subject: Thoughts on future NSF EPS project
Status: RO

Any comments?
Larry

NSF Electronic Proposal Submission

In the last few years, NSF has actively introduced new communications technology into the proposal process. The first formal project was EXPRES, EXPerimental Research in Electronic Submission, an NSF funded project to develop a new information technology environment to support NSF and its scientific/engineering constituency in the creation, submission, and review of proposals. As part of the EXPRES project Carnegie-Mellon University developed a set of programs to facilitate the preparation of electronic proposals. Out of this effort came the current NSF focus, the Electronic Submission of Proposals (EPS) project.

To date NSF has received over 200 proposals electronically. In the current procedure the proposal is sent electronically over the Internet and printed in the Office of Information Systems (OIS). A fax of the cover sheet is concurrently sent to satisfy the certification requirements. OIS takes the printed proposal to the Proposal Processing Unit (PPU) for login and subsequent routing to the research division. PPU retains no copies of the proposal. When the division wants copies for the review process, it contacts OIS and we print the number of copies needed.

NIH has started its own Electronic Grant Application Development (EGAD) project. NSF and NIH are developing a common set of data, file, and software formats.

By this summer OIS will upload the electronically submitted proposal data directly to the IBM mainframe so that division staff need not enter the proposal initial entry data. At that stage the benefits of the project will be reduced copying and transmittal costs for the universities, as well as decreased proposal storage and data entry requirements for NSF.

However, the real benefits of EPS will not be apparent until much more of the vision is implemented. The current project is just the start of a long-term revolution in how we process proposals as well as other university submissions, e.g., the 98A. The vision is more than an NSF "electronic proposal folder" for it includes processing at the universities.

The first step is a new definition of a proposal. NSF is developing, with NIH, a representation of an electronic proposal that is a combination of data and compound text. The data are the elements in the various boxes on the NSF (and NIH) forms, as well as information like Budget Justification and Results from Prior NSF Support. They are normally simple text and can be entered and stored in the universities' and NSF's information systems.

The intellectual content is contained primarily in the project description and typically is compound text, i.e., contains equations, graphs, even photographs. At present it is not technologically feasible to handle compound text in an information system, except to store it for subsequent printing. The sections of the NSF proposal which are compound text will be represented as printable files.

The "proposal" then would no longer be any paper presentation but the set of data and compound text submitted to NSF.

The implementation of this representation of a proposal will facilitate and require a new "view" of the proposal.

1. Staff at both the universities and NSF will be able to deal with parts of the proposal. For example, as a proposal goes through the approval chain at a typical university, not all offices are interested in the actual intellectual content, i.e., the project description. Many are interested only in the budget and/or the presence of certain flags, e.g., research involving genetically engineered organisms. Such a representation would allow the universities to deal electronically with the appropriate subset of the entire proposal. This should expedite the development of universities' automated proposal processing systems, especially as the form of the NIH proposals will be the same. It may be that simple email would suffice for the transferral and approval of these data subsets within the university.

2. Similarly, the proposal forms will be printed in appropriate format. For example, NSF reviewers do not need/want to see all the information on the current cover sheet, e.g., institution code, the authorized organizational representative's telephone number, the PI's social security number. Then the printed copy of the proposal that is sent to the reviewers should not contain those data. Thus the presentation of the "proposal" could vary at both the universities and NSF according to the needs of the particular viewer.

APPENDIX THREE

INTERNET DESCRIPTION AND SERVICES

INTERNET

Internet arose during the 1970's through the funding of the Defense Advanced Research Projects Agency (DARPA). It is estimated today that Internet has between 40,000 and 500,00 hosts (UMT, Selway, and Clarke are considered hosts) and a user base of 500,000. The INTERNET is principally a North American network, but has a growing number of overseas connections. INTERNET is estimated to have access to over 400 other networks, among them, BITNET, CSNET, and USENET.

INTERNET Resources

It should be noted that the following lists are incomplete and provided only to indicate the variety of information resources and services available via INTERNET. Descriptions of these and other services are available from the National Science Foundation Network via anonymous FTP to NNSC.NSF.NET.

Computational Resources

- Air Force Supercomputer Center at Kirtland AFB
- Center for Theory and Simulation in Science and Engineer
(Cornell National Supercomputer Facility)
- John von Neumann National Supercomputer Center
- National Center for Atmospheric Research
- National Center for Supercomputing Applications
- National Energy Research Supercomputer Center
- Northeast Parallel Architectures Center

Ohio Supercomputer Center
 Pittsburgh Supercomputing Center
 San Diego Supercomputer Center
 US Army Ballistic Research Laboratory
 University of California at Berkeley
 SuperComputing Services, The University of Calgary
 Center for Experimental Research in Parallel Algorithms,
 Software and Systems (CERPASS)
 University of Texas System Center for High Performance
 Computing
 North Carolina Supercomputing Center
 University of Arizona Supercomputing Center
 UCLA Office of Academic Computing

Library Catalogs

Boston University (TOMUS)
 Univ. California and California St. (MELVYL)
 Colorado Alliance of Research Libraries
 Research Libraries Information Network (RLIN)
 Florida Center for Library Automation
 MIRLYN, The University of Michigan's Online Catalog
 University of New Mexico Gateway
 Emory University Libraries Online
 Public Access Catalog
 MAGIC
 Info-Lib
 InfoTrax
 ARLO, The Library Catalog for the University of
 Colorado at Colorado Springs
 The Catalog of the University of
 Pennsylvania Libraries
 The University of Wisconsin

Madison and Milwaukee Campuses
 Network Library System (NLS)
 Northwestern University LUIS Online Catalog
 URSUS, University of Maine System
 Library Catalog
 University of Illinois at Chicago
 NOTIS/LUIS
 Cleveland Public Library Catalog
 Penn State University Library Information
 and Access System
 Harvard Online Library Information System
 (HOLLIS)
 Cataloging from the Library of Congress
 The Online Catalog, Princeton University Libraries
 POLYCAT, The Cal Poly, SLO, Kennedy Library's
 Online Catalog
 OASIS University of Iowa Libraries

Data Archives

Gene-Server
 LiMB
 MEMDB: Medieval and Early Modern Data Bank
 NETLIB Mathematical Software Distribution System
 SIMBAD
 SIMTEL20 Software Archives
 Southwest Research Data Display & Analysis System (SDDAS)
 IBM Supercomputing Program Data Base
 VxWorks Users Group Archive
 Washington University Public Domain Archives
 Matrix of Biological Knowledge Archive-Server
 COSMIC
 IuBio Archive for Molecular and General Biology

PENpages

Dartmouth Dante Database

DDN NIC SERVICE Mail Server

**NASA Network Information Center On Line Aid
System (NICOLAS)**

MATLAB User Group Archive

**Statlib Statistical Software and Data Distribution
System**

Molecular Biology Computer Research Resource (MBCRR)

NED (NASA/IPAC Extragalactic Database)

INFO-SOUTH

Unidata

UNC Chapel Hill INFO

Networks and Email Gateways

CICnet

CREN/CSNET

JvNCnet

Los Nettos

MRNet

NasaMail

NCSAnet

NEARNet

NSFNET

NYSERNet

Sesquinet

USAN

Westnet

Los Alamos Natl. Lab Integrated Computing Network

NASA Science Network

PREPnet

SURAnet

UUNET
NORDUnet
Commercial Mail Relay (CMR)
Terrestrial Wideband Network
ICBNet
CONCERT
SWITCH
NevadaNet
BARRnet
NorthWestNet
SUNET
THEnet
ILAN
ESNET
WVNET
FidoNet Gateways
California Education and Research Federation Network
(CERFNET)
SprintMail X.400 Gateway
PSINet
MIDNet, A Midwestern Regional Network
SDSCnet

BIBLIOGRAPHY

Beasley, Kenneth L., and Associates. The Administration of Sponsored Programs. San Francisco: Jossey-Bass Publishers, 1982.

Davies, Thomas R. and William M. Hale. "Implementing a Policy and Planning Process for Managing State Use of Information Technology Resources." Public Administration Review 46 (Nov 1986): 516-521.

Edwards, Larry. *Your procedures for handling electronic proposals*. Note.nsf.gov id aa29937. (NeXT-1.0 (From Sendmail 5.52)/NeXT-2.0). (May 9, 1991, 10:41 EDT).

_____. *Document.txt. NSF Electronic Proposal Submission*, NNSC.NSF.GOV (February 14, 1991).

Esmay, Gerald. "Computer Users Advisory Committee (CUAC) Annual Report." May 23, 1990. University of Montana. Missoula, Montana.

_____. Conversation with author, 1990. Missoula, Montana.

Gould, Stephen B. "Computing and Telecommunicating in the Federal Government." CRS Review (July-August 1990): 12-15.

Hickey, Anthony A. and Kendall W. King. "A Model for Integrating Research Administration and Graduate School Operations at a Regional Comprehensive University." Research Management Review Vol. 2 No. 1 (Spring 1988): 31-44.

Hubbard, Kendall., Budget Specialist, University of Montana Office of Research Administration. Conversation with author, 1990. Missoula, Montana.

Kraemer, Kenneth L. and John Leslie King. "Computing and Public Organizations." Public Administration Review 46 (November 1986): pp 488-496.

Lewis, Peter H. "Group Dynamics: When the Going Gets Tough The Tough Go To Meetings." PC/Computing (October 1988): 108-117..

Murray, Raymond. C., Associate Provost for Research and Economic Development, University of Montana. Conversation with author, 1991. Missoula, Montana.

Stroebel, David. Acting Associate Dean of the Graduate School, University of Montana. Conversation with author, 1990. Missoula, Montana.

Tien, James M. and James A. McClure. "Enhancing the Effectiveness of Computers in Public Organizations." Public Administration Review 46 (Nov. 86): 553-562.

- Norton, David P. and Ronald L. Evans. "Keeping Pace With Technology," Personal Computing, (January 1989) 207-214.
- National Science Foundation. OLPA, NSF. "Announcements." Bulletin Volume 18, No. 9 (May 1991).
- National Science Foundation Office of Information Science and Information/Analysis Japan Section of the International Programs Division, Science and Technology Information System (STIS) Manual.
- Rubin, Barry M. "Information Systems for Public Management: Design and Implementation," Public Administration Review 46, (November 1986) pp 540-552.
- U.S. Congress, Office of Technology Assessment, *The Regulatory Environment For Science: A Technical Memorandum*, OTA-TM-SET-34 (Washington, DC: U.S. Government Printing Office, February 1986).