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A FIVE-YEAR AUTOMATION DEVELOPMENT PLAN FOR AID/W

AGENCY FOR INTERNATIONAL DEVELOPMENT

WASHINGTON, D.C.

Booz, Allen & Hamilton

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I. AID/W AUTOMATION STRATEGY

I. AID/W AUTOMATION STRATEGY

The AID/W automation strategy is described in detail in a previous Booz, Allen report entitled "Alternative Strategies for a Five-Year AID/W Automation Plan." The central thrust of the strategy is to:

> Use the majority of FY83-87 to fully digest and employ the technologies that are in hand, resolve current data base problems, and increase user capabilities so that a sound basis will exist for a major technological step forward in the fourth or fifth plan year.

The technological step forward that is envisioned three to four years from now involves the concept of professional workstations in which the rapidly merging technologies of computers, word processors, and telecommunications are combined to increase significantly the productivity of professional staff. In order to prepare for that future and to improve AID's automation support capabilities in the near term, the following major tasks must be accomplished.

- Upgrade immediately the capacity of the mainframe computer to handle on-line applications during normal working hours.

- Within the next 18 to 24 months, establish a new computer center and replace the upgraded mainframe configuration with a much larger, single mainframe processor that is software compatible with the current IBM mainframe.

- Continue to make the development and full operational capabilities of FACS the highest software priority and defer other applications activities, if necessary, to assure that this effort is well managed.

- Formulate a project to pinpoint problems in existing data bases and applications and to move towards the rationalization of the Agency's management information requirements.

- To relieve pressures for the development of new applications during the next few years and to promote the development of greater user sophistication,

encourage users to develop microcomputer applications in line with AID's recently articulated policy.

- Provide dial-up telecommunications capabilities for installed Wang OIS systems and microcomputers to improve AID/W communications capabilities and to test the requirements for future telecommunications improvements. When the need can be clearly established, provide communications links between specific Wang equipment and microcomputers and the mainframe, or between Wang's and microcomputers.

- Focus efforts on improving the nature and quality of automation services provided and on an improvement in user capabilities through:

  - Establishment of an organizational mechanism to bring high-level bureau/office perspectives on mainframe application planning decisions

- Establishment of an automation users group

- Improvement in user training programs.

II. EQUIPMENT PLANS

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This chapter discusses the necessary steps to implement elements of the automation strategy bearing on equipment acquisition and replacement. The tasks pertain to both the mainframe computer and "localized" hardware, such as the Wang OIS's and microcomputers.

The central thrust of this component of the strategy is to meet user needs during the next several years through a hardware configuration that has a large central mainframe (on which the vast majority of the Agency's data processing will be conducted), with links established to existing office automation and microcomputer equipment as those links are deemed necessary on a case-by-case basis.

The following alternatives were considered and rejected either because they were too risky and costly or because they would not meet well the projected requirements:

- A large central mainframe plus free-standing, locally controlled mini/microcomputers

- A large mainframe plus local hardware linked through a local area network

- A moderately sized mainframe plus local hardware housing distributed data bases.

It should be noted, however, that the selected strategy can be converted into the local area network strategy in several years if the need for a local area network materializes strongly and if the requisite technology develops adequately. It already exists but is not widely proven.

To meet user needs during this time period, AID must upgrade substantially the capabilities of its mainframe. Unfortunately, the time required to plan for, acquire and install a major new mainframe is substantial, and, with the development of FACS and the general growth in system usage, AID may find itself unable to meet its demands for TSO services as early as the summer of 1983. It is therefore necessary for AID to complete an interim upgrade of its current hardware as quickly as possible while the work necessary for the more ambitious upgrade proceeds. The tasks outlined below describe these and other steps. Exhibit II-1 following this page shows the recommended schedule.

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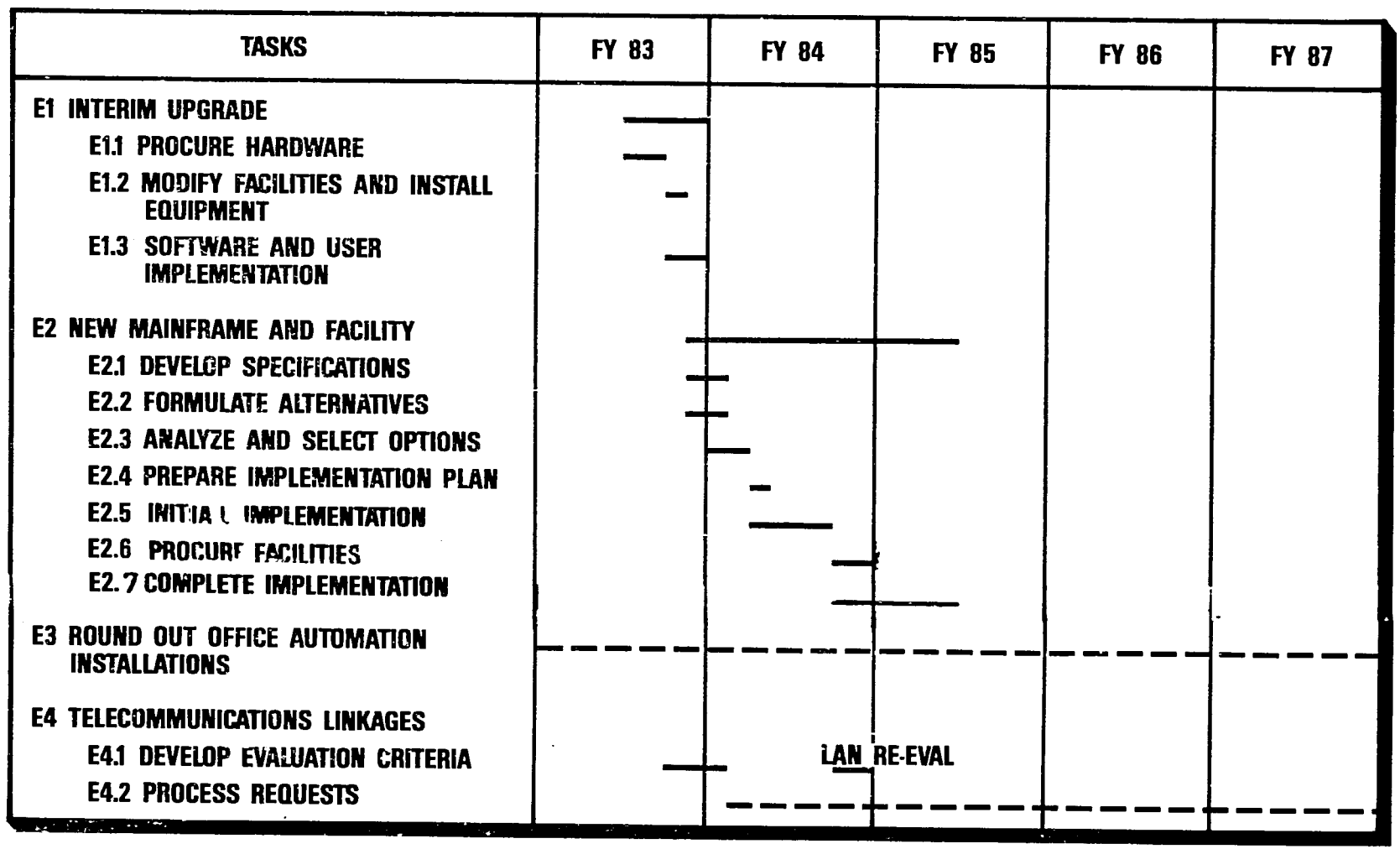
EXHIBIT II-1
EQUIPMENT PLANS



TASK E1 -- COMPLETE THE INTERIM UPGRADE OF THE MAINFRAME COMPUTER

The objective of this task, underway since May 1983, is to add more main memory and processing capacity to meet projected needs through the mid-term. The focus of the effort is the upgrade of the Agency's DASD equipment and its IBM 4341 processor from a Model 1 to a Model 12. This action will triple the machine's main memory capacity and, with the 4341 set-up to run TSO and with appropriate work load balancing, will increase the total throughput of the mainframe configuration by at least 50 percent. With these additions, it is anticipated that the mainframe can handle the Agency's growing ADP work load for a period on the order of 18 months, by which time a total replacement of the existing mainframe configuration by a single, larger new processor will have been installed or obtained through contract.

The target date for completion of the upgrade is September 30, 1983.

The sub-tasks to be completed are:

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Task E1.1 -- Procure Necessary Hardware

This task involves the purchase of the Model 12 upgrade package and necessary DASD equipment through two separate procurement actions. Since both the Model 12 and DASD equipment can be purchased most quickly from the GSA schedule, the necessary steps are essentially identical. They are:

- Develop requirements
- Publish intent to purchase notice in CBD
- Evaluate responses, if any, and assess need for a competitive procurement
- If a competitive procurement is unnecessary, issue purchase order to respective vendors.

Task E1.2 -- Modify Computer Facilities and Install Equipment

To accept the new equipment, the current computer room will require modest facilities modifications such as:

- Modifying the air conditioning system to make sure it will operate at its peak capacity

- Re-engineering air flows

- Installing window shielding to reduce heat entry into the room

- Relocating the tape library

- Moving a heat-generating duplicating machine out of the computer room.

These modifications must be scheduled to avoid conflict with the equipment installation.

The equipment installation steps are sequential and involve the following:

- DASD installation
- DASD acceptance testing
- Installation of Model 12 package
- 4341 acceptance testing.

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Task E1.3 -- Software and User Implementation

The major steps required to implement the upgraded system are:

- Prepare an operating system plan
- Conduct a SYSGEN/IOGEN
- Conduct system test
- Conduct system stress test
- Operate system and balance work load over time.

TASK E2 -- DETERMINE THE MOST ADVANTAGEOUS METHOD FOR PROCURING AND OPERATING A MORE POWERFUL MAINFRAME AND NEW FACILITY

The objective of this task is to determine and implement the most advantageous method for AID to procure a new, more powerful mainframe; a larger, more conveniently located computer facility also needs to be evaluated, although it is presently uncertain whether AID will give up its current leased space for the computer center in the Universal North Building. While the interim upgrade (Task E1) will meet medium-term needs (through about 18 months), larger capacity is needed for the longer term.

The target date for determining the most advantageous alternative is November 30, 1983. The target date for fully implementing the alternative is the first quarter of calendar year 1985 (16 to 19 months after the interim upgrade is anticipated to be fully operational).

The period of analysis and review of the alternatives and the initial implementation steps will comprise a two-phase effort.

In the first phase, the following tasks will be performed.

Task E2.1 -- Develop Hardware and System Operating Specifications

The first task is a detailed requirements analysis to determine the mainframe and periperhal specifications that will be necessary to meet user requirements in the future and to specify AID's overall operating requirements such as number of shifts, hours per day of TSO availability, etc., at the initial date of operation and at six-month intervals thereafter. This set of specifications will form the baseline against which alternative procurement strategies will be evaluated.

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Task E2.2 -- Formulate Alternatives for Study

Several types of arrangements need to be fully developed in concept. They will describe a spectrum ranging from the present case (a fully AID-owned facility, with contractor support comparable to the present arrangement) to the other extreme (a single vendor who would acquire hardware and operate it is a privately owned facility, and provide all the operations, development, and maintenance necessary, with a bare minimum of AID direct hire oversight.)

Task E2.3 -- Analyze Alternative Arrangements

In this task, the advantages and disadvantages of the alternatives would be comprehensively analyzed. Major elements of the analysis are:

- Costs (operating and investment-related, as appropriate)
- Time required to implement
- Risks (technical, financial, operational)
- AID direct hire staffing implications.

Task E2.4 -- Prepare Implementation Plan for Selected Alternative

A detailed plan is necessary due to the complexity and extended period of implementation, which could have activities related to specification, acquisition, logistics, legal review, facilities and financial analysis. The plan will identify major implementation tasks, time frames for accomplishment, and recommended responsibilities. This task will conclude Phase I.

Phase II will include the following implementation tasks.

Task E2.5 -- Conduct Initial Implementation Steps

This task will launch implementation activities by developing and executing the acquisition phase of the selected alternative and initiating detailed implementation planning:

- Preparing solicitation documents, such as RFP's
- Evaluating proposals and processing the award.

- Planning for equipment installation and any necessary applications/data base conversions.

Depending on the alternative being implemented, it may be necessary to prepare special studies for GSA or for the Office of Management and Budget (Circular A-76 analysis).

Task E2.6 -- Acquire/Modify Space

Any alternative which would have AID continue to provide a facility would require this step. In the case in which the Universal North Building remains the site of the Agency's mainframe, modifications in air conditioning, fire protection, and other environmental aspects of the space would be necessary with a new, larger machine; there is also the possibility that more space would be required within that building. In the instance in which an AID-controlled facility is located in Rosslyn or other government-leasd or owned space, the necessary steps in space acquisition would have to be taken, preceeding any modifications. As part of this step, the actual moving process (assuming some presently owned equipment is retained) would also have to be planned and executed. Necessary coordination among M/SER/IRM, M/SER/MO and GSA will be critical throughout this task.

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Task E2.7 -- Complete Implementation

This task is initiated with the installation of any equipment and/or the beginning of the period of performance of a contractor or contractors to run or support the new, longer-term arrangement for centralized ADP services. In addition to setting up appropriate administrative and technical oversight arrangements for the new contract(s), activities in this task will include the development of capacity monitoring and evaluation measures to ensure systematic evaluation of the new configuration's utilization over the longer term.

TASK E3 -- ROUND OUT OFFICE AUTOMATION INSTALLATIONS AND EVALUATE THEM

The objective of this task is to complete the installation of Wang office automation equipment throughout AID/W and to continue the annual acquisition and placement of from 10 to 15 of the Agency's standard microcomputers. With regard to office automation equipment, there are outstanding requirements for a 15 percent increase in end-user workstations for advanced, shared-logic configurations, such as the Wang OIS-140, as well as for additional stand-alone equipment, such as the Wang 5 units and microcomputers.

The key activities in this task are to program and budget for these additional acquisitions, and formulate system designs, considering not only hardware, but the software applications, management arrangements, costs and benefits, and implementation requirements.

For microcomputer acquisitions, there will exist the annual need to screen and justify requests in line with the Agency's microcomputer policy, and to facilitate the full use of these machines, provision of packaged software and necessary training (see Sections IV of this plan.)

The target date for rounding out the Wang installations is the close of FY84. The microcomputer acquisition and support activity is annual and ongoing, not necessarily occuring at a particular point of any of the fiscal years covered by this plan.

In addition to the acquisition and support of this smaller-scale hardware, it is also necessary to formulate and fully implement an evaluation plan to assess utilization rates and patterns, paving the way for any necessary redistributions of equipment.

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TASK E4 -- CONTINUE INCREMENTAL INSTALLATION OF TELECOMMUNICATIONS LINKAGES

The objective of this task is to continue the installation of telecommunications devices, such as modems, and hard-wired connections where warranted. As noted in the strategy document, volumes and frequencies of communications are not yet sufficiently dense in AID to consider installing a local area network (LAN) with dedicated lines to link all automation devices.

This is a continuing task with no fixed end date. However, a re-evaluation of the need for and the feasibility of a LAN should be conducted in fiscal year 1984.

Task E4.1 -- Develop Criteria and Procedures for Evaluating Proposed Communications Links

This developmental activity is necessary before the acquisition and installation of telecommunications devices, lines, and appropriate software can be placed on a routine basis. This activity is the setting of minimum or threshhold conditions which need to be met before such acquisitions are warranted. Based on experience with the volume and frequency of communications to and from one device, such as a

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microcomputer or OIS, M/SER/IRM needs to set these minimum measures. After the minimum threshholds are established, IRM can have a clear, consistent standard for handling requests for telecommunications hardware and software.

In addition to laying the groundwork to handle supportable requests for communications linkages within AID, M/SER/IRM will also have to monitor telecommunications developments in the Department of State. These include the development of an advanced phone and telecommunications system for the Department's Washington headquarters and for overseas communications. Depending on improvements in transmission speed and volume capacity, there may be implications for AID/Washington automation equipment, e.g., permitting electronic distribution of incoming and outgoing cable transmissions from individual AID buildings and specific equipment configurations, such as the AID mainframe and the Wang OIS's. These developments could also require modification of AID's network of existing ADP terminals located in users' offices.

Task E4.2 -- Screen Requests for Communications Links

This task will be ongoing, using the product of Task E4.1 to determine the disposition of incoming requests.

III. SOFTWARE PLANS

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The Agency's software strategy, as articulated in the strategy document, are synchronized closely with equipment, management and resource considerations. The major task to implement the software strategy is the rationalization of the Agency's existing software applications and data bases in order to simplify and broaden their use. At the present time, many of these applications and data bases have needlessly inconsistent or incompatible features, such as different definitions for the same data elements and incompatible file and record structures.

Rationalization, rather than true integration of AID applications and data bases, was selected as the approach to software for a variety of reasons. First, a conceptually elegant, integrated set of applications would take an extraordinary amount of time and effort to develop--many years--and the Agency has not easily attempted such

large-scale design efforts before (PBAR, FACS). Second, many of the existing data applications and data bases are not fundamentally flawed--individually they can be operated and have much of their intended value, in most cases.

The keys to rationalization of applications is making them standard where they should be (e.g., data element defintions), capable of being inter-related when required, and widely accessible to users. Though certainly a difficult undertaking, this effort can be approached incrementally and systematically. Since no very large-scale system design would be at issue, the problem can be made manageable in technical (software) and managerial terms, i.e., building Agency-wide agreement on a useful approach. This approach also has the important advantage of having an organizational vehicle in place to carry out the project.

Exhibit III-1 following this page illustrates the schedule for this project and for the additional tasks that comprise the software plan.

EXHIBIT III-1
SOFTWARE PLANS

TASKS	FY 83	FY 84	FY 85	FY 86	FY 87
S1 ESTABLISH RATIONALIZATION PROCESS					
S1.1 ESTABLISH ORGANIZATIONAL BASIS					
S1.2 PLAN WORK PROGRAM					
S1.3 CONDUCT WORK PROGRAM					
S2 ANALYZE CABLE DISTRIBUTION SYSTEM					
S3 ESTABLISH ADMINISTRATIVE FUNCTION AUTOMATION PROJECT					

TASK S1 -- ESTABLISH THE APPLICATIONS RATIONALIZATION PROCESS ON A MULTI-YEAR BASIS

The purpose of this task is to establish a long-term organizational basis for conducting the rationalization project, to determine the sequence of applications and data bases to be dealt with, and to perform the rationalization, extending beyond the present charter of the Portfolio Analysis Review Project.

Task S1.1 -- Establish Organizational Basis

In June of 1982, the Administrator organized a study of the Agency's portfolio and operations information systems, which was completed in the fall of that year. In a February 9, 1983 action memorandum, the Administrator approved the formation of a permanent Program Information Management Committee, chaired by representatives of the Management Bureau and PPC, to recommend a variety of actions concerning the Agency's software applications and data bases. These include the modification of existing data bases to create a "core" data base which is responsive to project and non-project operations and monitoring, as well as the standardization of data, data sources, terminology, and reporting requirements. With membership from M/SER/IRM,

PPC, FM, PM, and the operating and central bureaus, the group can carry out the process of specifying applications and data bases to be studied after determining the user needs to be met.

While the group's charter pertains to program information, the make-up of the committee clearly recognizes the need for M Bureau involvement. The Management Bureau's data bases provide data to program and project managers, and there is a clear desire to relate administrative management data, e.g., contracts and personnel, to program and project data.

At the present time the Committee has not been formally constituted. A task force is proceeding with a first project, the development of an "activity" flash report using bureau OYB, FM flash data, PBDS and some other applications with project assistance data. The remainder of a work program has not been developed, nor is there a firm deadline for completion of the first project.

In order to put the present informally constituted task force on a firmer footing, it needs to be formally established as the originally intended Committee, and a

work program and schedule need to be prepared and accepted by the Administrator. The target date for completion of this task is October 30, 1983.

Task S1.2 -- Plan the Work Program

The present informally constituted task force has concentrated on a very important, but limited portion of the more then 50 mainframe applications/data bases for its initial work. In addition, its focus has mainly concerned the functional use of these applications for portfolio analysis. This work has to be extended to touch upon other applications and data bases in order to achieve the following goals:

- Consistency in data element definitions

- Collection of uniform data/elimination of redundant data

- Access and linkages among and between data bases which professional staff have need to run in combination

Permit useful cross-walking between programmatic and administrative (e.g., COORS) data bases.

At the point that the task force completes its initial project and the Committee becomes formally established, a work program indicating which data bases/applications will be assessed in what sequence needs to be prepared. In addition, in order to make available the time of members and staff, a detailed completion schedule needs to be prepared.

Task S1.3 -- Conduct Work Program

The Committee will function on an ongoing basis for an estimated 2 1/2 years (through FY86).

TASK S2 -- ANALYZE THE FEASIBILITY, COSTS, AND BENEFITS OF AN AUTOMATED CABLE DISTRIBUTION SYSTEM

Currently, AID/W receives daily a huge volume of cables. These cables are duplicated and manually distributed throughout AID/W for action and information. Storage and retrieval of distributed cables is entirely a manual process that consumes a substantial amount of professional and secretarial time and can lead to frustration when individual copies of cables are lost or misplaced.

Although the technology for automatically distributing, storing and retrieving cables is readily available, it is not entirely clear that the costs and difficulties of applying it in AID/W would be outweighed by the benefits. It is clear, however, that the present manual methods are adequate, and that in comparison to other possible projects, an effort to automate cable distribution, storage and retrieval is not a pressing priority.

To make certain, however, that AID does not overlook a potential opportunity to ease one of its major paperwork burdens, a project to examine carefully the feasibility,

costs and benefits of an automated cable distribution, storage, and retrieval system is scheduled to occur in late FY84. This timing is appropriate because (1) more important initiatives should be well in hand at that time and (2) a new, larger mainframe, capable of supporting such a system, should be approaching operational status.

It is estimated that this study could be completed in three months. Should AID conclude that the system is warranted, it could take an additional nine to twelve months to formulate the detailed design, develop and install needed software, procure and install additional terminals, and train users.

TASK S3 -- ESTABLISH AN ADMINISTRATIVE FUNCTION AUTOMATION PROJECT

Within AID/W there are several routine administrative functions that involve substantial manual processing of paper. Examples include:

- Processing of personnel actions and records
- Processing purchase orders and short contract actions, e.g., some amendments
- Processing vouchers (FM and technical offices).

Some of these functions appear to be promising candidates for extensive automated support, which could reduce substantially the labor-intensive and time-consuming effort now required.

As FACS becomes operational and as the new computer center comes on-line, AID will be in a position to consider major initiatives in this area. To prepare for that time, a study effort needs to be established to:

- Identify possible automation candidates
- Assess the feasibility, likely costs, and benefits of automating the manual processes
- Establish priorities among the desirable projects
- Develop plans for accomplishing each selected project.

This effort should be led by M/SER/IRM and should be initiated in the last half of FY84 so that the first major project could be considered for a start in the first half of FY85.

IV. MANAGEMENT PLANS

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This chapter specifies the management plans which support and complement the Agency's equipment- and software-related plans over the five-year planning period. Exhibit IV-1 on the following page shows the recommended schedule for the tasks involved.

Task M1 -- Establish Automation Development Review Board

The purpose of this Board is to make Agency-wide decisions on the priority and sequence of the development of new ADP mainframe applications and major modifications to existing applications. The Board will meet at least once annually and take as the foundation for its work an annual systems development plan prepared by M/SER/IRM.

Because of its high-level membership, the Board can also serve as a decision-making vehicle for other, important planning decisions, e.g., on hardware resource allocations and support levels for automation services.

EXHIBIT IV-1
MANAGEMENT PLANS

TASKS	FY 83	FY 84	FY 85	FY 86	FY 87
M1 ESTABLISH AUTOMATION DEVELOPMENT REVIEW BOARD					
M1.1 ESTABLISH BOARD MEMBERSHIP					
M1.2 ESTABLISH PLANNING CYCLE					
M2 ESTABLISH USER GROUP					
M3 DEVELOP AN ADP TRAINING PROGRAM					
M4 ESTABLISH A MICROCOMPUTER RESOURCE PROGRAM					
M4.1 ESTABLISH TRAINING PROGRAM					
M4.2 ESTABLISH INFO TRANSFER MECHANISM					

Task M1.1 -- Establish Board Membership

The Board members as a group are intended to apply a high-level, Agency-wide perspective to decisions which will allocate the Agency's limited systems development resources. Accordingly, its formal membership will consist of the AA from each bureau who may elect to designate a high-level alternate member. In order to serve the intended purpose, these designees should be at the DAA level or office director level. A senior official of the Management Bureau will serve as a chairperson.

In its first cycle of work, considering FY84 systems development activities, the membership should be established by the end of October 1983.

Task M1.2 -- Establish Systems Development Planning In An Annual Cycle

The purpose of this plan is to gather Agency-wide requirements, subject them to analysis by M/SER/IRM management, and provide that Office's recommendations to the Board for review, approval, deferral, modification, or disapproval.

In the annual cycle of planning, IRM will issue a call for requirements through the Board's chairperson no later than May 1, with a one-month response period. The IRM elements concerned with administering this process will be Planning and Evaluation Division and the Directorate for AID/W Client Services. The call for systems development requirements will solicit the following information:

- Purpose of the application and identification of how it contributes to the accomplishment of the bureau/office mission

- Relationship to any other existing data bases or applications

- Some best estimates of the size of the application or data base, how it would be used, and nature of processing desired (e.g., batch, on-line)

- Statement of how the requestor's mission would be affected if the requested application were not developed (or modified).

During the one-month response period, IRM staff will be available to discuss requirements with client bureau staff. Of course, it is also desirable for IRM staff and client bureaus to have completed as much of their assessment of systems development needs prior to the May 1 call for requirements.

Following the June 1 receipt of responses, IRM staff will analyze requirements. The analysis will consist of a review to determine if the requirement is truly new or could be met by any existing applications or data bases. In addition, IRM will estimate the amount of systems development effort necessary to fulfill the requirement. Finally, the analysis will also include development of IRM recommendations on the priority and sequence of each requirement in the following fiscal year's systems development budget.

The recommended systems development activities for the fiscal year being planned will be circulated by IRM to Board members on August 1 of each year, leaving time for at least two meetings to take place before the new fiscal year begins.

During the Board's first year of operation, the schedule for the call for requirements, IRM's analysis, and the Board's meeting will have to be advanced due to the reduced amount of time to establish the Board and its procedures.

Following Board action on the plan as a whole and each proposed requirement, results will be circulated to all requesting bureaus. Should requesting bureaus desire reconsideration of a Board action, an appeal to the Deputy Administrator should be provided for.

Task M2 -- Establish Users Group

The objective of establishing a users groups is to provide forums for the continuing exchange of views among users and between users and IRM. While individual operational issues and service requests can be dealt with routinely through the Directorate for AID/W Client Services in IRM, the purpose of the users groups is to deal with those problems of wider interest, i.e., those concerning more than one user or applications and data bases which are used by more than one user.

While the administrative support for the groups, e.g., scheduling of meetings, should be provided by IRM, the group's chairperson can be elected by the membership. Membership in the group is open to any user of applications which IRM supports. Meetings would be widely publicized and would take place every other month.

Examples of topics suitable for the users group are the modification of the mainframe, the automation training program, evaluation of Wang equipment utilization, and how to make requests for equipment acquisitions.

The users group should be established no later than September 30, 1983.

Task M3 -- Develop an ADP Training Program

The purpose of this task is to round out, regularize, and adequately publicize the Agency's mainframe-related training. As noted in the strategy document, mainframe users will benefit markedly by a program put on a standardized basis, with regular course offerings, in a manner similar to the Wang training which has been established.

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Some of the potential course material is already developed, e.g., INQUIRE training, while other curricula will have to be developed in a cooperative project between IRM and PM/TD. Potential courses would include:

- Overview of the Agency's ADP resources, policies, and procedures

- INQUIRE (beginner's and advanced courses)

- Use of remote terminals

- Client bureau participation requirements in systems development efforts (what a client bureau needs to be prepared for in requirements, design and development phases).

The activities in this task include (1) establishing the framework for developing courses (2) making decisions on courses to be offered, (3) course development, and regularizing procedures for disseminating information on courses. In connection with

decisions on courses to be offered, IRM and PM/TD will need to survey users to assist in making their selections.

The target date for establishing the training program framework and deciding on courses to offer is October 30, 1983. Course development would occur in the first half of FY84, although some courses, such as INQUIRE, could be offered immediately in the new structure.

Task M4 -- ESTABLISH A COMPREHENSIVE MICROCOMPUTER RESOURCE PROGRAM

The purpose of this task is to establish mechanisms for fully exploiting the Agency's investment in microcomputers by making as much expertise as possible widely available and also by distributing lessons learned and products, e.g., software, widely in AID/W.

Task M4.1 -- Establish Microcomputer Training

At the present time training has occured through ad hoc contacts among users and between IRM and users, through outside training courses available from many sources, and

by contractors' work in bureaus and offices. With the fast-growing interest, it is in the Agency's interest to identify a set of sources for training and to establish routine procedures for enrollment. The activities involved in this task are to review experiences with the various sources of training, establish informal selection procedures, and to acquire services, through an appropriate contractual arrangements, on a routine basis. The preferred arrangements would be to have instruction available on a scheduled, periodic basis in a suitable training facility. The training would be tailored to Agency needs and would, at a minimum include:

- An overview of IBM PC, Apple II, and Wang PC capabilities
- Selection of packaged software and adapting it for specific applications
- Agency policy on microcomputer utilization and acquisition
- Operation of the machines.

The target date for selection of appropriate training sources is October 30, 1983. The initiation of training sessions, would depend mainly on completing appropriate contractual arrangements; it cannot be specified, but should be no later than the close of the first half of FY84.

Task M4.2 -- Establish Information Transfer Mechanism

The purpose of this mechanism is to serve as a clearinghouse for puchased software packages and uniquely programmed software. The clearinghouse should be established in the Technical Support Division of IRM. The clearinghouse function would include the following activities:

- Development of a directory containing descriptive information on:

  - Packaged software already purchased by AID/W and identification of bureaus/offices who use it

  - Uniquely programmed applications and identification of their users

  - How to borrow or acquire these this software

  - How to acquire information on commercial software available for purchase

- Occasional meetings with the users group to describe the status of AID microcomputer resources and planned acquisitions

- Phone-in, walk-in referral service.

In order to be comprehensive, the clearinghouse would have to gather data from, and be closely coordinated with, activities of the Mission and Program Services Division.

The target date for establishment of this clearinghouse is October 30, 1983. The target date for issuance of the first microcomputer software directory is December 30, 1983.

ANNEX - A

09001-020-100
July 1983

ALTERNATIVE STRATEGIES FOR A FIVE-YEAR AID/W AUTOMATION DEVELOPMENT PLAN

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Washington, D.C.

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

During the last five years, AID has taken a number of initiatives that have affected significantly the level and nature of automation support provided in AID/W. Among the most notable are:

- The commitment of several million dollars to the development of an on-line Financial Accounting and Control System (FACS)
- The installation of sophisticated word processing systems in almost all parts of AID/W and accelerating installation of office automation equipment overseas
- The continuing development of on-line computer applications that are directly accessed by users through a network of remote terminals.

Begun in a period when automation technology has been developing at an extraordinary rate, these initiatives have helped to introduce the AID/W staff to the wide range of automation support applications that are now possible or will soon be possible. At the same time, AID has experienced the difficulties which often accompany attempts to introduce new technologies into Federal agencies and other large organizations. Among them are:

- Difficulties in developing user sophistication sufficient to operate the new technologies and applications successfully
- User dissatisfaction with the responsiveness and quality of service provided
- Difficulties, both technical and managerial, in the design and development of new, large-scale applications
- Difficulty in reaching agreement on solutions to specific hardware, software, and policy issues.

The strides that AID has made in recent years, the difficulties it has encountered in its automation efforts, and the rapid pace of technological development together create a situation in which the Agency must thoughtfully choose a strategy that will guide its automation support efforts during the next five years and provide a framework for making a coherent set of decisions on the many issues it will face.

In the broadest perspective, AID's strategic alternatives for automation support are:

- Aggressively employ the newest technologies and move rapidly towards a future in which professional staff must be sophisticated users of office automation, computing and telecommunications capabilities. In essence, let technology advances drive the pace at which new and expanded automation capabilities are introduced to AID/W.

- Use the next several years to fully digest and employ the technologies that are now in hand, resolve current data base problems, and increase user capabilities so that a sound basis will exist for a major technological step forward four or five years from now.

The choice between these alternatives is a function of the needs that will exist in AID/W during the next five years, the relative costs of the alternatives, and the ability of the Agency to successfully execute the strategies.

1. THE NATURE OF AUTOMATION REQUIREMENTS IN AID/W IS NOT LIKELY TO CHANGE FUNDAMENTALLY DURING THE NEXT FIVE YEARS

Currently there is no reason to believe that AID's mission will change dramatically during the next five years or, more importantly, that the fundamental roles and activities of the AID/W bureaus and offices will shift significantly. AID/W's needs for automation support services are therefore likely to remain essentially similar to current requirements, except that the level of support required will certainly increase. These requirements can be summarized as follows:

- Regional Bureaus - Their greatest need is to receive, store, access and perform simple data manipulations on financial and programmatic information that relates to the status of and plans for their projects and programs. There is a similar need for administrative information, mainly concerning personnel and budget. The predominant emphasis is on timeliness, accuracy and the convenience with which these functions can be performed.

- Central Policy and Program Bureaus - Their predominant requirements are similar to the requirements for regional bureaus, but with the significant distinction that central bureaus are primarily merging, aggregating and manipulating information from multiple bureaus. The efficiency and accuracy with which this can be done is a function of the accuracy and compatibility of information maintained by each of the regional bureaus and some administrative offices and the compatibility of the software that controls the individual data bases.

- Administrative Offices - Offices like FM, PM and CM generate large volumes of data. Their predominant automation support needs are related to (1) the automation of routine processing of data and (2) efficient maintenance of large data bases.

It is important to note that these characteristics do not include the need for complex data manipulations, access to remote data bases, or scientific application software. Such needs represent a small fraction of the total needs for automation support.

Given the foregoing, it is reasonable to believe that the predominant automation support requirement for AID/W during the next five years will be centered around (1) the refinement of large data bases and improving the ease and accuracy with which data can be stored, accessed, merged and formatted into reports, and, (2) the continuing development and refinement of FACS and perhaps one additional large-scale effort.

2. AID'S DATA PROCESSING STRATEGY SHOULD CONTINUE TO BE MAINFRAME ORIENTED

AID's current hardware configuration consists of an IBM model 158/AP processor and an IBM model 4341-1 processor, both utilizing the multiple virtual storage operating system. During the last two years, the data processing work load handled by this configuration has doubled, and, although it is difficult to predict future work load growth, the on-line processor may soon approach saturation during prime shift if a change in the configuration is not made. AID could choose to respond to this situation either by making a relatively inexpensive upgrade in this configuration's capacity to forestall, for an additional year or two, the point at which saturation is reached, and/or by investing soon in a new set of hardware that will meet its needs for the foreseeable future.

A short-term upgrade is desirable if there is sufficient uncertainty about AID's future data processing requirements to make a major investment risky, or, if there is the likelihood that major technological breakthoughs, desirable for AID, will be available within the next several years. Neither of these conditions, however, appears to exist.

Because AID's predominant data processing requirement will continue to be oriented around large data bases that need to be accessed by many users, it is impractical to comtemplate an environment in which each major bureau controls its own, independent data processing hardware. There are, therefore, only three generic hardware alternatives that warrant serious consideration. They are:

- A large mainframe capacity with remote terminals to provide user access, and freestanding microcomputers, where justified. This, in effect is the current hardware configuration.

- A network that includes a mainframe and mini- and microcomputers that are linked through a local network. This alternative would limit the growth in mainframe applications by off-loading applications to the micros and minis.

- A network of mainframe, minicomputers, and microcomputers that support distributed data bases. There still would be a number of individual data bases, but they would be controlled by a specific bureau or office and could be accessed by any authorized user.

Upon analysis, the third alternative was rejected primarily for two reasons:

- Distributed data base technology is still partially experimental and requires very advanced technical and management expertise to make it function well. It would therefore be very risky to attempt it now in AID.

- Distributed data bases have their greatest practical advantage over other technologies when secondary users need to access the various data infrequently. When many users must frequently access common data, as in AID, a common data base configuration tends to be less complex, more efficient, and provides better user access and response.

On balance, the third alternative could compound present automation support problems.

Analysis also indicates that the second alternative is less desirable than the current approach. The primary advantage of a network of processing hardware is that individual machines can be located at remote sites where they can be configured and operated in a way that best suits the needs of local users, yet can communicate with each other and share processing loads. While these features have some potential utility in AID, they require the ability to operate and maintain hardware and software at each location (a capability which cannot be easily or quickly developed in AID/W), and they require a greater dollar investment to achieve comparable levels of computing power available through a single large mainframe computer. Because the data processing requirements of AID bureaus are largely similar, the potential advantages of a distributed processing network are relatively minor compared to the costs of acquiring and operating successfully this type of hardware configuration.

For these reasons, it is believed that AID/W's primary data processing requirements will be best met during the next five years through a strategy that involves the acquisition of an expanded mainframe capacity, acquired within the next twelve to eighteen months. All major applications should continue to be developed for and operated on the mainframe, but stand-alone microcomputers should be permitted for special, localized applications where the ability to support the applications exists.

3. BACKUP INSURANCE, IF DETERMINED TO BE NECESSARY, SHOULD BE OBTAINED THROUGH A CONTRACT WITH A COMPUTER SERVICE VENDOR

If a fire or vandalism or other catastrophic occurence should render AID's mainframe inoperable for more than one week, AID would be unable to generate current financial and accounting information, once FACS is fully operational, and may find it difficult or impossible to operate as an agency. At certain times of the year, a long-term computer outage would also make it extremely difficult for AID to meet its OMB and Congressional commitments for budgeting and programming information.

As insurance against this situation, AID could:

- Operate, either directly or through contract, a second, remote computer center. Both computer centers could be configured and sized to be capable of operating FACS and a few additional, critical applications so that in the event the one that was running FACS were destroyed, the applications running at the second center could be put aside and FACS could be shifted to it.

- Enter into a contract with a large computer service vendor who will guarantee access to a compatible mainframe computer should AID's computer become inoperable.

As is the case with any type of insurance, the cost of the insurance must be weighed against the probability of the catastrophe occuring and the costs or consequences associated with the catastrophe. In this instance, the probability of a catastrophe occuring is very low and the cost of the first alternative (a second remote site) is very high -- estimated to fall within the range of $3.8 to $4.2 million over a five-year period. The second alternative strikes a better balance with the direct costs of a backup contract estimated at $2.4 million over the same period. Even so, it is not clear that this alternative is warranted given the low probability of a catastrophic occurence and the difficulties associated with the continuous actions that would be required to assure operational success.

4. APPLICATIONS DEVELOPMENT AND MAINTENANCE EFFORTS SHOULD GIVE EQUAL WEIGHT TO SOLVING CURRENT DATA BASE PROBLEMS AND DEVELOPING NEW APPLICATIONS

The fundamental software strategic issue relates to the relative priorities that should be given to three necessary initiatives during the next several years:

- Continuing development of FACS, including any necessary redesign efforts
- Development of new applications, especially those that require the development of new specialized data files
- Resolution of problems that trouble current data bases.

It is recommended that the highest priority be given to the implementation of FACS and any subsequent redesign efforts that are required to make FACS perform to its full potential. Major considerations include:

- Benefits that will accrue from a fully functioning system
- Protecting the investment already made in FACS
- AID's ability to undertake additional large development efforts prior to the completion of FACS
- Maintenance of credibility.

While there are a number of reasons to be cautious about a project that is intended to resolve both the conceptual and pragmatic problems that affect AID's current data bases, it is important to understand that AID may be unprepared to take full advantage of future technology advances unless it rationalizes its data base requirements. Technology is evolving towards a future in which professionals will have instant access to vast amounts of information at very low cost. This capability offers the prospect of further advances in professional productivity and better decisionmaking through better information. The latter capability, however, is contingent upon a carefully structured framework that defines what is to be managed, how it is to be managed, and what information is relevant to these issues. Without this kind of structure, large quantities of information can be more confusing than helpful.

It is for this reason that efforts to resolve these problems should not be postponed. However, the rationalization of AID's current data bases and applications should not be approached as though it were a total redesign that would produce a single, integrated data base for several reasons:

- The problems currently do not appear to be so severe that they require a complete redesign
- With FACS as the major priority, AID's ability to successfully undertake a second project of similar magnitude is very limited
- A complete redesign would require the resolution of all conceptual issues, which could take several years, before a systems design could be completed. In the face of slow, painful progress, it is uncertain that the project could be maintained.

Accordingly, the Agency can afford to work towards the rationalization of its applications and data bases at a moderate pace. During the course of this effort, some new applications and modifications can also be developed, provided that they are compatible with the rationalization scheme.

5. <u>ADDITIONAL TELECOMMUNICATIONS CAPABILITIES SHOULD BE ADDED INCREMENTALLY WHEN JUSTIFIED, BUT THE DEVELOPMENT OF AN EXTENSIVE LOCAL NETWORK SHOULD BE POSTPONED FOR FOUR OR FIVE YEARS</u>

A local network, if constructed throughout AID/W, would greatly facilitate advanced telecommunications applications such as:

- Electronic transmission of text and processed information among many locations
- Electronic transmission of cables and storage and retrieval of cables
- Electronic mail
- Professional workstations.

However, there are a number of significant problems associated with a local network for AID/W. They include:

- The value of some telecommunications is very limited unless the capabilities are spread throughout AID/W. For example, the ability to instantly transmit an action memorandum to only a few of the offices that must receive it is of limited value compared to the value of being able to transmit it to all offices. It is therefore generally necessary to make a large initial investment in a local network to assure wide coverage.

- The size of the Main State Building and the frequency with which AID offices are relocated would require the installation of a very large network.

- The problems of interconnecting other AID/W office buildings into the network would substantially increase costs and technical risk.

- The required technology is very new and still under development. It would require substantial sophistication to make it work well in the next several years.

Because of these problems and because there is little reason to believe that these capabilities will be pivotal to improving AID's effectiveness during the next five years, there is no rationale to invest a substantial amount of financial and staff resources in an effort that could divert AID from more pressing priorities. Instead, it is recommended that additional telecommunications capabilities be added incrementally when the benefits clearly justify the costs. Two capabilities that should be considered for implementation during the next year or two are:

- A system to distribute, store and retrieve unclassified cables. By using AID's mainframe computer and its remote terminals, this kind of system could be developed for a cost estimated in the range of $150,000 to $200,000.

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- Telephoned-based communications capabilities among selected microcomputers, word processing systems and the mainframe. For modest costs, AID can easily create the ability to transmit text among selected systems.

6. POLICIES AND PROCEDURES SHOULD BE ADOPTED THAT ENCOURAGE GREATER USER INVOLVEMENT IN AUTOMATION SUPPORT PLANNING AND OPERATIONS

Concerns voiced by users during this study indicate that communications between them and service providers are not what they should be. Many users are unsure how to obtain support for development of new or modified applications and how decisions are made to provide this support. There are also problems in obtaining responses to operational and maintenance problems.

These concerns are sufficiently widespread to seriously consider devising ways to build more concerted user participation into the processes of systems development and operations. Two levels of this more formalized user involvement are necessary:

- Participation in decisions to undertake software development projects for new mainframe applications or modifications.

- Participation in solving operational problems which affect multiple applications or multiple users.

In order for users to participate in the consideration of projects for software development, an Automation Development Board, chaired by the Management Bureau, should be formed. Other members would consist of senior officials of other bureaus and independent offices or their designees. The Board would act upon an annual systems development plan prepared by M/SER/IRM after that Office has made a "call" for applications development needs, analyzed the justifications for each project and recommended a specific sequence for development. It would be up to the Board, in an annual meeting, to deal with problems of competing priorities and allocation of resources for the necessary software development. The Board would also deal with Agency-wide issues concerning the allocation of equipment resources, as well as other important aspects of automation support levels.

This approach would require consideration of user needs at several points, and users' participation in the decisionmaking process:

- Users would respond to the "call" with a brief justification, and would have the opportunity of reacting to M/SER/IRM's analysis. This analysis would identify any alternative approaches (such as modifying another existing application to meet the need), estimate the resources required to complete the project and place the project in a sequence of Agency-wide priorities.

- Users could append a "dissenting" view to any portion of the plan going before the Applications Review Board.

- User organization's senior staff would be represented on the Board, and participate in deliberations concerning the plan.

- Board action would have to have the concurrence of its chairman, the but in the event a user organization is dissatisfied with the Board's action, an appeal would be possible to the Deputy Administrator.

For day-to-day user concerns, a different forum, requiring considerably less senior representation, is called for. This group would deal with operational problems experienced with particular sets of applications and/or sets of users. Present arrangements for handling such problems as delayed response time and operational problems with INQUIRE, affect a number of users and applications. Thus, the solutions have a wider application. Accordingly, the opportunity to discuss problems on a periodic basis in a group has particular value, and could help extend the capacity of service providers to deal with users. This users group, consisting of user staff most immediately concerned with operational issues, would meet every other month with M/SER/IRM staff. A specific, single-issue discussion would be the basis for the meeting, attendance at which would be voluntary. Leadership of the user's group would be elected. IRM, as the central service provider (and a user) would be an integral part of the users group.

7. <u>THE RECOMMENDED OVERALL STRATEGY FOR THE NEXT FIVE YEARS IS TO RESOLVE CURRENT PROBLEMS, INCREASE USER SOPHISTICATION AND TAKE MAXIMUM ADVANTAGE OF PROVEN TECHNOLOGY BEFORE AGGRESSIVELY PURSUING NEW TECHNOLOGY</u>

The major elements of this strategy are:

- Within the next few months upgrade the IBM 4341 processor from a Model 1 to a Model 12, adding enough capacity to take care of interim needs until a longer-term equipment acquisition can be put in place.

- Within the next twelve to eighteen months, replace the current mainframe configuration with a single large mainframe processor that is software-compatible with the existing IBM mainframe.

- Review procedures and precautions to safeguard the new mainframe and upgrade as necessary, but do not invest in one of the backup insurance alternatives unless it is concluded that the risks of a catastrophe are unacceptable.

- Continue to make the development and full operational capability of FACS the highest software priority and defer other applications activities, if necessary, to assure that the effort is well managed.

- Formulate a project to pinpoint problems in existing data bases and applications and to move towards the rationalization of the Agency's management information requirements. Give equal emphasis to this effort and to the effort to develop new applications, but postpone when possible new applications that would compound existing problems.

- To relieve pressures for the development of new applications during the next several years and to encourage the development of greater user sophistication, encourage users to develop microcomputer applications in line with AID's recently articulated policy.

- Provide telephone line-based telecommunications capabilities for installed Wang OIS systems to improve AID/W communications capabilities and to test the requirements for future telecommunications capabilities. When the need can be clearly established, provide a permanent communications link between specific microcomputers and the mainframe.

- Conduct a requirements and feasibility study of a cable distribution, archival and retrieval system that utilizes the mainframe and existing remote terminals, and, if warranted, proceed with the system.

- Focus efforts on improving the quality of automation services provided and on an improvement of user participation and capabilities through:

  - Establishment of user groups and the Applications Review Board
  - Improvement in user training programs.

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It is expected that this strategy will be appropriate for the next four to five years. Its costs, beyond the base costs necessary to maintain current services and to perform essential functions such as planning and policy development, will be on the order of:

Millions					
FY83	FY84	FY85	FY86	FY87	TOTAL
$0.07	$2.22	$4.01	$1.84	$1.30	$9.44

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I. BACKGROUND

I. BACKGROUND

A previous report entitled "Baseline Findings for a Five-Year Automation Plan for AID/W" analyzed the current status of automation in AID/W, described user requirements, analyzed current automation capacities and capabilities, and described the dollar resources that are likely to be available for automation during the next five years. Using those analyses as a base, this report analyzes the critical elements of an automation strategy, analyzes several alternative approaches for each element, and presents an overall strategy which combines the best alternative for each element. This chapter reviews the issues which the automation strategy addresses.

1. IN RECENT YEARS, REQUESTS FOR IMPROVEMENTS IN AUTOMATION SUPPORT HAVE GROWN STEADILY

- AID/W offices are now supported by 35 major administrative management and 23 program management applications on the mainframe computer. Few bureaus and offices are not directly supported or do not utilize information processed by them. M/SER/IRM's plans in mid-FY 83 called for the development or redesign of 14 mainframe applications over the next two years, in addition to several major user service improvement projects. These new applications are in addition to FACS, which is the single largest system development project undertaken by AID and will, in some part, be under development for several years to come.

- About 100 new applications or modifications to existing applications have been identified by users. Almost all of them are derived from existing manual or automated systems. It has been estimated that the 33 most important new applications could require as much as 16 person-years of effort to develop.

- By the end of FY 83, AID/W offices will be supported by office automation installations capable of meeting their word processing requirements and will also permit system interconnections. This position will have been reached through an intensive two-year priority effort to analyze requirements, design, and install 18 Wang shared-logic office automation systems.

- Requests by program and administrative offices for the acquisition of stand-alone microcomputers have been mounting steadily. In response, M/SER/IRM has initiated an experimental program with 15 IBM and Apple microcomputers, and AID has recently promulgated a policy covering the acquisition and utilization of microcomputers. It is expected that requests for this kind of equipment will continue to grow.

- Many users have voiced strongly the need for improvements in the quality, timeliness, and responsiveness of the automation support they receive. With the number of applications and amount of equipment now in place, and with the substantial number of unmet requests that have been identified, AID's automation support resources will be heavily stressed in the near-term future.

2. DURING THE NEXT FIVE YEARS, THE NATURE OF AID's AUTOMATION SUPPORT REQUIREMENTS ARE NOT LIKELY TO CHANGE DRAMATICALLY

While it is difficult to predict the future accurately, there are currently no substantial reasons to believe that the roles and functions of AID/W bureaus and offices will change dramatically during the next five years. The fundamental character of their automation support requirements are therefore not likely to change either. These requirements can be broadly characterized as follows:

- Regional Bureaus - Their greatest need is to receive, store, and access data in order to perform simple minipulations on financial and programmatic information that relates to the status of and plans for projects and programs. There is a similar need for administrative information, principally information about personnel and budgets. The predominant emphasis is on timeliness, accuracy and convenience with which these functions can be performed.

- Central Policy and Program Bureaus - Their predominant requirements are similar to the requirements for regional bureaus, with the significant distinction that central bureaus are primarily merging, aggregating and manipulating information from multiple bureaus. The efficiency and accuracy with which this can be done is a function of the accuracy and compatibility of information maintained by each of the regional bureaus and the compatibility of the software that controls the individual data bases.

- Administrative Offices - Offices like FM, PM and CM generate very large volumes of data. Their predominant automation support needs are related to (1) the automation of routine processing of data, and (2) efficient maintenance of very large data bases.

Given the foregoing, it is reasonable to believe that the predominant automation support requirement for AID/W during the next five years will be centered around (1) the rationalization of large data bases and improvements in the ease and accuracy with which data can be stored, accessed, merged and formatted into reports; (2) the continuing development and refinement of FACS and perhaps one additional large-scale effort; and (3) heightened efforts to upgrade users' ability to fully exploit improvements in data bases, processing capacity and telecommunications through training and operational support.

3. AN AUTOMATION STRATEGY IS NEEDED THAT INTEGRATES SEVERAL MAJOR DECISIONS INTO A COHERENT FRAMEWORK FOR THE FUTURE

The major decisions that will have to be made are outlined below.

- Much of the data required by bureaus and offices are essentially similar in nature, yet most bureaus and offices believe that many of their data needs are unique and resist efforts to find common data element definitions and common data base designs. As a result, many computerized data bases and application programs have been developed that are similar in their essential features, but differ in important ways such as currency, definition, and uses. The consequence is inefficiency and conflicting information. A fundamental issue, therefore, revolves around the approach AID should take to applications development during the next five years. In broadest perspective, the choices are:

  - Mount a major effort to resolve current data base problems and delay new applications that would compound current problems

  - Accept the fundamental data base problems as a pragmatic reality that is not likely to be changed, and proceed rapidly with new applications designed to meet individual user's requirements

  - Find a middle ground between the two extremes that holds some promise of avoiding the likely confusion and frustration at either extreme.

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- Recent analyses uggest that AID's mainframe computer may soon approach prime-shift saturation, and user response time may degrade significantly. How soon this situation occurs will be a function of (1) the amount of FACS development and testing that will be occuring during prime-shift, and (2) the date when FACS II comes up. Because a significant amount of lead time is needed to successfully plan for and acquire on-line new hardware, a response to this situation cannot be delayed long. The fundamental choices are:

  - Make relatively minor upgrades in the current hardware in order to delay an equipment replacement decision

  - Commit now to a mainframe strategy and invest in new mainframe hardware

  - Commit to a distributed processing strategy and off-load mainframe applications growth onto a network of micro- and minicomputers.

- When FACS becomes fully operational and replaces current methods of generating financial information, AID would quickly lose its ability to process financial transactions if it loses its mainframe computer. The longer FACS is inoperable, the more difficult it would become for AID to operate. AID must decide, therefore, if it is willing to accept the risks of a catastrophic systems failure and the ensuing consequences, or whether it must commit some of its resources to a backup capability. The basic choices are:

  - A duplicate, remote site

  - A contract with a vendor that guarantees the availability of a compatible mainframe.

- Some individuals see substantial benefits to a telecommunications network that would interconnect AID/W offices and permit the electronic transmission among them of cables, memoranda and other documents. This kind of network could speed the distribution of information throughout AID/W and could contribute to greater convenience for the staff. If AID elects to pursue a distributed data processing approach, these telecommunications capabilities could be achieved relatively inexpensively, because much of the necessary hardware would have already been installed for data processing purposes. If the Agency elects to

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take a more conventional, non-distributed approach to data processing, the costs of these telecommunications capabilities could be substantial and could divert automation resources which are sorely needed elsewhere.

4. THIS REPORT DESCRIBES AND ANALYZES THOSE AUTOMATION STRATEGIES THAT ARE BELIEVED TO BE MOST VIABLE

Using the previous report as a base, the issues that were fundamental to an AID automation strategy were analyzed, and the range of possible solutions for each issue were narrowed to those that were feasible. Different combinations of feasible solutions were then combined to form alternative strategies, and each strategy was analyzed in terms of resource requirements, benefits, and implementation difficulties. The most advantageous set of feasible solutions is presented in Chapter VI, Strategy Summary.

5. IN RESPONSE TO THIS REPORT, AGENCY MANAGEMENT PROVIDED STRATEGIC DIRECTION THAT LEAD TO THE FORMULATION OF A FIVE-YEAR AUTOMATION PLAN

Following a review and discussions of the contents of a draft of this report, AID managers specified for the study team a preferred automation strategy. That strategy was developed into a five-year automation plan for AID/W. That plan set forth an agreed upon general strategy for providing automation support to AID/W and identifies:

- The general kinds, quantities, and deployment of hardware required
- The major new types of applications that will be developed
- Telecommunications capabilities to be developed
- Annual schedule of events for implementing the plan.

The plan is provided in a separately bound report entitled "A Five-Year Automation Development Plan for AID/Washington."

II. SOFTWARE STRATEGY

II. SOFTWARE STRATEGY

The satisfaction of AID/W's automation support needs should hinge on users' applications requirements, more than any other factor. The baseline analysis indicated that these needs can be most broadly categorized as one of two types:

- Organization, storage and retrieval of information which has, or will, cross organizational boundaries in the Agency
- Response to recurring and one-time-only questions on the status of projects, programs, and Agency-wide activities, with little complex data manipulation necessary.

Approaches to meeting these requirements generally coincide with one of two paths for automation development:

- Building an integrated, Agency-wide set of data bases which individual users can tap to process and retrieve information according to their individual needs.
- Constructing individualized applications and data bases (continuing the present course).

This chapter discusses two key questions in order to determine the most promising software alternative:

- To what extent should the Agency emphasize improvement of existing applications for more effective Agency-wide usage, or, continue the development of new applications responding to individual user needs?
- Should the trend toward on-line, real-time processing of INQUIRE applications be continued?

The following sections address these questions by characterizing AID's current applications, reviewing user-defined needs identified in the baseline analysis, and assessing where the Agency has feasible options.

1. THE MAJORITY OF AID'S EXISTING APPLICATIONS PROVIDE INFORMATION RETRIEVAL CAPABILITIES AND ARE ACCESSIBLE TO USERS, BUT HAVE RECOGNIZED STRUCTURAL PROBLEMS WHICH OBSTRUCT THEIR POTENTIAL USEFULNESS

- Automation support in AID/W today is concentrated in mainframe applications which can be accessed by users in individual AID/W offices and bureaus.
  - A network of approximately 150 terminals and printers is in place, linking AID/W users to the mainframe configuration.
  - In the majority of cases, users collect and input their own data at these terminals.
  - Most of the applications are designed for on-line, real-time processing which provides users with immediate access to processing, as well as interactive response during processing.
  - New applications are being developed in one of the more flexible data base management systems, INQUIRE.
- These mainframe applications are typically large data base applications-- basically automated files--which provide information retrieval capabilities, rather than complex analysis and process control applications, and are used to:
  - Generate a regular series of reports, e.g, Project Accounting Information System (PAIS)
  - Provide historical and current reference information, e.g., Development Information System (DIS)
  - Monitor program budgets and operations, e.g., Budget On-Line Reporting System (BORS)
  - Permit, in the hands of a skillful user, file searches to develop additional information files for other purposes, e.g., PPC's new evaluation monitoring system which draws on PAIS and DIS data bases.

- The set of existing FM applications and the new FACS are some of the few applications which actually process data to satisfy a user's principal mission, i.e., keep Agency accounts.

- While the majority of applications are data base-oriented and many are regularly used by most AID/W offices, the full potential of these information retrieval systems is not being realized; this has spurred user concerns and requests for customized applications to meet their individual information needs.

- The concerns raised most frequently include data quality, service responsiveness, including access and timeliness of response, and difficulty in interrelating different data bases.

- M/SER/IRM's review of portfolio analysis found that while many applications performed overlapping or duplicative functions, there also were several critical information gaps. This paper concluded that data definition problems are a major source of concern.

2. <u>MANY OF THE USER-IDENTIFIED INFORMATION NEEDS ARE FOR LOCAL APPLICATIONS WHICH DUPLICATE INFORMATION AVAILABLE IN EXISTING AGENCY-WIDE AND LOCAL APPLICATIONS</u>

- The baseline analysis of AID/W's information needs leads to conclusions that:

  - Fundamental information requirements for essential administrative and program management functions are being met, but are not without problems.

  - The major information gap repeatedly identified by AID/W users is core project data to support program management and evaluation activities.

  - There are few needs for complex data manipulation, access to remote data bases (outside AID), or customized scientific applications software.

  - User requirements over the next five years are not expected to differ from today's needs for large data bases, standard data manipulation, access to internal data bases and Washington-based data bases, packaged statistical analysis software, and other "off-the-shelf" software packages.

- The survey of users' priority information needs did not show the need for large mainframe development efforts of the scope and duration of FACS, but indicated the following types of information needs:

  - Internal management information systems, which could be developed as modifications to larger Agency systems, e.g. RAMPS, or as smaller, local applications

  - Special, ad hoc inquiry and analysis applications to respond to external requests from Congress, GAO and other oversight agencies, as well as to analyze internal management, policy and evaluation issues

  - Program- and project-specific analysis (e.g., economic analysis) and communications needs (e.g., electronic exchange of project information).

- Over half of the priority information needs are for local, as compared to Agency-wide, applications.

  - Local applications are tailored to meet the requirements of single users or a small set of users; these applications have individual data bases usually comprised of information inputs originating in a single office.

  - Agency-wide applications, in contrast, are designed to meet the requirements of multiple users, and, as a result, require information inputs from more than one source and are set up to serve a large set of users.

  - Agency-wide applications can, however, support local applications by providing information which can be manipulated to meet local requirements.

- While there is broad interest in an Agency-wide project data base system, there were also frequent reminders of the Agency's past experience in unsuccessfully establishing an integrated core project data base, which seems to have led users to favor individual data bases, locally controlled, rather than integrated data bases.

- The major problems with the Agency's applications are recognized, and some actions have been initiated to resolve them, including the following:

- Improve existing applications and provide reference materials to inform users of the capabilities of existing information systems

- Redesign of the Project Accounting and Information System (PAIS) to address the problem of competing data definitions and information gaps

- Take the initial steps to establish a core project data base potentially serving a variety of user needs, particularly portfolio analysis

- Introduce microcomputer applications support for localized information needs not appropriately met by the mainframe computer configuration.

3. THE MOST CRITICAL SOFTWARE STRATEGY ISSUE INVOLVES THE RELATIVE PRIORITY OF RESOLVING CURRENT DATA BASE PROBLEMS VERSUS NEW APPLICATIONS

The previous sections of this chapter have described (1) some of the structural problems which limit the effectiveness of current applications and data bases, and (2) the kinds and number of new applications that users believe they need. Many of the problems with the current data bases and applications have given rise to some of the newly articulated applications which are desired. The issue, therefore, is whether AID should invest a substantial amount of its resources in resolving these problems at the expense of new applications, or, whether it should focus the vast majority of its resources on the development of new applications which will give immediate assistance to its users.

(1) The Argument in Favor of Emphasizing New Applications Centers Around the Intractable Nature of the Data Base Problems

- Current data base problems have developed over a long period of time. In part, they reflect the incremental and compartmented way in which new applications have been developed, and in part, they reflect a fundamental characteristic of the Agency. That is, each major component of AID has had substantial freedom to determine how it wants to manage its operations. It is not surprising, therefore, that there are substantial differences among bureaus in the information they believe they need and in the ways they want to define various data elements.

- Both of these conditions make the problems fundamentally difficult to solve. A complete restructuring of the current data bases and applications into a coherent, integrated data base could become a long and tortuous project. Perhaps even less appealing is the prospect of forcing each involved office to reach agreement with other offices on the information that is to be maintained and the definitions of the data elements.

- A major effort to resolve these problems could consume a significant portion of available resources and leave little effort available for new applications or incremental improvements in current applications. If the data base redesign effort were to last several years, current users would receive little support in achieving the improvements they now seek.

- If the redesign effort were not well conceived, it could flounder and die with no benefit and substantial costs.

(2) <u>New Applications, However, May Compound the Current Problems</u>

- The baseline analysis found that more than half of the new automated applications desired by users are local applications that would require the construction of new, specialized data bases. They would support:

  - Internal management, e.g., in a bureau
  - Special, <u>ad hoc</u> inquiry and analyses
  - Special program and project analyses.

- As the number of these kinds of applications increases, the total number of data bases will increase, and the current problems pertaining to data quality, difficulty in interrelating different data bases, overlapping/duplicative data bases, and data element definition problems will multiply.

- These problems, if not controlled soon, could lead to a future in which the positive support provided by AID's automated systems is substantially offset by the confusion and frustration they create. If that point is reached, the costs of fixing the problems may be several times greater than they are now.

(3) AID Will be Unprepared to Take Advantage of Future Technology Advances Unless it Rationalizes its Management Information Requirements

- Technology is evolving towards a future in which professionals will have instant access to vast amounts of information at very low cost. This capability offers the prospect of further advances in professional productivity and better decisionmaking through better information. The latter capability, however, is contingent upon a carefully structured framework that defines what is to be managed, how it is to be managed, and what information is needed for management. Without this kind of structure, having large quantities of information is more confusing than helpful.

- If in the next few years AID staff can make additional progress in reaching agreement on the Agency's management information needs (kinds of data, their definitions, and the procedures for maintaining data currency), then AID will be positioned more strongly for the future.

4. THE RATIONALIZATION OF AID'S CURRENT DATA BASES AND APPLICATIONS SHOULD NOT BE APPROACHED AS THOUGH IT WERE A COMPLETE REDESIGN

- While this effort should be a high priority, it should not be conceived as a total redesign that will produce a single, integrated data base.

  - The full development and implementation of FACS will continue to be a major, difficult project for some time, and will limit AID's ability to successfully undertake a second project of similar magnitude.

  - A complete redesign would require the resolution of all conceptual issues before a systems design could be completed. This process could take several years to complete, and there is substantial danger that the difficulties that would be encountered would slowly erode the Agency's determination to resolve them before any real improvement is achieved.

- The problems are best approached along the lines suggested by the M/SER/IRM issue paper on portfolio analysis. That is, the problems are best attacked by aggregating them in discrete groups, and then resolving the grouped problems sequentially. While this approach is not likely to yield an optimal data base design, it is more likely to produce constructive results in the long-run than a more ambitious project.

- While most problems and user interest centers on program and project information, there is also high potential to improve the Agency's work processes through automation of some existing manual processes in the administrative area. The major candidate for automation is personnel actions, which are currently recorded when completed in the automated RAMPS data base. On a separate track from the program/project data base concerns, the automation of such administrative processes such as personnel actions should also be undertaken.

5. <u>THERE WOULD BE QUESTIONABLE LONG-TERM GAINS IN RETREATING FROM THE CURRENT USE OF ON-LINE, REAL-TIME PROCESSING AND INQUIRE APPLICATIONS</u>

- The Agency has already made substantial investment in the hardware and software needed to support on-line, real-time processing and to standardize with INQUIRE applications. It would be hard to retreat from this trend which gives local users more timely and flexible data processing support. Although a shift to batch processing could result in more efficient mainframe computer utilization, AID/W users have come to expect rapid turnaround of inquiry and report production requests, and some are critical whenever processing responsiveness is impaired.

- While INQUIRE is considered flexible, it requires considerable training and skill; its continued use tends to maintain the need for INQUIRE specialists in M/SER/IRM to support users, rather than permitting users to fully maintain their own INQUIRE applications.

- INQUIRE data bases can be successfully linked with Wang OIS equipment and the standard microcomputer; although professional programmers in M/SER/IRM would have to be involved in making these linkages, there is no software barrier to a distributed data processing network which would link the mainframe with local hardware, such as microcomputers.

- A change to a more user-friendly programming language than INQUIRE provides may permit more local applications development and support, but does not appear feasible given the costs and elapsed time associated with such a conversion.

6. NEW, LOCALLY-SUPPORTED TECHNOLOGY SHOULD INCREASINGLY PROVIDE SOFTWARE, AS WELL AS HARDWARE, OPTIONS FOR MEETING AID/W'S APPLICATIONS NEEDS

- Since a significant portion of AID/W user priorities are for local applications, the Agency is not entirely dependent upon the mainframe computer and its associated software to meet all user information needs.

- Depending upon specifications in such areas as size, data manipulation and user populations, many of AID's applications could be supported by a variety of locally-supported hardware.

- Exhibit II-1 indicates the types of applications which are most appropriately supported by the office automation and data processing equipment installed or being introduced to AID/W offices and bureaus.

- Exhibit II-2, following Exhibit II-1, indicates which hardware options are most appropriate for software requirements associated with various types of applictions.

- Software and hardware decisions are necessarily complementary, and, in many cases, the same application may be satisfied with different hardware and software mixes depending upon available options and design specifications.

7. THE RECOMMENDED SOFTWARE STRATEGY PLACES SUBSTANTIAL EMPHASIS ON RESOLVING CURRENT DATA BASE PROBLEMS

In summary the recommended software strategy is:

- Continue to make FACS the highest priority development effort--through implementation and any subsequent modification efforts that may be needed. It is essential that FACS meet fully its initial operating objectives and that AID's substantial investment to date be protected.

- Place equal but subsequent emphasis on (1) resolving current data base problems and (2) development of new applications. To the extent practicable, postpone those new applications that may compound current problems. Wherever possible, shape new or modified applications to broaden their utility for professional users.

EXHIBIT II-1

Hardware Options by Application Characteristic

APPLICATION CHARACTERISTIC	HARDWARE			
	IBM MAINFRAME	WANG VS	IBM PC/APPLE II PLUS	WANG OIS 140
Main Memory Requirements	Unlimited	Up to 256 K bytes	Up to 4MB/256 K bytes	64K bytes
Interrelationships With Existing Applications	Agency-wide	Limited Agency-wide	Office-specific	Office-specific
Data Base/File Size	Unlimited	Up to 2.3 B bytes	Up to 5 MB	Limited
User Control/Access	Shared/unlimited	Shared/limited	Standalone	Standalone
Simultaneity of Users	Unlimited	Limited	Single User	Single User
Processing Speed	Fast	Medium	Slow	Slow
Data Manipulation	Complex/Large	Complex/Medium	Simple/Medium	Simple/Small

B = megabytes

EXHIBIT II-2

Hardware Options by Application Characteristic

APPLICATION CHARACTERISTIC	HARDWARE			
	IBM MAINFRAME	WANG VS	IBM PC/APPLE II PLUS	WANG OIS 140
Main Memory Requirements Batch processes	Unlimited	Up to 256 K	Up to 4MB/256 K	64K bytes
Time Sharing				
Large or shared data bases				
Computational/scientific				
Multiple ineractive users				
Local non- duplicated data bases				
Personal Computing (spread sheet business graphics, etc.)				
IRM - developed and maintained				
User-developed and maintained				
Local office automation (WP)				
Inter-office automation (mail, filing, document retrieval, etc.)				
Simple list processing				

- Relieve pressures for new applications by permitting users to continue to develop local applications on microcomputers using standard software, but require the development of adequate system documentation.

III. HARDWARE STRATEGY

III. HARDWARE STRATEGY

The fundamental hardware issues are:

- What hardware configuration will best meet AID/W automation support requirements in the next few months (due to capacity-related concerns) and over the next five years?

- When should changes in the current configuration be made?

This chapter identifies and describes four hardware "architectures" that are potential candidates for satisfying AID/W user requirements for automation support. Each alternative is analyzed in terms of its advantages and disadvantages, its technological feasibility, and its compatibility with other strategy components. This analysis concludes with a recommended architecture and hardware strategy for AID/W.

1. THE FUNDAMENTAL NATURE OF AID/W USER REQUIREMENTS FOR DATA PROCESSING SUPPORT SHOULD NOT CHANGE MARKEDLY IN THE NEXT 5 YEARS, BUT THE VOLUME OF SERVICE REQUIRING SUPPORT IS LIKELY TO INCREASE

The nature and volume of data processing support requirements during the next five years are two of the key determinants of the kinds of alternative hardware strategies that are feasible for AID.

(1) AID/W Users Require Access To Large-Scale Data Bases To Support Inquiry And Reporting Applications

- AID/W users most often rely on large-scale data bases as central sources of information. However, several individual AID/W users may rely on the same data bases for common information or may require unique data base systems to support their own operations.

- The types of data required by AID/W users can be broadly characterized as follows:

- Regional bureaus need detailed program/project and budget information for project development, implementation monitoring, and evaluation of their projects and programs. There is a similar need for administrative information, principally information that relates to their budgets, contracts and personnel. The predominant emphasis is on timeliness, accuracy and convenience with which this information can be stored, retrieved, and manipulated into reports.

- Central policy and program bureaus need aggregate program and budget information for planning, evaluation, and monitoring. Their requirements are different from the program bureaus in that they are primarily merging, aggregating and manipulating information from multiple bureaus. Their principal need is to be able to do this accurately and efficiently.

- Administrative offices need detailed financial and transactional administrative information for management and control. They need to automate routine processing of data and maintain efficiently very large data bases.

- These fundamental requirements, like the Agency's basic charter, are not likely to change over the next five years; however, the volume of information stored, the number of times the data will be accessed, and the number of individual users can all be expected to rise appreciably.

- Automation requirements for these large data bases indicate the continued need for mainframe computer hardware, which responds to the large size, multiple user and complexity of data manipulation.

- Assuming the need for mainframe support capabilities, one key hardware decision centers on how much hardware is placed locally to provide access, storage and processing capability to individual AID/W offices and bureaus.

(2) <u>AID's Current Mainframe Computer May Soon Approach Prime-Shift Saturation and User Response Time May Degrade Significantly</u>

- Although AID's mainframe is now operating at less than its maximum capacity during prime-shift, there are two reasons to believe that prime-shift saturation may be reached within the next six to twelve months:

- During the last two years, the amount of CPU time utilized during prime-shift has doubled. Much of that growth can be attributed to the development and testing of FACS, but even if the amount of machine time used by FACS development does not increase in the near term, the recent pattern of work load growth indicates that that mainframe configuration could very well reach effective saturation within the next year or two.

- If current estimates of CPU requirements for FACS Phase II are accurate, it is certain that FACS will saturate the "on-line" processor when it is operational. The current schedule calls for Phase II to be mostly implemented by October 1983.

- As hardware approaches saturation, user response time will begin to deteriorate episodically, and user discontent with the service will increase proportionately. Clearly, an upgrade of the current hardware or a complete replacement is required in the near future.

2. FOUR ALTERNATIVE SYSTEM ARCHITECTURES COULD SUPPORT AID/W ADP REQUIREMENTS OVER THE NEXT FIVE YEARS

Alternative system architectures for AID/W must address the issues of control of data processing resources, expansion potential of the hardware, and the ability of the architecture to satisfy user requirements. The technology must also be examined to determine whether the architecture can be effectively operated in the AID/W environment and whether the existing hardware can be integrated with the recommended architecture. Four alternative hardware architectures have been developed:

- Alternative No. 1: Mainframe plus decentralized, small-scale local hardware -- AID/W can continue to rely on a mainframe configuration for primary information processing support. Supplemental processing support can be provided to selected users who can justify the need for it. This supplemental support could take the form of decentralized (non-communicating) minicomputers, microcomputers and/or office automation equipment used for localized processing applications that do not require access to the mainframe data bases.

- Alternative No. 2: Mainframe plus smaller-scale, communicating local hardware -- Like the first alternative, this one would distribute some limited computing power to users at their office locations, but would permit the distributed hardware to be connected to the mainframe when the need for doing so was

clearly evident. This communicating feature would permit local applications that manipulated data obtained from the mainframe data bases. The distributed intelligence would consist of minicomputers, microcomputers and office automation equipment.

- Alternative No. 3: Mainframe plus local hardware linked with a network -- This approach features a full-service local network, linking the mainframe configuation with distributed intelligence and linking all distributed devices together. This alternative would allow data exchange and processing among all equipment, including minicomputers, microcomputers, and the mainframe; however, the primary data would still remain centralized and simply be transferred as required.

- Alternative No. 4: Mainframe plus local hardware housing distributed data bases -- This alternative consists of a distributed data processing network supporting distributed data bases. Each hardware device connected to the local network would house its own information, rather than storing all data centrally on the mainframe. Requirements for a large mainframe processor would decrease as major processing requirements were assigned to the distributed hardware and data bases, with control over distributed data in the hands of users.

(1) A Centralized System Constructed Around A Mainframe, With Only Limited Use Of Decentralized Minicomputer And Microcomputer Technology, Parallels The Existing Architecture

- A centralized architecture consisting of a mainframe capable of supporting all of the large data bases required in AID/W and a limited number of decentralized minicomputers and microcomputers could meet current and future AID/W ADP requirements.

  - The mainframe would have to be expandable to provide increased processing power, main memory and disk storage as processing volume and data storage requirements increase over time.

  - Decentralized minicomputers and microcomputers would be provided to a limited number of users for small, single-purpose applications.

- The mainframe would support a network of terminals and printers for large-scale applications as it now does, but there would be no communications among the minicomputers and microcomputers to/from the mainframe, limiting their applications' flexibility to send or receive data from other processors.

- The centralized approach would allow AID/W to retain a single management structure that controls all data processing resources. Use of mainframe resources, as well as acquisition of decentralized processing capacity, would have to be approved centrally, however.

- Office automation applications would be segregated from data processing applications. Data could not be exchanged electronically among systems, thus retaining individual applications' integrity.

- All major applications development activities would be performed on the mainframe. Decentralized equipment would only be used for unique, single-purpose applications best performed on a stand-alone device.

• This centralized architecture would allow AID/W to retain close control over its data processing resources. Computer support would be provided to users in accordance with an Agency-wide plan, and expansion would be monitored effectively.

(2) <u>A Second Alternative Is A Semi-Distributed Processing Architecture With A Core Mainframe Computer Supported by Both Decentralized and Distributed (Communicating) Minicomputers And Microcomputers</u>

• In this alternative, a central mainframe supports large data base systems, batch processing and multi-user on-line systems.

- Small decentralized (non-communicating) computational and analytical applications would be processed on microcomputers.

- Dial-up or dedicated telephone lines can be used to connect distributed (communicating) office automation equipment and selected microcomputers to the mainframe to extract data from central files to support "local" applications.

- This off-loading of smaller applications to microcomputers and office automation equipment would help to reduce mainframe capacity requirements, but the effects may be slight since most applications performed on the decentralized and/or distributed equipment would likely be small, supplemental applications rather than replacements for mainframe applications. Therefore, the mainframe must be capable of being upgraded in processing power, main memory, disk storage and telecommunications.

- Under this alternative, there would be centralized control over most ADP resources. While it would be impossible to control the use of individual microcomputers, the Agency can limit the budget allocated to custom applications development and require that standard, commercially available software be used on microcomputers.

- AID/W can also control the growth of integrated applications on decentralized and distributed equipment. By limiting the number of communications links from the distributed equipment to the mainframe, AID/W can also pace the development of its local network.

- A limited distributed processing architecture provides AID/W with central control over critical ADP resources.

  - The continued installation of microcomputers should be encouraged, but central control over microcomputer hardware acquisition, software procurement and user training can also be retained.

  - By combining this control with the power to provide access to the mainframe for data, AID/W could create a strong centralized architecture with some of the advantages of a decentralized distributed architecture.

(3) <u>A Third Alternative Is A Fully Integrated Distributed Processing Architecture With Communications Among All Automated Devices In AID/W, Using A Fully Developed Local Area Network to Access and Extract Data From a Centralized Data Base</u>

- AID/W can construct a distributed processing architecture based on a local network, a core mainframe, mini- and microcomputers and office automation equipment.

- By linking all the equipment together, a significant portion of the data processing work load could be shifted from the mainframe, thus reducing capacity, storage and main memory requirements.

- Although all the equipment would be connected, minicomputers, microcomputers and office automation equipment throughout the Agency would also be capable of stand-alone processing.

- This configuration would permit data exchanges among systems as well as the ability to support advanced telecommunications functions.

- Each distributed hardware resource could serve as an individual computing resource, allowing users to process applications independently of the mainframe. With users controlling their own data processing hardware, the resources and central control of AID/W data processing would be fragmented.

- Communications among hardware devices would allow equipment to serve multiple uses. All equipment could exchange data, update master files on the mainframe and serve as a gateway to non-AID/W computing resources, such as time-sharing services and commercial data bases.

- It is, however, relatively difficult to manage a fully distributed architecture, in part because the technology is more complex and in part because control of the resources rests with the users.

(4) <u>The Fourth Alternative, A Distributed Data Processing Architecture Supplemented By Distributed Data Bases, Represents the Greatest Change From Existing Architecture And Depends Upon State-of-the-Art Technology</u>

- Because the majority of AID/W applications are data base-oriented and since, at present, there are mainly centrally-located individual data bases rather than a single integrated data base system, AID/W could develop an architecture that uses a distributed data base concept, the latest technological advancement.

  - Minicomputer and microcomputer resources would be distributed to users for localized processing.

- Data would be stored on the distributed equipment rather than on the central mainframe. When a user requires data from another office's or bureau's data base, the requesting user would use the local network to communicate with the device storing the needed data.

- Data exchange among remote devices over the local network should increase the use of distributed hardware resources and decrease the mainframe work load.

- Users would have the greatest control over their data and computing resources under this alternative.

  - Data in the distributed data bases would be defined and maintained by users in accordance with Agency-wide standards.

  - Users would also have more control and flexibility in hardware utilization, since local control of information requires local control of hardware.

- Central, Agency-wide systems would still require mainframe support. Users could use distributed hardware, such as microcomputers and office automation equipment and the local network, to access centralized information systems.

- The decentralized hardware architecture, enforced by decentralized data storage, places the majority of AID/W ADP resources under the control of users.

- This alternative would represent an even more demanding management requirement than alternative 3 due to the sophistication of the hardware and the high level of user skill demanded to effectively manage local hardware and use the local network.

3. TWO OF THE ALTERNATIVE HARDWARE STRATEGIES ARE NOT DESIRABLE IN AID/W'S CURRENT ADP ENVIRONMENT

Two of the four identified hardware architectures are not viable alternatives for the AID/W hardware strategy. AID/W has already passed the point where the fully centralized architecture, alternative 1, is feasible since there are several communication

links between the mainframe and distributed processing devices, such as Wang OIS's. A commitment to this architecture would require AID/W to reverse several technological advances it has made to increase ADP service levels by providing individual communications links. Conversely, a distributed data base architecture, alternative 4, approaches the limits of current state-of-the-art technology, and AID/W would not be able to fully absorb or manage it effectively at this time.

(1) A Centralized Architecture With Limited Decentralized Procesing And No Communications Support Is Too Regressive and Unnecessarily Limiting

A strategy that severely limited the introduction of microcomputers to AID/W and prevented the development of simple data processing applications on Wang OIS equipment would be both difficult to enforce and inefficient. Microcomputers, using packaged software, can reduce substantially the costs of developing small-scale, local applicatons and can free centralized application design and development resources for other, more critical applications.

- A total prohibition against interconnections between the mainframe computer and microcomputers and OIS systems would either (1) preclude a set of applications that could be handled efficiently on microcomputers if they could easily access appropriate data bases, or, (2) force users to manually input some data to the microcomputers and thereby waste substantial resources.

- Should AID choose an applications strategy that diverts a significant amount of its design and development resources to the resolution of current data base problems rather than new applications, a hardware strategy that permits the reasoned use of microcomputers could help relieve concerns of users by permitting them to develop their own applications.

(2) The Distributed Data Base Alternative Is Unnecessarily Risky

- Because much detailed user data in AID/W is aggregated for reporting purposes, distribution of data bases would complicate most reporting and inquiry applications and make it even more difficult than it is now to ensure data compatibility. Centralized data base systems still provide the simpler reporting and inquiry features.

- Distributed data base technology expertise is not resident in AID/W and is required before any distributed data base approach could be feasible. Because this technology is still state-of-the-art, the acquisition of the expertise, by both M/SER/IRM and users, would be a long-term undertaking.

- Integrated distributed processing with distributed data base technology represents a major advancement into new data processing technology. It has its greatest theoretical advantage when users need infrequent access to data bases maintained by other users. It is at a comparative disadvantage when, as in AID/W, users must frequently access and aggregate data from multiple data bases. AID/W neither requires this advanced technology nor is capable of managing it effectively in the near-term. Therefore, the hardware architecture that utilizes distributed data base technology is not now a viable strategic hardware option for AID/W.

4. <u>THE CURRENT LEVEL OF USER REQUIREMENTS, COMBINED WITH NEAR-TERM ADP REQUIREMENTS CAN BE SUPPORTED BY A CENTRAL MAINFRAME WITH LINKS TO EXISTING OFFICE AUTOMATION EQUIPMENT AND MICROCOMPUTERS ON AN AS-NEEDED BASIS</u>

- The majority of existing AID/W ADP applications require mainframe computer support. Of the planned and other desired applications identified by users, the larger applications (in terms of data volume, number of programs, number of on-line users) require mainframe support.

- Many desired applications, however, can be satisfied efficiently by microcomputers and office automation equipment. Further, users have expressed interest in using microcomputers for stand-alone analysis and data manipulation. Users have also expressed interest in using microcomputers to access data bases and systems external to AID/W (e.g., World Bank, UN, contractor systems, commercial data bases -- ORBIT, DIALOG, etc.), thus enforcing the need for distributed processing support.

- Occasionally, users have specific requirements for data from the mainframe for use in analysis and reporting applications requiring communication between the mainframe and microcomputers or word processing equipment.

  - There is little justification, however, to link all distributed processors to the mainframe on a continual basis. The costs and complexities that would be introduced by a fully developed local network are substantial.

- Rather, an ad hoc, telephone line-based capability for selected devices and a smaller number of permanent, dedicated links should satisfy AID/W hardware requirements for at least the next several years. (See also Chapter IV.)

A centralized mainframe operation ensures that AID/W management can control the majority of ADP expenditures and align ADP efforts with Agency priorities.

- Use of microcomputers and office automation equipment for ADP applications, when justified by users, can increase service levels without diluting central control or creating redundant processing resources.

- If AID/W users increase their ability to use decentralized and/or distributed intelligence in the future, the Agency will be well positioned to shift from a modified centralized approach to a more fully integrated distributed approach.

- There is no apparent need for minicomputers under this alternative, and their use could pose problems.

  - Considerably larger and more sophisticated than microcomputers, minicomputers would offer local users more storage and processing capacity.

  - However, since the larger applications which could run on these machines are already on the mainframe and are needed by multiple users in most cases, housing them on a minicomputer adds considerably to applications and telecommunications software requirements.

  - In equipment capability terms, minicomputers offer no economies of scale compared to the mainframe or smaller-scale equipment, such as microcomputers.

  - Minicomputers require considerably more expert support than is available locally in AID/W bureaus and offices; housing minicomputers in user offices is likely to make this support considerably more expensive than if provided centrally,

regardless of whether the support is through direct hire or contract staff.

5. IN VIEW OF ITS PRESENT MAINFRAME COMPUTER USAGE AND ITS EXPECTED WORK LOAD GROWTH RATE OVER THE NEXT FIVE YEARS, AID SHOULD PROCURE A MORE POWERFUL MAINFRAME COMPUTER WITHIN THE NEXT 12 TO 18 MONTHS

(1) AID's On-Line Model 158 Computer System Is Near Saturation During Prime Shift, And Both The Model 158 And Its Counterpart, Model 4341, Experience Moderate Utilization During Second And Third Shifts

- As previously discussed, the Model 158 on-line system is very busy and possibly near saturation during prime shift, and both systems are moderately busy during all other times.

- The Model 158 processor has been expanded to its largest processing capacity, with only peripheral expansions (e.g., adding disk storage) remaining available.

- The Model 4341 precessor can be expanded from its present Model 1 configuration to a Model 12, providing an approximate 50 percent increase in pure processing power with a potentially smaller (30-40 percent) increase in throughput. However, at this point, the Model 4341 would be at its maximum processing configuration and, therefore, would offer no further potential for the absorption of future work load.

- Therefore, these two processors offer only short-term potential for supporting the future work load growth of the Agency.

(2) AID Needs To Significantly Increase Its Mainframe Processing Power In The Next 12 To 18 Months By Procuring Additional Or Replacement Mainframes For Those Already Installed

- As previously stated, the existing mainframe systems do not offer the significant upgrade potential required to support the AID user requirements for the next three to five years.

- Ideally, AID's strategy for upgrading the mainframe computers can be built upon a single or dual processor configuration, with the decision factors basically being those presented in the previous point.

(3) <u>The Best Long-term Strategy For AID To Employ With Respect To This Mainframe Computer Upgrade Is To Procure A Single Large Mainframe Computer To Replace The Two Exisiting Systems</u>

- Several vendors offer large mainframe computers which are software-compatible with the existing IBM mainframe, such as IBM, Itel, and Amdahl.

- Some large mainframes, such as the IBM 3081 series or similar equipment from another vendor, offer a four- to six-fold increase in power through field modifications. Therefore, a machine of this capacity would adequately serve the needs of the Agency for the forseeable future.

- The operation of a single-processor system is simpler and requires fewer periperhal devices than a dual system such as exists today and yet will not inhibit a selected approach to disaster backup, if management elects to provide such "insurance" (see Chapter IV).

- It can be anticipated that the one-time costs of this upgrade will be on the order of $1,250,000 to $1,750,000, and monthly recurring costs for equipment maintenance will be on the order of $10,000 to $15,000.

(4) <u>The Agency Should Begin Its Investment in New Capacity Now, Beginning with an Interim Upgrade of the 4341 Processor, While Planning a Longer-term, Larger-scale Capacity Increase</u>

The capacity situation is sufficiently tight and the work load unbalanced between the two existing processors in the mainframe configuration that the Agency would do well to upgrade the 4341 in the next few months. This action would have the following benefits:

- Forestall for 12 to 18 months the peaking of utilization of processing capacity, with its attendant problems for users

- Reduce the probability that FACS Phase II's impact, when it comes on-line at the end of Fiscal 1983, will not "swamp" the mainframe and very substantially worsen response times to users of other applications

- Increase the likelihood that an eventual replacement of the dual processor configuration can be made with a more efficient and/or more economical single, large machine, reflecting the continual gains in capacity and value which mainframe processor vendors have achieved.

While the interim upgrade is being implemented, M/SER/IRM will be in a position to begin preparations for the large-scale replacement. Mainly because of government-wide procurement regulations, such acquisitions typically take from 18 to 24 months. Therefore, substantial lead-time is necessary. During this period, other important issues bearing on the large-scale replacement, such as its possible location in Rosslyn, can also be explored and determined.

IV. BACKUP DATA PROCESSING SUPPORT

IV. BACKUP DATA PROCESSING SUPPORT

In 1981 the Agency began to investigate how best to provide a backup data processing capacity. This capacity may be needed in the event of a catastrophe, such as a major fire in the computer center. The premise for having the backup capacity is that AID cannot perform its fundamental mission for more than a limited period of time if it cannot process financial data and certain programmatic data.

Part of the Agency's initial investigation of a backup capacity was linked to the possible need to expand the mainframe computer's storage and processing capacity, and a study was conducted to investigate the concept of a second, "mirror-image" center located remotely from the Universal Building which could satisfy all of the Agency's data processing needs now met on the existing mainframe configuration. As work load growth rates could not be reliably forecasted (see the Baseline report), this particular approach was discarded, although it makes sense to consider possible capacity expansion along with the backup question.

In the study team's view, backup capacity for the mainframe should be examined as though it were a kind of insurance. It is only necessary to meet unpredictable contingencies. This chapter explores the alternatives for putting this "insurance policy" in place.

1. THERE ARE BASICALLY TWO ALTERNATIVES TO PROVIDING SUITABLE BACKUP SUPPORT, ONE RELYING ON AN EMBEDDED CAPABILITY, THE OTHER ON A STAND-BY ARRANGEMENT WITH A COMPUTER SERVICE VENDOR

(1) AID/W's Requirement For Backup Computer Support Is Based Upon The Need to Plan For Long-Term Outages and Catastrophic Destruction of The Computer Center

- The Agency's reliance on on-line processing support for some critical information systems is already significant and will increase even more with the implementation of the Financial Accounting and Control System

- The major goal of FACS is to provide timely, continuously updated financial information to AID/W managers.

- FACS is being designed as a real-time system with heavy emphasis upon on-line data entry and inquiry functions.

- Although the Agency's financial systems are the most time-sensitive applications and are primarily designed for real-time use, they can be inoperative for medium-term periods (one day to seven days) without significant impact to the operations of the Agency through the use of manual reports and procedures.

- The majority of AID/W non-financial applications are also designed to support real-time use during normal operation, but are less time-sensitive than the financial applications; therefore, their temporary outage should not inhibit Agency operation, even during medium-term periods of system outage.

- The use of a coupled dual processor configuration, such as the one in the present data center, is relatively ineffective at fulfilling AID/W's primary need for long-term and catastrophic backup support. The reason for this is that if one of the two units is inoperative, the other may well be inoperative if the cause is a fire, power outage, etc. M/SER/IRM, recognizing this limitation, never intended to use one processor as a backup for the other.

- The most effective protection that the Agency has from short-term system outages is a well planned, managed and implemented program of system's maintenance, including prudent safeguards against fire and physical security threats.

(2) <u>Two Primary Backup Alternatives Exist, One Being a Stand-by Arrangement With a Contractor's Facility, The Other Representing a Division In Total Data Processing Capacity, With One Facility Remote From the Other</u>

- Both types of facilities can provide AID/W with the long-term, catastrophic failure backup protection which is required to operate essential applications.

- Both alternatives can provide the compatible hardware and operating system software upon which a viable backup support operation must be built.

- The primary differences between the two are the public, or shared, status of the public data center/timesharing option versus the wholly-owned status of an AID/W backup center and the one-time and recurring cost differential between the two alternatives.

(3) Alternative One Centers Around the Acquisition of a Second Computer Center Located Remotely From the Present Universal North Center

- In this alternative, AID/W would acquire, either through direct purchase or contract, a backup computer center which is several miles distant from the present Universal North Center.

  - The backup center would contain the AID/W-owned IBM 4341 mainframe (possibly upgraded) with the existing (or enhanced) operating system and application support software.

  - A new IBM-compatible mainframe with an AID/W-compatible operating system and application support software would be procured and installed in the existing Universal North primary computer center. The existing model 158 could either be moved out of the primary center or retained, since its market value is small.

  - The backup center would be dedicated to the operation of FACS and would be accessed through a network of AID/W remote terminals in users' offices. The Universal North center would be used to operate all other on-line and batch systems.

  - Should the backup center that operates FACS suffer a catastropic outage, FACS processing could be shifted to the Universal North center relatively quickly, provided the necessary backup arrangements were in place.

- To make the AID/W backup center functional, M/SER/IRM would have to procure the additional computer and construct the computer center, modify its

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existing networking software and hardware to share the user terminals between the two centers, and establish comprehensive and frequent tests of policies and procedures.

- For networking, the existing telecommunications controller and its software would have to be modified to share the terminals between the two centers, and additional peripheral equipment, such as line switches, may be required.

- With this backup alternative, as well as with any other, comprehensive and frequently-tested policies and procedures for the initiation and operation of the backup support must be established.

- The advantages of this alternative are the complete operational control which AID/W would have over the backup facility and the day-to-day automation support that the center could provide when not employed in emergency use.

- The costs associated with this alternative include both one-time (startup) data center costs and recurring personnel and equipment costs as shown in Exhibit IV-1, following this page.

  - Start-up costs are estimated in the $2.7 million to $3.4 million range.

  - Monthly operating costs are in the range of $48 thousand to $59 thousand, or about $600 thousand to $700 thousand per year.

- If this alternative were chosen, however, it would not obviate the need to upgrade the mainframe computer, as recommended in Chapter III. As a result, the incremental cost of this insurance option is the cost shown in Exhibit IV-1, less the cost of the mainframe upgrade otherwise needed. The net incremental costs, therefore, are estimated as:

EXHIBIT IV-1

Estimated Costs of an Embedded Backup Computer Center

Cost Element	Estimated One-Time Costs	Estimated Monthly Recurring Costs
• Site Development and Leasing (2200 sq. ft.)	$ 350,000 - $ 450,000	3,000
• Hardware Procurement	2,250,000 - 2,750,000	18,000 - 24,000
• Software Procurement	22,000 - 28,000	7,000 - 8,000
• Personnel	-	10,000 - 12,000
• Miscellaneous	$ 100,000 - 125,000	10,000 - 12,000
TOTAL	$2,722,000 - $3,353,000	$48,000 - $ 59,000

	One-Time Costs	Monthly Recurring Costs
Estimated Full Costs of Backup Center	$2,722,000 to $3,353,000	$48,000 to $59,000
Less Cost of Capacity Upgrade	$1,250,000 to $1,750,000	$10,000 to $15,000
Net Insurance Costs	$1,472,000 to $1,603,000	$38,000 to $44,000

- Should AID pursue this alternative under a contractual relationship, it is possible that the one-time costs could be amortized over the life of the contract and that additional savings might be achieved through the investment tax credits the contractor might receive.

(4) Alternative Two is Based Upon the Use of a Public Data Center or Timesharing Service Bureau on a Stand-by Basis

- With this alternative, AID/W would contract with a public data center (timesharing service bureau) for ongoing storage of data files and processing support during periods of outage of the AID/W computer facility.
  - The backup center could be any public or private data center which will contract with AID/W to provide the necessary support, or, it could be any public timesharing facility. In either case, the selected contractor would have to provide compatible hardware, a compatible operating system and packaged application support software.
  - The backup center could be accessed through a dedicated switch or public switched terminals from the AID/W site, or, from locally attached terminals provided on the backup site.
  - When the backup service is in use for long-term, catastrophic backup, AID/W would be charged for data storage, computer and terminal usage; however, when the service was inactive with respect to AID/W applications, only data storage and backup testing charges would be incurred.
- To employ this timesharing data service concept, AID/W would have to negotiate an agreement for data storage, testing and emergency use with the selected facility and either modify AID's existing terminal configuration or arrange for access to public switched terminals for emergency use.

- For networking, the existing telecommunications controller and its software could be modified to share the terminals between the two sites; as in alternative one, public switched terminals could be procured and used from any AID/W location, or available terminals on the backup site and owned by the backup contractor could be employed.

- With this approach to backup, as with any other, comprehensive and frequently-tested policies and procedures must be established.

- The primary advantage to this alternative is that AID/W does not incur the significant one-time and recurring costs associated with the construction and maintenance of a private data center for backup use. In addition, AID/W can hire, as needed, technicians from the public facility to support the backup operations.

- The estimated costs associated with this option include data storage, testing and computer operations costs as shown in Exhibit IV-2.

- These estimates do not include the costs of operating the stand-by system provided by the contractor once it is accessed for emergency use. The costs involved include computer time, ancillary charges for mounting or dismounting disks, and the labor cost of additional technicians and operators. For an outage of a month or less, these costs, though extraordinary, can be considered bearable, given the need to run critical systems. For an outage of several months or more, the costs would be sufficiently heavy that they could rapidly close the gap with the AID-owned alternative, which is initially far more expensive to implement and operate.

2. THE BACK-UP COMPUTER CONCEPT IS ESSENTIALLY INSURANCE, AND, ITS REQUIRED EFFORT AND COSTS MUST BE WEIGHED IN LIGHT OF THE DEGREE OF RISK ASSOCIATED WITH NON-INSURANCE

The staff effort and funds consumed by a viable backup are both significant and ongoing. That is, every facet of the backup approach must be planned, assigned to a point of responsibility and tested, not only during the start-up period, but periodically throughout the life of the backup arrangement.

EXHIBIT IV-2

Estimated Costs of Stand-By Arrangement With a Timesharing Service Bureau

Cost Element	Estimated Monthly Recurring Costs
• Site Development	$ -0-
• Hardware Rental	$24,000 - $30,000
• Telecommunications Cost	$ 1,000 - $3,000
• Personnel	-0-
• Computer Time	$ 5,000 - $10,000
• Miscellaneous	$ 2,300 - $3,000
TOTAL	$32,300 - $46,000

- Policies and procedures will have to be developed and implemented and each will have to be tested on a monthly or, at a minimum, on a quarterly basis.

- Specific policies and procedures will be required for data storage and update on the backup site, data entry and correction, operating system and application support software compatibility, error recovery, and output delivery.

- Staff time will be required from AID/W not only to prepare the required policies and procedures, but also to conduct full operational tests on a periodic basis.

- The required backup effort is significant and remains so no matter which of the backup alternatives is selected. The inverse to this statement is also true; that is, if the effort is minimized and remains unsupported on an ongoing basis, neither alternative for backup support will be effective.

- However, due to the significant cost differential between the two alternatives, the timesharing concept appears to offer a viable level of insurance at the minimum necessary cost.

- The final decision on whether or not to "buy this insurance" must be based upon the desire and concerns of AID/W. It is an unusual step for a Federal civilian agency, or even a private corporation, to take.

  - If backup insurance is deemed desirable, the value of that insurance must be weighed against its start-up and maintenance costs.

  - If the Agency wishes to systematically gauge the degree of risk to the existing computer center, several risk assessment methodologies and specialists in this field are available.

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V. TELECOMMUNICATIONS STRATEGY

V. TELECOMMUNICATIONS STRATEGY

The discussion of alternative hardware architectures for AID/W in Chapter III addressed the general pattern of telecommunications linkages. These linkages would connect the mainframe with distributed data storage and processing power; in these cases, the principal concern is "vertical" telecommunications between centralized and distributed equipment.

This chapter concerns a second, overlapping dimension of telecommunications: linkages between and among AID/W bureaus and offices, and also examines a specialized capacity to distribute cables. The nature of this inter-office communications can be characterized as "horizontal." The key question concerning this type of telecommunications is what arrangements are necessary for the distributed equipment, such as Wang OIS's and microcomputers, to transmit data and text from one device to another.

In creating the capability for this type of distributed equipment to communicate, AID/W can substantially add to the fundamental word processing and smaller-scale data processing capabilities which this equipment serves. If appropriate linkages are established, the following types of capabilities could be added:

- Electronic text and data transmission -- transmission of text and/or data from one device to another to avoid redundant data entry
- Electronic mail -- distribution of memos, letters, messages, etc., from one device to one or more discrete locations
- Electronic calendaring -- "tickler" files and automated support files for the issuance of reminders of meetings and deadlines and to schedule meetings for multiple participants.
- Professional workstations -- office automation devices capable of supporting word processing, data processing, electronic mail, and other office automation functions for professional staff, as well as support staff, use.

One characteristic shared by most of these applications is the need to interconnect most or all offices in order to make automation viable. For example, electronic mail is of vastly diminished utility if the majority of AID users cannot be reached by such transmissions.

1. LOCAL, INTER-OFFICE COMMUNICATIONS CAN BE ESTABLISHED USING THE EXISTING INFRASTRUCTURE OF TELEPHONE LINES AND/OR HIGHER-CAPACITY HARD-WIRED LINES

There are essentially two viable ways to link AID/W bureaus and offices. One utilizes existing telephone lines, while the second requires the installation of a permanent network dedicated to communications for automation equipment.

(1) In The Easiest To Implement Alternative, Telephone Lines Would Be Used On An As-Needed Basis

In this "dial-up" arrangement, one of the two offices wishing to communicate would initiate an ordinary telephone call using modified telephone equipment. Once the receiving office is on the line, the operators at both ends of the conversation would permit their machines to transmit to each other.

The requirements for this approach include special communications software, which can be readily purchased and installed with the types of distributed equipment which AID/W already possesses. In addition, one modem would be needed for each piece of terminal equipment.

This approach is most suited to a low-volume, infrequent type of communication. It requires the most manual intervention, i.e., to establish the connection between equipment, and ties up a telephone line during transmission. It is not suited for lengthy or higher speed transmissions, and becomes inconvenient when transmissions are frequent because of the need to establish contact manually each time communications are desired. However, when frequent communications are required, a permanent, hard-wired telephone-type line can be installed between any two or more pieces of terminal equipment. Finally, because of its intermittent nature, the dial-up approach does not constitute a network. In other organizations it is typically used for communications between two or a very few additional remote locations which need to exchange information infrequently.

Costs for the necessary software and hardware can vary substantially. For the type of equipment installed in AID/W, each pair of modems is estimated to cost as much as $1,500, and the additional software and hardware (e.g., for coupling) for each automated system connected will require on the order of $2,000 to $4,000. Standard local telephone charges would be additional.

(2) Coaxial Cable, Permanently Installed To Connect All AID/W Bureaus And Offices, Would Permit The Highest Volume And Error-Free Communications Through a Local Area Network.

In this most technologically advanced alternative, AID/W would install a permanent coaxial cable among all bureaus and offices with a need to communicate. This cable, much like that used to link workstations to the Wang OIS central processing units, would be dedicated entirely to this communication function. It would be capable of much higher volume and higher speed transmissions than is possible over telephone lines. To use the cable, additional software and hardware would also be necessary, and because of more traffic and multiple use, a substantial controlling device is necessary.

The cabling is very expensive. The necessary controller alone, such as a Wang VS minicomputer and associated software, would cost in the range of $50,000 to $100,000. Thus, cabling the AID/W offices in Main State, where several thousand feet of cable are necessary, would be a significant cost.

Of course, with AID offices dispersed in many buildings in Virginia and the District of Columbia, inter-building connections would be necessary, with telephone lines being the most technologically feasible, and microwave and laser technology being options. Each of these links is likely to be expensive, with several thousands of dollars for necessary equipment, as well as a substantial monthly operating costs.

2. AID/W USERS REQUIRE ONLY LIMITED COMMUNICATIONS AT THIS TIME, AND A SLOWER PACED TELEPHONE-LINE BASED STRATEGY IS SUFFICIENT FOR THE PRESENT, AND WOULD APPEAR TO BE SUFFICIENT FOR THE BALANCE OF THE FIVE-YEAR PLAN PERIOD

The two options for linking AID bureaus and offices described above could, in fact, represent two, successive stages of AID/W telecommunications development. The principal factors governing at what point in time to initiate installation are the nature and volume of user needs.

(1) AID/W User Needs Can Be Met With a Telephone-Line Based Approach

An analysis of the user needs for automated support, which were reported in the Baseline report, reveals only modest needs for a permanent, high-volume local communications network. Instead, communications needs are, in almost every case, confined to the following types of applications:

- Communication with the mainframe from remote data processing terminals, already in place in bureaus and offices, to operate existing systems now housed on the mainframe

- Additional (new) access by one bureau or office to another bureau's or office's application, also using existing data processing terminals for accessing the mainframe

These needs are the predominant theme in both existing applications and the projected applications which users articulate. There were no appreciable needs articulated for inter-office communication, and when these were stated, they were indicated as infrequent and typically less than high-volume.

Accordingly, AID/W communications needs can be satisfied with telephone-based approaches, rather than the more extensive and expensive coaxial cable approach.

(2) The Advanced Technology Of The Coaxial Cable Approach To A Local Network Poses Many Risks, Without Offsetting Benefits At This Time

In addition to the lack of sufficient user need for this most advanced alternative, coaxial cable presents additional problems:

- The technology is not fully proven--there is only a handful of such networks in existence, and they are not yet trouble-free.

- Their expense, with associated controller, cables, equipment and the need for inter-building links, is considerably greater than the telephone line-based approach by at least an order of magnitude.

- To be worth the expense, virtually all AID/W space would have to be cabled; with continual office moves, cabling would extend far into the future, and when AID/W staff are withdrawn from cabled space, some of the investment would be lost, as it is often impractical for technical reasons or not cost-effective to remove installed cable.

- A cable-based local network is the most demanding in terms of management expertise; unlike the other alternatives, this one requires some ongoing attention and maintenance, including some specialized technical expertise which would not be required for a telephone-based approach in all but the rarest circumstance.

As a result, while a coaxial cable-based network may eventually be supportable, it is not now.

(3) Implementation of Inter-Office Communications Should Begin With a Needs-Based Determination of Where Communications Are Needed

The principle which should be followed in beginning to connect AID bureaus and offices with each other is demonstrated need, in terms of volume of information which requires electronic transmission and the frequency of such transmissions. Existing patterns of clearances, the inter-office mail flow, and the number of instances in which documents presently need to be hand-carried provide some of the most promising indicators of where communications may be needed. A set of threshold measures relating volume, frequency, and time-sensitivity needs to be established in order to determine where connections should be made. Based on user needs articulated during this study, it should be expected that most linkages indicated as necessary could be handled adequately through the dial-up approach, and only a few would might likely warrant a hard-wired telephone line, strictly for convenience.

In order to systematically determine where these linkages are, bureaus and offices will have to devote some effort to logging their flows of hardcopy documents to and from other offices. These logs, in turn, need to be analyzed. As the clearance point for communications acquisitions, M/SER/IRM would be the appropriate point to advise bureaus and offices on the necessary logging procedures and to analyze the collected information.

3. AUTOMATED CABLE DISTRIBUTION AND ACCESS, LONG DESIRED BY SOME AID/W USERS FOR CONVENIENCE, IS FEASIBLE USING EXISTING EQUIPMENT

Most AID/W professionals are frequent users of cables. Many would like more timely distribution of cables and on-line access to historical cable data. Therefore, distribution of nonclassified cables directly to, and retrieval of cable information by, remote locations in AID/W is a desired communications application. The timeliness of cable distribution, long a perceived problem but recently improved, would be addressed by this application. Further, the application affords some potential for increased productivity of professionals in retrieval and access of current cables.

(1) The Existing Data Processing Network Can Be Modified To Distribute and Store Cables

- Cable distribution within AID/W presently is constrained by
  - The State Department's stewardship over the system, which keeps AID at arms length from the first processing of incoming cables
  - The classified nature of a limited portion of AID/W cable traffic
  - The manual nature of the distribution, access, and retrieval of cables
- Cables from the State Department REARC System are currently off-loaded to an AID minicomputer where they are printed and manually distributed
- A widely held view among AID/W professionals is that on-line cable access would be beneficial, although it could create an information overload which could ultimately outweigh benefits derived from the support
  - AID/W employees would have access to some cables with only marginal value
  - Paper copies of cables could still be retained by users for reference and personal files, thus lessening the need for and use of on-line access to cables

- With work load backlogged, the more rapid physical receipt of cables may not result in any faster review or action on cables.

The existing data processing communications network can be modified to receive cables from the central REARC minicomputer and store and distribute the cables using mainframe support and existing remote terminals.

- The mainframe would be an effective vehicle for the storage and retrieval of cables. Additional systems software would be required to support such a configuration, and additional disk storage would be required. However, the existing communications network and remote terminals could be used, possibly as-is, or with a potential upgrade in the number of lines and line speed.

- Cables would be received on the REARC Xerox minicomputer and transmitted to the mainframe. The mainframe would transmit cables to bureaus and offices over its network, for printing on its remote printers.

- A user would have to initiate daily access to current cables by requesting all incoming cables to specific addressees to be printed out at the user's location.

- Inquiries to current cables (most recent six months) would be made using mainframe terminals. Inquiries would be received by the mainframe and switched back to the REARC minicomputer for access to historical cable texts.

- Using the mainframe configuration for supplemental telecommunications capabilities is both technically feasible and requires little new telecommunications support.

Using the mainframe as a storage and communcations vehicle makes the most cost-effective use of existing AID/W equipment.

- The central mainframe needs to be linked to the REARC minicomputer by a direct line at an approximate hardware cost of $2,000 to $4,000

- Printers and terminals needs to be added to those offices without equipment already linked to the mainframe. For those offices with terminals but no printers, printers could be connected to existing lines. For offices with no terminals, additional lines or drops may have to be added along with terminals and printers

- Disk storage of about 400 megabytes will have to be added to the mainframe to retain six months of cable data, at a cost of about $100,000 for the purchase of the storage devices.

- Limited systems software will be required to link the REARC minicomputer with the mainframe to handle the message switching and to allow access to stored cables. It should cost about $50,000 to $100,000 to develop this software.

(2) <u>This Project Is Not Sufficiently Pressing to Begin Implementation In The Near Term</u>

Though promising in terms of the added convenience automated cable distribution will provide, this project need not be initiated soon. Cables are being adequately distributed under the current procedures. Furthermore, with several more pressing applications-related needs already in process or under consideration, this project appears relatively unimportant. Accordingly, the Agency can readily defer action until other projects are underway or completed. This would have the added benefit of waiting until major changes in the capacity and telecommunications capabilities of the mainframe are made. However, the likely eventual requirement of the mainframe to serve as the storage and distribution point for cables needs to be taken into account as a requirement in any major modification to its configuration.

VI. STRATEGY SUMMARY

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During the last ten years, AID's automation support services have progressed through two major phases. During the mid- and late 1970's, AID concentrated its automation efforts on taking advantage of the large mainframe computer capabilities that were available to it and preparing for the utilization of advanced office automation technology that was to come. During this period:

- Many new mainframe data processing applications were developed
- Agency-wide data bases were constructed
- Users were provided with remote terminals to facilitate on-line data processing applications
- Users experimented with stand-alone word processing machines
- M/SER/IRM began detailed planning for the installation of sophisticated word processing systems that would change substantially the way in which the Agency's paperwork was produced.

In 1979, a second phase was entered when M/SER/IRM began a planning study for AID's entry into new automation technology. Among the events that have occurred since then are:

- The automated installation of Wang Office Information Systems in most bureaus and offices in FY82 and FY83
- Acquisition of 30 to 40 microcomputers as the first step in distributing computing capacity among AID data processing service users
- Design and development of a sophisticated on-line accounting and financial management system that will automate almost all accounting transactions that were previously performed manually.

As this phase draws to a close, AID must choose its next course of action. In the broadest perspective, its choices are to:

- Aggressively employ the newest technologies and move rapidly towards a future in which professional staff must be sophisticated users and controllers of computing and telecommunications capabilities. In essence, let technology advances drive the pace at which new and expanded capabilities are introduced to AID/W.

- Use the next several years to fully digest and employ the technologies that are now in hand, resolve current problems, and increase user capability so that a sound basis will exist for a major technological step forward in the fourth or fifth plan year.

The analysis described in this report concludes that the latter strategy is much more desirable. This conclusion is based on the characteristics of user needs that will exist over the next five years, the capabilities of AID to absorb new, sophisticated technology, and the basis that will be required to successfully implement the technology that will bring the office of the future into reality.

1. THE RECOMMENDED STRATEGY HAS NINE KEY ELEMENTS

- Upgrade the IBM 4341 processor from a Model 1 to a Model 12, substantially increasing gross processing power and paving the way to improved response time for on-line users, even with the addition of FACS Phase II in the fall of 1983.

- Within the next twelve to eighteen months, replace the current mainframe configuration with a single large mainframe processor that is software-compatible with the existing IBM mainframe. A computer such as the IBM 3083/3081 or similar equipment may be appropriate.

- Take all reasonable steps to protect the security and operational capabilities of the mainframe, such as installing advanced fire protection equipment, reviewing computer room access procedures, and perhaps the periodic archiving of critical data files. The expenditure of additional resources to guarantee backup computer capability does not appear to be warranted.

- Continue to make the development and full operational capability of FACS the highest software application priority and defer other applications activities, if necessary, to assure that the effort is well managed.

- Formulate a project to pinpoint current data base and applications problems and to move towards the rationalization of the Agency's management information requirements. Give equal emphasis to this effort and the effort to develop new applications, but postpone when possible new applications that would compound existing problems.

- To relieve pressures for the development of new applications during the next several years and to encourage the development of greater user sophistication, encourage users to develop microcomputer applications in line with the Agency's recently articulated policy. Supplement the policy with appropriate software documentation requirements.

- Provide dial-up telecommunications capabilities, where warranted, for installed Wang and microcomputer systems to improve AID/W communications capabilities and to test the requirements for future telecommunications capabilities. Where the need can be clearly established, provide a hard-wired communications link between specific microcomputers or Wang machines and the mainframe.

- Conduct a requirements and feasibility study of a cable distribution, archival and retrieval system that utilizes the mainframe and existing remote terminals. If the study supports the action, implement the system within the next several years.

- As FACS nears completion, consider the feasibility of a project to automate AID's personnel transaction processing (that are not yet automated) and consider the need to redesign RAMPS.

- Focus efforts on improving the quality of automation services provided and an upgrade of user capabilities through, among other things:

  - Establishment of user groups to improve communications between service providers and users and to guide the establishment of priorities

  - An improved user training program.

2. THIS STRATEGY IS INTENDED TO POSITION AID/W, WITHIN THE NEXT FIVE YEARS, FOR A SECOND MAJOR STEP FORWARD INTO NEW AUTOMATION TECHNOLOGY

During the next five years, it is certain that automation technology will continue to develop rapidly along the following lines:

- Hardware developments will continue to increase dramatically the amount of computing power that can be put in the hands of users, rather than computer specialists, at lower costs

- Developments in software will make it easier for non-systems professionals to develop their own applications

- Instantaneous data, text, voice, and visual communications will become more estensive, and relative costs will be reduced

- Executive workstations that provide instant information access and decision support capabilities will become more prevalent.

These advances will enable professionals to perform their managerial responsibilities better and to make better informed decisions, provided that (1) the individuals who will utilize the technology have developed a basic facility with it, and (2) a fundamental management framework has been established for determining and organizing the kinds and uses of information that are pertinent to decision makers. If both of these conditions do not exist, the technology will not be utilized well, and professionals may find themselves buried under an avalanche of information that confuses issues rather than clarifies them.

The proposed strategy seeks to avoid these problems by setting as its major objective the establishment of a solid foundation, during the next five years, for a future step forward into its advanced technology. That foundation will be created by resolving the current conceptual and pragmatic problems in AID's data base structure and focusing efforts on developing user capabilities.

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3. ALL OF THE PROPOSED INITIATIVES SHOULD BE STARTED DURING THE NEXT TWO YEARS

Exhibit VI-1 displays a recommended schedule for the proposed initiatives. Upon the finalization of the automation strategy, efforts should be made immediately to establish appropriate user groups (see Chapter VII) and to formulate the data base rationalization project. The latter will probably require three or more years to complete. Priorities in FY84, in order of importance, are:

- Plan for the replacement of the Agency's mainframe computer and implement the plan. This effort should also include a review of the safety and security arrangement for the computer and critical data bases and appropriate upgrades.

- Provide telecommunications capabilities among Wang systems and develop Agency-wide procedures for its utilization. Develop policies for determining when telecommunications links between the mainframe and microcomputers are appropriate, and install capabilities as required over the next several years.

- Conduct a requirements and feasibility study of the suggested cable distribution, storage and retrieval systems.

4. THE MAJOR ELEMENTS OF THE PROPOSED STRATEGY MAY REQUIRE EXPENDITURES ON THE ORDER OF $9.5 MILLION DOLLARS OVER THE NEXT FIVE YEARS

Costs can be roughly estimated (in millions) as shown in Exhibit VI-1 on the following page.

These costs are in addition to basic costs necessary to maintain current services (such as equipment maintenance, personnel, and current levels of contractor support) and to perform other essential functions, such as planning and policy development.

5. A NUMBER OF VARIATIONS ON THE PROPOSED BASIC STRATEGY ARE POSSIBLE

Without abandoning the fundamental intent of the proposed strategy, AID might consider several alternatives:

The timing of the costs associated with the acquisition of a new mainframe computer could be changed by leasing the new mainframe, AID could avoid a major capital outlay in FY84 and instead spread the lease costs more evenly over the plan years

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EXHIBIT VI-1
Estimated Costs of Recommended Strategy

Initiatives	FY83	FY84	FY85	FY86	FY87	Total
New computer center:						
Planning	$0.07	$0.12	-	-	-	$0.19
Acquisition/implementation*	-	-	$1.50	$0.15	$0.15	1.80
Data base rationalization project	-	0.20	0.30	0.30	0.30	1.10
Administrative function automation project	-	0.10	0.25	0.25	-	0.60
ADP system design and development**	-	0.76	1.00	1.00	0.75	3.51
Continued new office automation acquisition**	-	0.45	0.70	-	-	1.15
Telecommunications:						
Near-term incremental expansion	-	0.06	0.06	-	-	0.12
Local area network feasibility study	-	0.15	-	-	-	0.15
Cable system feasibility study	-	0.13	-	-	-	0.13
Training (development/ implementation)						
ADP	-	0.15	0.10	0.07	0.05	0.37
Microcomputer	-	0.10	0.10	0.07	0.05	0.32
TOTAL	$0.07	$2.22	$4.01	$1.84	$1.30	$9.44

* Estimates reflect an AID-owned and operated computer center, which is only one of several possible options; with contractor-owned or operated facilities, costs could be substantially different.

** Figures for FY84 and FY85 are those reflected in IRM June 1983 ABS.

- AID may conclude that it does not wish to accept the consequences of a catastrophic computer outage with a guaranteed backup alternative. If so, it may want to pursue a contractual standby arrangement with a computer service vendor, as described in Chapter IV.

- An alternative to the balanced emphasis between new applications and the proposed data base rationalization project would be to place greater emphasis and more resources on the latter in order to complete the effort more quickly.

VII. MANAGEMENT REQUIREMENTS

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The previous chapter summarized the principal features of the recommended automation development strategy for AID/Washington. There are several elements of the strategy that are demanding, for example, the necessary upgrade in capacity to the mainframe configuration, and implementation of the Agency's new microcomputer resources. No less demanding are several management functions required to keep the accomplishment of planned activities on target, on time, and within budgetary limitations, and, to hasten the absorption of technology by the Agency.

The process of collecting the data needed for this study helped to identify a number of management functions which are not being done or are performed inadequately at present. These functions will be necessary to successfully implement and to maintain the automation program. They include:

- A systematic method of keeping senior-level users involved with automation planning and projects, and to a substantial degree, participating actively in decisions concerning the development of needed applications

- A single point of contact for maintenance and administration of data bases with multiple users

- An up-to-date training program to ensure the maximum exploitation of the Agency's limited automation resources

The recent reorganization of the Office of Data Management should help to contain some of these problems. The new structure emphasizes a single point of access and coordination for users and also includes a workable distribution of automation support functions, including planning and evaluation. Nevertheless, the measures recommended in this section should be implemented; they are fully consistent with the new organizational structure and charter of the new Office of Information Resources Management.

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1. AID/W NEEDS TO IMPLEMENT A TWO-TIERED STRUCTURE FOR USERS TO ACTIVELY PARTICIPATE IN APPLICATION STRATEGY AND TO RESOLVE OPERATIONAL PROBLEMS WITH EXISTING SYSTEMS

The types of concerns voiced by users during this study indicate that communications between them and service providers are not what they should be. Considerable uncertainty exists in most phases of the systems cycle from the standpoint of many users. This affects the quality of service--or the perception of quality--from the system development phase through operational and maintenance activities. Whether real or perceptual in nature, quality concerns tend to accumulate, worsening communications and diminishing the prospects for improvements.

The concerns are widespread and deeply rooted enough to seriously consider devising ways to build more concerted user perspective into the processes of systems development and operations. This is especially important in an environement in which users typically do not budget funds for services.

Accordingly, two tiers of user involvement are proposed. The first permits direct, high-level user participation in the selection of applications to be developed for the mainframe and other automation resources allocation issues, the second to remedy operational problems. The rationale for having two levels of user involvement is that one is essentially an operating policy concern and requires assured top-level involvement and less frequent input, while the latter is more the direct concern of day-to-day system users, typically at the mid-level.

(1) An Automation Development Board Should Be Established to Ensure Meaningful, Top-Level User Participation in Determining the Course of Mainframe Applications Development

Chaired by the Management Bureau, the membership would consist of the AA's and heads of independent offices, or their designees. The specific charter of the Board would be to approve an annual applications development plan. The plan would be prepared by appropriate M/SER/IRM staff after that Office has made a "call" for mainframe application development requirements for both new systems or major modifications. The Board could approve, disapprove, or defer consideration (until a following year) for the plan as a whole, or individual parts (specific projects). In addition to acting on systems development plans and priorities, the Board's membership and perspective are also well suited for dealing with other critical automation resource issues. These include the allocation of hardware resources and establishing levels of support, such as for system operations and maintenance. These issues, too, could be brought before the Board when they are Agency-wide in scope.

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The plan would be developed from an analysis of responses to the call for requirements. The responses would be justifications of need, containing the following information:

- Purpose of the application and identification of how it contributes to the accomplishment of the bureau/office mission
- Relationship to any other existing data base or application
- Some estimate of the size of the data base, how often it would be used, and what type of processing is required.
- Statement of how the mission of the bureau/office would be affected if the requested application is not developed.

This justification statement need not be lengthy, but it needs to be sufficiently detailed to permit analysis and facilitate any subsequent clarifying discussion between M/SER/IRM and the user organization. Inasmuch as the Board's deliberations could have a direct effect on allocations within the M/SER/IRM program budget, the statement needs to be as supportable as possible.

An important part of the analysis of each user request will be to determine if the need can be met by less expensive and/or more expeditious means. For example, the application requested could be patterned on another bureau's existing application. Or, some of the data to be generated by the application may be available in another, existing data base which could be tapped for this additional purpose. This close examination to find possible alternatives is particularly important if the Agency becomes committed to rationalizing its applications and data bases in a multi-year process.

Another important part of the analysis of each user request will be the estimation of the amount of systems development effort needed to meet the requirement. In the process, the analysis would also have to roughly estimate the size of the ongoing systems maintenance work load which would be represented by the application once it becomes operational.

Once all of the requests have been analyzed, they will be arrayed in a sequence for development during the plan year, and those which appear to be unsupportable, for whatever reason, will be identified and a rationale for an exclusion or deferral

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supplied. The plan would then go forward to the Board for review. Bureaus and offices which have submitted application development requests will have the opportunity to review the plan, and append any comments, before the plan goes to the Board.

The Board would make two types of decisions. The first would be to determine if a proposed application or modification has merit, in and of itself. The second--and more difficult--decision will be to reach agreement on the appropriate sequence for development. The plan will reflect M/SER/IRM's best judgment in both cases, but it should be expected that there will be some differences of views on priorities and the appropriate allocation of a limited amount of systems development resources.

Actions taken by the Board would have to be concurred with by its chairperson. Should a bureau or office be dissatisfied with the action taken by the Board with respect to a particular systems development project, an appeal to the Deputy Administrator could be made.

Once the plan is approved by the Board, it becomes a blueprint for the systems development staff and its contractors for the operating year. While the recommended process adds additional staff work and will consume some valuable senior management time, its advantages are considerable:

- Assurance of top-level involvement in the planning for an increasingly important Agency resource--its larger-scale (mainframe) automated information systems

- Provides a forum for any competing user priorities to be examined from an Agency-wide persepctive

- Regularizes the process for requesting mainframe-related systems development support.

(2) <u>A Users Group Should Be Established to Deal With Multi-Bureau or Multi-Application Problems With the Operation of Existing Applications</u>

Individual users of mainframe applications typically deal with one or more M/SER/IRM staff to resolve any problem bearing on the service they receive from the mainframe. Certain problems, however, may affect more than one user, or concern more than one application. This group would be a forum to discuss these broader types of problems and work towards solutions.

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- Examples of the types of issues which would be brought before the users group include:

  - Response time and turnaround time
  - Use of remote terminals
  - Telecommunications problems
  - Training needs
  - Software maintenance
  - Allocation of M/SER/IRM system maintenance resources.

- Any user could be a member, although AA's and directors of independent offices would be encouraged to designate one principal user of each application to represent the bureau's/office's interest in the group. A chairperson would be elected from among the members.

- Attendance would be voluntary; users would deterimine whether they should attend by reviewing an agenda, to be circulated one week in advance of meetings:

  - The agenda would be prepared by an executive committee consisting of representatives of M/SER/IRM, PPC, and one regional bureau.

  - It would be circulated at least one week in advance of the meeting.

- Meetings would be held every other month.

An important caveat in the charter of the users group is that it will not be a client for automation support services itself. While its individual members are by definition clients of IRM, the group should not be viewed as a client which will request studies or any other staff-intensive support from IRM. IRM, as the central provider of service (as well as a user), will be an integral part of the users group, but the staff time the Office can devote to the group needs to be limited so that automation support capacity is available for individual application and user needs.

Finally, it should be recognized that the typical automation user is not technically oriented, and for that reason, highly technical issues would not normally be a subject of its activities. However, with automation-related skills and technical knowledge growing at a fast pace in AID/Washington, there may eventually

be a need for a technically oriented users group. This group could be established and run in a manner similar to that of the general-purpose users group.

2. A DISCRETE DATA BASE ADMINISTRATION FUNCTION NEEDS TO BE ESTABLISHED WITHIN M/SER/IRM TO IMPROVE AND PRESERVE THE INTEGRITY OF AID/W AUTOMATED DATA RESOURCES

As recommended in Chapter II, AID/W needs to move systematically in the direction of the rationalization of the applications and data bases on the mainframe. This recommendation is based not only on the need to improve access to users and the convenience of existing data resources, but also to extend the usefulness of data by establishing standard definitions of data elements and to develop software to inter-relate data bases with common or compatible data elements, and to aggregate data.

The improved capability to make such broader uses of automated data bases is achieved only through the establishment of data discipline and improved communication and documentation. Many organizations, particularly those which are decentralized and have many incompatible data bases, approach this problem by establishing a centralized data base adminstration (DBA) function. AID/W would benefit particularly by the establishment of a full-time data base administration function.

- The data base administration function would have the responsibility to develop and administer data standards (e.g., standard data element definitions), control procedures, and user documentation for all data bases on the mainframe.

- The principal responsibilities of the DBA function are as follows:

  - Review existing applications and work with users to fill gaps in documentation to establish standard data element definitions and data field definitions for input data and output data formats (reports)

  - Determine and identify common data elements across applications, both input and output, and identify multiple data sources and users of identical data, by application and bureau/office

  - Publish and maintain all applications documentation, and take steps to assure its wide availability

  - Assist the AID/W-wide data base rationalization program (see Chapter II).

- The DBA function, which is best located in M/SER/IRM, will take direction from M/SER/IRM management, but would also respond to initiatives decided upon by the Applications Review Board:

  - Work with existing and prospective users to identify data bases which need to be brought up to standard individually and/or integrated with other existing or planned applications

  - Participate with system development staff to ensure that new applications, in terms of their data element definitions, reduce or eliminate problems of non-standard data, redundant data and reports, or impeded access to data bases

  - Exercise "change control" during modifications of existing applications.

3. <u>TRAINING NEEDS FOR MAINFRAME USERS SHOULD BE SYSTEMATICALLY IDENTIFIED AND A PROGRAM FOR FULFILLING THEM DEVELOPED</u>

One of the necessary features of the recent implementation of Wang OIS office automation equipment throughout AID/W was the development of training program, consisting of the identification of training needs, bureau by bureau, development and performance of in-house training, and enrollment in the vendor-provided training. Though much longer in use, mainframe applications have not been subject to as systematic an approach to training, leaving some users with an insufficient understanding of how to use their applications and how to operate remote equipment for maintenance, report generation, and telecommunications.

- M/SER/IRM needs to take an inventory, bureau by bureau, to assess needs for training in the following areas:

  - Data entry
  - Report generation using INQUIRE and other report-generation software
  - Remote terminal operations.

- Individual bureaus, working with M/SER/IRM and M/PM/TD, need to review vendor training, which is typically the only type of training resource used, and consider the establishment of in-house training, particularly for INQUIRE.

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- The adequacy of user documentation needs to be assessed, particularly as to the extent to which it meets application-specific needs.

- Where user documentation for existing applications is absent or insufficient, it has to be created.

- Looking forward to new or modified applications, training needs should be assessed early, e.g., during system development, and a program for training--in parallel to the testing of software and hardware--should be implemented in every case.

- In order to make the most of the capacity of individuals trained in particular hardware and software, i.e., making them available informally as in-house sources of expertise, M/SER/IRM and M/PM/TD need to prepare a roster of trained individuals for circulation. (This should be Agency-wide, in order to deal with the rotation of trained in staff to and from the field.)

- For the newly available microprocessors, M/SER/IRM is in the process of formulating a user training program, which, like the Wang training, can be conducted independently of a mainframe training program.