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The study reveals that the federal government is making rapid strides toward the stage where information on a wide range of its activities, including programs of grants, contracts, and other forms of financial assistance to colleges and universities, will be stored and retrieved in machine-readable form in federal computer systems. Paralleling the growth of these federal management information systems will be the development of a network of computer-connected communications lines enabling information to be shunted throughout the entire multi-campus State University of New York, other large university systems, and ultimately a national educational network. Eventually, much of the information on federal programs needed by colleges and universities will be put directly into university information networks either in the form of magnetic tapes purchased or leased from the federal government, or by linking information systems directly together. Three types of experimental projects are proposed to provide the experience needed to design and operate an effective communications link between the federal government and the higher education community as a whole. The 3 experimental projects would lay the groundwork for the day when information transmission between Washington and the universities will be automatic, as part of a larger national and international network of knowledge. (WM)

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Sources Of Federal Support for Higher Education

EXPERIMENTAL SYSTEMS FOR A NATIONAL INFORMATION NETWORK

A Report By

Rowan A. Wakefield
Walter F. Dunne
Frederick Kirch

HE 000 617

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The Research Foundation of State University of New York
Albany, New York

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OFFICE OF THE CHANCELLOR

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December 1, 1968

Mr. Mort Grant
Director
The Research Foundation of
State University of New York
Albany, New York 12224

Dear Mr. Grant:

Transmitted herewith is the final report on "Sources of Federal Support for Higher Education, Experimental Systems for a National Information Network," which has been supported by Research Foundation Project Grant No. 15-26B.

In brief, the report concludes that we are moving rapidly toward the stage where information on a wide range of federal activities, including programs offering financial assistance to the State University of New York will be stored and retrieved in machine-readable form in federal computer systems. Paralleling the growth of these federal management information systems will be the development of a network of computer-connected communications lines enabling information to be shunted throughout the entire State University system. I know you are well aware of this latter development because of the important pioneering work in the computerized grants management system you are doing at The Research Foundation for much of the State University.

We can clearly look for the time, in the foreseeable future, when much of the information on federal programs needed by the

State University can be put directly into its information network either in the form of magnetic tapes purchased or leased from the federal government, or by linking the two systems directly together.

The report concludes by proposing three experimental pilot operations which would continue to lay the groundwork for the day when information transmission between Washington and the University will be automatic as part of the larger national and international "network of knowledge" recently predicted by President Johnson. We have proposed that The Research Foundation serve as the information center of the system in two of the proposed experiments, not so much because of the Foundation's convenient geographic position, but more because we see the automated information service we propose as a logical extension of the automated grants management service the Foundation has already begun so successfully.

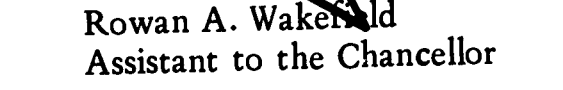
I would like to express our gratitude to the Directors of The Research Foundation for their foresight and cooperation in providing, a little more than a year and a half ago, the grant which has made this valuable study possible. I know from the widespread interest the study has generated in Washington, in other universities, in many private corporations, and throughout the State University system, that our efforts are timely and our recommendations are eagerly awaited. I hope that our study and our recommendations will provide useful insights and practical guidelines for building that "...great network of knowledge...one that employs every means of sending and of storing information that the individual can use," which President Johnson has called for.

Sometime next year I expect to report to the Directors of the Foundation on the possibilities for obtaining financial support for some of the experiments proposed at the conclusion of our study so that we can proceed to the next phase of this project. Quite apart from this, it may be considered worthwhile to update parts of this report, such as Chapter IV on "Availability of Information on Federal Programs" periodically in our *Washington Report*, or in some other formal manner.

In closing, I would also like to call your attention to a potentially valuable by-product of this study. Those of us working on

the project frequently cited the computerized grants and contracts management system which has been developed so effectively by The Research Foundation for the whole State University. In one instance, with the U.S. Public Health Service, this led directly to an experiment in reporting to the federal government in machine-readable form rather than in the more cumbersome manual manner. The time is right, I am convinced, for such experiments in machine reporting to be extended by The Research Foundation to the National Science Foundation, U.S. Office of Education's Bureau of Research, Department of Agriculture, Smithsonian Science Information Exchange, and other agencies which are, or will soon be, ready to receive fiscal and accounting reports on grants and contracts in machine-readable form.

Sincerely,



Rowan A. Wakefield
Assistant to the Chancellor

PREFACE

In June, 1966, the Directors of The Research Foundation of State University of New York approved a grant to the Washington Office of State University to study the feasibility of using an automated data processing system to provide information on federal programs of interest to higher education.

The study was planned during the summer and fall of 1966 by the Washington Office staff, in cooperation with Aaron Finerman, Director, and Sol Broder, Manager, of the Computing Center at the State University of New York at Stony Brook. Work on the project began late in the fall with the recruitment by the Computing Center of Walter F. Dunne as a full-time consultant. Frederick Kirch, former Manager of the Legislative Information Service of Xerox Corporation, joined the project half-time as a consultant in January, 1967. Overall supervision of the project was under the State University's Washington Office.

Most of the work was done during the calendar year 1967. The final stages were completed in the first six months of 1968 with the assistance of Francis M. Roberts, Director of Information Systems, Communication Service Corporation, Washington, D.C. The completed report is herewith submitted to the Directors of The Research Foundation.

Many persons on State University campuses took part in the study, while many others in the federal government, in private industry, and in other universities were also involved. Some furnished data; all gave valuable suggestions. The project staff expresses its thanks and appreciation to all those whose cooperation made possible the successful completion of the project. The project staff is particularly grateful to President John S. Toll and the faculty and staff at the State University of New York at Stony Brook, especially those at the Computing Center, for their efforts in support of this project; to Robert E. Thomas, Vice Chancellor for Educational Communications, and Richard C. Lesser, Director of Computer Systems Development, State University of New York, for their cooperation; to the personnel of the Research Foundation; and to the Washington Office staff, especially Paul R. Mahany, Editor of the *Washington Report,*

for help in preparing the bibliography, glossary, and index for this report, and Mrs. Elizabeth D. Farley, Administrative Assistant, who kept the project running smoothly. Finally, we owe special thanks to Norman S. Mangouni, Director, State University Press, for his valuable help in editing the final report.

For their helpful critical reviews of the final draft of this report, special thanks go to John Caffrey, Director, Commission on Administrative Affairs, American Council on Education; Jordan J. Baruch, President, Interuniversity Communications Council (EDUCOM); Robert Horn, President, Information Resources, Inc.; and F. Karl Willenbrock, Provost, Faculty of Engineering and Applied Sciences, State University of New York at Buffalo.

The project staff is grateful to the Directors of The Research Foundation for making this study possible and hope it has fully lived up to their expectations.

Rowan A. Wakefield

Washington, D.C.
June, 1968

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CHAPTER I

INTRODUCTION AND SUMMARY OF CONCLUSIONS

> "...We must consider new ways to build a great network of knowledge... one that employs every means of sending and of storing information that the individual can use."
>
> --President Lyndon B. Johnson, on signing the bill establishing the Corporation for Public Broadcasting, November 7, 1967.

Nearly one year before President Johnson identified the establishment of "a great network of knowledge" as a national goal, the State University of New York had already begun to work on possible ways of developing a storage and retrieval system for federal program information. In January, 1967, State University launched a feasibility study for a national or international network with a bank of data on federally sponsored programs. Such a facility would be of obvious value in providing faculty members and administrators in the higher education community with needed management information. This is a report on that study, which was sponsored by The Research Foundation of State University of New York and carried out by the Washington Office of the State University in cooperation with the Computing Center of the State University of New York at Stony Brook. The study was conducted by one systems analyst working full-time at the Stony Brook facility, two information systems consultants working part-time from the Washington Office, and the Director of the Washington Office.

The study was motivated primarily by State University's recognition that what some analysts in Washington have described as an "explosion in demand" for information on federal activities is largely the result of a parallel increase in available information on the expanding federal activities themselves.

During recent years there has been an enormous increase in the number and scope of federal programs providing assistance and support for the many objectives of colleges and universities. In fact, in the past 15 years or so, federal support for all types of education activities has increased from a few hundred million dollars to about $9 billion.

During the four-year period from 1963-66, the dollar amount of federal assistance to the State University increased by 245 per cent. For the current year (1968-69), federal assistance for the University is projected at slightly more than 10 per cent of the State University's total estimated operating budget of almost $400 million and more than 60 per cent of its organized research budget.

In addition to the opportunities presented to State University by these programs, the federal support patterns themselves are undergoing important changes which are creating new opportunities for the State University and, *pari passu,* increasing the possibilities for confusion. We are witnessing, for example, a shift in emphasis in research and development support from the pure physical sciences and technological subjects to interdisciplinary projects involving the cooperation of physical, social, and behavioral scientists. This new approach is directed towards finding solutions to complex national sociological-technical problems, such as curbing environmental pollution, developing means for rapid mass transportation, and dealing with the whole range of economic, social, and cultural urban affairs. While these areas may offer new opportunities for cooperation between the federal government and State University in the public service, they also create new information sources, new communication channels, new application procedures, and new regulations for administration of sponsored programs, many unfamiliar to the academician and the administrator.

At the same time, parallel changes are taking place in the mechanics of administering research. These changes may ultimately result in greater emphasis being placed by the federal government on its relations with the institution rather than the individual researcher and greater emphasis on geographic criteria for allocating federal funds to the education community. These developments, together with the enormous increases in the numbers of students, faculty, administrators, and campuses, and in the costs of higher education, account for the increased demand for information on federally funded programs in higher education.

Assumptions

The study was based on three assumptions, the first two of which were examined and substantiated, while the third was regarded as putative. It was assumed that:

1. The federal government is undergoing a major transition in the development of its management information systems which will ultimately lead to more sophisticated and efficient systems for disseminating information--much of it in machine-readable form--on personnel, programs, grants, and other activities of interest to State University;
2. State University will have available in the foreseeable future a network complex of computers and communications equipment connecting its 71 campuses and operating units and linking them to data banks inside and outside the system; and
3. A new generation of scholars and academic administrators, now being trained in the modern techniques of information science, will be able to apply these new techniques to the scholarly and administrative information needs of State University.

Availability of Information on Federal Programs in Machine-Readable Form

The data gained from this study of the management and program information systems of 40 federal agencies and from interviews with leading government officials substantiate the initial assumption. Ultimately, materials to satisfy most of State University's information needs, as defined by this study, can be obtained from the government in machine-readable form which can be stored and retrieved automatically from single or multiple centralized computer sources.

Today, only a limited amount of the needed information is already available in machine-readable form. It will be many years before most of State University's needs for federal information can be met in this manner.

To understand this, it is first necessary to examine the needs of State University's faculty and administrators for federal information. As identified by a study of State University inquiries handled by the Washington Office and a study of 17 campuses, the Central Administration, the Center for International Studies and World Affairs, and The Research Foundation, these information needs are of three general types: on the content and form of programs, on personnel, and on financial or budgetary matters. In constructing an information

profile, State University's needs were grouped in six categories, listed here in descending order of importance to those seeking the information:

1. Who are the persons to contact? E.g., the names of the persons or offices, or both, responsible for administering the programs which can provide support.
2. What is the nature of the programs which can provide support? E.g., descriptions of the key elements of the program.
3. What is the background information on these programs? E.g., the informal, behind-the-scenes news and current awareness information found in many of the State University *Washington Reports,* or supplied to individuals upon request by the Washington Office.
4. What funds are actually available? E.g., information indicating whether program funds are plentiful or so scarce that application may not be worthwhile.
5. What information is available on similar specific projects currently being supported by the federal government, in the State University and in the nation as a whole? E.g., the type of information available from the Smithsonian Science Information Exchange (SIE) that would provide information on the activities of one's "unseen colleagues."
6. What information is available on the mechanics of application? E.g., guidelines, deadlines, and proposal formats.

At present, the only information available in machine-readable form describes some projects and their sponsoring agencies. Most of these data come from management information systems designed to keep track of ongoing and completed research projects. There is a rapidly growing number of federal agencies perfecting computerized systems for storage and retrieval of information on the current research and other projects they are sponsoring within and outside the government. For the university researcher or administrator, this descriptive information on ongoing projects will probably remain one of the best indicators of the types of programs supported by various government agencies. Such information, including material on completed projects, may occasionally be more reliable than descriptions of programs planned by the agencies. In any event, such projections

may never be available to the public in machine-readable form. Key agencies which now have or soon will have computerized systems for storing and retrieving information on their current projects are the Department of Defense, through its Defense Documentation Center, in cooperation with the Director of Defense Research and Engineering, which has developed the Research and Technology Work Unit Information System (RATWUIS); the Department of Agriculture, through its Current Research Information Service (CRIS); the National Institutes of Health and the U.S. Public Health Service; the U.S. Office of Education, Bureau of Research, through its Bureau of Research Information Control System (BRICS); the National Science Foundation; the National Aeronautics and Space Administration; and the Atomic Energy Commission. Although all these systems are or will soon be operational, the general public usually does not have direct access to the computer tapes on which the information is stored. In most cases, the public does have access to this information indirectly through the Smithsonian Science Information Exchange (SIE). Several agencies, including the Defense Documentation Center, the National Aeronautics and Space Administration, and the National Library of Medicine will sell tapes with information on completed projects in the form of final project reports or published articles.

Other types of program information sought by State University, such as guidelines and grant or contract application forms, are not now available in machine-readable form and will not be available for some time.

As more and more government personnel records are put into machine-readable form, it is possible that information linking responsible federal offices with sources of funds for project support will exist in machine-readable form. Making this information available to the public poses serious problems. However, information on fellow researchers--one's "unseen colleagues" doing similar or related work--is already part of most systems which automatically store and retrieve information on ongoing and completed projects. Rapid access to this information can be obtained through the Science Information Exchange.

Financial or budgetary information of the type sought by university researchers or administrators exists in machine-readable form but is largely prepared for internal consumption. With sufficient screening,

information showing the unencumbered balances of appropriated funds available for obligation on individual projects might be available in the future.

The exchange of machine-readable information in the form of tape or disc packs is in the early stage of its development. However, it is clear that organizations increasingly will exchange information in this way. The projects recommended at the conclusion of this report offer opportunities for several experiments in the exchange of information in machine-readable form. Initially, it is likely that the proposed system would receive information, some of it experimentally, from several government agencies. As the system grows, it is likely that its data base will be of value to a wider user audience than State University. It could, for example, provide information to both the executive and legislative branches of the federal and state governments and to special task forces, for legislative surveys, research, and other types of reports, either in machine-readable form, or in printed or typewritten reports. When the government provides information from its automated data banks certain data elements may have to be withheld for reasons of security or personal privacy.

State University of New York Network

The second underlying assumption of this project, that State University eventually will have a network of computer-connected communication lines, thereby enabling information to be shunted throughout the entire State University system, also appears to be supported by the facts. Presently, the computing facilities at the State University Centers at Buffalo and Binghamton are experimenting with providing computing capabilities to users at remote terminals on nearby campuses. The State University of New York at Stony Brook will soon install an experimental system having remote terminals in various campus buildings. A user-oriented, on-line, real-time, computerized library system is being developed at the Upstate Medical Center. This discipline-based biomedical network will link libraries at the State University of New York at Buffalo, the State University Upstate and Downstate Medical Centers, and the University of Rochester. The new Medical School Library of the State University of New York at Stony Brook will join the network later. The Research Foundation also is developing a remote terminal system to provide for real-time entry from all the State University campuses it serves for certain accounting transactions to augment the existing computer-based grants management system.

From this rather impressive beginning, it would seem that the assumption is indeed realistic. While there is every reason to be sure of the eventual establishment of such a system it should be noted that all of the above networks are designed for specific purposes, and since the computer industry is rescheduling the development of time-sharing hardware and software, there is available at this time neither the computing capability nor the necessary multi-drop network that would allow for efficient real-time query and response on federal information, without dedicating a significant portion of hardware and communication lines to it. However, it is now entirely practical to "dial up" and transmit batched data from computer to computer and some project options discussed later in this report would indeed operate in such a mode.

Conclusion

The following report reviews the methodology of the study, summarizes the information collected, and suggests designs for three experimental systems of information dissemination to test some of the assumptions and conclusions. Two systems operated by The Research Foundation, using its IBM 360/40 computer to store and retrieve the needed information, would provide information by telephone, teletype, and mail to a minimum of 20 selected State University campuses and administrative units on varied types of federal programs. One system would use the existing data base created in Washington by Appleton-Century-Crofts, publishers of the *Guide to Federal Assistance for Education*; the other system referred to in this report as the "prototype" would depend for its information on a data collection, analysis and processing operation designed expressly for the project. (See page 54 for a schematic diagram of this system.) The third system would use the computerized data base of the Smithsonian Science Information Exchange (SIE) in Washington. SIE offers a more limited data base (information only on currently sponsored federal research) but it provides opportunities to test problems of information distribution which are not possible with the other experiments. The SIE system also could serve the same 20 campuses by telephone, teletype, and mail, and could offer the possibility of direct computer to computer responses as well. (See Annex A for a comparative chart of each of the proposed experiments

Although the prototype and Appleton-Century-Crofts experiments

are budgeted for three years, they should not necessarily be viewed as three-year closed systems. The State University would welcome the opportunity to discuss with other potential users increased participation if it contributes further information and practical experience toward fulfilling the objectives of the experiment.

The Research Foundation has been recommended as the information center for the experiment, and IBM's Document Processing Program would provide the software capability to test out the prototype operation. This would enable efforts to be concentrated upon establishing and communicating with the data base, without making too much of an investment in the development of a query language. The equipment configuration which is being installed at the Foundation will provide the necessary capacity for the document processing software mentioned above.

From the beginning, it has been clear that designing a federal program information system to serve the university community was well within the scope of existing technology. The more difficult problem was to determine the real needs of both scholars and administrators for information on federally-financed activities. Every effort, therefore, through the study, has been made to avoid the attractive pitfall of designing a system that would be technologically commendable but would not be responsive to human needs and to the unique behavioral pattern of the University's academic and administrative personnel. The time devoted to the study reflects this priority and concern; about twice as much time was spent on the campus-wide analysis of need for information than on all the rest of the study.

All three of the proposed experiments are seen clearly as transitional experiments which, if properly planned and carried out, could provide valuable experience needed to design and operate the most effective type of future communications link between the federal government and the higher education community as a whole. Only to the extent it can be demonstrated that these proposed experiments can do this and contribute constructively to the design and operation of the "great network of knowledge" referred to by President Johnson, is there justification for investing time and resources in them. Within this context, each should offer opportunities for portions of the conclusions and hypotheses of the report to be actually field-tested within the State University.

Funding for Experimental Systems

As of June, 1968, when the conclusions to this report were written, no further funds had been committed by State University for carrying out any of the recommended experiments. Nor is there any intention to request major support from the University for this purpose at this time. Efforts will be made, however, to seek financial support for carrying out at least some of the experiments from sources outside State University. In fact, preliminary discussions already have been held with representatives of certain federal government agencies, and with some private corporate computer and information handling firms. Foundations will also be explored as possible sources of support. In 1969, a progress report on these efforts will be made to the Board of Directors of The Research Foundation. At that time, it will be determined whether State University or The Research Foundation, or both, are willing to commit funds so that any of the proposed experiments may be carried out.

One final point should be made clear: Whatever system or systems ultimately store and send information on the federal government's programs to higher education scholars and administrators should probably be self-supporting, on a user-fee basis, and not permanently subsidized. This means such a system will need a user base much larger than all the schools of the State and City Universities of New York. Such a system could be operated by a private profit-making concern, such as Appleton-Century-Crofts or International Business Machines Corporation; it also could be operated on a non-profit basis by a consortium of universities or by a national or regional higher education association (e.g., EDUCOM). If it were to be operated by the federal government, it would more likely be as part of a larger information system such as envisioned in the proposed Program Information Act or as in the Department of Commerce's Clearinghouse for Federal Scientific and Technical Information which charges a fee for its service. There are also possibilities of various combinations of these. For example, the federal government could contract with Appleton-Century-Crofts or EDUCOM to be the agent for meeting the public need for information of this type.

CHAPTER II

METHODOLOGY OF INVESTIGATION

The grant for this study was approved by The Research Foundation in June, 1966, acting upon a recommendation by the Director of the Washington Office. The proposal had been reviewed by an *ad hoc* committee headed by the Provost of State University, Dr. Harry W. Porter, and also by the Chancellor's Committee on Computing Facilities. Planning for the study was carried out by the Washington Office and the Computing Center at the State University of New York at Stony Brook during the summer and fall of 1966. The study was carried out by the following persons:

Frederick Kirch, former Manager, Xerox Legislative Information Service, Washington, D.C., who began working for the project on January 1, 1967, as a half-time consultant to the Washington Office.

Walter F. Dunne, a systems analyst formerly with Control Data Corporation, who began working full-time for the project in December, 1966, at the Computing Center at the State University of New York at Stony Brook.

Francis M. Roberts, Director of Information Systems with Communication Service Corporation, Washington, D.C., who completed the survey of information available from the federal government in machine-readable form after Mr. Kirch's consultation period ended early in 1968.

Rowan A. Wakefield, Assistant to the Chancellor and Director of the Washington Office, who served as project director and did much of the writing and rewriting of the final report.

Several areas of investigation were carried out concurrently. They were concerned with the following basic questions:

1. What are the information needs of individuals and groups at the campuses and in the Central Administration, especially those at the points of contact between the campuses and

the federal government? This aspect of the study was carried out by Mr. Dunne.

2. What "outputs" will be available from federal agencies for use as "inputs" to an automated retrieval and dissemination system? This study was undertaken by Messrs. Kirch and Roberts, with assistance from Mr. Wakefield.

3. What computers and programs will be available for use in such a system? This study was carried out by Mr. Kirch.

4. What kind of communications network is envisioned for the State University and what is the timetable for actual operations? These questions were discussed with the Vice Chancellor for Educational Communications, Robert E. Thomas, and were investigated at each of the principal campuses of State University by Mr. Dunne.

The first three areas of investigation were further subdivided into the following tasks:

1. *Information Needs*

   a. A study was made by Paul R. Mahany of the Washington Office during 1966 to detect patterns of user needs (see Annex C, page 89, for summary report).

   b. A study was conducted at 19 campuses by Mr. Dunne, with one campus (the State University of New York at Stony Brook) studied in depth, to determine what the informational needs are at that level and to determine how individual behavior and specific individual requirements at the campus might affect the design of such a system (see pages 14-23 for full report on this study).

The New York State Division of the Budget was briefed to insure that the study was carried out with an awareness of the wider needs of the state for federal information and of related state activities and plans in the same area.

2. *Outputs from Federal Government*

   a. A survey was made of 40 federal agencies to get detailed information on their present operations and, more important, their plans for future operation using data processing techniques and equipment to

disseminate information on their programs. (See Annexes B and D for letters, questionnaires, and mailing lists, pages 83-88 and 96-100.)

b. Some other universities were contacted to learn how they are planning to deal with the information problem.

3. *Computer Programs*

a. Contacts were made with private organizations, such as Systems Development Corporation, International Business Machines Corporation, Xerox Corporation, and Documentation, Incorporated, to determine what information handling and what specific software packages applicable to the project might be available. (See Chapter V, page 45.)

b. Federal agencies surveyed for information on data systems development were concurrently asked for information on computer programs of possible relevance to this project.

Prototype Design

Based on the information gained from these surveys, the project staff began, during the final months of the project, to develop and design a prototype experiment. During the course of development, it was necessary to check back frequently with many of the federal agencies originally surveyed, with private firms producing software, with The Research Foundation, with representatives of several State University campuses, the Central Administration, and with the New York State Office of General Services. Once the prototype had been conceptualized and designed, the project staff reviewed various expressions of interest in cooperative participation in the project. Ultimately selected for cooperation were the Smithsonian Science Information Exchange and Appleton-Century-Crofts. Cooperative experiments were then worked out with these two organizations to fit within the concept of the prototype. These experiments are described in Chapter VI.

CHAPTER III

INFORMATION NEEDS OF THE STATE UNIVERSITY OF NEW YORK

Analysis and Use of Washington Office

Formal inquiries handled by the Washington Office during the calendar year 1966 have been analyzed. The more significant results of this analysis appear in Annex C, Tables I-V, pages 89-95.

For the purposes of the analysis, a "formal inquiry" was defined as a specific question complex enough to require research. Excluded were casual or simple questions answerable without research, personnel and recruiting matters, and instances in which information was distributed in response to a known need or interest rather than a specific inquiry.

During 1966, the Washington Office responded to 445 formal inquiries (see Table II). Of these, 57 (about 12 per cent) came from sources outside the State University system, including Congress, the New York State Legislature, the New York State Education Department, professional associations, private industry, and individuals. It should be noted that the Washington Office is a source of information *about*, as well as for, the State University. The non-State University inquiries were not further analyzed, and do not enter into the figures appearing in Tables II-V.

The Central Administration accounted for 108 inquiries, or more than one-fourth of those from within the State University system. The remainder was distributed over 35 campuses and three research centers. (See Table III for the distribution of inquiries by campus.)

Although inquiries handled in 1967 and 1968 have not been analyzed, it is clearly evident that the proportion of inquiries from Central Administration has dropped considerably, while there has been a significant rise in inquiries from the campuses, especially the four University Centers at Albany, Binghamton, Buffalo, and Stony Brook.

Ultimate sources of information within the federal government

revealed by analysis of the 1966 data (Table IV) show the Department of Health, Education, and Welfare (DHEW) leading with 29.3 per cent. Within DHEW, the U.S. Office of Education (USOE) is the largest single source of information, accounting for nearly 20 per cent of all inquiries handled; the U.S. Public Health Service (USPHS) accounts for almost 5 per cent. Second largest source of information, with 13.4 per cent, is the National Science Foundation. The full breakdown follows:

Department of Health, Education, and Welfare	29%
(USOE 19% USPHS 5%)	
National Science Foundation	13%
Congress	12%
Department of State	11%
(including Agency for International Development)	
Department of Defense	7%
Department of Commerce	6%
Office of Economic Opportunity	4%
National Aeronautics and Space Administration	3%
Department of Labor	2%
Atomic Energy Commission	1%
Smithsonian Institution	1%
All Others (less than 5 inquiries to each)	11%
	100%

Analysis of Information Needs at Campuses

In addition to the analysis of inquiries processed by the Washington Office, a field study was made during 1967 to determine the information needs of faculty members and administrators in State University units. This survey was carried out in a series of meetings held with personnel from various units. For the most part, the meetings were with those individuals or campus groups acting either officially or unofficially, as the focal point in the institution's dealings with the federal government. At the State University of New York at Stony Brook, further meetings were held directly with individuals heavily involved in research in an attempt to determine what informational needs

researchers have and to what extent these needs differ from the needs of administrators. As a result, it is felt that candid reactions have been obtained from a balanced cross-section of potential users.

Meetings were held with representatives of 19 different units, including the Central Administration. These units accounted for approximately 78 per cent of the inquiries directed to the Washington Office during 1966. In addition, these units accounted for well over 90 per cent of the dollar volume of sponsored research that was being transacted between The Research Foundation and the federal government as of March 31, 1967.

Meetings have been held also with representatives of Brown University and the City University of New York to determine the patterns of their information needs.

For analytical purposes, this report places in six groups the State University units from which information was elicited. They were grouped as follows:

University Centers

State University of New York at Albany
State University of New York at Binghamton
State University of New York at Buffalo
State University of New York at Stony Brook

Colleges of Arts and Sciences

State University College at Brockport
State University College at Buffalo
State University College at Cortland
State University College at Fredonia
State University College at Oneonta

Specialized Colleges

College of Forestry at Syracuse
College of Ceramics at Alfred
Downstate Medical Center
Upstate Medical Center

Agricultural and Technical Colleges

Agricultural and Technical College at Alfred
Agricultural and Technical College at Morrisville

Community Colleges

Kingsborough Community College
Suffolk County Community College

Central Administration and Special Center

Central Administration
Center for International Studies and World Affairs

Needs have been grouped into categories. In order to present an accurate analysis, it is necessary to include needs which are not "informational" in nature (i.e., "improving local administration" and "improving communications"). Some respondents felt that these were indeed the overriding considerations and, as such, should be presented in any overall analysis of requirements. Another category, "Better Interpretation of Information" likewise does not specify an informational need as such, but implies a qualitative improvement of what is already being made available. It is felt that the nine categories listed below adequately span the entire range of needs that have been expressed either in interviews or through analysis of queries directed to the Washington Office.

Category 1 -- Nature of Program

This category is defined as the minimum amount of useful information needed to describe both the substance and form of a particular federal activity to which a college or university might apply for funds or other forms of assistance. Included are those elements normally presented in publications such as the *College and University Reporter,* the *Guide to Federal Assistance for Educati on* published by Appleton-Century-Crofts, and the *Catalog of Federal Assistance Programs* of the Office of Economic Opportunity. This information consists of the following elements:

Program title

Nature and purpose of program (brief abstract)

Administering agency

Authorizing legislation

Eligibility criteria

Reference to available printed information

Category 2 -- Information on Funds Available

This category of information includes the amount of appropriated funds actually available for obligation to specified federal programs and may be shown in relation to the appropriation and authorization levels for the responsible department or agency. If possible, the data should include a reasonably accurate balance of unexpended funds, as well as any percentage of funds specially earmarked for the project for which support is being sought. Likewise, financial information regarding single projects funded for other successful applicants would be useful.

Category 3 -- Individuals and Offices to Contact

This category of information would be useful in directing the potential grant applicant to the appropriate office, and preferably to the responsible individual within that office. This information should link individuals to programs and also, if possible, to professional interest. Any additional information that would assist the user in making and maintaining the appropriate contact, such as office address, telephone number, professional degrees, interests, and responsibilities should be included.

Category 4 -- Guidelines, Deadlines and Proposal Writing

This category would include the formal printed or mimeographed texts issued by federal agencies explaining how to apply for specific programs. This type of information is of most assistance after the user has selected what is considered to be the appropriate program.

Category 5 -- Other Projects and Proposals

This category would cover all currently funded projects, including those within the State University. Pending and rejected proposals, in both cases showing sponsoring agencies, would be useful in providing opportunities to learn from the successful or unsuccessful experiences of others. Meaningful data would include the name of the searcher's unseen colleague, i.e., the project director or principal investigator, his office address and telephone number, the size of the project, and a brief project abstract.

Category 6 -- Current News and Awareness

This category would include information similar to that presently provided by the Washington Office's *Washington Report.* It would consist chiefly of "inside information," such as shifts in program emphasis, pending legislation, interpretation of statements or program objectives, advance announcements of new programs, and organizational changes. These data should be so arranged to enhance the information they supplement.

Category 7 -- Better Interpretation of Programs

This category would include interpretive program information relating to the various groups of institutions within the State University. This is a purpose of the *Washington Report* and the *Special Reports,* also produced by the Washington Office. These interpretations, hopefully, would clarify any confusion created by omission or implication. Once again, the purpose of this category would be to augment the information to which it is appended.

Category 8 -- Improving Communication

This category has been included, as previously stated, to meet an apparent need among potential users. Its aim is to eliminate excessive or redundant reading materials and to provide a more meaningful and selective dissemination of information.

Category 9 -- Improving Local Administration

This category of need deals with the administration of the federal liaison function at the campus level. In many newer institutions, especially those which are only now beginning to have extensive contact with the federal government, there exists an organizational deficiency. There is a need for a more realistic understanding of the magnitude of this function and for establishing the necessary organizational structure for assistance.

Charts

Charts 1 - 4 illustrate the emphasis placed on the nine categories of need by the various units. In determining values for the various needs, explicit opinions were used whenever they were provided. However, it was not always possible to elicit specific graduated responses and in these cases values based upon the general tone of the interviews and the histories of the units in their dealings with the federal govern-

ment have been interpolated. The three levels used to weigh interest are low (1), medium (2), and high (3). Chart 2 illustrates the cumulative weights for each category of need. Chart 3 shows the relative importance of the categories of need within institutional groupings and Chart 4 the degree of interest each of the unit groupings has in the nine categories of need.

The following general conclusions can be reached from analysis of the user interest profiles in the six information categories:

1. There is a consistently high degree of interest in categories 3 and 6 (Individuals to Contact and Current Awareness).
2. Categories 2, 3, and 6 (Funds Available, Individuals to Contact, and Current Awareness) have very significant appeal to those institutional groupings which account for the vast majority of federal funds.
3. There is an above average overall degree of interest in category 1 (Nature of Program) even though this need can be satisfied by certain publications currently available to most units.
4. Categories, 1, 2, 3, 5, and 6 have a high degree of interest for the Central Administration, which accounts for a significant portion (about 32 per cent) of the queries directed to the Washington Office.

CHART I

INDIVIDUAL RATINGS OF CATEGORIES OF NEED AT STATE UNIVERSITY OF NEW YORK

	NATURE OF PROGRAM	AVAILABLE FUNDS	INDIVIDUALS TO CONTACT	GUIDELINES, DEADLINES, ETC.	OTHER PROJECTS, PROPOSALS	CURRENT NEWS AND AWARENESS	BETTER INTERPRETN OF PROGRAMS	IMPROVING COMMUNI-CATION	IMPROVING LOCAL ADMINISTN
University at Albany	2	3	3	2	2	3	2	2	1
University at Binghamtan	2	3	3	2	3	3	2	3	1
University at Buffala	2	3	3	2	2	3	2	3	1
University at Stony Broak	2	3	3	2	3	3	2	3	3
College at Buffala	2	3	3	2	3	3	3	3	1
College at Brockpart	3	3	3	2	2	3	2	2	1
College at Fredonia	3	3	3	2	2	3	2	3	3
College at Oneanta	2	3	3	2	3	3	3	2	3
College at Cortland	2	2	3	2	2	2	2	3	3
College of Forestry	3	3	3	2	3	3	2	3	1
College of Ceramics	1	1	2	1	1	2	2	2	1
Alfred Agriculturol & Technicol College	3	1	2	3	3	3	3	3	1
Morrisville Agricultural & Technicol College	2	1	3	2	3	3	3	3	1
Kingsborough Community College	2	1	2	3	2	2	3	3	1
Suffolk County Community College	2	1	2	2	1	3	3	3	1
Downstote Medical Center	3	2	3	2	1	3	2	3	2
Upstote Medical Center	3	3	3	1	1	2	1	2	1
Internationol Center	3	2	3	1	3	3	3	3	1
Centrol Administration	3	3	2	1	3	2	1	3	3
	45	44	52	36	43	52	43	52	30

CHART 2

CUMULATIVE INTEREST LEVELS · STATE UNIVERSITY OF NEW YORK

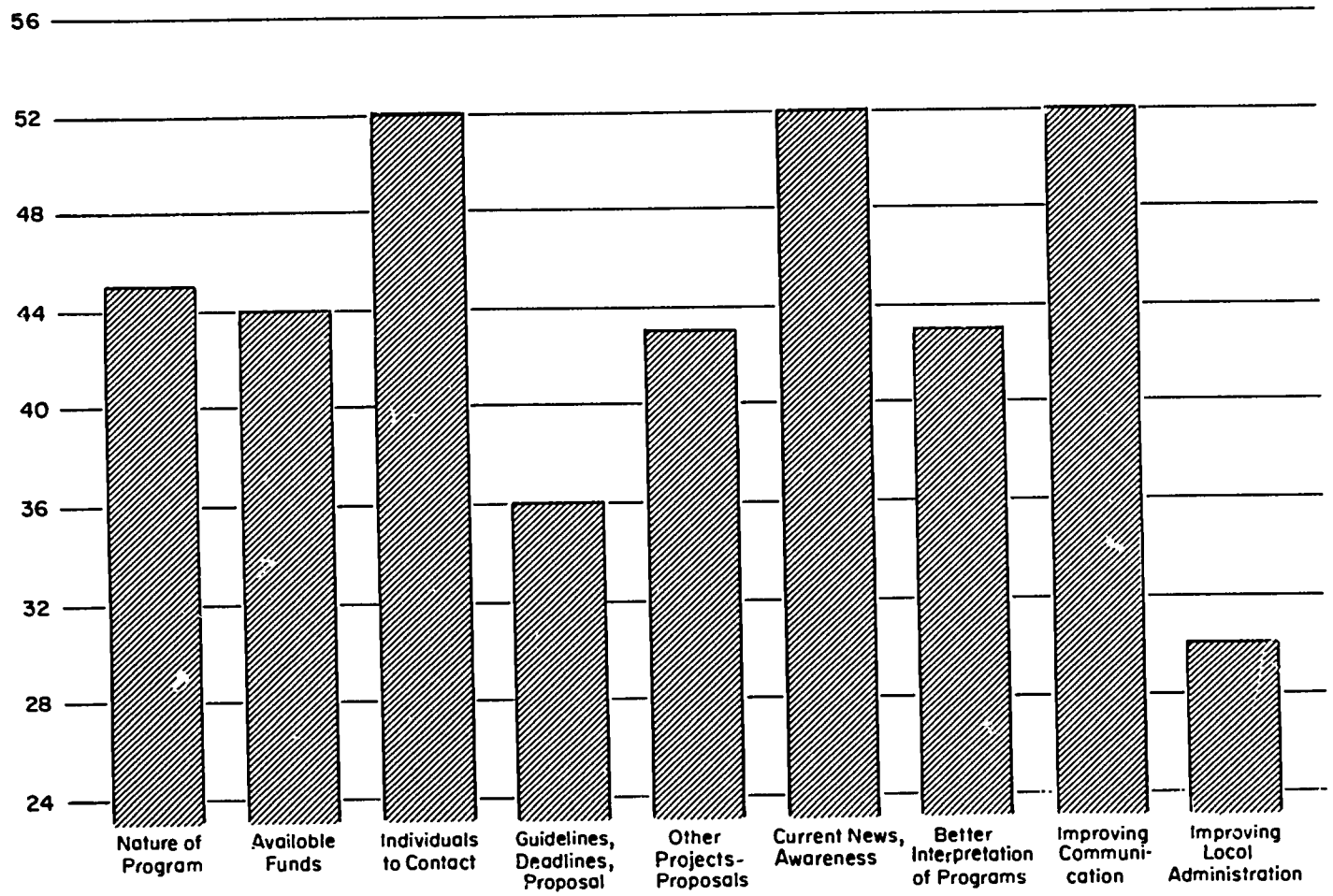


CHART 3

RELATIVE NEEDS BY INSTITUTION TYPE
STATE UNIVERSITY OF NEW YORK

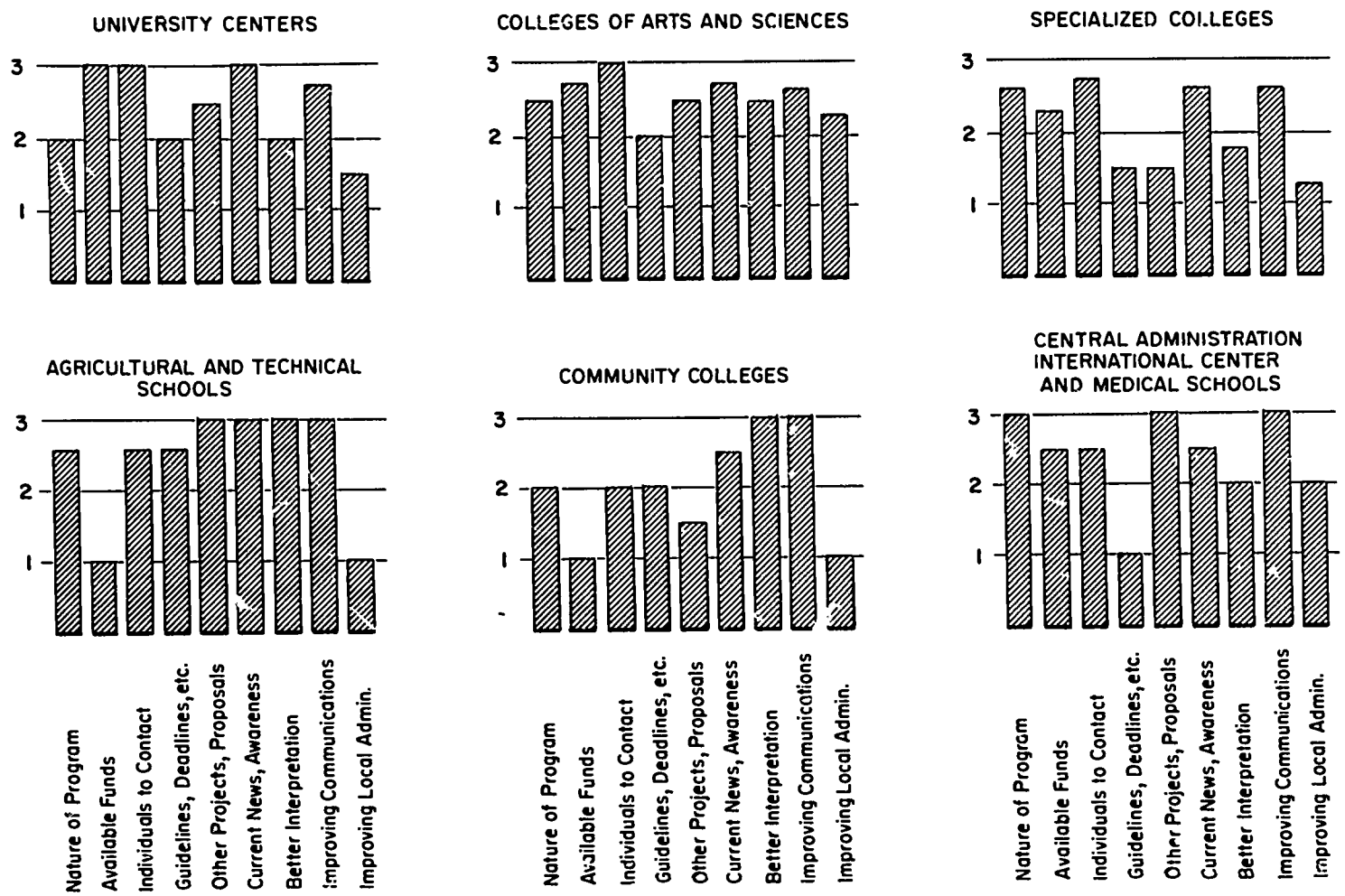
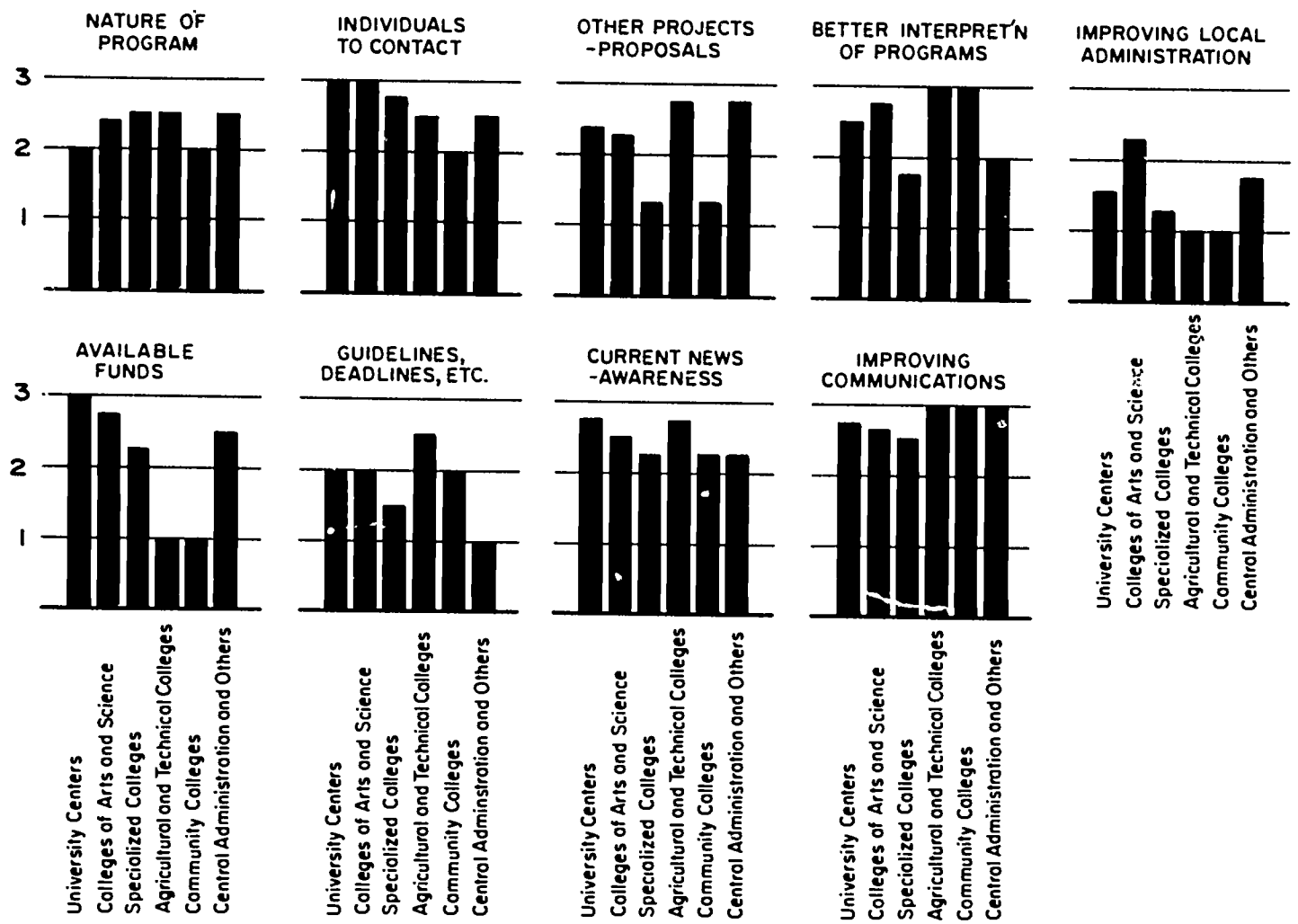


CHART 4

EACH NEED AND ITS RELATIVE IMPORTANCE TO THE 6 INSTITUTIONAL GROUPINGS



CHAPTER IV

AVAILABILITY OF INFORMATION ON FEDERAL PROGRAMS

Method of Survey

At the outset of this study, it was decided to include in the survey every federal agency which had programs providing potential support to any area of interest to a large multi-campus institution such as the State University. Thus, for example, the survey included programs of applied and basic research and development, facilities and equipment, student and faculty support, curriculum development, institutional development and support, and public service.

This part of the survey focused on two main areas: (1) identifying and reviewing federal programs concerned with the development of more effective methods of handling program information, and (2) determining if the government had or was developing software that might be used or adapted for the project.

Two questionnaires (see Annex B), followed up by personal and telephone interviews, were used to collect and analyze information needed for the study from the federal government. The agencies contacted and their subdivisions are listed in Annex B. The most extensive follow-up involved programs of the U.S. Public Health Service (originally approached through the Comptroller of the Department of Health, Education, and Welfare, the Surgeon General, and the National Library of Medicine), U.S. Office of Education Bureau of Research, Office of Economic Opportunity, General Services Administration, and the Institute of Applied Technology of the National Bureau of Standards. Next in order were the National Science Foundation, Atomic Energy Commission, National Aeronautics and Space Administration, Veterans Administration, Library of Congress, Department of Justice, Department of State (including the Agency for International Development), and the Department of Defense.

In the final months of the study, efforts were made to check the findings and preliminary conclusions with persons having considerable knowledge about government-wide activities and plans in closely related areas; for example, Colonel Andrew A. Aines, Executive Secre-

tary of the Committee on Scientific and Technical Information (COSATI) of the President's Science Advisory Committee. Notes were also compared with Dr. F. Joachim Weyl, Executive Secretary, Committee on Scientific and Technical Communication of the National Academy of Sciences.

Replies to our questionnaire and notes on many of our telephone and personal interviews are on file in the Washington Office, 1730 Rhode Island Avenue, N.W., Suite 500, Washington, D.C. 20036.

Congressional Concern

Congress has had an important influence on the development of information systems and the improvement of data processing management in the federal government during the last four years. Paradoxically the Congress itself has a very great need for effective data processing. As is pointed out very well by Kenneth Janda in his chapter on "Information Systems for Congress" in *Congress: The First Branch of Government,* the full potential of computers and data processing is far from being utilized by Congress, either to make its day-to-day legislative operations more efficient, or to give it better access to the enormous amount of information it needs to fulfill its legislative function and to answer inquiries from constituents. Only recently did Congress acquire its first computer, and that was for accounting purposes. Congressional concern, however, has tended to focus more on the data processing activities of the Executive Branch.

Significant in this context are the hearings which have been held on data processing management since 1963 by the Government Activities Subcommittee of the House Committee on Government Operations, chaired by Rep. Jack Brooks of Texas. The hearings were held in support of legislation to consolidate the data processing equipment and to change the acquisition policies. The effect of the resulting legislation was to create an office in the General Services Administration to coordinate rentals and to encourage purchase.

Another major effort fostered by the Congress and encouraged by the Air Force has been the Air Force Project LITE (acronymous for Legal Information Through Electronics). This project called for use of a computer to search legal information, such as the United States Code. This project was, in fact, an out-growth of research conducted at the Health Law Center of the University of Pittsburgh over

a period of several years. In addition to setting up the system, the University of Pittsburgh also created the data files and actually operated the system, under contract for the Air Force. The system is now operated at Denver, Colorado, by the U.S. Air Force Accounting and Finance Center, which has handled the project from the beginning. Hearings were held this year on the system by the Military Operations Subcommittee of the House Current Operations Committee, chaired by Rep. Chet Holifield of California. Generally everyone is satisfied with the system and with the Air Force's handling of what is essentially a government-wide effort.

In the 89th Congress, Sen. Edward M. Kennedy of Massachusetts submitted a joint resolution (S.J. Res. 187) calling for a study to be conducted by the Advisory Committee on Intergovernmental Relations on the application of computers to the problem of keeping communities throughout the United States informed on sources of federal funding. The objectives of this resolution parallel, in several respects, those of this study by the State University. Hearings were held on the resolution but it subsequently lapsed without action. The resolution, with virtually no changes in committee, was reintroduced in the 90th Congress (S.J. Res. 110). In the hearings on the resolution held by the Subcommittee on Intergovernmental Relations of the Senate Committee on Government Operations, chaired by Sen. Edmund S. Muskie of Maine, Charles J. Zwick, Director of the Bureau of the Budget, testified that he thought the problem was not the computer but rather the data required by such a system, because of the lack of standardized data reporting procedures by the many agencies. There is, however, a trend toward standardizing data inputs on a government-wide basis, as evidenced by the Federal Information Exchange System (FIXS), see page 36.

Program Information Act

Certainly the most significant recent development in disseminating information on programs of the Executive Branch was the introduction on June 25, 1968, by Rep. William V. Roth of Delaware, of a bill to create a catalog of federal assistance programs (variously numbered H.R. 17915, 18113-5; the latter three differing only that they include the names of co-sponsors, including Rep. Charles E. Goodell of New York) to be known as the Program Information Act.

At the same time, Rep. Roth introduced into the *Congressional Record* of June 25, a massive study of federal assistance programs, resulting from a questionnaire survey by his staff. Rep. Roth's report and "catalog" cover 151 pages in the *Congressional Record* for Tuesday, June 25, 1968 (Vol. 114, No. 109, pages H 5434-5585). Of the 1,271 questionnaires sent to federal agencies, 520 were returned with more or less complete information. Some agencies, particularly in the Department of Health, Education, and Welfare, did not respond. Members of Rep. Roth's staff reported that they understood that Secretary Wilbur J. Cohen had instructed his subordinates *not* to reply. If true, this seems to have been the most important instance of non-cooperation. Rep. Roth's survey missed some other important program areas, particularly the large research programs in the Department of Defense, through failure to submit questionnaires. There are plans to cover the missing programs and press unresponsive agencies (mainly DHEW) for replies and publish a supplement in the *Congressional Record.*

In addition to providing the public with information on federal programs, the Roth bill directs the President to transmit, with the catalog, a report setting forth the specific measures taken in the past year to simplify and consolidate the various forms and program guidelines a potential beneficiary would have to use. The President is further directed to coordinate, simplify, and consolidate application forms for related programs (see Sec. 8, page 4, of the draft bill).

The President is also directed to revise the catalog at least once each month. Rep. Roth's staff indicates that this frequency would require a computerized method of production. The catalog is to be the *only* complete source of data on federal programs; individual agencies would be able to reprint appropriate parts, but not produce their own books as they do at present. Production of the catalog would be assigned to the Bureau of the Budget, but the bill does not specify an appropriation for the purpose. The Office of Economic Opportunity is specifically eliminated from the catalog production business (see Sec. 13 (a) of the bill).

In some respects, the Roth bill goes beyond the information given in the OEO catalog or other federal reports. Since a monthly revision is contemplated, Rep. Roth believes it practicable to ask for the names of specific contact persons, the average size of grants, full budgetary information, and other data too volatile for a yearly catalog.

The Roth bill has been referred to the House Committee on Government Operations under the chairmanship of Rep. William L. Dawson of Illinois. However, unless a Republican majority is sent to the House of Representatives in the November, 1968, general elections, the bill is not likely to come up for hearings. The present membership of the committee is cool to the idea, suspecting that conservative Republicans are more interested in using the bill to identify and eliminate what appear to be overlapping federal programs than in providing a better information service to the public. Rep. Roth, a Republican, denies that this is his intent.

If the Roth bill were enacted and the catalog published, with monthly updated installments, the collection of information for the type of proposed higher education information program we recommend would be vastly simplified. Not only would this catalog provide much of the program personnel and budgetary information needed by the State University campuses, but it would have it in machine-readable form available to the public. This would supply at least three-fourths of the information input for the proposed system.

It is obvious that the information problem seen by Rep. Roth and Sen. Kennedy will grow as federal programs affect an ever widening range of community and public interests. Pressures for solution will increase even more rapidly, fed by the need to improve the efficiency of the federal bureaucracy and by the availability of improved information handling systems and technologies.

Information Centers and Information Management Systems

As noted earlier, the executive branch of the federal government is a major generator of information. It is also a major user of computing equipment, a major developer of software, a major creator of data for computer processing, and should be a major source of answers to citizens' queries. There are a number of reasons why it is difficult for the executive branch to function in this way. Despite the widespread use of computing equipment, for example, there is still little coordination among agencies in creating and exchanging data. One reason for this is that the agencies use different kinds of equipment which are incompatible. Also, the agencies are organized differently, generate and store information differently, and, as a result, respond differently to such queries. Few of the agencies are organized even in the same manner as their constituencies and as a result one query can cut across

many areas of an agency's activities. The Bureau of the Budget, which is well aware of this problem, has directed the agencies to redesign the automated information systems to have more uniform and reciprocal capabilities.

One way of dealing with this problem is to create better interagency or government-wide information centers, which would have a single mission and draw information from a large number of agencies. Another way is to create compatable management information systems enabling agency managers to keep better track of their organization's activities and to exchange information with other agencies and, as a result, to be better able to respond to queries from outside the government. These two possible methods were carefully examined in this study:

Information Centers

There are hundreds of information centers operated by the federal agencies and located throughout the United States. There are, however, probably more such centers in the Greater Washington area than in any other area. The chief concern of this report is with "document retrieval" centers rather than "information retrieval" centers, since the latter deal with raw material, such as statistics, technical measurements, and research data.

These document retrieval centers were created for a variety of reasons and for a variety of purposes. Some are subject-oriented. Others are mission-oriented. Some are little more than a pile of documents on a shelf with a card catalog for access, while others involve use of sophisticated computing equipment. None seems to be using data communications on a regular basis. There are enough experiments underway, however, so that it seems likely that data links between users and centers will be possible in the near future.

The centers, most of which are open to qualified users, seem to operate in a number of modes. Some have systems for alerting the users to newly received documents of interest in their fields.

Once a computer is involved in the information center operation, many services are then possible. If a computer is used to keep track of the documents, then it is possible to provide a service to alert people to materials coming into the center within

their areas of interest. Such a system of selective dissemination of information has been discussed in a previous section of this study. In such a center, the computer usually assists in the process of publishing abstracts and indexes to the materials, although automatic abstracting or indexing systems using the computer are still quite rare.

One such center is the *Clearinghouse for Federal Scientific and Technical Information,* at Springfield, Virginia, which sells published reports of federally sponsored R & D efforts. The *Clearinghouse* operated by the National Bureau of Standards of the Department of Commerce, is a national center for government-generated information in sciences and engineering, usually in the form of final published or progress reports on government-funded research projects. The *Clearinghouse* is also the repository for unclassified Department of Defense documents. Approximately 50,000 documents are added to the *Clearinghouse* annually. Last year, the *Clearinghouse* produced 2,500,000 copies of documents on request. These documents are stored in printed or typewritten form and on microfiche.

The *Clearinghouse* publishes three reports of its own: *Government-Wide Index to Federal Research and Development Reports,* a monthly; *U.S. Government Research and Development Reports,* a bibliography of documents available at the *Clearinghouse;* and *Technical Translations,* a bi-monthly index of translations of foreign reports.

Project LITE was set up as a government-wide effort and is operated by the Air Force in Denver. The LITE system is a full-text searching system in which every word of legal documents is stored on magnetic tape available for computer processing and information retrieval. The system is designed to retrieve legal documents in response to search questions containing key words and phrases. The bulk of the development work was done at the Health Law Center of the University of Pittsburgh which had been active in the development of such systems for a number of years. The search strategy used in the program is the same as that used at Pittsburgh and has also been adopted by the IBM Corporation for its Document Processing Program.

This program can be used for any type of document and is

of great interest for this reason. The program is available at cost from the Air Force. It is also available from the Health Law Center as part of a data package at a substantial price. The IBM version is, however, available to IBM equipment users at no cost.

The *National Aeronautics and Space Administration* is very active in establishing and operating information centers. NASA maintains large amounts of technical information and is charged with making available as much of the knowledge generated by its R & D program as may have applicability in other fields. Both functions are accomplished through a central and regional information dissemination system operated under contract by outside organizations. The key to NASA-generated information is a semi-monthly publication, *Scientific and Technical Aerospace Reports (STAR),* which presents abstracts and indexes of both United States and foreign research reports. NASA maintains for use by its regional centers and at its headquarters an index of the technical documents on magnetic tape for computer processing. The tapes can be searched on a given subject or they can be used to print out listings of the documents for publication. Recently, the agency has experimented with real-time, on-line dialog searching of these materials.

The *Science Information Exchange (SIE)* was established to carry government-wide reports on current, unpublished research funded by federal agencies in the biological sciences. It has since expanded its missions to cover all science and technology and some of the social science research activities of the government. SIE is operated by the Smithsonian Institution.

The Office of Education in the Department of Health, Education, and Welfare, has established a number of regional information centers under the name of *Educational Resources Information Centers (ERIC).* Each Center has a defined subject area of specialization. ERIC also publishes a monthly catalog, *Research in Education,* containing indexes to the information at the Centers and abstracts of newly received information.

The Department of Defense has created a number of specialized information centers covering research and development by federal agencies in virtually all areas of science and technology. The documents are disseminated primarily through the

Defense Documentation Center (DDC) in Washington. DDC has produced more than 450,000 usable reports during the last 16 years. Besides collecting and selling documents, DDC publishes the *Technical Abstracts Bulletin* and performs "demand" searches for bibliographies on topics within its field. Such bibliographies are available without charge to government contractors and federal agencies but are sold to the general public through the *Clearinghouse for Federal Scientific and Technical Information.*

The major contribution of the National Library of Medicine is the *Medical Literature Analysis and Retrieval System (MEDLARS),* which (1) compiles several specialized bibliographies in both basic and clinical research fields, best known of which are those in the multidisciplinary *Index Medicus,* a subject-author index of articles published in more than 2,400 United States and foreign journals on subjects ranging from air pollution to zoology; (2) compiles lists of citations on specialized topics, which are available to any researcher upon request; and (3) offers a limited number of recurring bibliographies compiled at intervals for small groups of researchers.

MEDLARS is computer-based and much of its searching and publication is done by computer.

The *Atomic Energy Commission* sponsors or participates in the sponsorship of about 20 decentralized information centers directed to subjects related to atomic energy.

The Department of Agriculture maintains a *National Agriculture Library* which carries copies of completed reports on its sponsored R & D efforts.

The *Government Printing Office* sells publications and reports on all subjects prepared by the federal agencies and by the Congress. These are listed in monthly catalogs and in bi-weekly price lists.

Within the Library of Congress, the *National Referral Center for Science and Technology* answers without charge requests for information on where to find material on a specific topic in any of the sciences or related technical areas. The Center also compiles directories of information resources in selected scientific and technical fields.

In addition to the information centers described above, two programs of the executive branch offer assistance in dealing with various types of problems at the rural and municipal levels.

Best known is the *Catalog of Federal Assistance Programs,* two editions of which have been published by the Office of Economic Opportunity. The current edition of 700 pages outlines 459 programs, with emphasis on those that "assist the American people in furthering their social and economic progress." With this emphasis, research support has been treated rather briefly. The diverse programs of the National Science Foundation's research wing have been reduced to one item headed "Scientific Research Grants," while veterans' benefits or Indian programs are spread over many pages, in accordance with the purpose of the publication.

Each description is fitted into a standard format giving the nature of the program, contact office, eligibility, publications, legislation, and administering agency. These telegraphic entries are prepared by the agencies according to specific instructions. The *Catalog's* elaborate indexes and appendixes include a 150-page master classification of programs by problem area.

The first version, named the *Catalog of Federal Programs for Individual and Community Improvement,* appeared in late 1965; the current edition is dated June 1, 1967. Experience suggests that this edition, at best, must represent federal programs as they were at the end of 1966. The OEO's Information Center is beginning work on a third edition, scheduled for publication in January, 1969. By then, the second version will be two years old. The 1969 book will list about 100 more programs, but the OEO cannot say whether its format will be varied. However, it will still not be possible to relate the contents to the computerized or conventional internal information systems of the agencies. OEO's instructions indicate that replies should be derived from agency data, but relatability is not yet mandatory; this requirement is being held over for the fourth edition.

Another publication, the *Vice President's Handbook for Local Officials,* was produced by the Office of the Vice President with far greater resources than were available to Rep. Roth. Presumably completed in November, 1967, this book actually

became generally available in June, 1968. The delay in production suggests some of the difficulties inherent in information services concerning federal programs.

The *Handbook* is designed for use with OEO's *Catalog of Federal Assistance Programs.* It is a narrative account with marginal key numbers relating it to pages in the OEO book. Although considerable effort seems to have been made to update and improve the information, the *Handbook* does not seem to have risen very far above its source. It includes information on most programs benefiting localities. Programs directly benefiting individuals, on the one hand, or higher education, on the other, are played down. No budgetary information is given. Application procedures are not described in any detail. It is a good account of what the federal government is trying to do for our communities; it is not a useful guide for individuals interested in applying for some specific benefit.

Preparation of the *Handbook* imposed no additional duties on the agencies, and it does not require them to coordinate, simplify, or report anything.

Finally, mention should be made of the recognition given this problem by the Intergovernmental Task Force on Information Systems, whose report, *The Dynamics of Information Flow*, was published in April, 1968. Chapter 7 of this report titled, "Improving Information About Federal Assistance Programs," formally recommends the designation of a "Federal Information Center on Assistance Programs" to serve as a primary national source of information on some 400 federal grant-in-aid programs available to state and local governments. Referring to a Bureau of the Budget study recommending a Comprehensive Catalog of Federal Assistance Programs, the report suggests that the Office of Economic Opportunity be designated as the agency to operate the proposed Federal Information Center on Assistance Programs.

Information Management Systems

Unlike the information centers, which may or may not use a computer in their operations, the information management systems of the agencies are almost universally computer-oriented.

Although computers have been used for many years by fed-

eral agencies, the development of effective information management systems is a recent phenomenon. There have been increasing pressures on agency managements from other parts of the executive branch and Congress to respond on short notice to detailed requests for information. Also, the increasing volume of questions from those seeking federal assistance has burdened the established mechanisms for handling such queries. Automated data processing seems to be the solution to both of these problems.

Although these systems were created to inform agency management rather than to inform the public, it appears that there are present in such systems informational elements that could be used to answer questions from the public. These informational elements should be available from such systems in machine-readable form to permit data to go into a system created to answer questions on the federal programs with a minimum of cost. This possibility is considered in depth later in this report.

One of the best developed automated management systems for handling program information is that operated by the Department of Defense (DOD). The Department's Defense Documentation Center (DDC) in cooperation with the Director of Defense Research and Engineering (DDR&E) has developed a computer-based information system for making available to all Department of Defense scientists, engineers, and managers, brief descriptions of efforts in research and technology currently in progress. The objective of this system, known as the Research and Technology Work Unit Information System (RATWUIS), is to help the R & D manager in (1) identifying ongoing DOD research in any scientific discipline or technology area (e.g., what is the Department doing in propellant chemistry, or in behavioral science research), (2) coordinating programs easily with other parts of the Department of Defense and other agencies to eliminate undesirable overlap of efforts, and (3) determining whether specific areas of endeavor adequately reflect the Department's R & D policies.

The RATWUIS system is intended to help scientists or engineers (1) determine the approach and current status of technical efforts related to their own work, (2) identify scientists and engineers who are working in related areas, and (3) maintain current

awareness through periodic review of progress reports.

Each of the major research arms of the Department--the Office of Naval Research, Air Force Office of Scientific Research, Army Research Office, and the Advanced Research Projects Agency--prepares information on its sponsored R & D programs and puts it on magnetic tape for its own use In addition, copies of the tapes go to DDC, which uses its computer facilities as a clearinghouse for information on all the Department's R & D programs.

A very different approach--and one of the most promising systems at first glance--is the *Federal Information Exchange System (FIXS)* operated by the Office of Economic Opportunity, with the assistance of the Bureau of the Budget. OEO has collected information from many federal agencies concerning a large number of federal programs providing assistance to rural communities, municipalities, and states. The initial data collection effort was primarily directed to the dollar outlays under each program. At present, more than 410 programs administered by some 69 departments and agencies are included in the system. The system is tape oriented and operated on an RCA 70/45 computer system.

Most of the federal agencies responsible for sponsoring research and development now have or are developing automated management information systems for keeping track of their ongoing sponsored activities. The objectives of these systems are similar to those of the Department of Defense, although they are operated somewhat differently by each agency.

The Bureau of Research in the U.S. Office of Education has developed a computer-based proposal and project control system of particular interest. The system, known as the *Bureau of Research Information Control System (BRICS)*, combines the attributes of a proposal control system and an information retrieval and reporting system. The objectives are to insure that proposals received by the Bureau of Research are considered expeditiously and that agency management is informed of ongoing sponsored programs. It is likely that this system will be adopted by the entire U.S. Office of Education.

Once research projects are completed and final reports

written, responsibility for storing and disseminating information on the project is transferred to the ERIC centers already described.

The *U.S. Public Health Service* of the Department of Health, Education, and Welfare, is currently developing a data base that can be used for keeping the Service and the Department informed on proposal and project activity. Actual implementation of the system is still expected to take place late in 1968. The initial design effort is being directed to producing a single application form for use throughout the Service and the National Institutes of Health. At present, 90 different application forms are used. The system will contain information on pending proposals and on ongoing projects funded by USPHS.

When research projects are completed and the results published, the information is entered in the MEDLARS system.

The *Department of Agriculture* has a well developed automated system, known as *Current Research Information System (CRIS),* for keeping track of its ongoing R & D efforts. Once projects are completed and final reports published, responsibility for keeping track of information on the project moves to the National Agriculture Library.

The *National Science Foundation* and the *National Aeronautics and Space Administration* also have computerized systems for keeping track of their ongoing sponsored research efforts.

At present, the *National Aeronautics and Space Administration* magnetic tape system is not open to the public because, in the main, it contains information on classified research efforts. However, NASA officials have indicated that the unclassified portion of the file may become available to the public.

NASA officials also have described aspects of the general organization of the file which should be of particular use in answering the kinds of inquiries likely to be made by the university community. The NASA tape system information is grouped in three broad areas, proposed research, approved research which has not commenced, and research presently underway. The utility of this kind of information for the university researcher contemplating a project is quite obvious.

From what has been reported so far in the area of management information, it would appear that one would have to contact each agency separately to get information on currently supported R & D efforts. This is only partly true. In theory, however, the Smithsonian Science Information Exchange (SIE) is supposed to be the single central clearinghouse for just this type of current, unpublished research. However, the sponsoring agencies, with some exceptions, do not report their ongoing research efforts to SIE with the same completeness or promptness that they do for themselves. Thus, there are often serious gaps between what an agency is currently sponsoring and what may be in the SIE computer. Despite these shortcomings, SIE remains the only single government-wide information center which the public can approach for information on current R & D efforts. Educational research not currently being reported to SIE will eventually be included.

This summary of information programs would be incomplete without mentioning the influence of the recently organized *Committee on Academic Science and Engineering (CASE).* Administered from the National Science Foundation, this is a two-phase reporting system for keeping track of federal support to higher education and of the impact of this support on the educational and scientific manpower of colleges and universities. All agencies which provide significant amounts of funds to higher education are included in this program. These are the Department of Health, Education, and Welfare; Department of Defense; National Science Foundation; Department of Agriculture; Department of Interior; Department of Commerce; Atomic Energy Commission; National Aeronautics and Space Administration; Agency for International Development; Department of Labor; Department of Transportation; Office of Economic Opportunity; and Department of Housing and Urban Development.

Working out the details of this reporting system has forced these agencies to re-examine their management information systems in an effort to standardize at least some of the vocabulary and definitions. Most of them are now modifying their automated management systems to produce the information needed for the CASE report, which will be published annually. Data supplied to NSF for the production of the CASE report are being stored on magnetic tape.

Availability of Information in Machine-Readable Form

It is apparent from the previous section on management information systems that the federal government is making rapid strides toward automating a great deal of its administrative information, much of it in the areas of interest to State University as revealed in the campus user need survey. In following up the earlier survey of federal government programs for this study, it was decided to determine the availability of machine-readable information in the specific areas of interest to the University. A questionnaire was sent to 20 agencies selected from the list of 40 which had received our earlier questionnaire (see Annex D, page 96).

To simplify the questionnaire, the information needs of the University described in Chapter II were placed into three categories:

> Personnel information, including the name of the person responsible for administering the program of interest to the State University, and the "unseen colleagues" of the university researcher or seeker of federal support.
>
> Program information, including a general description of the program which would provide assistance, information on ongoing and completed sponsored research in the area of program interest, and information on guidelines, application procedures, deadlines, etc.
>
> Budgetary information, including information on the cumulative fiscal year balance available by projects or programs.

The questionnaires, after being mailed, were discussed with agency officials by telephone or in person before the requested return date. This survey took place from April to early June, 1968. Responses revealed that information is now or will eventually exist for all but one of State University's areas of interest (application procedures). Not all of the agencies could see the value of putting such information into their automated management information systems.

By weighing the responses, the comparative states of development of machine-readable information in the categories covered in the questionnaire were charted (see page 40).

Nearly one-half of the agencies responding to the questionnaire reported that they had or expected to have within two to three years

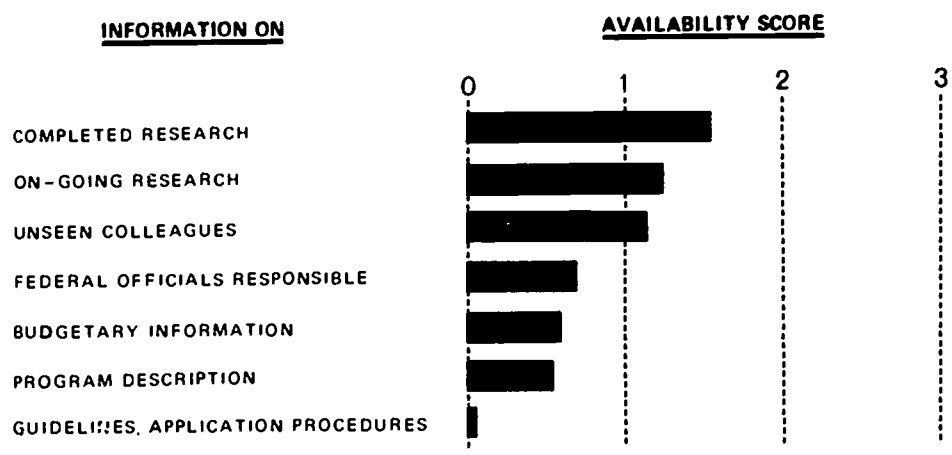
AVERAGE RESPONSE OF 20 FEDERAL AGENCIES TO QUESTIONNAIRE ON AVAILABILITY OF INFORMATION IN MACHINE READABLE FORM

0 Not available and no future availability anticipated or no mention of possible future availability.

1 Not now available but future availability anticipated in 1 to 3 years (occasionally longer).

2 Now available in partially effective form or a partially limited availability.

3 Now available to the public.



descriptive information on their programs in machine-readable form in their management information systems. These were the Atomic Energy Commission, Department of Agriculture, Economic Development Administration of the Department of Commerce, Office of Economic Opportunity, and the Agency for International Development, as well as the Defense Department in some program areas. The Bureau of the Budget foresaw a point in the future when, as the government moves toward an integrated management system, one of its subsystems will provide selected information in machine-readable form on agency program plans.

Here, too, some problems may be anticipated in separating such information into different categories for external and internal use as it becomes available in machine-readable form.

As for information on ongoing, unpublished research--a valuable indicator of the types of programs an agency supports--almost all agencies replied that such information is or will be available in machine-readable form for internal use within two or three years. Several agencies which will not have information in this form will give printed or typewritten copies to SIE, which will transcribe the data into machine-readable copy. Bureau of the Budget officials asserted that the future plans of virtually all agencies call for this information to be available in machine-readable form.

Almost all of the responding agencies reported having information on completed sponsored R & D projects in machine-readable form now or in their plans for the next two to three years. This information, however, is of relatively low priority among the program information needs of the University.

The final element of program information deals with guidelines, application procedures, deadlines, etc. Not one of the responding agencies reported keeping such information in machine-readable form, nor did they indicate any intention or even see any reason to do so.

Personnel Information

Only a handful of the agencies receiving the questionnaire have fully automated their personnel records. They include the Department of Defense, Atomic Energy Commission, Department of Agriculture, Department of Housing and Urban Development, Agency for International Development, and Civil Service

Commission. Some of them have plans for identifying people with their specific job responsibilities in their automated system. This meets one of the highest information requirements revealed in the user survey of State University campuses.

Although the technological capability exists, and the government is clearly moving in the direction of automating its personnel records, a very different problem exists here. Release of personnel information to the public or to contractors would pose some serious operational and ethical problems, including the danger of invasion of privacy. Thus, some time may lapse before these systems can be designed to meet the State University's information needs while withholding information considered sensitive or limited to internal use by the government.

As for information on "unseen colleagues," nearly all agencies which now have or are developing management information systems for keeping track of ongoing and completed research will have such information on magnetic tape. In some cases, this type of information is available to the public directly from the agency, but in most instances it is obtained through the Smithsonian Science Information Exchange (SIE), which serves as a central clearinghouse for most federally-sponsored ongoing research.

Program Information

The category of program information contains several elements of the campus survey: general program descriptive material, information on ongoing research, information on completed research, and guidelines, applications, deadlines, eligibility criteria, etc.

The availability of elements of information in this category varies widely, as the chart on page 40 indicates, with information on completed and ongoing research most readily available in that order. Virtually all agencies sponsoring any appreciable amount of research now have computer systems designed to keep track of fiscal, personnel, and descriptive subject data on completed and ongoing research projects. For example, the Department of Defense, through its Defense Documentation Center (DDC), in cooperation with Defense Research and Engineering, has developed the *Research and Technology Work Unit Information System (RATWUIS)* for this purpose; the Department of Agriculture has

its *Current Research Information Service (CRIS);* the U.S. Office of Education, Bureau of Research, has the *Bureau of Research Information Control System (BRICS);* the National Institutes of Health and the U.S. Public Health Service expect to have an automated system operational later this year which will keep track of all ongoing research projects. Such systems are also in operation at the National Science Foundation, National Aeronautics and Space Administration, and the Atomic Energy Commission.

Although all these systems are or will soon be operational, the general public usually does not have direct access to the computer tapes or punched cards on which this information is stored. In most cases, however, the public does have access to this information indirectly through the Smithsonian Science Information Exchange (SIE). Several agencies, including the Defense Documentation Center, the National Aeronautics and Space Administration, and the National Library of Medicine, will sell tapes with information on completed projects in the form of final project reports or published articles.

Although some agencies have some general descriptive information on their programs now in machine-readable form, this is at the low end of the availability chart. As for information on guidelines, applications, etc., most agencies do not see the day when this type of information would or should be put in machine-readable form.

Budgetary Information

There was considerable interest on the campuses in information showing the cumulative fiscal balance for the programs to which applications were being made. Slightly less than half of the agencies responding indicated that such information was available in machine-readable form, but that it was for internal use only. Some references were made to the availability of this information through the CASE reports being collected and edited by the National Science Foundation. However, some of this information is in aggregates too large to be useful. One agency, NASA, reported that budgetary information sought is available on tape and may be purchased.

Those agencies reporting that the budgetary information described would be wholly or partially available now or within

three years or more for internal purposes were: the Department of Agriculture through its CRIS system, the Economic Development Administration of the Department of Commerce, the U.S. Public Health Service, the Bureau of Research in the U.S. Office of Education, the Department of Labor, and the Department of Defense.

CHAPTER V

ANALYSIS AND AVAILABILITY OF COMPUTERS AND COMPUTER PROGRAMS

Availability of Software

Preparing a computer program can be an expensive and time-consuming activity involving technical skills that are in short supply in the personnel market. If it were possible to obtain prepackaged software to match queries and sources of information, it would be possible to save considerable amounts of time and money. The system would be available for immediate implementation instead of undergoing a development period of one or two years.

Several possible sources of software were investigated in this study--federal government agencies, private organizations, and computer manufacturers.

The federal government is the largest single user of computing equipment in the world and as such is a major user and developer of computer software. However, the federal government turned out to be the least productive source in the survey of software. There seems to be considerable duplication in agency effort and very little cross-agency cooperation in developing software systems that can be used government-wide. Both the manufacturers of computers and private organizations are, however, developing generalized "information management systems" that could be applied to the problem.

Options Investigated

At the outset of the project, four theoretical models were devised for retrieving and disseminating information on sources of federal funding needed by the University.

Looseleaf Service--Looseleaf pages are prepared describing the various funding programs and the procedure for getting funding under each. The pages must be rewritten periodically to reflect administrative changes in the programs. Changes are sent automatically to the looseleaf subscribers. Access to program information in the catalog is through an index of key words and

phrases. Publications of this type include *College and University Reporter,* published by Commerce Clearing House, and *Guide to Federal Assistance for Education,* published by Appleton-Century-Crofts.

Selective Dissemination of Information (SDI)--Interest data are compiled on each person drawing or requesting information from the system. As program information is gathered, abstracts are read into a computer system that then match the information against the interest profiles. When a match of interest and information is made, a notice containing the abstract is sent to the appropriate person, who may then request the full text if he desires more information. SDI was created by the IBM Corporation and is widely used.

Computer Processing of Requests for Information–This system could be called an "information management system." The objectives of the system are to create and maintain a file of relevant documents, and to retrieve them upon request. A request for information is read into the computer and then a search of the data file is made to determine which documents are available that are relevant to the request. The end results of these efforts are printouts of relevant documents which are then forwarded to the person requesting information.

Time-Shared Computer Processing Requests for Information--It is recognized that only rarely will a person be able to describe his research interests exactly the first time. Batch processing of inquiries does not allow for changes of mind. Ideally the most productive kind of computer-based system would be one that allows a dialogue between the person with the question and the information base. Such a system would allow the question to be posed from a remote location and the response to be received at the same location. The software would be similar to that of the previously described system. The computer hardware is, however, significantly different.

There are many possible combinations of the models described but these are the basic options to be considered and investigated.

Considering the Options

Looseleaf Service--The concept of the looseleaf service was

immediately rejected for a number of reasons. There are presently available a number of catalogs and directories published with varying degrees of quality by federal agencies and private firms. Creating another catalog would add little to what is already being done. Such an activity is labor-intensive and as a result quite expensive. It is also difficult to recruit personnel with the skills necessary to do the job.

But the most important reason for rejecting this option was that it apparently could contribute little toward the automated system envisioned in the basic assumptions underlying this study, even though such printed or typewritten copy can, under certain circumstances, generate tape.

Similarly, the study conducted within the federal government indicated that there are sources of data available in a machine-readable form and that these sources will increase their offerings as time passes. From the outset, then, it seemed that a computer-based system was more desirable than attempting to duplicate something already being done.

Selective Dissemination of Information--Although this concept is used quite effectively in many environments, it was decided that other programs permitting more flexible interaction between the searcher and the data base would be more suitable to the system being designed. The SDI system uses abstracts of relevant documents as input elements. They are then circulated to those persons whose interest profiles coincide with the subject matter of the abstract. The person receiving the notice can then request the full document if he desires. The survey of the State University campuses showed that the users were significantly more interested in having their questions answered than in having notices sent to them when new information was available. Thus, in the final analysis, the system was disqualified because it was incapable of responding to questions.

Computer Processing of Requests for Information--The key to using this type of system is in having the data from the agencies available in machine-readable form. If it were necessary to gather information, analyze it, rewrite it, and then put it in machine-readable form, another option such as the looseleaf service would be equally attractive. One of the objectives in

designing a system must be to avoid unnecessary physical handling of data before it can be made available.

The survey of the federal government agencies indicated that data will be made increasingly available from them in machine-readable form--a factor which encourages the selection of a computer-based system to do the job.

To be effective for this application, the system must be capable of "reading-in" textual data, creating files of the data, maintaining the files when changes in the data are required, and retrieving and printing out the data upon request. It appears that there is software available with these characteristics.

Time-Shared Computer Processing of Requests for Information--As indicated earlier, this option would be ideal since it allows two-way communication between the user and the data base and is, therefore, responsive to the user's needs. Although there are a number of such systems operated across the country, it is unlikely that many of them are economically profitable. It is also unlikely that the economics of time-sharing will be worked out for some time.

Time-sharing systems will be established within the State University during the coming year. These systems are, however, earmarked for applications that bar the intrusion of a system of the kind described in this study.

The software needed to accomplish this task on a time-shared system would be quite similar to that used in a non-time-shared computer system. It would be necessary, however, to revise the processing strategy considerably to accommodate real-time communications.

Further Consideration of the Options

Looseleaf Service--Discussions were held with representatives of Commerce Clearing House, publisher of *College and University Reporter;* Appleton-Century-Crofts, publisher of the *Guide to Federal Assistance for Education;* and the Office of Economic Opportunity (OEO), which publishes the *Catalog of Federal Assistance Programs,* to determine their future publishing plans and their possible use of computing equipment in disseminating information.

OEO has never used its computing equipment in preparing the *Catalog* and does not seem to have such plans. Also, unless the subject matter coverage of the *Catalog* was significantly increased, it is unlikely that the resultant data base would be of much utility to institutions of higher education.

Commerce Clearing House, a Chicago-based company, uses computing equipment to assist in the publication of the *Reporter,* and there even seem to be plans to have computers actively participate in the editorial process. CCH representatives were pessimistic about the chances for increased availability of government information in machine-readable form and doubted that the government would use computers in the editorial process in any event.

In discussions with an Appleton-Century-Crofts representative, it was learned that the *Guide to Federal Assistance for Education* is structured in a way which permits the data base to answer questions from the campuses. Its program coverage is reasonably complete. Moreover, it has been ACC's intention from the beginning to develop a computer-searchable data base, and the *Guide* was designed with that ultimate objective in mind.

Out of those discussions came the possibility of the joint project described in Chapter VI.

Selective Dissemination of Information--This option, discarded early in the study, was not given further consideration.

Computer Processing of Requests for Information--The keys to the use of this option are the availability of information from the agencies in machine-readable form and the availability of software to match questions and data to produce answers.

Much attention is being directed by companies and consulting firms to the creation of generalized software packages that can handle a variety of input materials, including full text, and can be interrogated by people who are not programmers.

Following is a list of systems of this type that have been developed or are under development at this time:

Generalized Information System (GIS)--When completed, this will be a set of general purpose file processing programs designed for use on the IBM System/360 computer.

Development is very slow; the system will probably not be completed until the end of this year. GIS is designed for operation on large configurations of the System/360.

Document Processing System--This was to have been part of the Generalized Information System but was pulled out for development by itself. An initial version of the system, designed for text processing, is now available. At least an IBM 360 model 40 computer is required for its operation. Apparently this is a further development of the text processing system developed by the Health Law Center at the University of Pittsburgh for handling statutory and legal materials. The Pittsburgh system is presently in operation in about ten states, including New York.

MANAGE--Introduced by Scientific Data Systems for its computers in July, 1966.

INFOL (Information-Oriented Language)--Introduced by Control Data in 1965 for use on its computers, but now being discontinued.

IMRADS (Information Management Retrieval and Dissemination System)--Introduced by UNIVAC in 1966 for the UNIVAC 1108.

BEST (Business EDP Systems Technique)--Introduced by NCR for its computers in 1964.

TDMS (Time-Shared Data Management System)--Introduced by System Development Corporation in 1966.

MARK IV File Management System--The fourth in a series of information management systems developed by Informatics, Inc. Currently available for the System/360.

DATRIX--Developed for Xerox Corporation by Computer Command and Control System. Development is being carried on by Xerox, which now offers a bibliographic retrieval service through its subsidiary company, University Microfilms, Inc.

Also considered were systems created by Documentation, Inc., which has developed bibliographic retrieval and publication systems for use by the National Aeronautics and Space Administration and a grant management system for the Air Force Office

of Scientific Research and for the Ford Foundation.

The primary mission of most of the systems considered in this report is to create and maintain information files and to retrieve and report information from the files in response to specific search requests. One of the keys to such a system is a dictionary that defines parameters for the data contained in the files. Specific forms are used when framing a search based on the dictionary.

The main appeal of such a system is that once created, the files can be interrogated by a layman who may not know programming techniques but is conversant with the method of framing searches.

Time-Shared Processing of Requests for Information--One of the earliest and largest time-shared systems in the world is operated by System Development Corporation (SDC) at its facilities in Santa Monica, California: the AN/FSQ-32, a unique computer created specifically for time-sharing. This sytem is to be replaced with two large-scale System/360 configurations this year.

SDC's software system, TDMS is designed for optimum operation on the equipment they have on order and is based on work done with previous sytems such as LUCID.

Unfortunately, the economics of such systems are still essentially unfavorable and it seems unlikely that the project proposed as a result of this study could be done favorably on equipment that is presently available or is likely to be available in the near future.

It is likely, however, that when such equipment is available to do this job economically that appropriate software will also be available.

Conclusion

The software system created by IBM, the Document Processing Program, is recommended for two of the proposed pilot projects for a number of reasons. The text processing strategy used in the system was validated at the University of Pittsburgh and has been used successfully by a number of organizations, including the Office of General Service of New York State.

The software is now available and will be undergoing constant improvement during coming months and years. It will be available at no cost to the State University since it is a major user of IBM computing equipment.

Since software development is a rapidly changing field, it is quite conceivable that other software may become available for use in this experiment, as well.

Availability of Hardware

The study of computer hardware has been limited to that available or on order within the State University. There are approximately 43 such systems, listed at Annex E, page 101.

In recommending hardware to be used in this project, the criteria were that the inquiry center of operation should be situated at or in close proximity to The Research Foundation, and the equipment should have sufficient capacity to handle recommended software and must accept the software language.

The only system which met these criteria was the IBM 360/40 system, which has recently been installed at The Research Foundation offices in Albany.

CHAPTER VI

RECOMMENDED EXPERIMENTS

After completion of the surveys on information needs, federal management information systems, and available hardware and software, a number of theoretical alternative comprehensive information systems were considered. In order to provide a conceptual backdrop for the design of a suitable system, the three different types of experimental projects described below were developed and adopted to test the conclusions of this study and advance the state-of-the-art in this field.

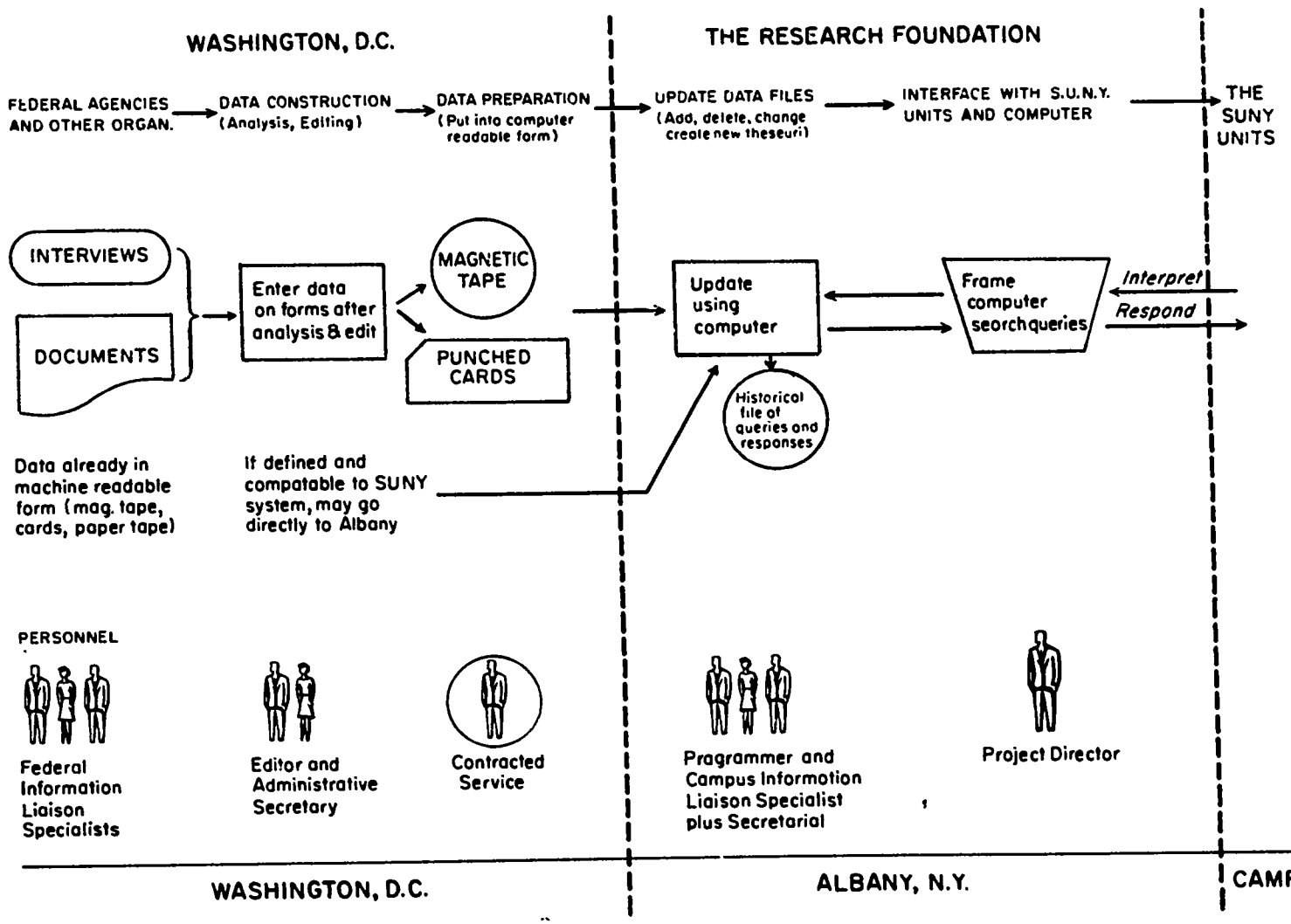
A Complete Prototype Design

The problem in designing a basic prototype was one of meeting the following varied requirements: It must (a) be responsive to the real needs of the University for information, (b) test the use of machine-readable and other federal information in an automated system, (c) pave the way for a direct union to automated data sources, and (d) be feasible.

In order to meet the feasibility requirement, the design experiments had to be limited in data input, in linkages between the government and the State University system, and in user access.

It was decided that the focal point of the system would be a centrally situated information center and computer in which detailed information on a limited number and variety of types of federal programs is stored. The IBM 360/40 computer facilities at The Research Foundation were recommended for this role. This experimental facility would service the needs of a select number of campuses in the State University. A schematic diagram of the proposed prototype appears on the following page. Its proposed operation is described under the headings of data base construction, data collection, data editing, recommended software, recommended hardware, recommended federal agency participation, recommended center of operations and user locations, and proposed three-year budget.

PROPOSED PILOT PROJECT



Data Base Construction

As indicated earlier, although most queries from the campuses appear to be unique, there are indeed marked similarities in the types of information required to answer the queries. Analyses of queries coming from the campuses to the Washington Office and of the comments made in campus interviews indicate that there are a dozen or so questions implicit in each campus query regardless of the subject and suggest that each question could be answered by a similar number of "informational or data elements."

Examples of the types of questions generally found in campus queries are:

1. What assistance is available?
2. What conditions must be fulfilled to get funding?
3. Who can I see or call within the agency about my interest?
4. What funds are available?
5. What is the probability of my getting an award?
6. How long will it take to get a project funded?

Based on the types of questions implicit in the queries from the campuses and the informational interests expressed in campus interviews, it was possible to develop a list of specific "data elements" that must be available in each federal program description if that description is to answer the majority of queries related to a specific program or subject, or both.

The person asking the question generally does not know what program will satisfy his interest. His question, however, will ultimately lead to program descriptions. The program descriptions must consistently have certain data elements present if they are to answer his question.

The exhibit below describes data elements that must be present for each program in a data file. Some information, because of its ephemeral nature, cannot be included in this data file.

List of Data Elements

Program Name

Program Description

Responsible Federal Official

Type of Assistance Available (e.g., grant, loan, technical assistance)

Functional Purpose for Which Funds Can Be Spent

Eligibility Requirements

Conditions for Receiving Assistance (e.g., matching funds)

Application Procedure (e.g., format for proposal)

Responsible Regional or State Official

Program Authority (e.g., statutory identification)

Average Size of Grant or Loan

Application Processing Time

Appropriation

Once the information requirements are defined, the structure of the necessary data base is almost self-evident. The main logical unit present in the data base is the "program description." Within each program description is a set of data elements. It is the data elements that provide the response to the initial query.

It is the job of the computer software to locate the appropriate program descriptions and to instruct the computer to print them.

The exhibit on the following page illustrates the data base structure.

Provision must be made for the addition to the data base of new programs as new programs are authorized by Congress and implemented by the federal agencies, for deletion of old programs when the life of the program runs out, as well as for the numerous changes to the data elements resulting from administrative actions. This data base maintenance is the function of the computer software. Inputs are provided by the editorial liaison personnel.

Many of the data elements contain information that changes quite frequently, which means that new data must enter the system constantly to keep the data base current. Budgetary information, for instance, is changing almost daily since funds are constantly being obligated by the agencies. Other data elements, of course, contain information that changes rarely and, therefore, needs to be reviewed less frequently. A program name and description, for instance, is static.

Example of Type of Program	Program Number	1 Program Name	2 Program Description	3 Type of Assistance	4 Eligibility Requirements	5 Application Procedures	6 Responsible Federal Official	7 Responsible Region or State Official	8 Program Authority	9 Average Dollar Size of Such Grants	10 Time Required	11 Status of Appropriations
Graduate Facilities	1											
Computer Equipment	2											
NDEA Graduate Fellowships	3											
Continuing Education Title I - HEA	4											
Law Enforcement Training	5											
Juvenile Delinquency Research	6											
Molecular Biology and Research	7											

For planning purposes, the following exhibit shows an estimate of the "volatility" or frequency of change of each data element. The system should be designed, however, to pick up changes whenever they occur. A cursory review of this exhibit suggests that the data file needs constant attention.

Exhibit - Volatility of Data Elements

	Volatility Rating*
Program Name	1
Program Description	2
Type of Assistance Available - Grant, Loan, Technical Assistance	1
Functional Purpose for Which Funds Can Be Spent	3
Eligibility Requirements	2
Conditions for Receiving Assistance - Such as Matching Funds Required	1
Application Procedure - Form or Proposal	3
Responsible Federal Official	4
Responsible Region or State Official	4
Program Authority - Such as Public or Statute Number and Name	1
Average Grants or Loan Size	4
Application Processing Time	4
Average Lapsed Time Between Receipt of Application and Notice of Approval or Disapproval	4

* 4 = Changes Frequently (as often as every month)
3
2
1 = Changes Infrequently (not more than once a year)

Historically, the task of assembling program information (normally published in catalog form) is one requiring highly skilled personnel. Keeping the data current in this fashion is laborious and expensive. One of the assumptions investigated in the course of this study was that it would be possible to gather data of this kind from the appropriate agencies routinely in machine-readable form.

While still a valid assumption, it is clear from the study that this will not be possible for several years. The survey of agencies, described in Chapter IV, shows that the agencies are in various states of readiness in terms of having computerized data available to organizations outside the federal government. Several of the federal agencies seem to have come a long way toward reaching this goal and fortunately, for the proposed prototype system, most of the agencies that have come the furthest are also ones with which the State University has the most contact and are, therefore, of great interest as prospects for participation in the prototype study.

Data Collection

Before data can be collected routinely from the agencies, it will be necessary to identify specifically what information is available from the selected agencies in the form of data elements, and conclude formal agreements with the selected agencies to assure that current information on the programs will be made available.

Two or three persons will be recruited to furnish liaison with the agencies cooperating in the prototype development. Each person will be assigned one or more agencies for which he will be responsible for establishing and maintaining contacts, routine gathering of information, checking of information for relevance and accuracy, writing and abstracting when necessary, and fostering arrangements for exchanging information in machine-readable form. The number of programs that will be included in the prototype operation will be limited by the number of liaison people employed.

Data Editing

There is virtually no uniformity in document or computer output among federal agencies. As a result, it will be necessary to subject the information gathered from the agencies to a rigorous quality check and some editing to insure that data entering the computer will ultimately be responsive to the questions directed to the data base.

This will be the function of the editor. The editor must review the information coming from the agency to see that it meets the standards set for data entering the system. He will make those editorial changes necessary or else seek to clarify the information. He will see that data coming from the agencies in an automated medium are transcribed as necessary for computer input.

Data Input Preparation

Data collected from the agencies, once properly edited, will be put on magnetic tape for transportation to the site of the computer center and for subsequent input to the data base. Since the amount of data coming from the agency can vary greatly from time to time during the course of a year, it is suggested that the actual task of putting the data on tape be done by a computer service bureau. The service bureau, by its very nature, is designed to accommodate the ebb and flow of daily input processing requirements.

Software Recommended

As reported in Chapter V, a variety of existing software systems have been examined in relation to the needs of the prototype experiment proposed in Chapter VI. The possibility of designing software specifically for this project was considered and rejected as costly and unnecessary. Instead, it is recommended that IBM's Document Processing Program be used on a computer already installed. This program will, in effect, act as an interface between the person posing a question and the information available on federal funding sources to answer that question. It will be necessary, however, to frame the question in such a way that the computer can respond. This will require a person who will specialize in interacting between the computer and the person on campus posing questions.

The Document Processing Program carries on essentially three major functions in (1) maintaining the data base by "reading-in" new data and updating the data already on file, (2) producing a word list or thesaurus used in preparing the search questions, and (c) searching the data base in response to appropriately structured questions.

The output of the program is a full printout of appropriate program information.

Generally, questions will be batched and submitted to the computer in economical quantities although they can be processed singly,

if necessary. The latter situation, however, is not the most economical.

At some point in the future, it will be possible, with appropriate changes in the software, to input questions on a real-time basis by simply interrupting whatever else is being processed on the machine at the time and temporarily substituting the document search program and the appropriate data base.

Recommended Hardware

The project could acquire its own system and devote it exclusively to real-time servicing of federal information queries. The approximate cost of hardware for such a system would be about $10,000 to $12,000 per month. It is doubtful that a pilot project of limited scope would have enough usage to justify this expense.

Some of the many computing centers within the State University could be equipped with so-called "interrupt" hardware and some basic communications gear. On a dial-up basis, queries could be submitted which would cause "resident" programs to temporarily "roll-out" while the federal information data and software "rolled in" to perform the necessary search to satisfy the query. It is extremely unlikely, however, that any of the centers could justify or afford an intrusion of this type on their workloads, especially considering the fact that there might well be interactive dialogue, which conceivably could require much machine time. Those computers that would be involved in real-time monitoring of scientific experiments could not coexist with impositions of this type. The same could be said for any of the hardware that would be involved in serving remote users on a fast turn-around basis.

On the other hand, The Research Foundation's computing facilities are nonacademic service-oriented, and its IBM 360/40 has the capacity to use the IBM document processing software that has been recommended.

Queries could be telephoned to an information center at The Research Foundation which had access to several hours of computer time per week, and in turn could submit them on a batched basis, to the computer at given intervals of time. At present, since time-sharing is not yet here and very few of the major University Centers could afford on-line response, this option would seem the most feasible and

is, therefore, recommended as the mode of operation for the pilot project. Interaction could then take place as necessary and responses could be either returned to the user by telephone, teletype, mail, or be sent over lines (computer to computer) to the campus making the inquiry.

Recommended Federal Agency Participation

The exact design of the sequence in which federal agencies are requested to participate in the development of this prototype system will not be given at this time. This will depend upon the application of several criteria at the time the prototype experiment is actually undertaken. These criteria are (1) the state of automation of information in the agency, (2) the willingness of the agency to cooperate in the prototype, (3) the relevance of the agency's programs to the interests of the State University, (4) the depth of coverage of different program areas, and (5) the assurance that there are enough programs to give a representative cross-section of the University's major interests (e.g., research and development, facilities and equipment, curriculum development, student and faculty support, institutional support, etc.).

If the selection were to be made today, the following agencies would be high on the list of priority: U.S. Public Health Service, U.S. Office of Education, National Science Foundation, the Department of Agriculture, and Office of Economic Opportunity.

Recommended Center of Operations and User Locations

The information referral point of this prototype project should be situated centrally within the State University, preferably to be administered within an organization that has an intrinsic, functional interest in fully exploring the various dimensions of the system. It is suggested that in order to create a useful, practical tool, its development should be removed from a campus computing center environment where substantial progress might be impeded by strictly academic and scientific demand. For these and other reasons, The Research Foundation appears best qualified to administer the system, or at least to serve as its overseer.

The Research Foundation works very closely with practically all federal agencies. Consequently, a keen sense of awareness regarding federal information systems would naturally exist. Furthermore,

the Foundation has been in close contact with information organizations such as the Smithsonian Science Information Exchange (SIE) and these established lines of contact would be extremely useful. As a matter of fact, it is quite possible that The Research Foundation would be considered eligible to ask SIE almost any type of administrative query, whereas the campuses might not be. The computerized data files that are currently being used by the Foundation are basic to an information system and their further development would be best served by those personnel who have established expertise in developing and operating them.

The Research Foundation interfaces with each campus in direct proportion to the amount of activity that each has in sponsored research and training programs. Therefore, it could be safely assumed that most of these interfaces are the very ones which would most effectively service the pilot system. Although a significant portion of the federal information required by the State University is a result of interest in research, other units which have interests in nonresearch areas would also have the ability to link into this system. This is possible because the use of telephones will remove any of the network restrictions or constraints that a terminal system might have posed. Conceivably, the only limitation on participation would be the size of the project staff and its ability to handle queries. It should be noted that with this rather wide user base, evaluation techniques would have greater significance. Should it prove more efficient to initially limit participation, then the four University Centers, the College of Forestry, the Medical Centers, and certain four-year colleges such as Brockport, Fredonia, and Oneonta should be included. The Agricultural and Technical Colleges at Alfred and Morrisville, along with several Community Colleges, would also be invited to participate for purposes of establishing a user population that has fairly diverse information requirements. Eventually, The Research Foundation's experimental on-line accounting system might be expanded to include capability for interrogating and interacting with the proposed data bank.

It is anticipated that initially queries would be telephoned to a staff of two specialists who, after detailed conversation with the user, would frame a computer search statement. Search statements would be batched together and at fixed times during the day would be submitted to the computer for a search of its data files. Information identifying the user and his unit would also be submitted. In addition to

the responses that would be immediately returned to the specialist, and probably in turn to the user within 24 hours, an historical file of the complete dialogue that took place between man and machine, would be maintained by the system. Periodically, this historical information would be sorted into a user-campus sequence, and listed. A questionnaire would be attached to the various dialogue listings and sent out to the user requesting his comments. (His response process would be facilitated by the immediate availability of the queries and responses as the computer had recorded them.) Another technique for evaluating the service could consist of sending brief questionnaires with the original responses. These questionnaires would provide basic information for the evaluative requirement discussed in Chapter VII.

Insofar as the search itself is concerned, a thesaurus would be created for purposes of aligning federal program subjects with specific academic, scientific, and administrative interests. The organization and use of this thesaurus from a technical viewpoint would be, for the most part, dictated by its software environment. From a content point of view, this determination will depend largely on the program selected and the interests of the user population. In addition to servicing requests, the specialists would be constantly evaluating the technical aspects of the system and implementing changes for increasing its effectiveness. The estimated budget for this experiment appears on the next page.

Limited Experiments Using Existing Data Bases

There does not appear to be a need to create an entirely new data base and information system to test the recommendations of this study. It is possible, and considerably less costly, now that a satisfactory conceptual design exists, to conduct somewhat more limited experiments in cooperation with organizations which have already established data bases containing information needed by the State University. This approach would be much less costly.

With this objective in mind, several exploratory discussions have been held with representatives of Appleton-Century-Crofts and with the Smithsonian Science Information Exchange, and two such cooperative experiments are proposed.

The proposed experiments are not mutually exclusive. It would certainly be advantageous to run the SIE experiment in conjunction with either the prototype or with the ACC experiment.

I. Estimated Budget - Prototype Experiment

	First Year $	Second Year $	Third Year $
A. Personnel and Services			
Project Director	20,000	20,500	21,000
3 Federal Information Liaison Staff Members (Washington)	36,000	37,000	38,000
Editor (Washington)	15,000	15,500	16,000
Administrative Secretary (Washington)	10,000	10,500	11,000
Secretary (Albany)	5,000	5,250	6,000
Programmer (Albany)	15,000	15,500	16,000
Information Liaision Official (Albany)	15,000	15,500	16,000
Contract Service - to punch cards or prepare tapes (Washington)	10,000	10,000	10,000
Part-Time Evaluation of Project	2,000	2,000	5,000
B. Material			
Magnetic Tapes	1,000		
Two Disc Packs	1,000		
Computer Rental (at one-half hour per day)	15,000	15,000	15,000
C. Other			
Office Space (Washington - rent and furnishings)	7,100	3,600	3,600
Travel (mostly between Washington and Albany)	2,500	2,500	2,500
Office Supplies	1,500	1,500	1,500
Teletype and Data Links	5,000	5,000	5,000
Telephone (largely between Washington and Albany - 5 phones and 3 lines)	2,000	2,000	2,000
Miscellaneous (insurance, postage, copying)	1,000	1,000	1,000
Publication of interim and final reports (800 - 1,000 copies)	230	250	1,000
TOTALS	164,350	162,600	170,600

Cooperative Project with Appleton-Century-Crofts

A cooperative project with Appleton-Century-Crofts would provide an already developed data base on federal programs described in the previous section. The ACC *Guide to Federal Assistance for Education* is a file of information on 400 federal programs from 40 agencies and is updated monthly by the ACC Washington Office. The *Guide* provides all data elements discussed in the prototype section except the name of the individual officials responsible (only the job titles and telephone numbers are provided). This information, however, is available in the ACC Washington Office. The *Guide* has only one major area where its information is thin from the standpoint of State University needs--the research programs of the Department of Defense. It is strongest in the program areas where our survey of questions asked of the Washington Office indicates the greatest information load. The *Guide* is a dynamic and growing system. In the space of one year its coverage of agencies and programs has increased by almost 50 per cent. Several new data elements are being introduced and several others are contemplated.

It should be noted that the ACC data base also includes New York State procedural information for federal programs operated through state agencies, such as the State Education Department.

A more detailed description of the Appleton-Century-Crofts cooperative project follows and is discussed under the same headings as the prototype.

Data Base Construction

As already indicated, the data base compiled by Appleton-Century-Crofts closely resembles the description in the prototype section. The same data elements are common to both. A much smaller editorial effort would be needed in analyzing the data base in preparation for data collection and editing. Instead of being limited to a few agencies as would be the case at the beginning of the prototype project, a much wider agency coverage could be expected.

Several lengthy meetings have been held with the creator of the *Guide*. Appleton-Century-Crofts is interested in exploring on-line information retrieval systems. In fact, the *Guide* system was built with this sort of future capability ultimately in view. In November, 1967, ACC began using punched paper tape as a medium to facilitate updating

and to economize the editorial and production processes. The first application of these techniques is in the preparation of new alphabetical user profiles (indexes for the system). ACC now has under consideration the possibility of putting on paper tape textual information on the data elements of federal programs. With appropriate editing, these tapes could be used for the machine language input to the system described here. This is one of the principal benefits of cooperation with ACC.

Data Collection

Appleton-Century-Crofts' Information Systems Group maintains a Washington office to support the *Guide*. It is staffed by six editorial and liaison persons and two secretaries and their task is to maintain close contact with the 40 federal agencies whose programs are described in the *Guide*. Their job is essentially that described in the corresponding "data collection" section under the prototype system.

In this cooperative project, a large part of the Washington Office portion of the proposed prototype would not be needed. Instead, the ACC operation would be substituted for this phase, with their tapes and processed information delivered to the central computer at The Research Foundation.

The entire Washington portion of the prototype would not be eliminated. One editor-liaison person would still be required to collect some of the information that ACC does not now provide and to work on the tapes which ACC provides, since certain modifications would have to be made for computer input.

Use of ACC personnel for most of the collecting, editing and processing of information, as suggested in the prototype, would be a major benefit of a cooperative arrangement with ACC. Their editors are trained and already have the contacts and rapport with the federal agencies.

Data Editing

The requirements described in the corresponding section of the prototype would also apply to a cooperative project with ACC. Any raw data coming out of a system intended for even a slightly different purpose needs some editing so that input into the computer will be possible. Much less editing would be required in this system than in the proposed prototype.

Data Input Preparation

In ways similar to those described in the proposed prototype, data on paper tape, properly edited, would be converted to magnetic tape or directly entered in the computer. An independent computer service bureau is again recommended for this function because of the variable amounts of data to be processed each week.

At or near the conclusion of this experiment, arrangements would need to be made with ACC for the use of their copyrighted material which constitutes a major portion of the data base. The exact details for such arrangements will depend upon the number of users, the volume of use, and decisions which will have to be made about offering the service beyond the State University.

Recommended Software

Same as prototype. IBM's Document Processing Program will be used.

Recommended Hardware

Same as prototype.

Recommended Federal Agency Participation

The ACC Washington Office now has cooperative data collection arrangements with 40 federal agencies and is enlarging the number each year.

Recommended Center of Operations and User Locations

Same as prototype.

Proposed Three-Year Budget

See page 71.

Comments on Proposed ACC Cooperative Project

The proposed cooperative project described above has been suggested for several reasons. There are significant advantages to using the ACC Washington staff for the project, which is already beginning to produce machine-readable data. It would enable much more to be done with a smaller amount of money (see Budget). More of the information needs of the State University campuses could be met than in the prototype project. Useful results from the pilot project would be achieved perhaps a year to a year-and-a-half earlier.

Another advantage to an ACC arrangement is the wide variety of options open in selecting the size of the pilot project. The budget suggested for this is comprehensive, and meant to be comparable to the budget of the prototype. However, selected parts of the total project could be done. For example, a first phase might be limited to file manipulation and search procedures by ACC personnel and the State University Washington Office.

Updating material and search requests would be forwarded on a batch basis to the computing center where the work would be performed and the results returned. A second phase might include a remote terminal tie-in to the computer from the ACC Washington Office. During this phase, some campus queries could be directed to ACC-Washington, which in turn would use the terminal to directly interrogate the system. Responses might then be transmitted back to the remote terminal from which the query had originally been submitted in much the same manner that SIE proposes to transmit information to university computing centers. Further phases of this system could include direct querying of the data base by State University personnel as well as the inclusion of other data files from the federal government as they become increasingly more available.

With a full direct-access system as an ultimate objective, this approach of limited scope could be undertaken to develop the experience and methods for building larger systems, as well as providing modules for an ultimate system.

The question has often been asked why the money budgeted for this experiment is not spent in providing more copies of the existing printed ACC information service to more offices on more campuses. The reason a computer-based system is being considered is that the State University's information needs will grow and technology must be developed to meet them. There are many intermediate steps to be taken now and in the next few years to match technology to needs. The recommended experiments outline what some of these steps should be.

This does, however, raise the question of whether this experiment affects subscription sales of the *Guide* over the three-year period to the State University units participating. This question should be carefully checked about every six months. If this appears to affect sales adversely, consideration should be given to augmenting the

project budget to compensate for this.

The proposed cooperative experiment with Appleton-Century-Crofts brings together a unique combination of private industry, government, and nonprofit educational involvement for the purposes of research, development, demonstration, and continuing service.

Cooperative Project with the Smithsonian Science Information Exchange (SIE)

The Smithosnian Science Information Exchange (SIE) is operated by the Smithsonian Institution and funded by the National Science Foundation.

Its information system has grown from a small manual file containing abstracts of current federally-funded biological research to a computerized file of more than 100,000 project descriptions in all fields of scientific research, including many of the social sciences. The file is maintained and inquiries are answered by SIE's staff of 50 scientists.

Because it now handles research in all subject areas of all scientific disciplines (life, medical, agricultural, social, physical, and engineering sciences), the collection has especial value in bringing together investigators working on similar problems in different disciplines--and in the interdisciplinary identification of such individuals.

Virtually every agency of the federal government provides one-page summaries, usually written by the investigators or project directors, of its ongoing funded research projects, and these are entered into the system as they are received. When the project is completed, the abstract is purged from the active file and put in an inactive file, still accessible to searching if necessary.

Many private and state organizations which sponsor research, including the State University, are now contributing abstracts of ongoing research to SIE.

Although the Science Information Exchange was originally created to respond only to queries from federal agencies, these agency queries now represent only a part of the total volume. In fact, the number of questions from universities has passed the total from the agencies. Administrative compilations now are limited primarily to government agencies because of their cost.

II. Estimated Budget - Appleton-Century-Crofts Experiment

	First Year $	Second Year $	Third Year $
A. Personnel and Services			
Project Director	*20,000*	*20,500*	*21,000*
Editor-Federal Information Liaison (Washington)	*15,000*	*15,500*	*16,000*
Administrative Secretary (Washington)	*7,000*	*7,500*	*8,000*
Programmer (Albany)	*15,000*	*15,500*	*16,000*
Information Liaison Official (Albany)	*15,000*	*15,500*	*16,000*
Secretary (Albany)	*5,000*	*5,250*	*5,500*
Evaluation of Project	*2,000*	*2,000*	*5,000*
B. Material			
Magnetic Tapes	*1,000*		
Disc Packs	*1,000*		
Computer Rental (at ½ hour per day)	*15,000*	*15,000*	*15,000*
C. Other			
Office Space (Washington)	*1,500*	*1,500*	*1,500*
Travel (mostly between Washington and Albany)	*2,500*	*2,500*	*2,500*
Office Supplies (including typewriters)	*1,750*	*1,750*	*1,750*
Office Equipment (including furniture)	*4,000*		
Telephone (largely between Washington and Albany - 2 telephones, 2 lines)	*1,000*	*1,000*	*1,000*
Teletype	*5,000*	*5,000*	*5,000*
Miscellaneous (insurance, postage, copying)	*1,000*	*1,000*	*1,000*
Publication of interim and final reports (800 - 1,000 copies)	*250*	*250*	*250*
TOTALS	*113,000*	*109,750*	*116,500*

SIE has also established several specialized information centers, including a center on urban research.

SIE is uniquely qualified to answer questions related to who is currently doing funded research and on which subjects.

The cooperative project described below could be carried out as a limited alternative to the proposed complete prototype experiment, in conjunction with it, or in conjunction with the Appleton-Century-Crofts cooperative experiment described previously.

SIE provides a well-developed data base, but of much more limited scope than that proposed for the main prototype experiment or that of Appleton-Century-Crofts. While SIE's data base is large and computerized, it does not provide very many of the data elements which the needs survey indicated were uppermost in the minds of State University users.

Even this limited data base, however, could directly and indirectly provide useful information and experience in developing a network to provide information on federal programs for the academic community. Direct use of SIE data can provide information and may lead to others doing research in the same or related fields. It can also show other programs and projects currently being funded by the federal government in various areas of interest. This information can be used at face value or indirectly as a clue to sources of federal support of research.

In addition, SIE offers an opportunity for experimenting with computer to computer transmission. Of the three proposed experiments, this would be the only one testing a direct computer link between the State University and the federal government. And it is the only one providing experience in on-line interrogation of a computerized file of information.

The SIE project must be described in different categories than those used in the previous two experiments.

Data Base

The data base of this experiment would be the 100,000 project descriptions currently maintained by SIE. No large nonroutine changes to this file or the methods used for maintaining it will be made because of the experiment.

System Elements

The system for this experiment would include many individual State University professors and administrators who would initiate most of the inquiries; the staff of SIE which would handle these individual inquiries; the computer at SIE and a CRT (cathode ray tube) display device which would store and permit interrogation of the data base; and various State University computers which would receive and send out information transmitted to them by the SIE computer.

How Inquiries Would Be Serviced

Inquiries from faculty and administrators on selected State University campuses would go to SIE's Washington office by telephone, mail, or teletype. These questions would be routed to the appropriate scientist on the SIE staff whose job it would be to frame the "intent" of the user's question in terms that the SIE computer understands. This query would be submitted directly to the SIE computer by the scientist at specified times during the day. Using a CRT Display Unit, he would enter the queries and accept or reject the answers that appeared on the display screen. He could instruct the system to print out the answers or to store them for later transmission directly to State University computers. This transmission might very well take place in the evening during off-peak hours for computer and data-link use. The SIE operator would dial the appropriate University computers and, after receiving a go-ahead signal, would have the SIE computer transmit the stored responses. These responses, along with the identity and location of the user, would be either printed immediately or temporarily stored and printed later by the State University computer. The responses could be on the desk of the requester in one day or less after the question was submitted. Optional present turn-around time for SIE is two to three weeks. For campuses without required computer equipment, mail or telephone would be used.

Schedule and Personnel

The programming and design work for the query and transmission procedures will be performed by SIE personnel. A full-time State University project coordinator will be needed to act as liaison among the campuses, the Washington Office, and SIE. SIE would like to begin working on the programming design as early as July, 1968, and begin operating on a test basis around September or October, 1968, and have a working system by January, 1969. Some of the State University

computing centers should have the necessary hardware installed by that time.

Comments on the Proposed SIE Project

SIE has several interests in seeing this project carried out. As more people in the research community become acquainted with SIE and make use of it, unit cost would be lowered. And the system could be more effectively evaluated and better assessment made of who uses the service, how, where, and why, and how valuable it is. This could be particularly helpful in the justification of SIE's requirement for additional funds.

SIE is interested in a pilot testing system which could easily, rapidly, and economically be expanded, perhaps through the planned EDUCOM network or the State Technical Services offices to universities throughout the country. SIE would also welcome the opportunity to analyze the costs of such rapid service in an operational environment.

Previous studies have been theoretical, on a laboratory scale, or done by firms where cost is no object.

SIE officials say that the proposed system, on an expanded basis, would help them in reaching the above objectives.

The State University and any of the campuses that might participate would probably gain a great deal of recognition by being pioneers in establishing a data link with the federal government. The possibility of a failure from a technical viewpoint is rather slight; the moot point is whether or not the campus would find the service itself useful.

Any new information service has to be publicized to its potential clientele. One of the major jobs of the State University project coordinator would be to stimulate interest and to encourage participation on the local campuses. Serious consideration should be given to an experiment at one campus such as the State University of New York at Buffalo, requiring a mandatory check with SIE on all grant proposals submitted to the federal government. Only after such a campaign could proper evaluation be made of the SIE service.

A considerable effort would also be made in developing evaluative procedures and drawing meaningful conclusions from them. Both the SIE and State University requirements are reflected in the detailed budget estimate appearing on the next page.

III. Estimated Budget - SIE Experiment

The following is an estimate of the costs of starting the experiment and continuing it for one year.

A. Cost Estimate for SIE Activities

	Minimum Estimates $	Maximum Estimates $
1. Cost of Requests*		
a. 250 Subject Requests @ $70	17,500	17,500
b. 25 Administrative Requests @$200	5,000	5,000
2. Leased Tie-Line & Transmittal of Printouts		
a. Line (Voice Grade - as needed, not leased)	1,000	5,000
b. Data Phone Set ($50 - $100 per month)	600	1,200
c. Control Unit ($500 - $600 per month)	6,000	7,200
3. Terminal in Science Division		
Would use two video devices with keyboard ($100 - $200 per month)	1,200	2,400
4. Cost of Other Programs ($10,000 per man per year)		
a. Remote Interrogation Via Video	20,000	30,000
b. Transmittal to State University of New York	10,000	15,000
5. Scientific Staff to Evaluate and Coordinate the System (1 - 2 man months)	1,407	2,814
6. Travel	400	500
SUBTOTAL	63,107	86,614

* This figure includes the cost of scientific personnel and computer costs for retrieval of information. It does not include any provision for Smithsonian overhead and is an estimate only, prepared by SIE, and not binding on the Institution.

B. Cost Estimate for State University of New York

	Minimum Estimates $	Maximum Estimates $
1. Salaries		
a. Project Coordinator	17,000	18,000
b. Secretarial (part-time)	5,000	6,000
2. Travel	2,500	3,000
3. Miscellaneous		
a. Evaluation - Consultation Fees (Perhaps this figure should be upped since we cannot evaluate ourselves and a thorough evaluation by both of us would be desirable.)	1,000	1,400
b. Publications, etc.	200	300
SUBTOTAL	25,700	28,700
TOTAL	88,807	115,314

CHAPTER VII

EVALUATION

There are many ways in which the experiments may be evaluated. A complete system and methodology for evaluation of any of the experiments has not been proposed, although several techniques are recommended in various parts of the study for collecting data to be used in evaluating parts of the experiments (see, for example, Chapter VI).

The best service that can be performed at this time is to suggest a series of questions for which any evaluative effort should seek answers to help determine the effectiveness or failure of the study and test its conclusions. Answers to the following questions should provide enough information to determine the overall success and effectiveness of any of the experiments.

1. Usefulness of Information

   Is this the information you wanted?

   What additional information would you have liked?

   What information, if any, that you received was not useful?

   Was the information you received timely?

   Was the information you received accurate?

2. Facility of Use of Information Center: Man-Man Interface

   Were you able to communicate clearly and easily with the center?

   Were your questions understood?

   Were your replies responsive to your questions?

   Was the center easily accessible whenever you needed it?

   Was the time it took the center to provide you with answers satisfactory?

3. Response Time

   Did it take too long for you to get a response to your query?

What is "too long"?

4. Linkage to Center

   What were the most effective means you found for communication with the Center: telephone, teletype, mail, personal visit, other?

   What was the best location on campus from which communication with the Center was most convenient and effective?

5. Effectiveness of Man-Machine Interface

   Is the hardware satisfactory?

   Is the software satisfactory?

   What recommendations are there for improving these?

6. Availability of Federal Information in Machine-Readable Form

   What federal agencies and programs offer the best opportunities for direct information links to the State University network?

7. Comparative Evaluation of Data Sources

   What are the advantages and drawbacks of the information from the SIE data base from both the administrative and academic vantage points?

   What are the advantages and shortcomings of the information from the ACC data base from both the administrative and academic vantage points?

   What are the advantages and drawbacks of the information from the prototype data base from both the administrative and academic vantage points?

   This comparison should be made to alternate systems and methods of getting federal information.

8. Other Uses

   What are other potential uses that can be made of the data base and system?

9. Alternatives Compared

   How useful is the information you received compared

to information available from alternative systems? Commerce Clearing House, Appleton-Century-Crofts, regular professional sources, industrial sources, other?

10. Cost Effectiveness

    What is the cost of query: subdivided by campus, administrative, academic units?

    What is the cost of inquiries in relation to total in-service handled and in relation to total dollar volume of federal support for whole State University system?

11. Relation to Other Information

    How does it appear that the information system being developed by this experiment will relate to:

    a. the State University of New York network?
    b. a regional and national network?
    c. an international network?

12. What are the Recommendations for Next Steps?

13. Other

ANNEX A

COMPARISON OF THE THREE PROPOSED EXPERIMENTS

	Type and Quantity of Information Input	How Information Is To Be Collected And Processed
New Prototype System	A cross-section of all information needed by the University collected from different types of programs in a selected number of different federal agencies. This would include programs of research and development, facilities and equipment, curriculum development, in-service and summer training institutes, institutional grants, student aid, and special projects. Compared to the other two projects, the volume of information needed for this project is the smallest. Information needs of the State University are defined in Chapter III of the report.	Washington information office to be established to collect information, edit it, and make it machine-readable. No effort will be made to duplicate information on currently-funded research in SIE data bank.
Cooperative ACC Experiment	Almost complete information needed by the University. Data bank includes information on 400 programs in 40 agencies and is constantly being enlarged. Information thinnest on Department of Defense research and development programs. Information elements include office but not person to contact, key aspects of program description, some background information on programs, information on patterns of annual funding, limited information on who else receives grants, complete information on guidelines, deadlines, and application procedures.	Information to be obtained from ACC's Washington Office in machine-readable form. For the most part, these will be tapes prepared for regular use by ACC. In addition, some special tapes will have to be prepared to provide missing information needed for this State University experiment. No effort will be made to duplicate information on currently-funded research in SIE data bank.
Cooperative SIE Experiment	Information on subject, agency, and principal investigator of most research currently funded by the federal government in the physical and biological sciences, and increasing amount of social sciences. Of the three projects this data base is the largest since at any one time it carries descriptions of at least 100,000 projects.	Information already collected from federal government and private agencies by Washington Office of SIE. Information has been edited and put in machine-readable form by SIE staff.

	How Information Is To Be Stored	How Information Is To Be Retrieved	Estimated Costs	
New Prototype System	Information will be prepared for processing on the IBM 360/40 computer located at The Research Foundation in Albany. Actual processing will be done on the computer using IBM's newly developed Document Processing Program. The project provides for the computer programmer to be located at The Research Foundation also.	Specially-created information center at the State University of New York Research Foundation where liaison personnel will receive inquiries from 18 selected campuses, the Central Administration, International Center, Washington Office, and Research Foundation. Inquiries to be received by telephone, mail, and teletype. Liaison personnel will query the computer indirectly, and if necessary, the SIE data bank, and send back replies by telephone, mail, or teletype, as appropriate. Turn-around time 24 hours or slightly less.	First Year Second Year Third Year TOTAL	$ 164,350 162,600 170,600 497,550
Cooperative ACC Experiment	(Same as bove)	(Same as above)	First Year Second Year Third Year TOTAL	113,000 109,750 116,500 339,250
Cooperative SIE Experiment	Information has been prepared for processing on SIE's IBM 360/30 computer. Actual processing will be done on the computer using SIE-created software. (This software is not applicable to the processing strategy used in the other projects described above.)	Specially-created information center at SIE Washington Office will handle inquiries directly, probably from same 22 campuses and other State University units above, by telephone, mail, or teletype. Special liaison personnel will query computer directly and return replies by telephone, mail, or teletype as appropriate. Experiment will provide option of computer to computer response. Turn-around time from 15 minutes to 24 hours.	$ 88,807 - 115,314	

Recommended State University Units To Be Served

Since access to the proposed information centers at The Research Foundation and the Smithsonian Science Information Exchange is to be largely by telephone, with teletype being used only in a few special cases, there is no reason why the entire State University system cannot take part in this experiment. For control and evaluation purposes, however, the following campuses have tentatively been selected on the basis of the information-need study conducted during the past year:

Central Administration, Center for International Studies and World Affairs, Washington Office, The Research Foundation, University Centers, Upstate and Downstate Medical Centers, Liberal Arts Colleges at Buffalo, Brockport, Fredonia, Oneonta, Cortland, College of Forestry, College of Ceramics, Agricultural and Technical Colleges at Alfred and Morrisville, Kingsborough Community College, Monroe Community College, and Suffolk Community College.

ANNEX B

INITIAL FEDERAL QUESTIONNAIRE

STATE UNIVERSITY OF NEW YORK
SUITE 808
1200 SEVENTEENTH STREET, NW
WASHINGTON, D. C. 20036

OFFICE OF THE CHANCELLOR

AREA CODE 202
659-2330

April 24, 1967

Dear

We are seriously studying the establishment of a new type of automated center to provide information on all federal programs relevant to the research and education needs of higher education. To do this, we need your advice and cooperation.

In brief, we are trying to determine the feasibility of creating a computer-based system which would match the information needs of individuals, groups, and institutions of a great multi-campus University to sources of information on federal programs. The study, undertaken jointly by The Research Foundation of State University of New York, the Computing Center at the State University of New York at Stony Brook, and the State University of New York Washington Office, has been under way for several months and is to be completed by the end of this year.

With rapid growth and diversification of federal programs in education, training, research, facilities, and other special project areas, all potentially affecting some aspect of the University, there has been a growing sense of misunderstanding and frustration among faculty and administrators on the campus when it comes to locating the most appropriate form of federal assistance or finding the best way to cooperate with the federal government.

We are seeking, therefore, to (1) identify existing or potential sources of program information that may be used as input to an automated system with terminals on all campuses; (2) establish what is the current state-of-the-art in software systems in this field; and (3) develop faculty, staff, departmental and institutional user profiles that can be used as a basis for designing an "inquiry" and "alert" system for output. We expect the state-of-the-art study to be completed by June and the entire study to be completed by the end of this calendar year. Included in the final report, if feasible, will be the design of a pilot operation to test out the concept.

Two important assumptions underlie the study:

(1) In the foreseeable future, the State University of New York will have an educational communications system linking its 67 campuses and special centers throughout the State. Involved in varying ways in this system will be our ETV network, libraries, computer centers, other types of data banks, and terminals at all campuses. The system will be a potential vehicle for providing access for all State University of New York campuses to a data bank on federal programs.

(2) That there will be a continual improvement in the efficiency of government information systems in all agencies, especially those systems dealing with quantitative and descriptive program information. It is obvious that we could not design a system now to meet the University's needs if we had to use today's information in its largely unprocessed and widely divergent forms. If our system is to be successful, it will have to use information that is more systematically prepared and in many cases is in the form that can be used as input to a computerized data bank.

The two key people working on this project for the State University of New York are Frederick Kirch, who created the Legislative Information Service for Xerox Corporation (and can be reached through the State University of New York Washington Office); and Walter Dunne, a computer systems specialist who will be working out of the State University of New York at Stony Brook Computing Center.

Attached are three questions relating to your agency's information handling techniques. The answers are needed for our state-of-the-art report, which we hope to have completed by June. The information you supply us will also be needed to help us with the subsequent preliminary design of the automated system. The attached questionnaire has return mailing instructions on it.

I hope we can count on your cooperation in this important effort. Please be assured that we will appreciate all the information and advice you can give us. If you have any questions, please let me know.

Sincerely,

Rowan A. Wakefield
Assistant to the Chancellor

State University of New York
1200 Seventeenth Street, N. W.
Washington, D. C. 20036

STUDY OF (1) THE STATE OF THE ART OF SYSTEMS FOR STORING AND RETRIEVING INFORMATION ON FEDERAL GOVERNMENT PROGRAMS RELEVANT TO HIGHER EDUCATION AND (2) THE FEASIBILITY OF USING AUTOMATED DATA PROCESSING EQUIPMENT TO MEET THIS NEED

1. Describe, send descriptive material or list available reference material on your current system or systems for storing and retrieving information on your agency programs, in particular those programs relevant to the research, education, training, and service interests of higher education.

2. Describe plans or hopes for improving the future handling of such information.

3. Give the names, titles, mailing addresses, and phone numbers of key persons in your agency most knowledgeable about your program information handling problems and plans. We will probably wish to get in touch with them as our study progresses and we may wish to include their names as references in our final report to the University.

We would be glad to supply additional information on our automated information handling project or further clarify any of the questions above. Please address inquiries and return answers to the above questions to: Rowan A. Wakefield, Assistant to the Chancellor, State University of New York Washington Office (659-2330).

April 24, 1967

ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS
William G. Colman
Executive Director
1800 G Street, N.W.
Washington, D.C. 20575

AGENCY FOR INTERNATIONAL DEVELOPMENT
William Gaud
Administrator
2201 C Street, N.W.
Washington, D.C. 20523

DEPARTMENT OF AGRICULTURE
The Honorable Orville L. Freeman
Secretary
14th Street & Independence Avenue, S.W.
Washington, D.C. 20250

APPALACHIAN REGIONAL COMMISSION
Ralph R. Widmer
Executive Director
1666 Connecticut Avenue, N.W.
Washington, D.C. 20235

ARMS CONTROL AND DISARMAMENT AGENCY
William C. Foster
Director
Department of State Building
Washington, D.C. 20451

ATOMIC ENERGY COMMISSION
R. E. Hollingsworth
General Manager
Washington, D.C. 20545

BUREAU OF THE BUDGET
Phillip S. Hughes
Deputy Director
Executive Office Building
Washington, D.C. 20503

CENTRAL INTELLIGENCE AGENCY
Richard Helms
Director
Washington, D.C. 20205

DEPARTMENT OF COMMERCE
The Honorable Alexander B. Trowbridge
Secretary
14th Street & Constitution Avenue, N.W.
Washington, D.C. 20230

DEPARTMENT OF DEFENSE
Solis Horwitz
Assistant Secretary of Defense for Administration
The Pentagon
Washington, D.C. 20301

FEDERAL AVIATION ADMINISTRATION
General W. F. McKee
Administrator
800 Independence Avenue, S.W.
Washington, D.C. 20553

GENERAL ACCOUNTING
Elmer B. Staats
Controller General
441 G Street, N.W.
Washington, D.C. 20548

GENERAL SERVICES ADMINISTRATION
Lawson B. Knott, Jr.
Administrator
18th & F Streets, N.W.
Washington, D.C. 20405

GOVERNMENT PRINTING OFFICE
James L. Harrison
Public Printer
North Capitol & H Streets, N.W.
Washington, D.C. 20401

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
James F. Kelly
Assistant Secretary Comptroller
Room 5660
330 Independence Avenue, S.W.
Washington, D.C. 20201

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
The Honorable Robert Weaver
Secretary
1626 K Street, N.W.
Washington, D.C. 20410

DEPARTMENT OF INTERIOR
The Honorable Stewart L. Udall
Secretary
C Street, N.W.
Washington, D.C. 20240

DEPARTMENT OF JUSTICE
The Honorable Ramsey Clark
Attorney General
Constitution Avenue & 10th Street, N.W.
Washington, D.C. 20530

DEPARTMENT OF LABOR
The Honorable W. Willard Wirtz
Secretary
14th Street & Constitution Avenue, N.W.
Washington, D.C. 20210

LIBRARY OF CONGRESS
L. Quincy Mumford
Librarian
First Street, S.E.
Washington, D.C. 20540

NATIONAL ACADEMY OF SCIENCES
Frederick Seitz
President
2201 Constitution Avenue, N.W.
Washington, D.C. 20418

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
James E. Webb
Administrator
Washington, D.C. 20546

NATIONAL ARCHIVES AND RECORDS SERVICE
Robert H. Bahmer
Archivist
Eighth Street & Pennsylvania Avenue, N.W.
Washington, D.C. 20408

NATIONAL BUREAU OF STANDARDS
Allen V. Astin
Director
Fourteenth Street, N.W.
Washington, D.C. 20230

NATIONAL ENDOWMENT FOR THE ARTS
Roger L. Stevens
Chairman
1800 G Street, N.W.
Washington, D.C. 20506

NATIONAL ENDOWMENT FOR THE HUMANITIES
Barnaby C. Keeney
Chairman
1800 G Street, N.W.
Washington, D.C. 20506

NATIONAL LIBRARY OF MEDICINE
Morton M. Cummings
Director
330 Independence Avenue, S.W.
Washington, D.C. 20201

NATIONAL SCIENCE FOUNDATION
John T. Wilson
Deputy Director
1800 G Street, N.W.
Washington, D.C. 20550

OFFICE OF ECONOMIC OPPORTUNITY
Sargent Shriver
Director
1200 Nineteenth Street, N.W.
Washington, D.C. 20606

U.S. OFFICE OF EDUCATION
The Honorable Harold Howe, II
Commissioner of Education
330 Independence Avenue, S.W.
Washington, D.C. 20202

OFFICE OF SCIENCE AND TECHNOLOGY
Donald F. Hornig
Director
Executive Office Building
Washington, D.C. 20506

OFFICE OF THE SURGEON GENERAL
William L. Kissick
Director
Office of Program Planning & Evaluation
National Institutes of Health
Building 31
Bethesda, Maryland 20203

SMALL BUSINESS ADMINISTRATION
Bernard L. Boutin,
Administrator
811 Vermont Avenue, N.W.
Washington, D.C. 20416

SMITHSONIAN INSTITUTION
S. Dillon Ripley
Secretary
The Mall
Washington, D.C. 20560

DEPARTMENT OF STATE
Idar Rimestad
Deputy Under Secretary for Administration
2201 C Street, N.W.
Washington, D.C. 20520

DEPARTMENT OF TRANSPORTATION
The Honorable Alan S. Boyd
Secretary
1717 H Street, N.W.
Washington, D.C. 20590

DEPARTMENT OF TREASURY
The Honorable Henry H. Fowler
Secretary
Fifteenth Street & Pennsylvania Avenue, N.W.
Washington, D.C. 20220

U. S. INFORMATION AGENCY
Leonard H. Marks
Director
1750 Pennsylvania Avenue, N.W.
Washington, D.C. 20547

VETERANS ADMINISTRATION
W. J. Driver
Administrator of Veterans Affairs
Vermont Avenue, N.W.
Washington, D.C. 20420

ANNEX C

INQUIRIES RECEIVED BY WASHINGTON OFFICE IN 1966

Formal inquiries handled by the Washington Office during the 1966 calendar year have been analyzed in some detail. The more significant results of this analysis appear in the tables below. A "formal inquiry" was defined as a specific question complex enough to require some research, the whole documented by correspondence or memoranda in our files.

Excluded from the analysis were: (1) casual or simple questions answerable without research; (2) personnel and recruiting matters; and (3) instances in which information was distributed in response to a known need or interest, rather than a specific inquiry.

During 1966, the Washington Office responded to 445 formal inquiries (see Table I). Of these 57, or about 12 per cent, came from sources outside the State University system, including the State Education Department, Congress, the State Legislature, professional associations, private industry, and individuals. It should be noted that the Washington Office is a source of information about, as well as for the State University. These non-State University inquiries were not further analyzed, and do not enter into the figures appearing in Tables II - V.

The Central Administration accounted for 108, or more than a quarter, of the State University inquiries. The remainder were distributed over 35 campuses and three research centers. See Table III for the distribution of inquiries by campuses.

Table I - Inquiries Handled by Washington Office During Calendar Year 1966

Month	Total	Non-State University	State University	Central Administration	Campuses
January	39	4	35	9	26
February	35	1	34	15	19
March	50	7	43	12	31
April	22	3	19	7	12
May	47	11	36	6	30
June	28	3	25	8	17
July	22	2	20	7	13
August	25	5	20	5	15
September	27	4	33	17	17
October	36	3	33	5	28
November	38	3	35	7	28
December	66	11	55	10	25
	445	57	388	108	280

Most of the State University of New York inquiries were submitted by university administrators, or by faculty members functioning in an administrative capacity as committee heads or department chairmen. Table II analyzes these inquiries by role.

Table II - State University Inquiries by Role of Persons Inquiring

Administrative	285
Administrative-Academic	77
Academic	50

The "Administrative" category includes presidents, vice presidents, and other officers; coordinators and research administrators, and all Central Administration personnel.

The "Administrative-Academic" category includes deans, department chairmen, and other faculty functioning as committee heads.

The "Academic" category is restricted to faculty members inquiring as such.

Of the 412 names associated with State University inquiries, 285 were those of administrators. Academic-administrative accounted for 77, or about 19 per cent. The names of faculty members appeared only 50 times, accounting for 12 per cent. Note that any one name may be associated with more than one inquiry and that several persons may join in the same inquiry.

Table III - State University Campus Inquiries by Campus and Type of Institution

UNIVERSITY CENTERS	
Albany	43
Buffalo	39
Stony Brook	29
Binghamton	22
	135
COLLEGES OF ARTS AND SCIENCES	
Fredonia	11
Brockport	9
Oswego	9
Geneseo	7
Buffalo	5

Cortland	5
Oneonta	5
Plattsburgh	5
New Paltz	3
Potsdam	1
	60

SPECIALIZED COLLEGES

College of Forestry at Syracuse	14
College of Ceramics at Alfred	2
School of Industrial and Labor Relations at Cornell	2
College of Agriculture at Cornell	1
	19

AGRICULTURAL AND TECHNICAL COLLEGES

Alfred	6
Delhi	6
Morrisville	3
Canton	1
Cobleskill	1
	17

COMMUNITY COLLEGES

Kingsborough	6
Monroe	3
Suffolk	3
Bronx	2
Dutchess	2
Fashion Institute	2
Westchester	2
Fulton-Montgomery	1
Hudson Valley	1
Nassau	1
Niagara County	1
Queensborough	1
	25

OTHER		
Center for International Studies and World Affairs	17	
Western New York Nuclear Research Center	5	
Atmospheric Sciences Research Center, White Face Mountain	2	
	24	
TOTAL INQUIRIES FROM ALL CAMPUSES	280	

Table III analyzes campus inquiries (including administrative, administrative-academic, and academic) by source.

The University Centers, heavily involved in federal programs, accounted for 135 inquiries, or about 49 per cent. The colleges of arts and sciences accounted for 60, or 21 per cent. The specialized colleges submitted relatively few inquiries--19, or about 7 per cent. The agricultural and technical colleges accounted for 17, about 6 per cent.

Fewer than half of the community colleges sent inquiries to the Washington Office. Community college inquiries totalled 25, or less than 9 per cent. The three research centers submitted 24 inquiries, about 9 per cent. The Medical Centers submitted no formal inquiries to the Washington Office during the 1966 calendar year.

Table IV - Agencies, Departments, and Organizations Involved in Inquiries

Department of Health, Education, and Welfare	15	
U.S. Office of Education	100	
National Institutes of Health	24	
National Institute of Mental Health	3	
Administration on Aging	2	
Children's Bureau	2	
National Library of Medicine	2	
Vocational Rehabilitation Administration	1	
Welfare Administration	1	
HEW Total		150
National Science Foundation		70

Congress	60	
Library of Congress	1	
Congress Total		61
Department of State	30	
Agency for International Development	26	
Department of State Total		56
Department of Defense	8	
Air Force Office of Scientific Research	8	
Advanced Research Projects Administration	5	
Army Research and Development	2	
Army Ordnance	2	
Office of Aerospace Research	2	
Office of Naval Research	2	
Department of Defense Total		37
Department of Commerce	6	
State Technical Services Administration	8	
Environmental Science Services Administration	5	
Economic Development Administration	3	
Clearinghouse for Federal Scientific and Technical Information	3	
National Bureau of Standards	2	
Small Business Administration	2	
Weather Bureau	1	
Department of Commerce Total		30
Office of Economic Opportunity		22
National Aeronautics and Space Administration		15
Department of Labor		8
Atomic Energy Commission		6
Smithsonian Institution	2	
Science Information Exchange	4	
Smithsonian Institution Total		6
American Council on Education		4

Department of Housing and Urban Development	4
Peace Corps	4
United Nations Educational, Scientific and Cultural Organization	4
Advisory Commission on Intergovernmental Relations	3
Bureau of the Budget	3
Department of Agriculture	3
Department of Interior	3
National Academy of Sciences	3
Pan American Union	3
White House	3
Appalachian Regional Commission	2
Civil Service Commission	2
Department of Transportation	2
National Association of State Universities and Land-Grant Colleges	2
National Commission for Technical, Automation and Economic Progress	2
Organization for Economic Cooperation and Development	2
American Chemical Society	1
American Psychological Association	1
Department of Justice	1
Ford Foundation	1
Inter-American Development Bank	1
General Services Administration	1
National Archives	1
Pan American Health Organization	1
Selective Service System	1
World Health Organization	1

Table IV indicates the departments, agencies, and organizations involved as the ultimate sources of the information and support sought by all of the inquiring State University of New York units.

Information in this Table is given by department and by agency, with subtotals. A figure entered directly opposite the name of a federal department means that the inquiry was general in character and that information was sought on the departmental level. It should be noted that more than one, indeed several, departments and agencies may be involved in any one inquiry.

The Table speaks for itself. Although the bulk of the inquiries required information from the Department of Health, Education, and Welfare (primarily the U.S. Office of Education), and the National Science Foundation, the inquiries actually ranged throughout the federal government and elsewhere, including 64 departments, agencies and organizations, on all levels.

Table V - Inquiries By Character Of Source Organization

50 Governmental

8 Quasi-Governmental (such as World Health Organization and United Nations Educational, Scientific, and Cultural Organization)

6 Non-Governmental (largely associations)

64

This Table analyzes sources in a different dimension. Agencies of the federal government were involved as sources in 520 instances, quasi-governmental bodies in 17 instances, and non-governmental organizations in only 10 instances.

ANNEX D

SECOND FEDERAL QUESTIONNAIRE

STATE UNIVERSITY OF NEW YORK
SUITE 808
1200 SEVENTEENTH STREET, N.W.
WASHINGTON, D. C. 20036

OFFICE OF THE CHANCELLOR

AREA CODE 202
659-2330

April 11, 1968

Dear

A little more than a year ago I wrote asking your help in a study of the feasibility of using computers and data processing to help meet the University's need for information on federal government programs. I would like to take this opportunity to extend my thanks for the help and cooperation we have received from your agency. Our study is almost completed. We hope to publish it within a few weeks and will send you a copy.

One important bit of information is lacking, however. We need to include data on certain specific types of information which are or will soon be available in machine-readable form. The information we need is indicated on the attached form.

Within a few days Mr. Frank Roberts, who is helping us complete the last part of our report, will be in touch with those of your management information personnel with whom we have been working over the past year. He will review with them the form accompanying this letter to assist in its proper filling out and clarify any confusions which might arise.

If you believe that there are others in your organization whom we should contact, please let me know as soon as possible.

I hope we can count on your continued cooperation in this project. If you have any questions, I will be glad to answer them.

With renewed thanks and with every good wish, I remain,

Sincerely,

Rowan A. Wakefield
Assistant to the Chancellor

RAW:bas

RETURN THIS FORM TO: Washington Office
State University of New York
1200 Seventeenth Street, N.W., Suite 808
Washington, D.C. 20036

Description of Information Needed	Form In Which Information Is Available *						***	
	Direct Access to Computer	Magnetic Tape	Magnetic Disc	Paper Tape	Punch Card	** Other	Availability Now	When
I. Individuals to Contact								
Federal Official Responsible for Program (personal records, by program assignment and discipline)								
Unseen Colleagues Outside Government - Who else is doing research in this field? (SIE data)								
II. Program Description								
General Descriptive Material								
On-Going Research								
Reports on Completed Projects								
Guidelines, Application Procedures, Deadlines, etc.								
III. Budgetary Information								
Cumulative Fiscal Year Balance Available by Program, Project, etc.								

* Use additional sheets if necessary to fill in boxes.
** Other refers to Optical Character Recognition (OCR), Mark-Sensed Data, or Any Other Machine-Readable Configuration of data.
*** Extent available to general public; conditions, i.e., sale, rental, cost, free; classified, privileged, proprietary.

AGENCY	ADDRESSEE	CARBON COPY
Atomic Energy Commission	Mr. R. E. Hollingsworth General Manager	Mr. Charles Getz Assistant Comptroller for Information Systems
Department of Commerce	The Honorable Cyrus R. Smith Secretary	
National Archives and Records Service	Dr. James B. Rhoads Acting Archivist	Dr. Everett O. Alldredge Special Assistant to the Archivist
Office of the Surgeon General	Dr. William L. Kissick Director, Office of Program Planning and Evaluation	Mr. William R. Berry Director, Data Systems Development Staff
Department of Agriculture	The Honorable Orville L. Freeman Secretary	Mr. John Broome Office of Management Improvement
National Library of Medicine	Dr. Martin M. Cummings Director	Mr. James P. Riley Deputy Associate Director for Library Operations
National Aeronautics and Space Administration	Dr. James E. Webb Administrator	Mr. Van A. Wente Chief, Information Systems and Development Branch
General Services Administration	Mr. Lawson B. Knott, Jr. Administrator	Mr. Edward D. Dwyer Assistant Commissioner for Automated Data Systems Management Services
U.S. Office of Education	The Honorable Harold Howe, II Commissioner of Education	Mr. Robert A. Kane Special Assistant for Management Information
Department of Labor	The Honorable W. Willard Wirtz Secretary	Mrs. Mary Bedell Chief, Clearing House and Utilization Service
Department of Interior	The Honorable Stewart L. Udall Secretary	Mr. Rodney J. Brown Assistant to the Director Office of Surveys and Reviews

AGENCY	ADDRESSEE	CARBON COPY
Department of Housing and Urban Development	The Honorable Robert C. Weaver Secretary	Mr. Roderick O. Symmes Director, Data Systems Development Staff
Office of Economic Opportunity	Mr. Bertrand Harding Acting Director	Mr. John D. Johnson Assistant to the Director
Library of Congress	Mr. L. Quincy Mumford Librarian of Congress	Mr. Robert L. Chartrand Information Sciences Specialist
Agency for International Development	Mr. David Mayer Chief, Program and Technical Information Staff	Mr. David Dale Chief, Data Systems and Automation Division
National Science Foundation	Mrs. Cecelia H. Hilgert Program Analyst Office of Economic and Manpower Studies	Mrs. Mary Seales Administrative Assistant Office of Data Management Systems

TELEPHONE CONTACTS

Defense Department	Mrs. Donna Spiegler Staff Assistant Office of Technical Information
Bureau of the Budget	Mr. Forest Horton Management Information Systems Staff
Civil Service Commission	Mr. Charles J. Sparks Deputy Director Bureau of Management Services
	Mr. Seymour S. Berlin Director Bureau of Executive Manpower

ANNEX E

STATE UNIVERSITY OF NEW YORK COMPUTER SYSTEMS

Campus	Installed	On Order
University Centers		
Albany	CDC 3100, IBM 1620	IBM 360/67
Binghamton	IBM 360/40	CDC 6400
Buffalo	IBM 7044, 360/40, 360/30	IBM 360/67, 360/50
Stony Brook	IBM 7044, 360/30	
Colleges of Arts and Sciences		
Brockport	IBM 1130, 1401	
Buffalo	IBM 1130	
Cortland	UNIVAC 9300	
Fredonia	IBM 1130, 360/20	
Geneseo	IBM 1130, 1401	
New Paltz		
Oneonta	IBM 1401	
Oswego	IBM 1130	
Plattsburgh	IBM 1440	
Potsdam	IBM 1401	
Agricultural and Technical Schools		
Alfred	IBM 1620, 360/20	
Canton		IBM 360/20
Cobleskill	IBM 1401	
Delhi		IBM 360/20
Farmingdale		IBM 360/30
Morrisville	IBM 1401	

Campus	Installed	On Order
Specialized Colleges		
Forestry	IBM 1620	
Maritime	IBM 1130	
Medical Centers		
Downstate	IBM 1410, 1440, 360/40, 360/44	RCA 70/45
Upstate	IBM 1440, CDC 160A	IBM 360/40
Research Foundation	IBM 1440, 360/40	

ANNEX F

BIOGRAPHICAL DATA ON INVESTIGATORS

The Project Director, Rowan A. Wakefield, is Assistant to the Chancellor, State University of New York. Mr. Wakefield directs the Washington Office of the State University of New York, which opened in July, 1965.

Mr. Wakefield's previous experience has been with the Executive Branch of the Federal Government, where he served in several capacities with the State Department. He was Acting Director of the Education Program for the Agency for International Development when he left to join the University in 1965. Prior to coming to Washington in 1961, Mr. Wakefield was Director of Development at Union College, Schenectady, New York. Previously he had done development work at a secondary school, served as a newspaper reporter and columnist, and in the State Department Foreign Service in Germany. He holds a B.A. degree from Williams College in Political Science.

The Assistant Director, Frederick Kirch, is a consultant in data processing management, who served half-time on the project out of the Washington Office of the State University of New York. Before joining the project in January, 1967, Mr. Kirch was Manager of the Legislative Information Service of the Education Division of Xerox Corporation in Washington, D.C. This Service had been developed by Mr. Kirch.

Mr. Kirch was founder of the International Data Corporation which provided information services to the computer industry. He has also served as a consultant to the Diebold Group, Inc.

The third member of the project staff is Walter Dunne, who has been on the staff of the State University of New York at Stony Brook Computing Center since December, 1966. He has 12 years of data processing experience since joining Remington Rand Univac in 1956 as a manufacturer's representative. Mr. Dunne next joined Honeywell, Inc. where he served in the New York branch as technical advisor to the sales force. He later joined Control Data Corporation where he conducted several in-depth investigations of the use of data processing

equipment in the brokerage industry.

Mr. Dunne was graduated from Manhattan College, majoring in Economics. He later attended the New York University Graduate School of Business Administration. He has been a member of the Association for Computing Machinery (ACM) and of several local chapters of the Data Processing Management Association (DPMA).

Mr. Francis M. Roberts is the Director of Management Information Systems of the Communication Services Corporation. His background encompasses experience as a consultant to the Stanford Research Institute in the design and implementation of the Federal Information Exchange System (FIXS), to Applied Information Management Systems for the design and prototype test of an information system for the Information Center of the Office of Economic Opportunity, to Appleton-Century-Crofts Publishing Company in design of source data for automation of individually prescribed instruction (IPI) developed at the Laboratory of Learning Research and Development of the University of Pittsburgh, to the Office of Economic Opportunity for development of an information management system for the Selection and Assignment Section of the Job Corps, to Saul Herner and Company for a state-of-the-art appraisal of information management and retrieval systems in the real estate industry, and to the Western Union Corporation for a state-of-the-art appraisal of information systems in the securities brokerage industry. He is presently a consultant to the Office of Economic Opportunity for the installation and implementation of management information systems for local Community Action Programs.

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GLOSSARY

Batch Processing - A mode of computer operation in which problems are accumulated according to some schedule and processed in groups rather than individually.

Dialog Search - A mode of operation in which the user can "converse" with the computer, restating and narrowing his inquiry.

Dial-Up - A mode of operation in which the computer is queried from a distant terminal by means of the telephone line or some other link-up; may involve an interruption of "resident" operations being carried on by the computer.

Hardware - Physical equipment, e.g., mechanical, magnetic, electronic, or electrical devices; the computer itself. Contrast with Software.

Machine-Readable - Much information processed by computers is numerical in form and can be transmitted directly into the computer from instruments and monitoring devices for analysis. However, most federal program information will have to be converted into a "machine readable" form for input into the computer. This can be done by a keyboard connected directly to the computer (on-line), or the keyboarding can create an input medium readable subsequently by the computer (off-line), such as punched cards, punched paper tapes, or magnetic tapes.

Microfiche - A refinement of the microfilm principle whereby as many as 58 pages of text can be stored on a flat sheet of film about 4 x 6 inches in size. In the simplest application, microfiche is read with an optical projector. In sophisticated applications, a file of microfiche can be linked to a computer so as to produce full-size, readable copy ("hard" copy) in response to a search query.

Module - (1) The dimensions or configuration of one design element taken as the unit by which the design of other related elements is regulated or standardized. (2) A packaged functional assembly of components designed to be put in train with various combinations of related components so as to achieve a high degree of versatility.

Multi-Drop Network - A communications system in which a series of

distinctly addressable remote terminals would be linked to a central computing center by a common line or set of lines but yet there would exist the capability for a "private" exchange of information between any of the remote locations and the central computer.

On-Line - Pertaining to computing equipment under direct control of a central unit, so that operations are carried through without interruption.

Real-Time - (1) Pertaining to the actual time in which a process transpires. (2) Pertaining to the performance of a computation during the actual time in which the related physical process transpires, so that the results of the computation can be fed back to control the physical process.

Roll-Out - A mode of operation in which routine "resident" computer programs are shunted aside while other programs and data are temporarily "rolled in" to satisfy a query, typically one "dialed in" from a remote terminal.

Software - (1) The collection of programs and routines which translate concepts into instructions to the computer enabling it to communicate, e.g., compilers, library routinès. (2) All the documents associated with a computer, e.g., manuals, circuit diagrams. (3) Contrast with Hardware.

Time-Shared System - A mode of operation in which the computer performs its functions for several users in rapid alternation according to some system of queing, so that each user is very nearly a "sole" user of the computer.

Unseen Colleagues - Investigators following parallel lines of research in the same or related areas; their awareness of one another constitutes one of the major problems of information science. In a broader sense, the "invisible college."

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STATE UNIVERSITY OF NEW YORK

Office of the Chancellor, 8 Thurlow Terrace, Albany, N. Y. 12201

University Centers

State University at Albany
State University at Binghamton
State University at Buffalo
State University at Stony Brook

Medical Centers

Downstate Medical Center at Brooklyn (New York City)
Upstate Medical Center at Syracuse

Colleges of Arts and Science

College at Brockport
College at Buffalo
College at Cortland
College at Fredonia
College at Geneseo
College at New Paltz
*College at Old Westbury
College at Oneonta
College at Oswego
College at Plattsburgh
College at Potsdam

*Three additional Colleges of Arts and Science are under development. The College at Purchase in Westchester County and the College at Old Westbury in Nassau County are in early planning. However, the College of Old Westbury accepted its first class in temporary quarters at Oyster Bay, Long Island. The third, upper divisional in concept (junior-senior years), has been proposed for the Utica-Rome-Herkimer area.

Specialized Colleges

College of Forestry at Syracuse University
Maritime College at Fort Schuyler (Bronx)

Agricultural and Technical Colleges *(Two-year)*

Alfred
Canton
Cobleskill
Delhi
Farmingdale
Morrisville

Statutory Colleges

College of Ceramics at Alfred University
College of Agriculture at Cornell University
College of Home Economics at Cornell University
School of Industrial and Labor Relations at Cornell University
Veterinary College at Cornell University

Community Colleges

(Locally-sponsored, two-year colleges under the program of State University)

Adirondack Community College at Glens Falls
Auburn Community College at Auburn
Borough of Manhattan Community College at New York City
Bronx Community College at New York City
Broome Technical Community College at Binghamton
Community College of the Finger Lakes at Canandaigua
Corning Community College at Corning
Dutchess Community College at Poughkeepsie
Erie County Technical Institute at Buffalo
Fashion Institute of Technology at New York City
Fulton-Montgomery Community College at Johnstown
Genesee Community College at Batavia
Herkimer County Community College at Ilion
Hudson Valley Community College at Troy
Jamestown Community College at Jamestown
Jefferson Community College at Watertown
Kingsborough Community College at Brooklyn
Mohawk Valley Community College at Utica
Monroe Community College at Rochester
Nassau Community College at Garden City
New York City Community College of Applied Arts and Sciences at Brooklyn
Niagara County Community College at Niagara Falls
North Country Community College at Saranac Lake
Onondaga Community College at Syracuse
Orange County Community College at Middletown
Queensborough Community College at New York City
Rockland Community College at Suffern
Staten Island Community College at New York City
Suffolk County Community College at Selden
Sullivan County Community College at South Fallsburg
Tompkins-Cortland Community College at Groton
Ulster County Community College at Stone Ridge
Westchester Community College at Valhalla

(Five additional Community Colleges, two to be located in the City of New York and the others in Clinton, Columbia-Greene, and Schenectady Counties, have been approved by the Board of Trustees.)