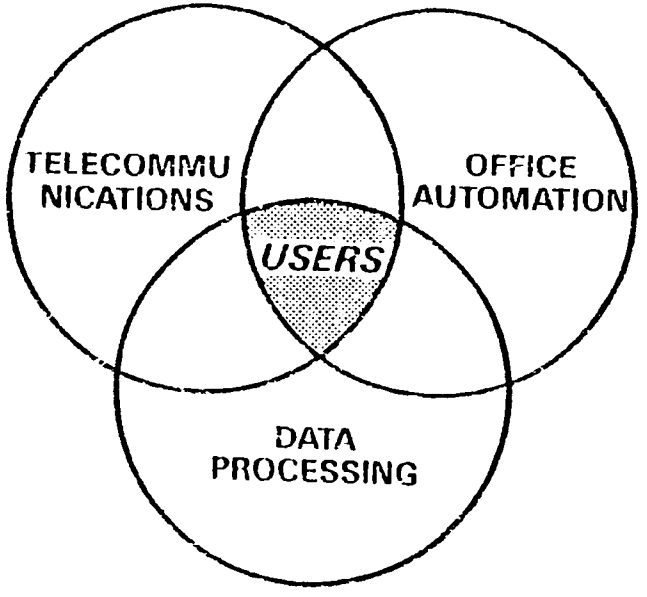
AID

TELECOMMUNICATIONS



STRATEGY FOR THE FUTURE

M/SER/IRM, SEPTEMBER 1984

FINAL REPORT

AID TELECOMMUNICATION REQUIREMENTS AND TACTICAL PLAN

(1985-1989)

Bureau of Management
Office of Information Resources Management
Agency of International Development

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EXECUTIVE SUMMARY

This report presents the results of a study to develop a long-range telecommunications plan for AID. Telecommunications, as broadly defined in the AID environment, include the electronic transmission of information and data between and among automatic data processing equipment (ADP), word processors of all types and microcomputers, as well as the Diplomatic Transmission System or cable system, run by the Department of State.

The purpose of the study was to examine the need for a new telecommunications system for AID and to develop a five-year tactical plan to guide implementation of the recommended telecommunications strategy for AID/W and the USAIDs.

1. BACKGROUND

Exhibit ES-1 summarizes the impetus, objectives and assumptions established in the initial planning for this study which emerged from the convergence of the Agency's continuing development of its information processing capabilities and the advent of new, more "user-friendly" communications technologies.

- AID's increasing familiarity with the communications potential of the existing equipment base has spurred user interest in the development of an integrated telecommunications system to unify the diverse technology components of AID's existing configuration, both in AID/W and the USAIDs.
  - This user interest has been highlighted by the increasingly large demand from the user community (both AID/W and USAIDs) for telecommunications connections to allow them to "dial-up" other users, computers, or data bases.
- Three Department of State initiatives have helped trigger AID's decision to develop a telecommunications plan:
  - The decision by State to purchase a Private Branch Exchange (PBX) to replace the existing telephone system. The PBX will also serve AID and has the potential to be the backbone of a telecommunications system.

EXHIBIT ES-1

STUDY BACKGROUND

IMPETUS

- CONTINUATION OF AID AUTOMATION INITIATIVES
- USER REQUESTS
- EXTERNAL DEVELOPMENTS
  - STATE'S PBX COMMITMENT
  - CABLE IMPROVEMENTS
  - HIGH SPEED NETWORK

OBJECTIVES

- IDENTIFY USER REQUIREMENTS
- ASSESS TECHNOLOGIES
- DEVELOP OPTIONS
- MAKE RECOMMENDATION
- PREPARE PLAN AND BUDGET

ASSUMPTIONS

- MAXIMIZE PRESENT INVESTMENTS
- USE STATE FACILITIES
- FIVE-BUILDING SCENARIO

- State's request that AID reduce the manual processing of outgoing AID cables by providing an electronic link from the AID Communications Center to State's cable transmission system.

- State's agreement to provide leased lines for international communications, apart from the cable system, between overseas posts and AID/W.

. New telecommunications technologies have appeared on the scene in the past two years that promise the capability of connecting AID's growing electronic information processing equipment base. (These new technologies are described in Appendix A.)

2. STUDY OBJECTIVES

The four basic objectives of the study were:

. Determine user requirements and size the traffic a telecommunications system would have to carry within AID/W and between AID/W and the USAIDs

. Assess existing telecommunications technologies in terms of a set of technical criteria, including performance, compatibility, ease of use, flexibility, technological maturity and costs

. Recommend a technical solution for AID/W and the USAIDs

. Prepare a telecommunications tactical plan and develop a budget for FY85 - FY89.

3. STUDY ASSUMPTIONS

From the beginning of the project to accomplish this study, three primary assumptions were developed and followed by the study team:

. Maximize present investments in equipment, software and personnel experience by looking for options which would be compatible with currently installed vendor systems (e.g., Wang, IBM, etc.)

. Use Department of State facilities in all cases possible to eliminate duplication of effort and management.

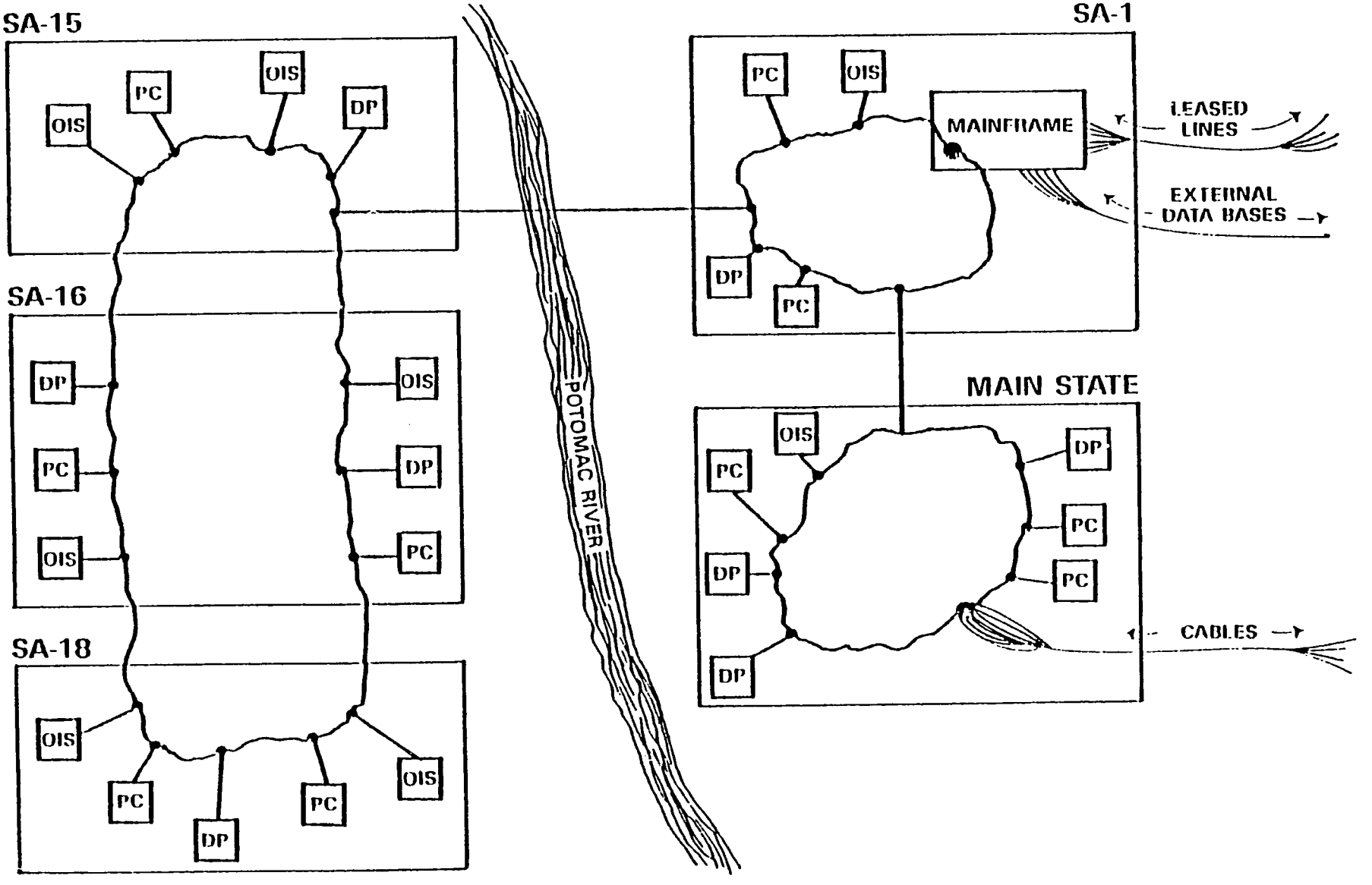
- A five building scenario was used throughout this study, since AID/W is planned for consolidation into five buildings, as compared to the present nine, by June, 1986, for all sizing, costing and developmental projections.

4. CAPABILITY OF COMMUNICATIONS FACILITIES TO MEET AID'S TELECOMMUNICATIONS REQUIREMENTS

- Based on the User Requirements Analysis, there are five primary capabilities that any new integrated agency-wide system would have to support:
  - Communications between office automation equipment for purposes of document and file exhange
  - Electronic mail, a service that allows users to send and receive messages stored in their electronic mailboxes
  - Access to the AID/W main computer for interactive and batch sessions and remote job entry
  - Access to a public data network to provide access to external computers
  - Within AID/W there is also need to distribute incoming cables via electronic links to the recipient offices
- Additionally, any telecommunications system would have to have the capacity to handle the volume of traffic and users projected for AID.
- Exhibit ES-2 summarizes the expected topology of any potential network in AID/W with regard to personnel locations and total traffic volumes within locations as well as between locations.
- The full range of telecommunications requirements described above cannot be met by AID's current communications facilities:
  - The APO, diplomatic pouch, AID/W inter-office mail and courier service are hardcopy distribution media that cannot be transformed into electronic transmission facilities. They are also perceived by users as "too slow."

EXHIBIT ES-2

LOCAL AREA NETWORK



Although other existing communications systems such as DTS, the telephone system and the incipient point-to-point telecommunications system being implemented on office automation equipment are being upgraded and expanded, these systems can only satisfy a limited range of the Agency's requirements.

The Agency is taking steps to provide communications support to the USAIDs, especially the regional financial accounting centers; but to date, this support has been on a case-by-case basis and does not provide the backbone for an integrated USAID-AID/W network.

5. TECHNOLOGY OPTIONS FOR AID/W

During the course of the study the team refined the set of potential technology options to arrive at a set of three alternatives considered best suited to the AID/W environment. These are:

- Local Area Network (LAN)
- PBX (Private Branch Exchange)
- Point-to-Point Communications

These three alternatives, while meeting the projected requirements, provide a wide range of technological options for the future. A brief description of each of the alternatives appears below:

- Local Area Networks

  The Local Area Network (LAN) alternative for AID/W is a distributed type of network or transmission medium that connects information processing devices such as word processors, computers, printers, ADP terminals and other equipment. Control of the various network elements may be distributed throughout the network, at the point where each device connects to the network, or it may be centralized at some network control location, such as the mainframe, or a Network Control Center.

- Private Branch Exchange (PBX)

  The most centralized of the technology alternatives available to AID is the Private Branch Exchange, or PBX, a private, on-premises switching system originally designed to handle telephone communications. The digital PBX

marketed by AT&T, the Dimension 85, that AID is acquiring for voice communications, also has some limited data switching capabilities. It cannot be determined with any degree of assurance at this time that this PBX will be developed sufficiently for use in AID/W for the full range of telecommunications requirements. Control of the PBX network is centralized in the PBX Main Control Center.

Point-to-Point Communications

This communications alternative corresponds must closely to present arrangements for AID/W telecommunications. Connectivity between devices is achieved when needed (although lines may be dedicated for this purpose), and a circuit must be established for each communications session through switching or multiple dedicated lines connected between parties wishing to communicate.

In the AID environment, by far the most practicable form of point-to-point communications would use a mainframe computer as the central switch. (This does not mean that the mainframe on which data processing is performed would play this role, only that a large computer is required to switch and route communications). Connectivity between devices, such as a PC in Rosslyn and a PC in Main State, would be through the independent connection of these devices to the communications controller of the mainframe. Besides connectivity, the mainframe would have software to resolve any differences between the characteristics of the devices attched to it (e.g. line speeds, protocols, etc.).

6. EVALUATION AND RECOMMENDED SOLUTIONS

These alternative architectures were first compared in terms of performance, compatibility, ease of use, flexibility and cost. The LAN scored highest on technical merit, while the PBX was most attractive from a cost standpoint, particularly since much of the PBX infrastructure will be supplied by the Department of State in support of the voice telephone system. The Point-to-Point option scored lowest on technical merit with the highest cost overall.

In comparing each of the three alternatives with regard to its capability to meet the short and long-range AID user requirements, the LAN scored significantly higher than either the PBX or Point-to-Point.

7. RECOMMENDED SOLUTIONS ARE A LAN TO SUPPORT AID/W WITH POINT-TO-POINT COMMUNICATIONS TO THE USAIDS

The recommended telecommunications solution for AID consists of a Local Area Network (LAN) to be installed in AID/W buildings, while USAIDs are given the capability of establishing leased and/or dial-up communications to a variety of equipment connected to the AID/W network. Telecommunications support should also be provided between USAIDs, especially those reporting to a regional centers such as the Regional Financial Management Centers (RFMC's).

The AID/W network will consist of two components:

- A Local Area Network connecting all of AID's equipment for purposes of exchanging documents and files between office automation equipment and providing connectivity to the USAIDs.

- A value-added component, consisting of all other system enhancements, including increased access to the AID main computer, access to external data bases via a public data network tap, electronic mail and, for AID/W, electronic distribution of incoming cables.

The USAID's telecommunications approach consists of two major components:

- Providing connectivity to the AID/W network and/or other USAIDs via the AID/W LAN

- Providing regional network hubs to support posts that have regional responsibility for other USAIDs (e.g., RFMC's, etc.)

The rationals for these solutions are explained briefly in the following paragraphs:

(1) AID/W LAN

Sizing and configuring the local area network for AID/W presupposes that AID/W will be located in five buildings by FY86, as M/SER/MO has projected. According to this scenario, based on staff and office allocation in these buildings and estimated traffic projections, the best solution for AID is a broadband local area network.

A LAN is a distributed type of transmission medium that connects automated equipment for purposes of electronic transmissions. In this case, a broadband coaxial cable network capable of supporting voice, data and video transmissions is recommended, for the following reasons:

- The broadband LAN scored highest on technical merit when compared to alternative telecommunications technologies
  - It offers the greatest performance capabilities in terms of load capability, transmission speed/time response/delays, error detection, maintenance and security.
  - It will be compatible with an estimated 90% to 95% of AID's installed equipment base by FY86, and consequently, with existing protocols, and can be connected to public data networks.
  - It is easy to use from the point of view of users, maintenance and supervisory staff, e.g., screen formats can be designed to make the circuitry "transparent" to the user.
  - It offers great flexibility for geographic expansion and reconfiguration, since equipment can be moved easily from one location to another by plugging it into the connector at the new site. (Broadband cable can be tapped for additional "drops" to user locations, as needed.)
- The LAN approach also lends itself to applications upgrading, should additional value-added functions be desired, such as graphics or video transmissions (for teleconferencing) to support growing user requests for those capabilities.
- The LAN also provides connections to wide-area or metropolitan-area networks, as well as public data networks.

Although the LAN is slightly more expensive than the PBX, especially since a large portion of the infrastructure of the PBX will be installed as part of the new telephone system, the technical advantages make the LAN a safer investment for AID at this time. Should PBX technology become more mature in its data handling capabilities, the LAN can also be integrated with the PBX to provide even greater connectivity and flexibility for AID's equipment base.

The network layout recommended for AID/W consists of two broadband coaxial cable networks, one connecting Main State and SA-1, and another located in Rosslyn (SA-18), with twisted-pair wiring (e.g., telephone-type wire) providing access to the network for AID/W staff in SA-15 and SA-16. The use of broadband coaxial cable in the three buildings is warranted by the high terminal/workstation density.

The two LANs would be tied together via leased lines crossing the Potomac River, probably as several channels on a line owned or leased by State as part of the Dimension 85 System.

(2) The Value-Added Network in AID/W

Value-added functions such as additional and more flexible access to the main computer, electronic mail, electronic cable distribution and access to other computers via a public data network can best be supported by a LAN.

- Value-added functions can be added to the network incrementally, e.g., phased in over time, as user needs and system capabilities change.

- Two cable enhancements recommended for implementation are value-added components of the network:

  - Automating the reverse link between AID's Communications Center and State's cable transmission facility

  - Providing AID/W offices with the capability of transmitting cables created on word processing equipment directly to the AID Communications Center for transmission overseas.

- Additional cable system enhancements may also be considered, such as:

  - Providing on-line cable queries from a cable data base housed on a computer in the AID Communications Center or on the AID main computer

  - Providing for electronic distribution throughout AID/W of incoming cables.

(3) Telecommunications for the USAIDs

A three-pronged approach is recommended for implementation of the USAID-based telecommunications system, depending on the level of automated support the USAID enjoys. Different types of hardware and software communications will be required to equip missions, depending on their existing automation capabilities:

- USAIDs with VS equipment, possibly also including an OIS, as well as microcomputers
- USAIDs with OIS equipment, also including microcomputers
- USAIDs with microcomputer only

Depending on the capability of the installed hardware and the installation schedule determined in concert with the Department of State, two types of telecommunications connections will be made from USAID's to AID/W:

- Point-to-point communications from VS equipment in the USAIDs to AID/W, via leased circuits provided by the Department of State
- Point-to-point communications from VS, OIS and microcomputer equipment from the USAIDs to minicomputers located on the AID/W distributed network, e.g., the broadband LAN.

Additionally, direct communications between USAIDs will be established, either via the Department of State's communication centers or via commercial dial-up lines, in those instances where regional responsibility for information processing exists, or where acceptable long distances links are unavailable.

Initially, until the LAN is installed, point-to-point communications between equipment in the USAIDs and AID/W will be put into operation. The amount of active user intervention and coordination will be much greater than will be the case when the LAN is in place. Moreover, some USAIDs with VS equipment will begin routing transmissions via the mainframe where it can be queued and stored until the recipient office in AID/W retrieves it. Typically, AID/W offices power down their OIS equipment in the off hours. Since transmissions cannot occur unless there is some queuing or store and forward capacity, it is expected that most USAID-AID/W transmissions will be channeled via the mainframe in this fashion until VS minicomputers on the distributed LAN take over this function.

Gradually, as the LAN is installed in AID/W buildings, a more "transparent," user friendly type of communications capability will exist between AID/W and the USAIDs, which will allow generic addressing of messages and access to data bases dynamically.

8. BENEFITS ACCRUING FROM THE PROPOSED SOLUTION

The benefits anticipated to accrue from the implementation of an integrated telecommunications system throughout the Agency would fall into three major categories:

- Measurable cost savings of an estimated $2 Million/Year -- The greatest direct cost savings would be reflected in reduced telephone bills, especially between AID/W and the USAIDs and travel, e.g., fewer TDYs. (Exhibit ES-3).

- Better Utilization of Professional Time -- It is estimated that between four and seven million dollars worth of professional direct-hire staff time per year could be used for more productive activities if a telecommunications system were in place and fully utilized. (Exhibit ES-4 estimates potential savings by reallocation).

- Intangibles -- The major "intangible" benefits would consist of reduced project cycle time, coupled with higher quality information and a reduction in the amount of paper circulating within the Agency (Reform 88).

These estimates were obtained directly from AID/W and USAIDs via the Requirements Analysis and from productivity improvement estimates based on a study of the impact of introducing automation technologies in the Fortune 500 and large government agency environment.

9. MANAGEMENT ISSUES AFFECTING IMPLEMENTATION

During the course of this study, a number of management issues have been identified which need to be considered and acted upon in conjunction with the detailed design of a telecommunications network:

- Information Resource Management issues concerning the expanded access of users to data and the proprietary (ownership) of the data. Distributed data bases resulting from this access need to be assessed with regard to their 'official' standing.

EXHIBIT ES-3

BENEFITS — ESTIMATED DIRECT COST SAVINGS

$2 MILLION PER YEAR

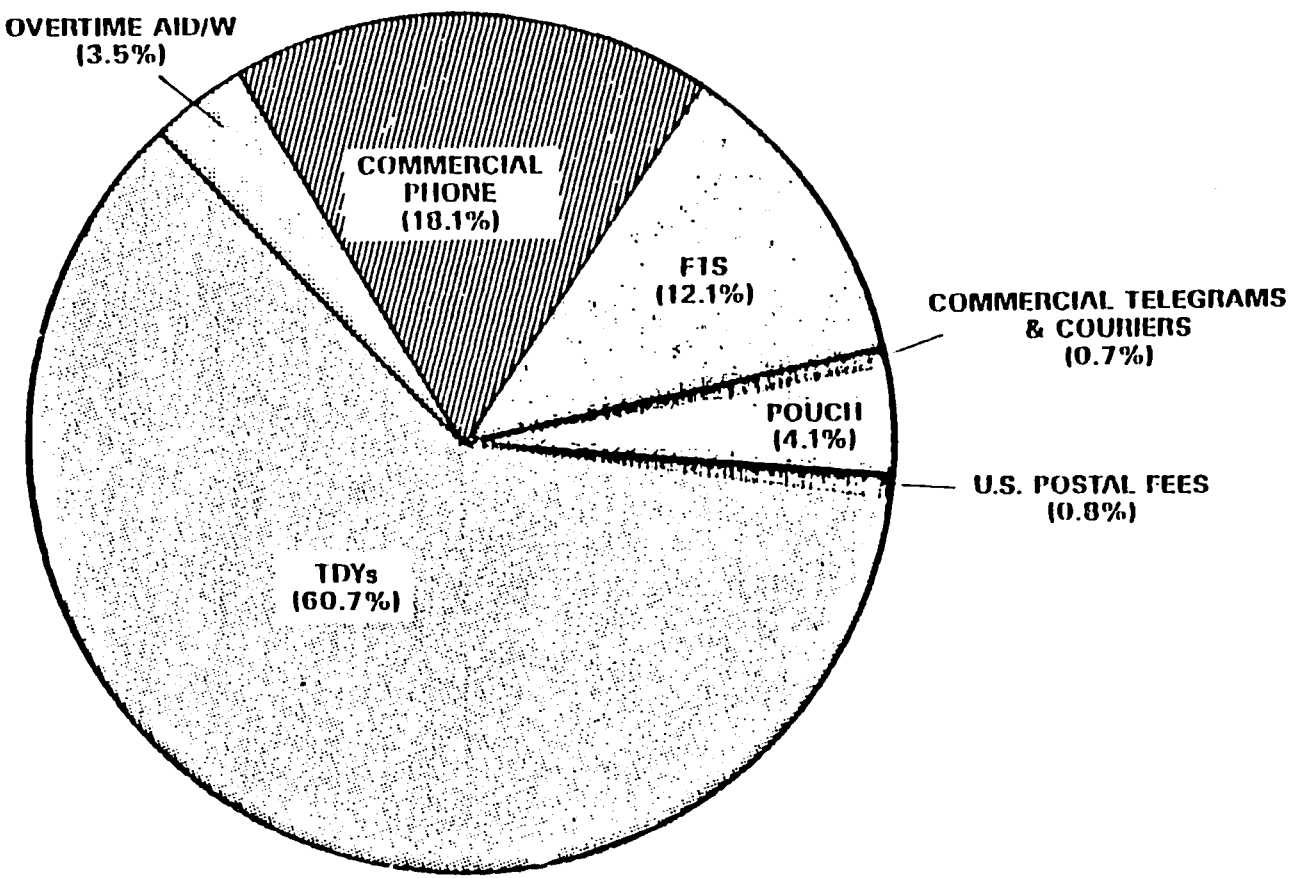
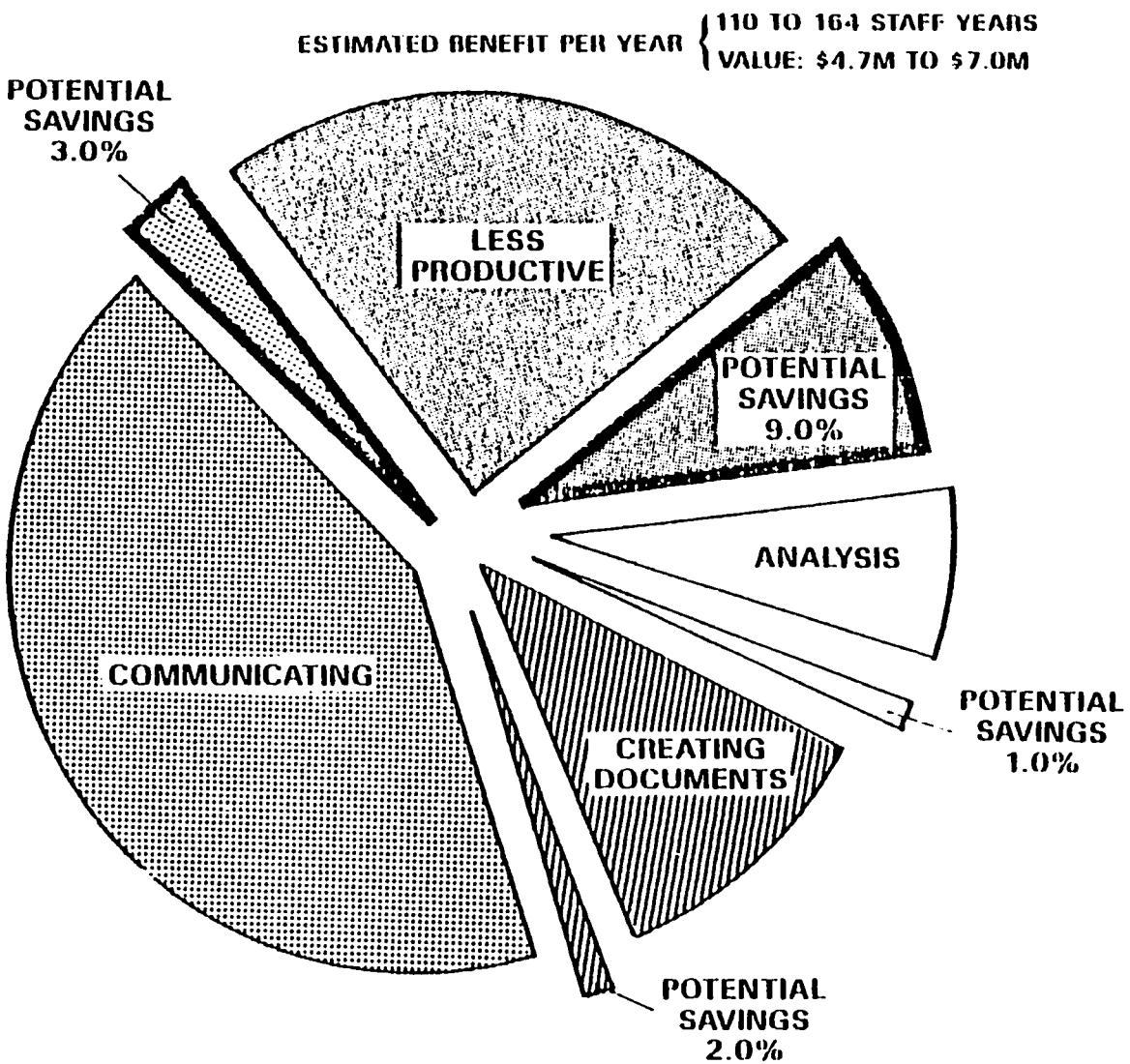


EXHIBIT ES-4

BENEFITS — REALLOCATION OF PROFESSIONAL TIME



- Cable related issues concerning what procedures are necessary to handle electronic signatures of outgoing cables (or any documents being transmitted via the network). Electronic storage of cables, limiting access to cables and/or cable database.

- System managerial issues concerning how the telecommunications function will be organized and staffed. Arrangements for 'local' management of the telecommunications in the USAIDS and in AID/W offices as well as how the centralized management functions in relation to the local organizations on matters of:

  - Training
  - User help and operational assistance
  - Applications design and development.

- User training will, just as the introduction of office automation and micros did, require the establishment of suitable user training and support capabilities.

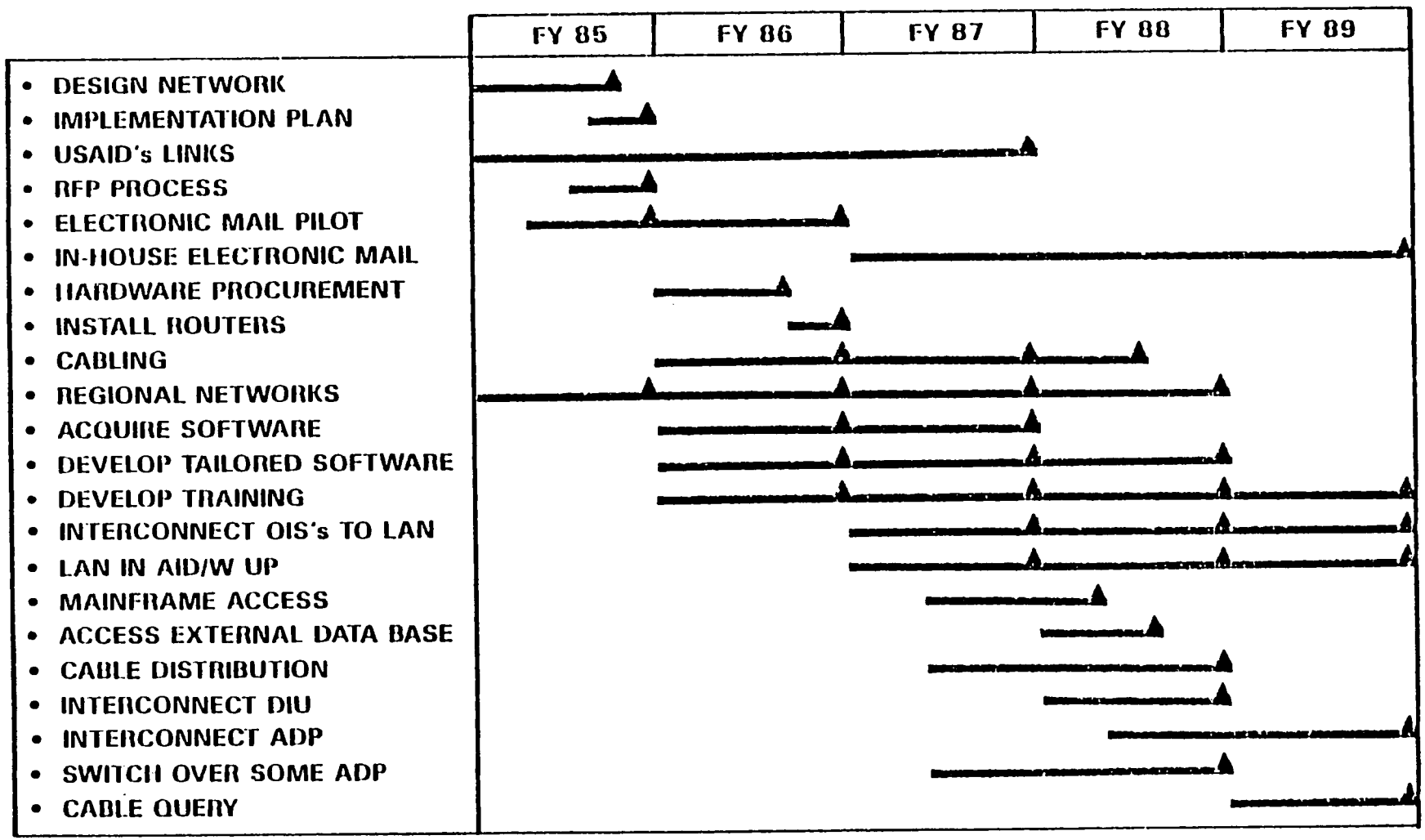
10. IMPLEMENTATION PLAN AND COSTS

Exhibit ES-5 and ES-6 depict the general plan at a very high level. ES-5, represents a bar chart showing the major tasks and projected target deliverables, while ES-6 shows the expected 'annual status' of the major functional components of the network.

A summary of the overall cost of implementing the recommendations outlined in this study are included in Exhibit ES-7.

EXHIBIT ES-5

AID TELECOMMUNICATIONS SYSTEM IMPLEMENTATION PLAN



*LINES WITH MULTIPLE MILESTONES REPRESENT DIFFERENT PHASES, E.G., BY BUILDING, MISSION, ETC.

EXHIBIT ES-6

AID TELECOMMUNICATIONS

COMPONENT MILESTONES

	FY85	FY86	FY87	FY88	FY89
AID/W BASE NETWORK	Design & Procurement	New State SA-1	Rosslyn	Maintenance	Maintenance
USAID MESSAGE SYSTEM	Design & 10 USAIDS	13 USAIDS	14 USAIDS	Maintenance & Continuance of Migration USAIDS	Continuance of Migration USAIDS
ELECTRONIC MAIL	Pilot Test Procurement	New State & SA-1	Rosslyn	Maintenance	Maintenance
CABLE DISTRIBUTION	Design	Procurement & Installation	Migrate into E-Mail	Maintenance	Maintenance
CABLE (AID-STATE) LINK	Design	Coding-Testing Installation	Maintenance	Maintenance	Maintenance

OTHER MAJOR INITIATIVES

* CABLE DATA BASE
* CLEARING HOUSE
* INFORMATION CENTER

EXHIBIT ES-7

AID TELECOMMUNICATIONS SYSTEMS

ESTIMATED BUDGET SUMMARY

	FY85	FY86	FY87	FY88	FY89	Total
AID/W Local Area Network & Overall Design						
. Non-Recurring Costs (one-time)	300	1740	850	150	150	3190
. Recurring Costs	200	750	700	700	700	3050
Total AID/W Network	500	2490	1550	850	850	6240
Other Functions						
. USAID Links	170	390	270	150	100	1080
. Cable System Distribution		300	300			600
. Electronic Mail	150	250	50			450
Total Other Functions	320	940	620	150	100	2130
Grand Total	820	3430	2170	1000	950	8370

11c

II. CONCLUSION

To conclude, by harnessing the present convergence of technology and integrating by means of telecommunications, office automation and data processing, the management of the Agency not only increases the productivity of the organization but assures for the Agency the following untangible benefits.

- A higher value-added dimension to information by increasing its timely delivery where and when needed

- By increasing the number of communication channels new sources of information become readily available where they may have a higher impact

- Networking, by its nature, allows management maximum flexibility in planning control and operations, since time and distance constraints are, if not eliminated, at least reduced extensively

- Finally by increasing the usage of telecommunication among the geographical distributed parts of the organization, concensus - which is an intrinsic characteristic of the culture of the organization - is reached in a more timely, economical and efficicant manner, thus assuring management an optional working environment.

1. BACKGROUND AND INTRODUCTION

I. BACKGROUND AND INTRODUCTION

This report presents the results of a study to develop a long-range strategy for the further development of AID's telecommunications. Telecommunications, as broadly defined in the AID environment, include the electronic transmission of information and data between and among automatic data processing equipment (ADPE), word processors of all types, microcomputers, and the cable system. Transmission can occur over ordinary telephone lines, leased lines, coaxial cable or in wireless form, such as by microwave or satellite, as in the case of the cable system.

The study was conducted by a team from the Bureau for Management, principally the Offices of Information Resources Management (IRM) and Management Operations (MO), with the support of three contractors. Begun in January 1984, the study generated results which were presented in briefings to senior managers in the Management Bureau in August and September 1984.

1. STUDY PURPOSE

This study is part of the Agency's continuing development of its information technology, which has received considerable management attention and budget, as well as increased utilization, in the past several years.

(1) User Requests

A major impetus for this study came from users in the missions and AID/W where approximately several hundred word processing, microcomputer and ADP terminals are now installed. Users have expressed a rapidly growing interest in expanded and more sophisticated telecommunications than they now have for several reasons:

- AID's interoffice mail, State's pouch system, and hand carriers are believed to take too much time for many kinds of document and message transmission, especially with regard to the USAID-AID/W communications.

- Most end user equipment, apart from the ADP terminal network, presently have minimal, if any, telecommunications hardware and software. Data for input and outputs need to be transmitted in hardcopy form, in most cases.

- Many new application software packages, especially for word processors and microcomputers, have or are suitable for telecommunications, but are not sufficiently exploited by the Agency.

The user interests have been highlighted by the increasingly large demand from the user community (both AID/W and USAIDS) for telecommunications connections (e.g., the Latin American Bureau has requested the ability to 'dial-up' all posts in the region from its WANG OIS).

(2) External Developments

In addition to user requests, a number of State Department-related developments helped to trigger the initiation of AID's own telecommunications strategy study:

- The Department has committed to buy an advanced private branch exchange (PBX) which will also serve AID staff in Washington. It is expected to provide not only sophisticated voice communications, but also serve as a potential channel for sending and switching data communications.

- State wishes to reduce some of the manual processing of AID's outgoing cable traffic, necessitating the identification of ways to provide this traffic in electronic form from the AID cable room to the State cable room.

- The Department is beginning to provide leased lines for international telecommunications, apart from the cable system, between overseas posts and AID/Washington, as part of a recently signed inter-agency agreement.

There is also reason to conduct this study due to the substantial amount of hardware and software acquisition budgeted or planned as part of the ongoing AID information technology program. These acquisitions include the significant upgrade in AID's mainframe computer capacity in the last half of FY84, as well as continued increases in word processing and microcomputer systems in AID/Washington and the missions.

2. STUDY OBJECTIVES AND METHODOLOGY

The study was chartered with four basic objectives, which are described in detail below.

(1) Determine User Requirements

As noted above, user requests for assistance in telecommunications center upon their needs to communicate in electronic form, not only to connect with data sources and the consumers of their outputs, such as documents, but also to do this more rapidly than present communications facilities allow. Therefore, the study had to be founded upon a characterization of how users employ ADP and office automation. Many telecommunications needs are, in fact, embedded in the processing of the data they receive and generate.

Accordingly, requirements of AID/W and the missions had to be understood in the following terms:

- Information processing functions of user offices and missions, present and desired

- Current and projected flow (automated or not) -- "traffic" -- of information between and among offices, so that additional telecommunications facilities would be sized and connected appropriately.

(2) Assess Technologies

Telecommunications technology is developing so rapidly that among many different alternatives, there are significant differences in technical risks and costs, in addition to capabilities, which senior management needs to be aware of before embarking on a major initiative and acquisition program. The purpose of this assessment was to screen all candidates and explore those which appeared to be capable of meeting requirements. The assessment covered the following points:

- Capabilities and capacities of hardware and software for transmission, switching, interfacing, and control of telecommunications

- Degree of maturity of what is available, and any associated risks

- Technical feasibility of using the equipment to meet AID's specific requirements

- Compatibility with existing and planned additions to the installed base of AID's office automation and ADP equipment

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- Costs of equipment--investment and operational
- Organizational impacts, both on managers of telecommunications and on the users.

(3) Develop Options and Recommendations

From the study's outset, it was clear that requirements would be multi-faceted and that there would be more than one technology which could satisfy AID's needs. Accordingly, it was determined that at least three well constructed alternatives would be developed and evaluated on technical, management, and cost factors. Also, since none of the technological alternatives had to be "pure" for technical reasons, the study team considered a variety of hybrids which could combine practical features of different technologies.

The evaluation was anticipated to lead to the identification of one most advantageous recommendation for an AID telecommunications network. A primary purpose of this report is to present the facts, conclusions, and this alternative to enable senior management consideration of the alternatives and their respective strong points and shortcomings.

(4) Prepare Plan and Budget

Each of the alternatives was to be costed to provide estimates of investment and recurring costs. As implementation was believed to be a multi-year proposition, the costing also represents a multi-year projection of budgetary requirements and impacts. Following AID budgetary procedure, detail was provided for the next two budget years, FY85 and FY86, but figures were also provided for the balance of the five-year plan period.

An implementation plan was also outlined including such items as planned acquisitions, pilot tests, additional studies, and recommended responsibility and timing for each step. In addition, a number of significant management issues, apart from the fundamental technological choice for the network, were also articulated in such areas as information resources management and training.

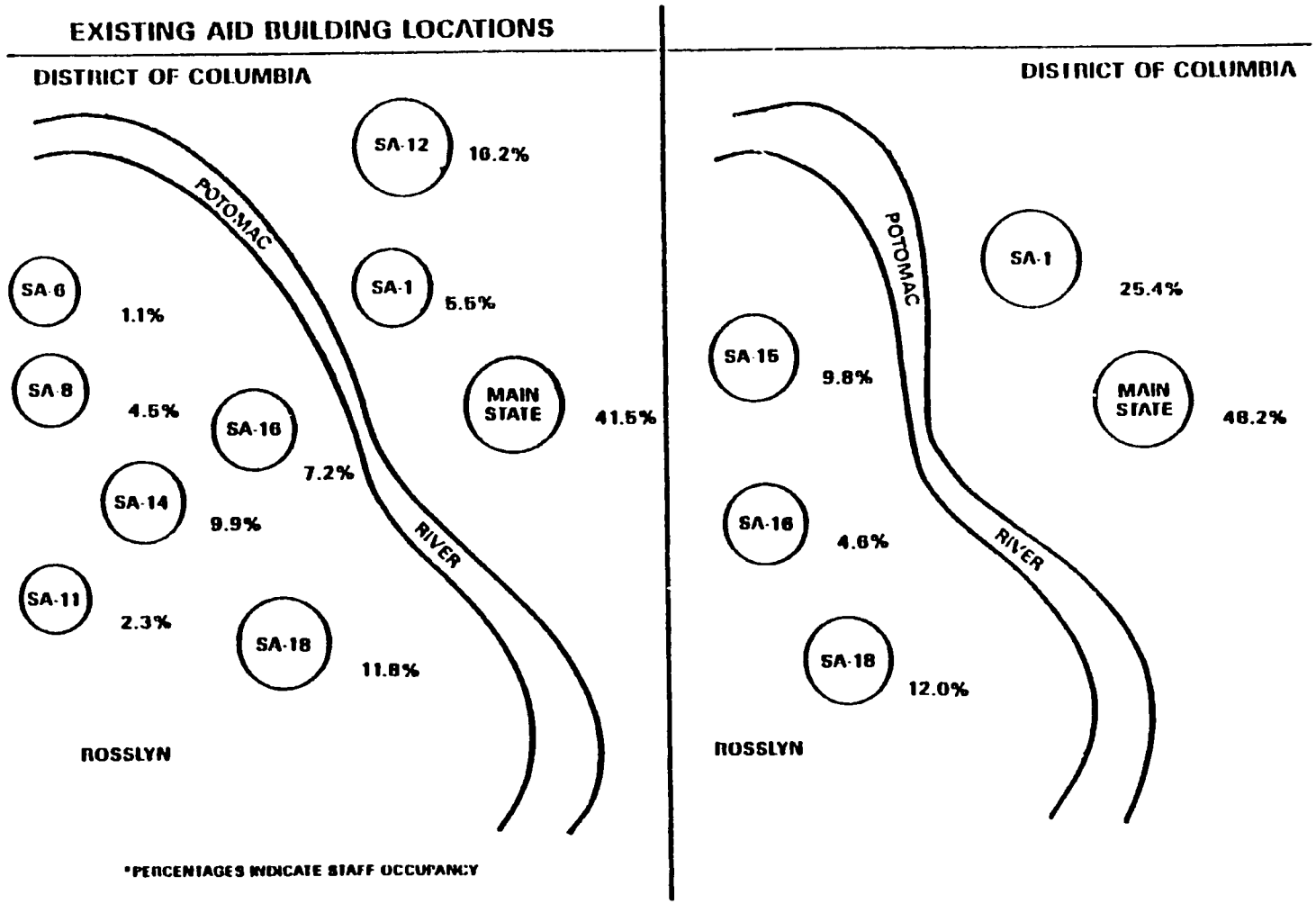
The project implementation plan delineates:

- Description of the activities and their sequence over a multiple-year period

EXHIBIT I-1

STUDY PARAMETERS AND AID'S "SPACE FUTURES" SCENARIO

AID/s "SPACE FUTURES" SCENARIO — JUNE 1986



*PERCENTAGES INDICATE STAFF OCCUPANCY

- Responsibility for implementation
- Resources:
  - Agency funds for investment and operations
  - Human resources, both direct hire and contractor, where appropriate.

3. BOUNDARY AND SCOPE ASSUMPTIONS

A complex study of this nature requires several assumptions, which were developed by the study team after initial work and approved by the IRM and MO task force overseeing the project.

(1) Geographical and Facility-Related Assumptions

- Since AID/W is planned for consolidation into five buildings (compared to the present nine buildings) by June 1986, all sizing projections, e.g., for volume and pattern of telecommunications traffic, need to reflect the five-building lay-out designated by SER/MO, as shown in Exhibit I-1.
- Alternative networks for AID/W need to show alternatives for each building (intra-building network), as well as for the links (trunks) between buildings.
- For the purpose of this study, in line with the capabilities of telecommunications devices and software, each overseas post is considered to be in "another building" connected with the AID/W network.
- The fundamental building blocks of a network within buildings are bureaus and independent offices, of which there are 23; these organizational units were the level used for accumulating data on users' requirements.

(2) Equipment-related Assumptions

- Since AID has a large investment in IBM and Wang equipment, telecommunications solutions should seek to employ this existing equipment to the greatest extent possible. Additional equipment acquired by AID should be compatible.

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Since AID, with the State Department, is committed to acquiring the Dimension 85 PBX, careful consideration had to be given to using that system not only for voice communications, but also for data transmission and switching, where possible.

Because the acquisition of an upgraded mainframe computer configuration is underway and the IBM 4341 processor will be freed up in the process, use of this machine for network control and telecommunications applications needs to be carefully considered, as does the impact of the network on the new mainframe being acquired.

(3) Cable System-related Assumptions

The State Department cable system and links between it and AID's cable room will be kept intact and will remain AID's only classified telecommunications network. (Because of prohibitive cost and AID's small amount of classified traffic, the AID networks evaluated will be unclassified.)

AID will have additional international telecommunications capacity, apart from the cable system, in new, non-secure lines provided by State; 5 to 10 missions will be so linked by the end of 1985, and others, through 1988.

These lines (2400 Baud, synchronous) are to be used for communications with the mainframe (queries, for example), transmission of bulk text (such as project papers), etc.

These facilities will not only provide more capacity, but also permit AID to directly control transmissions, without all of the procedural requirements of the secure cable system, for appropriate kinds of traffic.

4. ORGANIZATION OF THIS REPORT

This report is organized into four chapters, as follows:

Chapter I has described the goal, scope, objectives and assumptions of the study.

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- Chapter II describes AID telecommunications requirements, including user needs and estimated traffic flows, and the telecommunications requirements of the existing installed equipment in AID/W and the USAIDs.

- Chapter III presents the alternative telecommunications solutions (networks) with their rationale, based on the analysis of requirements and technology.

- Chapter IV analyzes the alternatives, costs them out, and presents an implementation plan.

A sizeable set of appendices support the body of the report and the methodologies used are explained. M/SER/IRM has on file a more detailed set of supporting materials in the form of project working papers.

II. TELECOMMUNICATIONS REQUIREMENTS

II. TELECOMMUNICATIONS REQUIREMENTS

This chapter presents the findings of the requirements analysis conducted for this study. That effort comprised a set of discrete activities, including:

- Assessing user needs in AID/W and selected USAIDs
- Mapping of existing traffic flows and distribution patterns
  - Within AID/W
  - Between AID/W and selected USAIDs
  - Between selected USAIDs
- Mapping and sizing existing AID cable traffic and internal distribution patterns, e.g., inter-office mail, within AID/W and between AID/W and the USAIDs
- Compiling hardware/software inventories in AID/W and the USAIDs
- Projecting equipment, staff and traffic.

All of the information collected is presented here as if AID were now housed in the five buildings M/SER/MO has planned for AID/W use by June 1986. However, data were collected at the organizational level, thereby permitting the re-aggregation of data should AID/W's "space futures" change.

The findings presented in this chapter are supported by appendices which describe the methodology of each component of the requirements analysis and summarize the major findings. A full set of working papers is on file in M/SER/IRM.

The remainder of this chapter is organized as follows:

- Part I -- The Existing Telecommunications Environment of AID. Contains a discussion of AID's existing telecommunications hardware in both AID/W and the USAIDs, including hardware, software, lines and communications protocols.

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- Part II -- Telecommunications Requirements. Describes the telecommunications requirements and user priorities identified from the information supplied by AID/W and USAID staffs.

- Part III -- Existing Traffic Loads and Projections. Includes data, text and cable traffic analyses for FY84 and FY86

- Part IV -- Equipment Projections. Describes the equipment projections developed by the study team, including IRM analysts, in line with staffing pattern projections.

- Part V -- Implications of the Requirements Analysis for AID's Telecommunications Future. Explains IRM's telecommunications goals and objectives and highlights some of the costs and benefits that would result from an enhanced telecommunications system, for AID/W and the USAIDs. Management implications and issues are also identified.

PART I. THE EXISTING TELECOMMUNICATIONS ENVIRONMENT OF AID

This section discusses the existing telecommunications environment in AID/W and the USAIDs.

1. AID'S TELECOMMUNICATIONS SYSTEM IS COMPOSED OF SIX SUB-SYSTEMS

AID's existing six sub-systems are:

- A telephone system that carries voice transmissions only, with FTS and WATS capabilities.

- A terminal network consisting of three basic types of data terminals extends throughout AID/W and provides communications from all AID buildings to the IBM mainframe computer.

  - This network contains remote job entry (RJE), IBM emulation (3270) and the older teletype (TTY) terminals, as well as printers. There are currently 82 IBM emulation terminals, 61 teletype terminals, three remote job entry terminals and 49 printers.

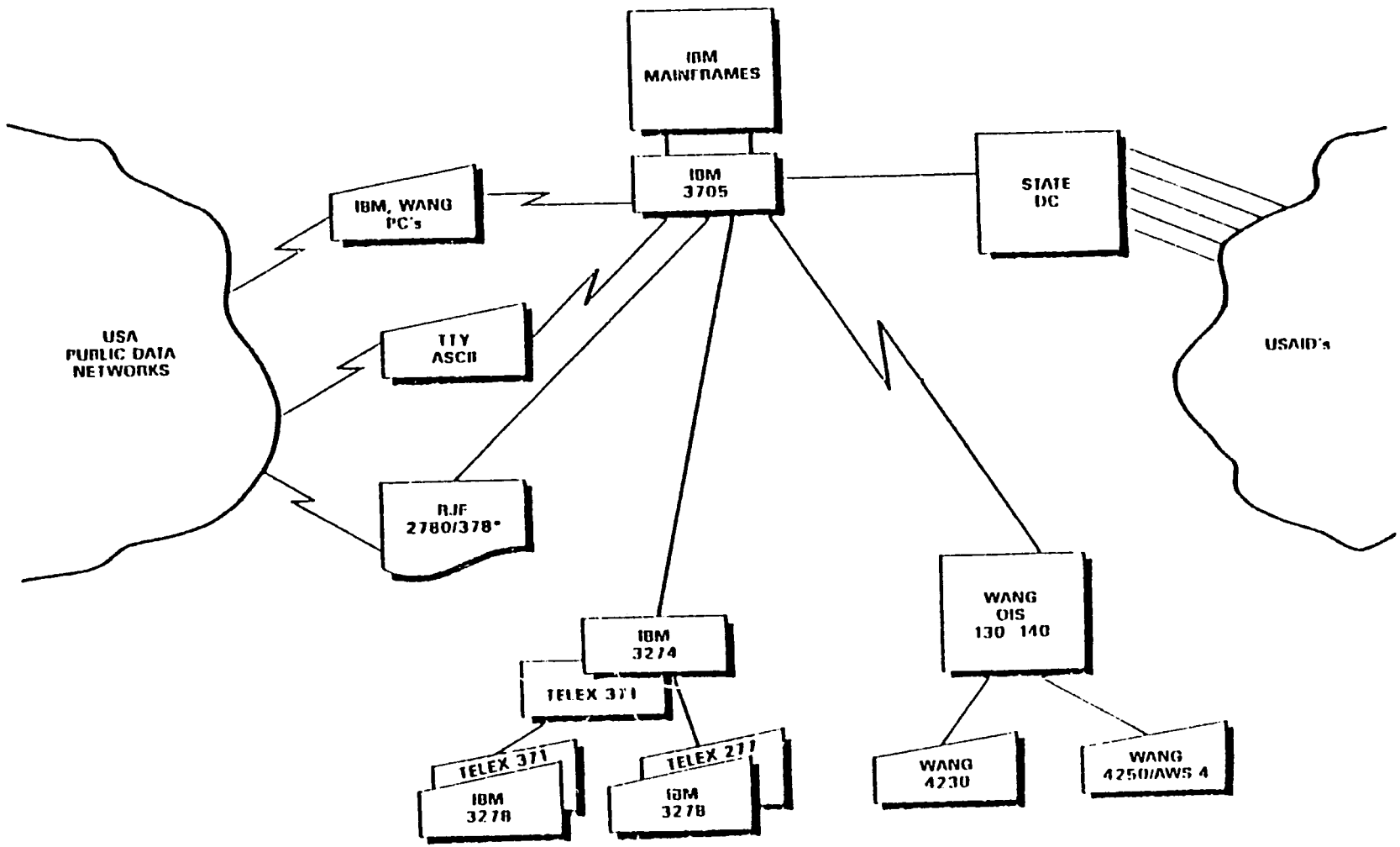
  - The topology of this time-sharing communications network is a star configuration, with the mainframe as the hub (See Exhibit II-1). Terminals are connected to the mainframe either via dedicated leased lines or dial-ups.

- The Diplomatic Telecommunications System (DTS) maintained by the Department of State provides secure cable communications between AID/W and the USAIDs. (DTS is commonly referred to as "the cable system.")

- Beginning in April 1984, the Department of State began providing USAIDs with non-secure leased lines for purposes of sending and receiving unclassified materials. This link will be established in 5-10 missions by the end of 1985, and in a number of others by 1988. The first test link was set up with Cairo in April 1984.

EXHIBIT II-1

AID/W EXISTING TELECOMMUNICATIONS TOPOLOGY



- There has been strong interest in this link, since USAIDs need a fast, dependable means of providing large volumes of financial and program data to AID/W.

- The Mission Accounting and Control System (MACS) is one of the primary candidates for using a regionally-based telecommunications network between groups of USAIDs. MACS operates in regional USAID centers and services remote USAIDs.

The Wang VS installation in AID/W is capable of communicating with VS minicomputers elsewhere, and has been used extensively for testing "dial-up" communications to selected USAIDs (Nairobi and San Salvador), but is not currently equipped for this purpose in a production environment. Its primary use is for mission applications development work and processing a few relatively small managment control type applications.

Word processing and microcomputer equipment form yet another strata in the AID telecommunications system.

- Most of the Wang word processors used in AID/W and the USAIDs support distributed word processing. The OIS shared-logic system permits users at OIS workstations to share libraries, documents, files and telecommunications facilities.

- Some AID/W Bureaus such as the Science and Technology Bureau have acquired two OIS CPUs which are connected through the Wang Inter-System Exchange (WISE) switch to permit sharing of information between the two systems.

- Some OIS units have been equipped with telecommunications hardware and software, as described below.

- Microcomputers, for the most part, are still used as stand-alone multi-functional processors within the AID/W environment, although some have recently installed (or requested) telecommunications software and modems.

- Wang microcomputers are being used as OIS and VS workstations, as well as stand-alone processors.

The existence of these six sub-systems establishes the basis for designing a potential network.

2. AT THE PRESENT TIME THESE SIX SUB-SYSTEMS ARE NOT NETWORKED

At present, these six sub-systems operate largely independently of one another. For the most part, mechanisms do not exist for them to share information. For example:

- The phone system currently carries only voice communications.

- The cable system is totally separate from AID's computer center and office automation installations.

  - The AID communications center is linked to the Department of State's Communications Center and via that link, to the embassies and missions.

  - AID's cable center uses Data General and DEC computers, in conjunction with Xerox laser printers. Exhibit II-2 depicts the hardware found in AID's cable center. For a description of how AID handles incoming and outgoing cables, see Appendix D.

- The AID/W ADP terminal network communicates with the mainframe, and via dial-up lines, to other computers. (For an inventory of AID/W's terminals and processors, see Exhibit II-3.)

- Workstations attached to VS equipment in AID/W are not set up to communicate with the IBM mainframe in a production ;mode, although they have the equipment and software installed to do so (used in support of the Property Management System).

- Only a few of AID's ADP terminals and workstations currently communicate with the contractor-supported, HP3000 minicomputer, which stores the DIS data base (AID's "institutional memory").

- Data communications between VS and OIS equipment have been tested in the USAIDS. The use of remote Wangnet to link this equipment is in operation in at least one mission overseas, but this linkage is not yet available in AID/W.

EXHIBIT II-2
AID'S COMMUNICATION CENTER EQUIPMENT

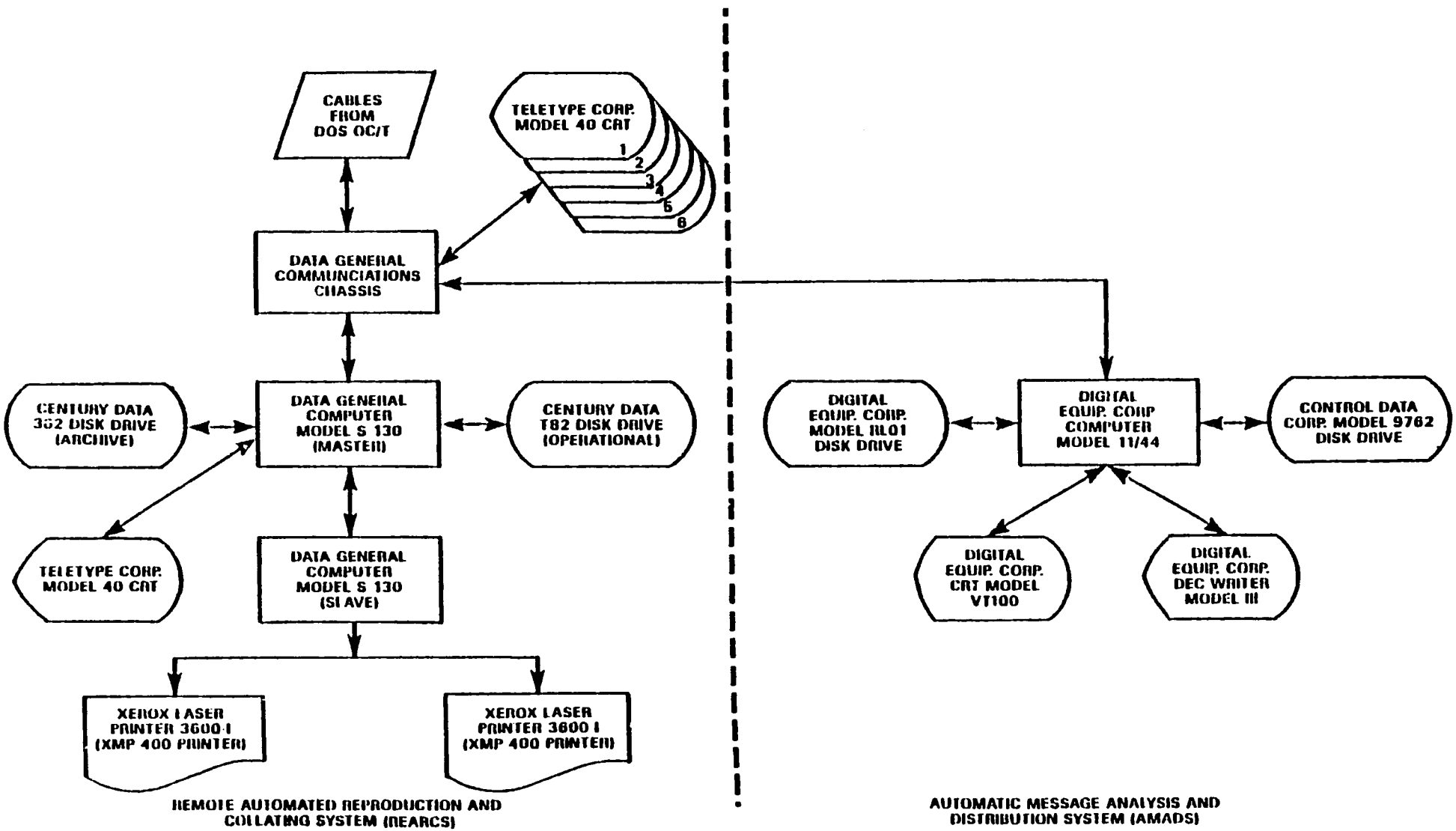


EXHIBIT II-3

Existing AID/W Telecommunications Hardware
Building Summary
(March 1984)

AID/W BUILDINGS	DATA TERMINALS 3270	TTY	RJE	PRINTERS	PROCESSORS	TEXT TERMINALS W/S	PRINTERS	PCs	FACSIMILE TYPE	LINE SPEED 9600	2400	1200	300	MODEM SYNCH	ASYNCH
MAIN STATE	12	16	1	13						13		13	2	13	16
					OIS-140 (11)	162	95			2	5			7	
					OIS-25 (2)	11	9								
					WANG 5	35	35				1			1	
						2	2	APPLE							
						15	15	IBM				9			9
						11	11	WANG				13			13
									PANAFAX (4)			4			4
									DEX (1)			1			1
SA-1	61	26	2	20						61		12	14	61	26
					OIS-140 (4)	71	35			1	2			3	
					WANG-VS (1)	19	9								
					ALLIANCE	6	4			2	1			3	
					OIS-50	2	2			1	1	1	1	2	2
					NP 25	7	5								
					NP 20	2	2				1			1	
					WANG 5	11	11								
						5	5	APPLE							
						15	15	IBM				4			4
						14	14	WANG							
									PANAFAX (2)			2			2
									QWIP			1			1
SA-15	2	3		3						2		2	1	2	3
					OIS-140 (3)	25	24			2	2			4	
					WANG 5	2	2								
									PANAFAX (8)			8			8
									DEX (1)			1			1
SA-16		1		1								1			1
					OIS-140	14	8			2	1			3	
					OIS-50	3	1								
					WANG 5	1	1								
						1	1	IBM				1			1
SA-18	7	16		12 1-plotter						7		11	6	8	16
					OIS-140 (8)	38	16				1			1	
					WANG 5	5	5								
						1	1	APPLE							
						4	4	IBM				3			3
						3	3	WANG				2			2
Total	82	62	3	49		485	335			93	15	90	24	109	114

Software has not been marketed to provide complete, bi-directional text and file transfer capabilities between OIS and micro equipment, even when Wang micros are cabled to the OIS as workstations.

Micro-to-micro communications are more complex in the mixed-vendor environment of the missions, where several different micro vendors are used. Data transmissions can be accomplished, but diskette exchange between different micro vendors' equipment is often not possible.

In many cases, the protocols have not been developed to permit data and document exchange between workstations attached to different processors. Several companies are developing software to facilitate this process, and some of this software is already being used within AID/W.

3. PROVIDING COMMUNICATIONS FOR OIS EQUIPMENT HAS BEEN A PRIORITY FOR IRM

Providing communications capabilities for the Agency's Wang OIS equipment has been a priority for IRM. Although the OIS is a shared-logic system, OIS users attached to different OIS CPUs also have a need to communicate with each other and with other computers. Special software is required to provide these communications capabilities to OIS users.

IRM has been providing three types of communications hardware and software for OIS equipment in AID/W, depending on the type of application:

- Nineteen OIS units can support batch transactions with the IBM main computer, as well as OIS-to-OIS communications (2780/3780/WPS protocol).

- Software to emulate an interactive IBM terminal for purposes of communicating with the IBM main computer has been installed on seven units in AID/W, and IRM plans to provide this capability to all of AID/W.

- Several OIS workstations are currently used as TTY (teletype) terminals.

  These TTY terminals may be used for dial-up communications to any number of external computers.

One TTY terminal has been designated as AID's sole node on the White House's electronic mail system.

Many refinements are required to make OIS telecommunications support all the types of transmissions AID users desire, including data file transfers.

4. TELECOMMUNICATIONS CAPABILITIES ARE BEING PROVIDED TO MICROCOMPUTER USERS ON A CASE-BY-CASE BASIS

To date a small number of microcomputers have been equipped with telecommunications hardware and software. These are provided to offices that can justify acquiring this capability. Micro-based telecommunications are still in the experimental stage within the AID/W environment:

- IRM is currently evaluating micro-based communications hardware/software and is training AID staff in the use of the IRM-approved communications software, ASCOM and/or CROSSTALK.
- IRM is also coordinating test efforts on transmission of documents via microcomputer links between AID/W and portable microcomputers overseas.
- A few micro users are uploading and downloading data files from the mainframe, but most of these transactions are occasion-specific operations, such as preparing a diskette containing a specialized data base for a USAID.
- Other AID micro users use dial-up communications to access external data bases.

Although the telecommunications capabilities of microcomputers are not fully developed within AID, some industry observers predict that multi-functional workstations, such as the current generation of microcomputers and other types of multi-functional terminals, will become the telecommunications workhorses of the future.

5. TELECOMMUNICATIONS SUPPORT TO USAIDS TYPICALLY HAS BEEN LIMITED TO LOCAL COMMUNICATIONS AND THE DTS CABLE SYSTEM

Much of what has been said above applies with equal force in the USAIDs, but there are also some important differences:

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There is more of a need for micro-to-VS and for OIS-to-VS communications in the USAIDs than in AID/W, since the VS is the USAID "mainframe."

USAIDs, until recently, had no direct access to the the AID/W main computer.

Telecommunications hardware/software currently installed on USAID equipment is almost non-existent. The USAID telecommunications software, as shown in the USAID OIS equipment inventory, is described below for each type of equipment:

Only Cairo and Nairobi are set up for batch communications with the mainframe and for communications with like equipment.

.. Cairo has IBM terminal emulation software, as well as VS-to-VS communications software for its VS.

.. Nairobi has IBM terminal emulation software for both its VS and OIS, and also software for OIS-to-OIS and VS-to-VS communications.

.. Both Cairo and Nairobi have TTY emulation software for communications with a variety of external computers.

Three USAIDs are equipped for internal Wang-to-Wang communications:

.. Quito uses the Wang Inter-System Exchange (WISE) switch to connect two OIS configurations

.. Guatemala uses OIS remote WANGNET to connect OIS and VS equipment

.. Yaounde has remote communications software on a Wang PC, to communicate from a remote location with OIS equipment

Other missions have asynchronous communications packages on Wang, IBM and Apple microcomputers, permitting dial-up communications with AID/W-based computer equipment and other computers, if desired.

An inventory of IRM-approved hardware located in the USAIDs appears in Exhibit II-4. Note the predominance of Wang equipment.

EXHIBIT II-4

Existing Telecommunications Hardware in the USAIDs

August 1984

	Mini-Computer Systems	Work Stns	Prtrs	Ofc. Info. Systs	Work Stns	Prtrs	Word Proc. Systs	Work Stns	Prtrs	Stand Alone Systs	Work Stns	Prtrs	Attached to:	Work Stns	Prtrs	Micros	Work Stns	Prtrs	Totals
Africa																			0
Addis Ababa																WANG PC	5	5	10
Gaborone																WANG PC	6	6	12
Bujumbura																WANG PC	1	1	14
Yaounde				OIS/140	6	4													0
Praia																WANG PC	2	2	4
Djibouti																WANG PC	2	4	6
Banjul																			0
Accra																WANG PC	2	2	4
Conakry										WP-5	1	1				WANG PC	2	2	30
Abidjan	VS-80	14	10													APPLE	3	3	62
Nairobi	VS-100	25	9	OIS/140	4	4	WP-25	9	5							IBM PC	3	3	6
																WANG PC	3	3	6
																WANG PC	3	3	6
Maseru																WANG PC	2	2	15
Monrovia				OIS/140	7	6										WANG PC	3	3	6
Lilongwe																IBM PC	6	6	12
Bamako																IBM PC	3	4	7
Nouakchott																IBM PC	3	3	23
Niamey				OIS/140	8	9										WANG PC	3	3	6
Kigali																IBM PC	1	1	22
Dakar				OIS/140	11	5				WP-5	2	2				WANG PC	1	2	3
Freetown																WANG PC	4	5	18
Mogadishu				OIS/140	6	3										APPLE	1	1	2
Ouagadougou																APPLE	6	6	18
Khartoum										WP-5	3	3				WANG PC	4	4	0
Mbabane																APPLES	4	4	0
Dar es Salaam																WANG PC	1	1	2
																			0
Cotonou																WANG PC	3	3	6
Kampala																IBM PC	4	6	10
Ouagadougou													OIS/140(ICA)	10	8	APPLE	3	2	23
Kinshasa																WANG PC	4	5	9
Lusaka																IBM PC	2	2	15
Harare				OIS/140	8	3													4
Lome										WP-5	2	2							
Asia																			
Dhaka										SYS25(EHD)	2	1				APPLE	6	6	12
Rangoon																			3
Suva																WANG PC	1	2	3
Jakarta							WP-25	11	4				VS-80(EHD)	12	7	WANG PC	4	4	42
New Delhi				OIS/130A	10	4										WANG PC	5	5	24
Kathmandu																			0
Islamabad	VS-90	10	5	OIS/140	8	3										APPLE	9	9	44
																WANG PC	2	2	4
Manila	HP-1000	12	2	OIS/130A	11	4													29
Colombo																TRS-80	3	2	5
Bangkok	VS-100	9	4	OIS/130A	11	5													29

EXHIBIT II-4 (2)

	Mini-Computer Systems	Work Stns	Prtrs	Ofc. Info. Systs	Work Stns	Prtrs	Word Proc. Systs	Work Stns	Prtrs	Stand Alone Systs	Work Stns	Prtrs	Attached to:	Work Stns	Prtrs	Micros	Work Stns	Prtrs	Totals
Lat. Amer/Car																			
Bridgetown				OIS/130A	7	2													9
Belize City							WP-5	2	2										4
La Paz				OIS/130A	19	5										IBM PC	1	1	16
San Jose				OIS/130A	7	5				WP-5	2	2				WANG PC	1	1	18
Sa. Domingo	VS-80	10	6							WP-5	1	1				TRS-80	1	1	20
Quito				OIS/130A	10	4													14
				OIS/130A	10	3													13
San Salvador	VS-80	10	8							WP-5	5	5				WANG PC	1	1	30
Guatemala City	VS-80	17	7	OIS/130A	3	1													28
Georgetown																			0
Port-au-Prince										WP-5	3	3				IBM PC	2	2	10
																WANG PC	3	3	6
Tegucigalpa	VS-80/100	23	8																31
Kingston				OIS/50	4	2							OIS/130A(EMB)	3	3	WANG PC	2	2	16
Mexico City													OIS/130A(EMB)	1	1				2
Managua										WP-5	2	2							4
Panama City				OIS/140	22	9										APPLE	4	4	39
Asuncion										WP-5	1	1							2
Lima				OIS/130A	12	4										WANG PC	1	1	18
Brazilia													VS-80(ICA)	1	1				2
Near East																			
Cairo	VS-100	39	19	OIS/130A	10	6				WP-5	7	7				WANG PC	2	2	92
																APPLE	1	1	2
Amman																WANG PC	6	6	12
																WANG PC	1	1	10
Beirut				OIS/115	5	3							OIS/130(ICA)	4	3	WANG PC	2	2	27
Rabat	VS-90	11	5																0
Muscat																WANG PC	1	1	2
Lisbon																			0
Damascus																WANG PC	1	1	12
Tunis				OIS/130A	6	4										APPLE	3	1	12
Sanaa							WP-25	4	4										
Europe																			
Paris													OIS/130A OECD	3	0				3
Rome							WP-5	1	1										2
Naples				OIS/105	1	1				WP-5	1	1							4
Geneva																			0
Total Systems	11			24			5			31			7			154			232
Total Work Stations		180			196			27			32			34			154		623
Total Printers			83			101			16			31			23			153	407
																			1016

PART II. TELECOMMUNICATIONS REQUIREMENTS

This section discusses the findings of the user questionnaires administered by IRM in AID/W and in a selected group of USAIDs. The AID/W questionnaire covered a wider range of questions than did the USAID instrument, but there was considerable overlap in the coverage of existing telecommunications capabilities, user-perceived needs, and existing volumes and patterns of traffic flow.

The methodology used in conducting the user needs assessment in AID/W and the USAIDs is discussed in Appendix C. This appendix describes the contents of the questionnaires and traces the steps performed in compiling, analyzing and interpreting the findings.

This approach was used instead of a functional analysis of requirements because user jobs within AID are highly variable and, in many cases, unique. Furthermore, needs for information change from day to day. Therefore, although the traditional functional analysis can be fairly precise for routine information handling jobs, it was not considered appropriate for determining AID's telecommunications requirements.

1. STAFF IN AID/W AND THE USAIDS IDENTIFIED FIVE FUNCTIONAL AREAS OF TELECOMMUNICATIONS NEEDS

The telecommunications user needs identified by AID/W and USAID staffs have been grouped into five functional areas, as described below:

- Mainframe access -- This refers to the capability of users in the missions and AID/W to obtain electronically stored information from the main computer in AID/W.

- External Data Base Access -- This refers to the capability of users to electronically access a computer external to AID/W or a USAID, respectively, to obtain information stored there.

- Communications Between OA Equipment -- This refers to the capability of transmitting information to and from office automation equipment, e.g., between an OIS in the Africa Bureau to a micro in PPC or Botswana. Since the number of VS installations is growing rapidly in the USAIDs, there is also a growing need for communications between micro, OIS and VS equipment.

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- Electronic Mail -- For purposes of this study, we are defining Electronic Mail as a service that provides various kinds of information directly to the user, usually at a terminal located on an individual's desk. The services provided can range from short messages to interactive calendar updating and scheduling, depending upon the type of service desired (see Appendix G -- Electronic Mail).

- Cable System Enhancements--The two types of cable system enhancements users most desire are electronic distribution of cables from the AID/W Communications Center (AID/W) and the capability of querying the cable data base (USAIDs).

These telecommunications functions are discussed in detail below.

2. USAIDS ASSIGNED A HIGHER PRIORITY TO MORE TELECOMMUNICATIONS FUNCTIONS THAN DID AID/W

In the questionnaires administered to AID/W offices and selected USAIDs by IRM, users were requested to prioritize a set of telecommunications functions that were either currently being used or needed. These responses are presented in Exhibits II-5 and II-6. Comparison of the exhibits reveals that:

- USAIDS consistently assigned a higher priority to each of the telecommunications functions than did users in AID/W. No USAIDs assigned a low priority to any of the telecommunications functions, even though the scales were identical The reasons for these differences in perception are probably due to the fact that:

  - USAIDs are dependent on the DTS for electronic transmissions:

    .. Use of the cable system requires special formats and procedures that can be very time-consuming in preparing and clearing. Many users in AID/W and the USAIDs would like to be able to communicate directly with other users throughout the Agency.

    .. Cable links to some third-world countries operate at 75 Baud and are often the only line speeds available for cable transmissions. The new leased circuits being provided to AID by State operate at 2400 Baud, or up to thirty times faster than the older TTY lines.

EXHIBIT II-5

USAID Telecommunications Requirements
(Shown by the Priority Assigned by the User on a Scale of One to Five)

USAID Telecommunications Functions	USAIDS with OIS Equipment		USAIDS with VS Equipment		Combined	
	Priority	Rank	Priority	Rank	Priority	Rank
1. Mainframe Access						
. Mainframe Access	3.7	High	4.0	High	3.8	High
. Mainframe - Microcomputers	3.4	High	4.0	High	3.6	High
. Mainframe - Word Processor	3.7	High	4.8	High	4.1	High
2. External Data Base Access						
. Federal and Commercial - USA	2.9	Medium	3.4	High	3.1	Medium
. External - Non-USA	2.3	Medium	3.3	Medium	2.7	Medium
. DIU/HP 3000	3.1	Medium	3.5	High	3.2	Medium
3. Communications Between OA Equipment						
. Microcomputer - Microcomputer	3.9	High	3.7	High	3.8	High
. Word Processor - Microcomputer	4.4	High	4.1	High	4.3	High
. Mini - Word Processor	2.9	Medium	4.3	High	3.4	High
. Mini - Microcomputer	2.9	Medium	4.3	High	3.4	High
4. Cable System Enhancement						
. Cable Computer Access	3.2	Medium	2.7	Medium	3.0	Medium
5. Electronic Mail						
. Electronic Mail	4.3	High	4.1	High	4.2	High

EXHIBIT II-6

AID/W Telecommunications Requirements
(Shown by the Priority Assigned by the User on a Scale of One to Five)

AID/W Telecommunications Functions	Priority	Rank
1. Mainframe Access		
. Mainframe Access	3.7	High
. Mainframe - Microcomputer	3.1	Medium
. Mainframe - Word Processor	2.9	Medium
2. External Data Base Access		
. Federal	3.3	Medium
. Commercial	2.5	Medium
. External (Public Data Networks)	2.1	Medium
. DIU/HP3000 Access	1.7	Low/Medium
. Other	1.5	Low
3. Communications Between OA Equipment		
. Word Processor - Word Processor	4.2	High
. Microcomputer - Microcomputer	3.1	Medium
. Bulk File Transfer	3.1	Medium
. Word Processor - Microcomputer	2.9	Medium
. Mini - Word Processor	1.7	Low/Medium
. Mini - Microcomputer	1.3	Low
4. Cable System Enhancement		
. Cable Computer Access	2.5	Medium
. Central Point Cable Distribution	3.5	High
. Desk Cable Destination	1.1	Low
5. Electronic Mail		
. Electronic Mail	3.8	High
. Electronic Signature	1.6	Low

.. Slower-speed lines are not efficient for transmitting materials such as complex graphics and lengthy documents that require more band width.

- USAIDs historically have not had the type and level of communications support enjoyed by AID/W., e.g., there is no ADP mainframe terminal network and the mail system works in terms of weeks, rather than hours.

- Distances and time lags involved in obtaining information in the USAIDs are spurring the need for faster, more reliable transmission of key documents and other kinds of information.

- Although USAIDs, as well as AID/W, resort to telephone calls to obtain information in a timely manner, the telephone is not a satisfactory substitute because:

  .. Many USAIDs are located in time zones where normal business hours do not coincide with AID/W working days.

  .. Some kinds of information, notably complex budget spreadsheets, do not lend themselves to a cell-by-cell updating or analysis by voice communications.

- These perceptual differences are even greater in those USAIDs which have Wang VS minicomputers. (Exhibit II-5 compares the responses from the 18 USAIDs sampled that have only OIS equipment with the 10 posts with VS installations.)

- The responsibilities of posts with VS equipment for processing regional MACS (the Mission Accounting and Control System) data are greater, since these posts are vital hubs in a geographically dispersed mission data base system.

In addition to the needs articulated by the USAIDs in their cable responses to the IRM questionnaire, several IRM managers travelled to a number of USAIDs during this phase of the investigation and were able to personally sample mission attitudes. These on-site visits contributed greatly to an understanding of USAID information needs and capabilities, as well as problems missions were encountering in obtaining the information and services required.

3. USAIDS ASSIGNED A MUCH HIGHER PRIORITY TO ACCESSING EXTERNAL DATA BASES THAN DID AID/W

USAIDs need to access external data banks to obtain data required for program implementation, strategic planning exercises and project evaluation. Much of this information is simply not available from the AID/W desk officer and/or AID/W data banks.

About half of the USAIDS reporting on this topic indicated a need to access external data banks (see Exhibit II-7). These included:

- REDSO-based data banks, or information located at another USAID
- Data maintained by regional and international financial institutions, such as the African Development Bank, the IMF, the World Bank, etc.
- Specialized technical data banks in the USA and other countries, such as France and Italy (FAO). USAIDs, especially those in Francophone countries, often find that the financial, agricultural and other economic data they need are contained in automated data banks in France. Such detailed information cannot be obtained directly from U.S. sources.
- Information vital to project planning, design, implementation and evaluation can often be obtained directly, via non-AID channels. The African Development Bank, for example, is a valuable source of information for USAIDs located in Africa.
- IRM staff visiting USAIDs in recent months have observed the frustrations experienced by USAID staffs in attempting to obtain needed budgetary and project-related information from AID/W.

4. USAIDS ALSO INDICATED A NEED FOR REGIONALLY-BASED TELECOMMUNICATIONS SUPPORT

USAIDS also indicated a need for the following types of regionally-based telecommunications support:

- Telecommunications lines between USAIDs assigned to REDSOs, RHUDOs, and other regional groupings of USAIDs, such as the RFMC in Nairobi.

EXHIBIT II-7

USAID Needs To Access External Data Bases

USAIDs Grouped BY REGION	DIU	INTERNATIONAL								U.S. FEDERAL									COMMERCIAL/UNIV.				
		IBRD	IMF	AFBD	FAO	UNDP, UNIDO	WHO	OECD	UNESCO	CDC	USDA	USDC	USDT	NTIS	USGS	RAMC	RFMC	Other	DRI	Lockheed Dialog	ERIC	IRDC (Iowa)	AWRA
AFRICA																							
Harare																	X						
Lusaka	X							X									X						
Mbabane	X	X	X								X								X				
Niamey	X	X						X			X											X	
Ouagadougou	X			X				X			X					X							
LAC																							
Bridgetown													X					*					
Guatemala	X																		X				
La Paz	X										X									X			
Panama City	X										X												
Port Au Prince	X							X			X	X							X				
Quito	X	X			X		X				X							*					
Tegucigalpa											X												
ASIA																							
Islamabad	X										X					X							
Jakarta		X	X						X	X	X	X		X							X		
Manila		X	X																				
NEAR EAST																							
Amman		X	X		X	X	X	X			X				X								X
Cairo																							

*Quito also listed six other Federal agencies and the Inter-American Bank. Bridgetown listed the State Allowances STF.

- Telecommunications between USAID buildings located at different sites within the same city, ranging from a few hundred feet, to a few kilometers, such as in New Delhi.

- Telecommunications between a USAID, U.S. Embassy and other U.S. agencies located in a particular city/country, such as Panama City.

The start-up of MACS may have set the stage for the full-blown implementation of inter-regional telecommunications links for USAIDs grouped in the two REDSOs in Africa, as the following example illustrates.

The Nairobi USAID has asked that IRM consider Nairobi as the hub of a regional telecommunications network with the following features:

- Wang Net (a broadband local area network) for networking VS, OIS and micro equipment.

- Facsimile machines or the Wang PIC for transmitting RFMC review documents such as vouchers between client posts and the RFMC.

- An open-switched network to enable the professional staff to access academic and commercial data bases through TELENET and TYMNET.

- A tail circuit to the Embassy/DTS line to support on-line transaction processing and report distribution with selected client posts in the four regional offices (RFMC, REDSO/ESA, RHUDO/ESA and RIG/A/N).

5. <u>SOME OF THE TELECOMMUNICATIONS CAPABILITIES GIVEN HIGHEST PRIORITY BY AID/W ARE ALREADY PARTIALLY IMPLEMENTED</u>

It is not surprising that AID/W users tended to value functions that:

- They were most familiar with and in some cases were partially implemented.

- Had the potential for making their jobs easier, e.g., provided enhanced processing capability, more timely access to needed information and more ease in sending/receiving messages.

The major telecommunications functions are described below.

(1) Mainframe Access

AID/W offices already have, through the data terminal network, access to the AID/W IBM main computer. That access, however, tends to be limited to specialized functions, and the terminals are usually centrally located in areas that are not easily accessible to other AID staff. IRM is taking steps to provide more user access to data stored on the AID main computer.

- Interactive telecommunications (3270 protocol) is being provided for selected OIS configurations, so that:
  - The OIS workstations can interact directly with the AID main computer, thereby providing new access for other AID/W staff.
  - Some ADP terminals can be replaced with multi-purpose terminals, thereby eliminating the need for duplicative equipment serving the same functional areas.

- Microcomputers in AID/W are also being equipped with telecommunications hardware/software, when justified on a case-by-case basis, so that:
  - Micros can be used for both interactive and batch communications with the AID main computer.
  - In addition, micros are more powerful processors than OIS workstations and can be used to further manipulate the data obtained from the AID main computer. Using micros to create office-level databases from portions of AID main computer files eliminates the need for continual, inter-active sessions, and thereby, provides greater overall user access to the AID main computer.

(2) External Data Base Access

- AID/W users indicated interest in obtaining information electronically from other data bases. To some extent, this is already occurring.

- Micros and TTY terminals are being used to communicate via dial-up telecommunications with a variety of external federal and commercial data bases.

- Dial-up communications on three AID TTY terminals are also being used in AID/W to access information from the Agency's "historical memory" stored on the HP3000. This minicomputer houses DIU's DIS data base. Accessing the HP3000 is more of a priority for the USAIDs than for AID/W, as shown in Exhibits II-5 and II-6.

(3) Communications Between OA Equipment

- Both the AID/W and USAID users list the need for communications between office automation equipment as one of the highest priorities for Agency-wide telecommunications.

- Users located at any point in the Agency want to be able to transmit documents, messages and other types of materials between office automation equipment, such as the VS, OIS and microcomputers. Geographical location and distance would be invisible to the user if this capability were provided.

- A small number of micro-to-micro and micro-to-OIS telecommunications capabilities are also highly desired by AID/W users.

  - Micro-to-micro communications for document and data transfers are currently being accomplished via asynchronous, dial-up links.

  - Offices are using micro-based telecommunications mostly for file transfer purposes, including bulk file transfer. The extent of this use is hard to measure, since it occurs directly between micros and does not pass through a central processor or control point.

  - An important requirement is the capability to print documents created on microcomputers on OIS or VS printers. Wang PCs can send documents to the OIS, but the reverse process is not yet supported.

- AID/W users expressed little interest in accessing the VS in AID/W because the Agency's central data base resides on the IBM computer, not the VS.

- USAIDs, on the other hand, considered VS access a high priority because the VS in the USAIDs is the repository of USAID-based data base, such as MACS.

(4) Electronic Mail

- There is a high demand for electronic mail both in the USAIDs and in AID/W, since being connected to this service would allow users to send mail to others on the network, as well as retrieve messages stored in their electronic "mailboxes."

- Only AID/W was asked to rank the components of an electronic mail system. AID/W users expressed little interest in electronic verification and validation systems such as Electronic Signature (Exhibit II-6).

- AID/W users viewed electronic mail as a tool to facilitate scheduling of tasks and meetings and for keeping track of their various activities (tickler files) (see Exhibit II-8).

  - Scheduling meetings, e.g., calendaring, was seen as the highest priority of such a service.

  - Three components were assigned a medium priority rank:

    .. Maintaining tickler files

    .. Filing and retriving messages

    .. Receiving cables electronically at the officer's desk.

  - The lowest level of interest was in using an electronic mail service for general and special interest bulletin boards.

EXHIBIT II-E

Electronic Mail Components
(Shown by Priority Assigned by AID/W Offices on a Scale of One to Five)
Grouped by Building

AID/W Offices and Bureaus (by building)	Bulletin Board	Special Interest Bullentin Board	Scheduling of Tasks, Meetings	Tickler Files	Filing, Retrieval of Messages	Receive Cables at Desk
Main State						
AID/A & ES	5	1	5	5	5	5
PPC	3	4	3	3	4	2
AFR	5	5	5	5	5	5
ASIA	5	5	4	1	3	2
LAC	2	4	2	4	4	4
NE	1	3	5	3	2	5
XA	5	5	5	3	3	4
LEG	1	2	5	3	3	3
GC	1	1	3	3	2	3
OFDA	5	4	2	1	3	5
BIFAD	1	1	5	5	5	1
SA-1						
M/SER/IRM	4	5	5	4	2	2
M/FM	3	3	4	3	4	4
M/PM	2	4	3	3	3	5
PRE	1	1	2	1	1	1
FVA	4	2	4	4	3	4
EOP	3	-	3	2	3	-
SA-15						
M/SER	1	1	2	5	5	4
M/SER/EOMS	1	2	5	5	5	1

EXHIBIT II-8 (2)

AID/W Offices and Bureaus (by building)	Bulletin Board	Special Interest Bulletin Board	Scheduling of Tasks, Meetings	Tickler Files	Filing, Retrieval of Messages	Receive Cables at Desk
SA-16						
IG	3	3	4	2	2	4
SCI	-	2	3	5	4	-
SA-18						
S&T	1	2	1	2	2	2
Average Rank Per Component	2.6	2.4	3.6	3.3	3.3	3.0
Rank Per Component	Low	Low	High	Medium	Medium	Medium

- The cable system enhancement most desired by USAIDs was the capability to query the cable computer. It was viewed as a medium-level priority.

6. RECENT STUDIES IN TWO REGIONAL BUREAUS SUPPORT THE NEED FOR AN ENHANCED TELECOMMUNICATIONS SYSTEM

- Over half of the microcomputer applications identified for implementation in a recent requirements study conducted in the Near East Bureau required telecommunications, primarily for downloading data from the AID main computer to create Bureau-level data bases and for speedier receipt of information from the USAIDs.

- The automation plan developed early in 1984 for the Asia Bureau raised similiar telecommunications issues, such as existing incompatibility problems between USAID and AID/W-based equipment in the areas of diskette exchange and data transmissions.

7. OTHER SPECIFIC TELECOMMUNICATIONS CAPABILITIES WERE REQUESTED BY A SMALL NUMBER OF USERS

A specific subset of AID users identified a few types of telecommunications needs. Most of these do not entail state-of-the arts technologies, although there are some exceptions.

- The need for image processing was mentioned by users in AID/W and the USAIDs:

  - DIU identified the need to transmit graphics, charts, multi-hued materials, maps, engineering drawings and photographs which are often contained in contractor and USAID documents.

  - Nairobi indicated an interest in using Wang's new image processing (PIC) functions for teleconferencing and for processing vouchers and other documents exchanged with client posts.

  - The Asia Bureau also is interested in using the Wang PIC function for transmitting contractual and authorization documents that require a signature, as well as other types of forms that require image processing.

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- The Asia Bureau also is interested in using the Wang PIC function for transmitting contractual and authorization documents that require a signature, as well as other types of forms that require image processing.

- An need to implement a secure line connecting the AID Communications Center to the Office of the Inspector General in Rosslyn in order to receive classified cables was identified by the IG's office. That need should be examined in the network design phase, should AID decide to provide electronic distribution of cables to outlying buildings.

PART III. EXISTING TRAFFIC LOADS AND PROJECTIONS

An important need in determining the scope of enhanced telecommunications capabilities and facilities is knowing the existing volume of information flowing within the Agency that could be transmitted electronically.

This section describes the existing patterns and volumes of information flows between AID/W and the USAIDs, between the USAIDs included in this study, and within AID/W. The types of information described here include the following:

- Data traffic to and from the IBM main computer
- Cable traffic
- Text document distribution.

The methodologies used to collect information on these types of information flows are described in two appendices: Appendix D -- Cable Traffic Analysis and Appendix F -- Text Traffic Analysis. A set of detailed working papers, describing the levels of analyses which resulted in the presentation of this high-level summary of findings is on file with M/SER/IRM.

1. SIZING THE FLOW OF DATA TRAFFIC TO AND FROM THE MAINFRAME IS IMPORTANT IN DETERMINING HOW MUCH ADDITIONAL TRAFFIC WOULD RESULT IF ALL USERS HAD ACCESS TO THE AID MAIN COMPUTER

It has been shown that one of the most important telecommunications requirements is for increased access by AID staff to data stored on the AID/W main computer. In order to determine the potential traffic flows that would result from this enhanced capability, it was necessary to map existing data traffic patterns within AID/W.

The methodology used to estimate existing and projected data traffic was to determine the following:

- Because of the number of new micros being installed with communications capability, the number of ADP workstations in AID/W communicating with the main computer will increase in excess of 50%

- Peak number of concurrent users (44) in FY84 and projected number of peak concurrent users by FY86 (66)

- Average number of commands per user at peak time (30)

- Average number of characters per transaction for queries and output from the computer, using industry standards, 90 and 700 characters, respectively.

Using this methodology, an estimate of the average number of characters per second was made, expressed in kilobytes per hour, as shown on Exhibit II - 9. This exhibit compares data traffic to and from the main computer from each of the five buildings AID is expected to occupy by FY86, compared to FY84 traffic levels. This analysis shows that data traffic between the main computer and AID/W users will increase by about a third within the next two years, from 13,000 Kbytes/hour to about 16,000 Kbytes/hour, or roughly between 50 to 70 pages/day.

This projected growth is considered a conservative estimate, since it does not include projections for the number of microcomputers and OIS and VS workstations that will be used in the future to access the AID main computer. For purposes of this study, microcomputers and word processing equipment with telecommunications capabilities are not included in ADP terminal projections, since their primary functions at present consist of document exchange with other office automation equipment and/or local microcomputer processing.

Since not all output from the main computer occurs in the form of interactive transmissions, a study was also made of the daily hardcopy printout distribution per building, within AID/W, as shown in Exhibit II - 10):

- This exhibit presents estimates of remote job entry/printers only, and does not include locally-attached printers in the computer facility.

- The number of hardcopy printouts is expected to grow roughly in the same proportions that additional users access the computer, from about 2,000 pages/day in FY84 to almost 3,000 pages/day by FY86.

- The combined data traffic by FY86 is estimated to be about 4,000 pages per day.

- All the estimates were made on the basis of the peak periods of main computer usage, i.e., from 10:30 a.m. until 2:00 p.m.

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EXHIBIT II-9

Estimated Daily Data Traffic
To/From AID Main Computer
FY86

Building	Kbytes/Hr+ To Main Computer	Kbytes/Hr From Main Computer	Kbytes/Hr Total	Total Pages Per Day*
Main State	324	2520	2874	9
SA-1	972	7560	8532	26
SA-15	162	1260	1422	4
SA-16	81	630	711	2
SA-18	243	1890	2133	6
Total	1782	13,860	15,672	47

+ Kbytes/Hr = # users & AVRG commands/Hr x AVRG # characters per query x 10 bytes

* Conversion of Kbytes/Hr to Pages Per Day = Kbytes/Hr/2000 x 6

EXHIBIT II-10

Estimated Daily Data Traffic
Pages Per Day
FY86

	Estimated Pages/Day in Data Traffic (Transmission)	Estimated Pages/Day Hard-copy Printouts	Total Pages/Day of Data Traffic
Main State	9	180	189
SA-1	26	2,562	2,588
SA-15	4	105	109
SA-16	2	3	5
SA-18	6	108	114
Total	47	2,958	3,005

These findings illustrate that the greatest volume of data traffic within AID/W involve remote job entry transactions from the main computer to the user. Considering only interactive main frame transactions, there is almost eight times as much traffic "downloaded" as there is traffic that originate as queries and "uploading." This pattern is not expected to change when microcomputers and other OS equipment is used throughout the Agency for this purpose.

2. INFORMATION OBTAINED FROM A STRATIFIED RANDOM SAMPLE OF AID'S RECENT CABLE TRAFFIC PROVIDED INFORMATION ON THE DIMENSIONS AND PATTERNS OF AID'S UNCLASSIFIED CABLE TRAFFIC

The purpose of the cable traffic analysis was to determine the requirements for:

- Upgrading AID's existing cable routing and distribution equipment
- Providing electronic distribution of cables to and from the AID cable center and AID/W offices
- Providing electronic distribution of cables directly to individuals' desks.

A separate component of this study examines the potential of enhancing the linkage between the AID and State cable centers (see Appendix B -- Cable Link to State).

(1) To Determine the Need to Upgrade AID's Cable Room Equipment, It Was Necessary to Estimate the Volume of Traffic and Describe the Functions That Would Have to Be Supported in a New Telecommunications System

- The telecommunications function most desired by AID/W users of a cable system enhancement is that of automated distribution to a central point in each office or bureau (see Exhibit II - 6).
- AID/W and USAID assigned a low to medium priority to the need for querying the cable computer and for storing and retrieving cables.

- In order to estimate the volume of cable transactions a fully-automated cable system would have to handle, a sample of AID's electronically-stored cable data base was taken. The findings of this survey are described below, broken down by an analysis of the flow through the AID communications center and incoming and outgoing cable traffic, including internal distribution within AID/W.

- The cable survey provided information on the numbers of pages (in terms of the word processor page equivalent) AID's cable center handles on any given day.

  - Exhibit II-11 traces the flow of incoming and outgoing cables from the USAIDs via the AID Communications Center to the end user in AID/W as if AID were now located in five buildings.

  - The volume (average number of pages per day) of incoming and outgoing cables is shown for all linkages in the cable system.

- This exhibit shows that the AID communications center typically receives about 650 pages of cables a day from USAIDs and transmits (via the Department of State) about 500 pages per day. (Note that AID/W offices only originated 160 outgoing pages of cables per day. This is not a discrepancy. The larger number of cables actually transmitted is a reflection that many cables have multiple addressees.)

  - To determine whether or not the AID cable computer could transmit this volume of cables and store them on line for whatever period was desired, it is necessary to convert pages to numbers of characters per second. (See Appendix B).

  - The number of pages is expressed in terms of the Agency's word processing standard. Cable data were collected in terms of numbers of lines, but for purposes of using a commonly-understood measure, the Wang page-equivalent was used for converting lines to pages.

- Once a cable is received in the AID communications center, distribution is assigned. This has a multiplier effect:

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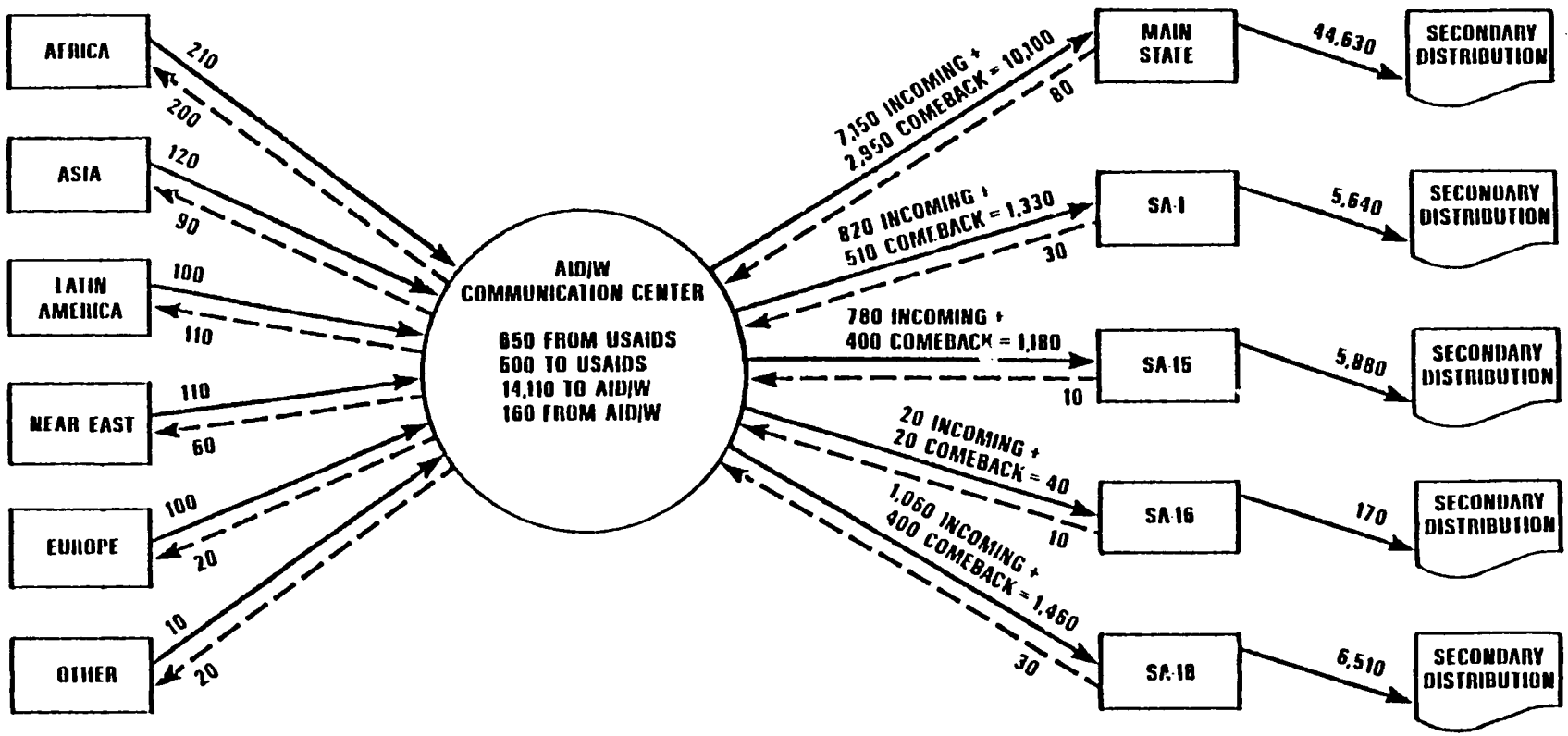
EXHIBIT II-11
ESTIMATED DAILY AID CABLE TRAFFIC
(SHOWN IN NUMBER OF PAGES)



LEGEND

INCOMING

OUTGOING

TOTALS (PAGES OF CABLES)

- INCOMING FROM USAIDS: 650
- OUTGOING TO USAIDS FROM AID/W COMMUNICATION CENTER: 500
- TOTAL INCOMING AID/W: 14,110
  - INCOMING: 9,830
  - COMEBACK: 4,280
- FROM AID/W OFFICES TO AID/W COMMUNICATION CENTER: 160
- SECONDARY DISTRIBUTION: 62,830

- Therefore, even though 650 pages of incoming cables were received by the AID Communications Center, it, in turn, distributed about 14,000 pages to other AID/W offices and buildings.

- Incoming traffic is shown by inter-building distribution

- "Come-back" copies, e.g., copies of outgoing cables sent by the AID Communications Center to AID/W offices, are included as part of the "incoming" traffic for inter-building distribution purposes.

. Once a cable reaches its destination, additional copies are often made within each office for the convenience of the staff. This is referred to in Exhibit II- 11 as the "secondary distribution."

- The volume of secondary distribution ranges between four to five times that of the distribution assigned by the AID Communications Center, according to estimates obtained from the AID/W user questionnaire.

- Should AID decide to distribute cables directly to the desks of staff, these estimates will be a fairly reliable indicator of the magnitude of this traffic.

. The estimated volume of pages of cables originated by AID/W offices in each of the five buildings is also shown. Note that this is a much smaller number than for incoming cables, due to the printing of information copies that occurs in the AID communications center.

(2) <u>Cable Traffic is Projected to Grow by About Nine Percent Per Year Over the Next Two years</u>

. Estimates provided by the AID Cable Center indicate that the volume of cables has been growing at a rate of approximately nine percent per year.

. Using that estimator, FY84 cable traffic has been projected out to FY86, as shown in Exhibit II - 12. By FY86, the estimated number of pages of incoming cables (including comeback copies) distributed within AID/W will be approximately 91,000 pages/day.

EXHIBIT II-12

Estimated Cable Distribution Within AID/W (Pages/day), FY86

Intra-Building Exchange of Cables

Building	Incoming Cables Remaining in Building	Comeback Copies Remaining in Building	Secondary Distribution (All Bldgs)	Total Incoming (All Bldgs)	Outgoing Cables (MS Only)	Total Intra-Building
Main State	8,500	3,500	52,700	64,700	100	64,800
SA-1	0	0	6,700	6,700		6,700
SA-15	0	0	6,900	6,900		6,900
SA-16	0	0	200	200		,200
SA-18	0	0	7,700	7,700		7,700
SUB-TOTAL	8,500	3,500	74,200	86,200	100	86,300

Inter-Building Exchange of Cables

Buildings	Incoming Cables Exchanged Between	Comeback Copies Sent to each Bldg		Total Incoming Exchanged	Outgoing Cables (other Bldgs)	Total Inter-Building
MS/SA-1	1,000	600		1,600	40	1,640
MS/SA-15	900	500		1,400	10	1,410
MS/SA-16	20	20		40	10	50
MS/SA-18	1,300	500		1,800	40	1,840
Sub-Total	3,220	1,620		4,840	100	4,940
TOTAL	11,720	5,120	74,200	91,040	200	91,240*

*Of this only 17,000 pages per day actually are handled by the AID Communications Center.

†Rounded to hundreds, or to tens, for two-digit numbers.

- AID's Communications Center will handle roughly 17,000 pages of cables per day, not including secondary distribution. Any new telecommunications system will have to provide for the traffic volumes and patterns suggested by this analysis.

3. THE MAPPING OF MAJOR DOCUMENT FLOWS WITHIN AID/W HELPED DETERMINE THE LOAD TO BE CARRIED BY A NEW COMMUNICATIONS SYSTEM

A major component of the requirements analysis was to determine the patterns and dimensions of document flow within the Agency, so that network designers can determine how much traffic the system would have to carry on any given day. That analysis entailed a series of data collection activities, aimed at sizing the volume of document flow at various critical junctures. This process of data collection and analysis is described in Appendix E -- Text Traffic Analysis.

(1) The Study Team Used Data Obtained From the AID/W User Questionnaire and Separate Samples of Documents Created and Exchanged Within AID/W to Determine the Most Probable Dimensions and Patterns of Document Exchange on Any Given Day

- There was no readily available source of data on document flow patterns within the Agency. To obtain data for estimating the most probable patterns and dimensions of this flow, the study team used a combination of measures:

  - Percentages of documents exchanged between each office and every other office in AID/W were obtained from an analysis of data supplied by AID/W users in the questionnaires administered by IRM.

  - These percentages were then applied to three independent measures of the volume of text documents created and exchanged on any given day.

  - Comparison of these independent measures (described in the Appendix E) revealed that a measurement of inter-office mail distribution provided the most reliable measure of volume of documents exchanged between offices and between buildings.

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- Information from the inter-office mail measurement was apportioned in accordance with the major patterns of text document flow that emerged from the analysis of data from the AID/W questionnaire.

(2) <u>This Analysis Provided Information on Inter-Building and Intra-Building Flows</u>

- Exhibit II-13 depicts the inter-building document patterns for FY84 and FY86. The exhibit indicates the number of pages of text remaining within each building, and the numbers of pages of documents exchanged between buildings.

  - These findings show that Main State is the major reservoir of information within AID/W and the major exchanger of information with the rest of AID/W:

    .. 50% of AID/W traffic remains within Main State.

    .. About 30% of all AID/W traffic is exchanged between Main State and other AID/W buildings.

  - The major exchangers of information are Main State and SA-18 (16%) and to a lesser extent, Main State and SA-1 (8%). The largest volume of traffic exchanged between buildings on any given day is about 4,000 pages, between Main State and SA-18, or nearly double the volume of text documents exchanged between Main State and SA-1.

- A detailed matrix is provided in Appendix F, showing the intra-building volume of document exchange, per office, per building. This information will help determine the types and numbers of intra-building lines and connectors required to support these patterns of interaction and these estimated daily volume loads.

EXHIBIT II-13

AID/W Document Traffic Patterns and Daily Page Estimates+
FY84 and FY86

Building	AID/W Daily Text Traffic Flow (Pages/day) Remaining Within the Building			
	Internal FY84	Internal FY86	Percent Internal	Percent All Text
Main State	11,800	12,600	85.7%	50.6%
SA-1	800	900	6.1%	3.6%
SA-15	100	100	0.7%	0.4%
SA-16	50	100	0.7%	0.4%
SA-18	1,000	1,000	6.8%	4.0%
Sub-Total	13,750	14,700	100%	59.1%

Buildings	AID/W Daily Text Traffic Flow (Pages/day) Exchanged with other Buildings			
	Exchanged FY84	Exchanged FY86	Percent Exchanged	Percent All Text
MS/SA-1	2,000	2,000	19.6%	8.0%
MS/SA-15	900	1,000	9.8%	4.0%
MS/SA-16	300	300	2.9%	1.2%
MS/SA-18	3,800	4,000	39.3%	16.1%
SA-1/SA-15	1,200	1,200	11.8%	4.8%
SA-1/SA-16	60	60	0.6%	0.2%
SA-1/SA-18	500	500	4.9%	2.0%
SA-15/SA-16	400	400	3.9%	1.6%
SA-15/SA-18	700	700	6.9%	2.8%
SA-16/SA-18	30	30	0.3%	0.1%
Sub-Total	9,890	10,190	100%	40.9%
Total Text Distributed Within AID/W	23,640	24,890		100%

+Rounded to hundreds, or to tens, for two-digit numbers.

(3) Text Traffic Within AID/W is Expected to Grow at a Rate of About Three Percent Per Year, Based on Trends Observed in Inter-Office Mail Flows

To determine the potential load the AID/W telecommunications system would have to carry over the next two years, existing traffic volumes and patterns were projected out to FY86, as shown in Exhibit II - 13. Based on these analyses, it is estimated that about 25,000 pages per day of text documents will be exchanged within AID/W by FY86.

These estimates are considered the 'worst-case' scenario, since it is unlikely that all documents would be electronically transmitted, even when the capability existed.

4. AGGREGATING CABLE, TEXT AND DATA TRAFFIC PROJECTIONS SHOWS THE MAXIMUM LOAD THE NEW TELECOMMUNICATIONS SYSTEM WOULD HAVE TO CARRY, FOR ALL APPLICATIONS

In order to determine how much traffic the new telecommunications system would have to handle on any given day, during its peak hours, for all applications, traffic projections described above for data, cable and text traffic within AID/W were aggregated. The results of this aggregation are shown in Exhibit II - 14.

The total traffic load the AID/W network would carry on any given day would be about 120,000 pages. About 65% of all transmissions would occur within the Main State building, primarily as a result of the secondary distribution of incoming cables. Data traffic to and from the mainframe comprises the smallest portion of the potential network load.

5. ESTIMATES WERE ALSO OBTAINED ON THE VOLUME OF INFORMATION EXCHANGED BETWEEN AID/W AND THE USAIDS

Information on the existing volume of traffic between the USAIDs and AID/W were obtained from three major sources:

- AID/W communications center cable sample
- Estimates provided by DIU

EXHIBIT II-14

Estimated Total AID/W Traffic, Pages/Day, FY86[4]
(Cables, Text & Data)

Intra-Building	Cables	Text	Data	Total	Percent* Of Total
MS	64,800	12,600	-	77,400	65.0%
SA-1	6,700	900	2,600	10,200	8.6%
SA-15	6,900	100	-	7,000	5.9%
SA-16	200	60	-	260	0.2%
SA-18	7,700	1,000	-	8,700	7.3%
TOTAL	86,300	14,660	2,600	103,560	
Inter-Building					
MS/SA-1	1,600	2,000	200	3,900	3.3%
MS/SA-15	1,400	1,000	-	2,400	2.0%
MS/SA-16	50	300	-	400	0.3%
MS/SA-18	1,800	4,000	-	5,800	4.9%
SA-1/SA-15	-	1,200	100	1,300	1.1%
SA-1/SA-16	-	60	0	70	0.1%
SA-1/SA-18	-	500	100	600	0.5%
SA-15/SA-116	-	400	-	400	0.3%
SA-15/SA-18	-	700	-	700	0.6%
SA-16/SA-18	-	30	-	30	0.03%
Inter-Building Total	4,850	10,190	400	15,600	
Total Traffic	91,150	24,850	3,000	119,160	100%

4Rounded to hundreds, or to tens, for two-digit numbers.

- Estimates provided by selected USAIDs

These estimates were grouped by region and projected out to FY 86, as shown in Exhibit II - 15. This exhibit shows that approximately 6,000 pages/day of documents would be electronically transmitted between AID/W and the USAIDs by FY86.

These figures have been adjusted to account for projected growth rates of three percent for non-cable traffic. Also, estimates were made for traffic between AID/W and the smaller USAIDs that were not included in the sample. It was found that the total volume of the more numerous smaller USAIDs was approximately the same as the volume of information exchanged between the larger USAIDs surveyed in this study and AID/W.

6. ESTIMATES WERE ALSO OBTAINED OF REGIONAL USAID TRAFFIC PATTERNS

A case study of a USAID (Nairobi) that is the hub of an AID regional financial management center (RFMC) was used to estimate the volume of information exchanged between regionally-grouped USAIDs. This analysis revealed that:

- The volume of traffic between the Nairobi USAID and other USAIDs in the same geographic region was twenty-five times greater than the volume of information the USAID typically exchanged with AID/W.

- This finding has implications for other USAIDs which serve as regional accounting centers and hubs in the Department of State's communications system.

- If the volume of information exchanged between all USAIDs and AID/W on any given day is approximately 6,000 pages, then the potential volume of information circulating between regionally-grouped USAIDs could be many times greater, if Nairori's traffic is typical of other USAID hubs.

- These findings indicate that there is a great need for regionally-based USAID telecommunications facilities, especially in posts with VS equipment that have responsibilities for MACS.

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EXHIBIT II-15

International AID Traffic Estimates, FY86+

USAID	Pgs/Cables Sent to AID/W	Pgs/Cables Received From AID/W	Total Pgs/ Cables Sent Received	Pgs/DIU Sent to AID/W	Pgs/DIU Rcvd From AID/W	Total DIU Pgs/Day	Total* USAID Estimates	Total Pgs Exchanged Daily Internationally
AFR	300	200	500	400	1,200	1,600	100	2,200
ASIA	100	100	200	200	700	900	300	1,400
LAC	100	100	200	200	600	800	200	1,200
NE	100	70	170	200	40	240	80	490
EUROPE	100	20	120	100	0	100	0	220
OTHER	10	20	30	20	40	60	0	90
TOTAL	700	510	1,220	1,120	2,580	3,700	680	5,600

* The total traffic from the 18 large USAIDs was roughly equal to the traffic from all other USAIDs combined.

+ Rounded to hundreds, or to tens for two-digit numbers.

PART IV. EQUIPMENT PROJECTIONS

This section discusses the equipment projection estimates developed by M/SER/IRM/CS and the study team, in light of the following factors:

- Industry standards for numbers of workstations per staffing levels
- Information obtained from M/SER/MO and M/PM on AID/W's most probable "space future" and staffing levels over the next two years
- Telecommunications functions to be supported
- Projected increments in traffic.

Estimates of needed equipment are discussed in light of the above-mentioned considerations.

1. INFORMATION FROM M/SER/MO SHOWS THAT ALMOST HALF OF AID/W STAFF WILL BE LOCATED IN MAIN STATE BY FY'86

The fact that Main State is the critical hub of a telecommunications network, in terms of the volume of traffic exchanged there, is further substantiated by an examination of the numbers of staff who will be located in each of the five buildings by FY'86. (See Exhibit II -16). Main State will contain 48 percent of all AID/W staff, including consultants.

2. THE BREAKOUT OF STAFF CAN BE USED TO DETERMINE HOW MANY TERMINALS WOULD BE REQUIRED FOR A FULL-FLEDGED IMPLEMENTATION OF AN ELECTRONIC MAIL SYSTEM

The information on the numbers of AID/W staff by category, shown in Exhibit II-16, can serve as a guide to design specialists in considering which staff should be served in an electronic mail system:

- If the electronic mail system selected is intended only for senior level managers, for example, a quick glance will reveal the number of staff who should be included.

Exhibit II-16

AID/W Staffing Level Projections*
FY86

	Senior Managers	Staff Professionals	Support Staff	Total Staff
Main State	87	640	320	1,047
SA-1	21	350	180	551
SA-15	8	155	50	213
SA-16	4	75	20	99
SA-18	20	180	60	260
TOTALS	140	1,400	630	2,170

* Not including contractors.

- If on the other hand, professionals would be considered appropriate recipients, then the number of professionals could also be readily determined.

- Should a more comprehensive breakout of staff by grade be desired, M/PM produced a special report, broken out by grade and FTE or part-time status. See Appendix C, Exhibit C-3.

3. BASED UPON THE STAFFING LEVEL ESTIMATES SUPPLIED BY M/PM AND SPACE ALLOCATION DATA COMPILED BY M/SER/MO, IRM HAS MADE THE FOLLOWING EQUIPMENT PROJECTIONS FOR AID/W

Using accepted industry standards for numbers of workstations per category of employee, IRM has developed the following equipment projections (see Exhibit II-17).

- By FY'86, AID/W plans to have the following equipment ratios per staff:

  - One executive workstation for every three senior managers
  - One microcomputer for every four professionals
  - One OIS workstation for approximately every two support staff.

- The Agency-wide ratio of workstations per staff, excluding consultants is one workstation for every three staff.

- Of the workstations shown, increments that can be attributed to anticipated telecommunications functions and incremental growth of traffic include:

  - 40 executive workstations
  - 4-5 additional OIS CPUs
  - 34 RJE/high speed printers.

4. IRM HAS COMPLETED SIMILAR STAFF AND EQUIPMENT PROJECTIONS FOR THE USAIDS

- Exhibits II-18 and II-19 provide information on projections of staffing levels and automated equipment through Fiscal Year '86.

- The ratios used by IRM to project equipment needs in the USAIDs are the same as for AID/W and also do not take into consideration the numbers of on-site consultants.

Exhibit II-17

AID/W Equipment Projections
FY86

	OIS CPUs	Executive Stations	Micros	W/S	ADP Terminals	Total W/S & Terminals	RJE/ High-Speed Printers
Main State	20	30	160	185	30	405	15
SA-1	10	7	100	100	90	297	10
SA-15	4	3	40	30	6	79	5
SA-16	3	3	20	16	4	43	2
SA-18	3	7	45	35	15	102	3
TOTALS	40	50	365	366	145	926	35

EXHIBIT II-18

USAID Staffing Level Projections
FY86

Region	Posts*	U.S. Direct Hires**	Foreign Service Nationals	Total
Africa	34	470	350	820
Asia	12	290	400	690
LAC	16	300	450	750
NE*	8	200	180	380
TOTAL	70	1,260	1,380	2,640

*Not including Paris, Geneva, Lisbon
**Not including Complement or Contractors

Exhibit II-19

USAID Equipment Projections
FY '86

Region	Posts*	VS Systems	OIS Systems	Total Systems	Work Stations	Micros	Totals
Africa	34	12	29	41	205	105	310
Asia	12	6	10	16	173	85	258
LAC	16	10	12	22	188	92	280
NE*	8	5	5	10	95	48	143
TOTAL	70	33	56	89	660	330	990

*Not including Paris, Geneva, Lisbon

- As of June 1, 1984, there were ten VS and 26 OIS installations in the 70 USAIDs. Attached to these processors were 471 workstations. In addition, there were 110 microcomputers.

- The projections provide for a three-fold increase in the number of VS installations and about a small increase in OIS processors. The number of workstations (OIS and VS) is only projected to grow a little more than one percent, due to the fact that Wang PCs will perform double-duty as workstations on these systems.

- There is a three-fold increase foreseen in micros. The projected distribution of micros by FY'86 is as follows:

  - Wang PCs, 65%
  - IBM PCs, 25%
  - Apple PCs, 8%
  - Others, 2%

It should be emphasized that these estimates are for IRM-approved acquisitions.

- Compared to AID/W, Wang PCs will constitute a slightly higher proportion of the microcomputer population.

- Wang PCs in AID/W, on the other hand, are projected to constitute about 60% of all micros, with the remainder being IBM PCs or XTs.

5. <u>INCREMENTAL TRAFFIC FLOWS THAT WILL RESULT FROM THE INTRODUCTION OF ADDITIONAL TELECOMMUNICATIONS EQUIPMENT ARE DIFFICULT TO ESTIMATE</u>

The introduction of additional equipment with telecommunications capabilities into the AID environment is expected to produce a sizeable increase in traffic flows, in the long-run, if not immediately.

(1) The Expected Growth in Data Transmissions Within the Agency Will Depend to a Large Degree Upon User Response to the Recommended Telecommunications System

The provision of additional automated equipment will occur within the context of the telecommunications system which supports the enhanced, new functions. Therefore, several factors will influence growth in Agency-wide traffic flows:

- Ease-of-use of the new system will impact on the learning curve of potential users, i.e., the easier the system is to use, the more "transparent" the technology appears to the end-user, the more readily the user will become proficient and begin maximizing the potential of the equipment.

- The type and amount of training system users, as well as system maintenance staff, receive will also be reflected in volume of traffic produced, as well as the type of transmissions, i.e., text documents, as opposed to bulk file transfer, graphics, etc.

- The provision of equipment repair and maintenance service to end-users is also a critical ingredient in assuring optimal, efficient use of the equipment. If users cannot print their documents due to recurring equipment failure or abuse, user confidence in the system will suffer and volume will be affected.

(2) As the Staff's Learning Curve Falls, Electronic Transmissions Will Become Commonplace

After an initial trial-and-error period in which users become acclimated to the new system and any routine post-implementation problems have been resolved, reliance upon electronic transmission for purposes of review and clearance is expected to become commonplace.

- AID upper management will be tied into the federal-agency-wide electronic mail system

- OMB's Reform 88 initiative will become the justification for revising existing review, clearance and authorization procedures that rely exclusively on exchange of signed documents.

- These Agency-wide changes in policy and procedures will gradually affect the way AID does business by encouraging increased reliance upon electronic information exchange.

(3) The Growth in Traffic that will Result in the Short-term, as well as in the Long-Term is Difficult to Estimate

The increase in traffic flows within the Agency resulting from the provision of additional telecommunications hardware/software is difficult to estimate.

- AID traffic tends to be "bursty," i.e., transmissions tend to be sporadic and relatively "light" in terms of the volume of data transmitted at any one time.

  - It is difficult to measure the volume of existing data traffic not currently routed through the main computer. Most probably this traffic appears in AID's cost-accounting as telephone costs.

  - Bulk file transfers will probably continue to be performed as needed, to establish or update office-level data bases. The number and length of these transactions is expected to grow, judging from the high priority AID/W and USAID users assigned to mainframe access.

  - Bulk file transfers are the most lengthy type of transmissions AID end users are likely to perform. Since many of these transfers are tied to Agency-wide budget preparation, review and presentation cycles, the size of the overseas AID program will also affect traffic flow.

- USAIDs provided with high-speed circuits by the Department of State are expected to divert a portion of the traffic currently being sent via the cable system to these new circuits. These will also have an impact on the use of other existing communications media such as the telephone, "pouch," and APO.

- Some of the data communications occurring in the USAIDs at present on privately-owned, contractor or host-government equipment, will shift to these new official AID channels.

- The extent of this shift is difficult to measure because no true baseline can be established for the existing level of communications.

- Communications with the Agency's main computer and with VS minicomputers in the USAIDs are expected to remain "bursty."

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This chapter has shown that there are well-defined telecommunications requirements for AID/W, as well as the USAIDs. In order to determine how much traffic the new telecommunications system would have to handle on any given day, estimates projected out to FY86 have been provided. The next chapter will discuss the network and telecommunications implications of these findings.

III. TECHNOLOGY OPTIONS

III. TECHNOLOGY OPTIONS

Based on an assessment of available telecommunications technology and identification of AID users' requirements, this chapter presents the fundamental options for building a network for the Agency, as follows:

- Broad technology options to fit AID's needs for connectivity and the installed or presently planned base of equipment
- Users' requirements, as translated into requirements for a telecommunications network
- Benefits which can be obtained by installing a telecommunications network
- Description of the three fundamental technology options
- Evaluation of the technologies.

1. AID'S EXISTING TELECOMMUNICATIONS AND AVAILABLE TECHNOLOGIES

As noted earlier, one of the key assumptions on which this study is based is that AID should try, to the extent practicable, to make use of the current installed base of equipment and State Department-provided communications facilities.

(1) AID's Existing Telecommunications System

Chapter II described AID's present telecommunications as a set of systems and facilities which are not presently connected or, for the most part, compatible:

- The telephone system is a stand-alone system dedicated to conventional voice traffic, although it is used for a small amount of dial-up communications between basically identical equipment.
- The ADP terminal network uses a "star" topology with dedicated (leased) or dial-up connections between user offices and the mainframe computer.

- External connections, such as to tap a university's data base from an AID PC, are effected using dial-up connections.

- A small but expanding number of leased lines connect Wang equipment in AID missions with the AID mainframe computer and, on a trial basis, to the VS.

- The State-operated cable system is a high-volume, stand-alone system which presently is unconnected with other equipment for either generation or distribution of cables.

(2) The Dimension 85 PBX System

AID is presently committed to participate with State in the use of this advanced PBX for voice communications.

- AID will receive the benefit of the many advanced voice communications features of Dimension 85 when the system is installed in 1985.

- For data communications, which will require considerable enhancement to the basic voice-oriented system, the capabilities will be obtained only at extra cost to AID, and at the present time the data communications features are neither fully developed nor proven by the vendor, AT&T.

- A major task of this study is to determine whether AID should risk planning on using the PBX for data communications in its local network.

(3) Other Technologies

In addition to the installed base and the data communications potential of the Dimension 85 PBX, there are significant transmission and switching technologies which warrant consideration:

- Local area networks (LAN), which are applicable to both inter-building transmission and intra-building connections:

  - In a LAN, all devices share the same transmission medium--there are no separate circuits.

  - In a broadband LAN, the bandwidth is separated into subchannels, each of which may have a different speed and service.

- In a baseband LAN, there is only one high-speed channel, which is shared by all users.

- Other types of transmission media include:

  - Optical fiber cable, in which signals are digitized and sent by means of lightwave pulses, which are then converted back to electronic signals when received.

  - Microwave, a wireless form of transmission, which uses-line-of-slght modulation of radio frequencies.

  - Infra-red transmission, a wireless mode using high/low frequency pulses of the infra-red spectrum.

- In addition to transmission media, there are several options for modifying the signal at either end of the transmission to gain higher capacity and separation between transmissions:

  - Multiplexers, to create many subchannels of communication within one channel.

  - Concentrators, to compact or expand the transmission.

2. <u>AID NEEDS TO CONSIDER THESE NEW TECHNOLOGIES BECAUSE THE CURRENT COMMUNICATIONS FACILITIES CANNOT SATISFY ALL THE REQUIREMENTS</u>

- The full range of telecommunications requirements identified in Chapter II cannot be met by AID's current communications facilities.

- The APO, pouch, AID/W's inter-office mail and courier service are hardcopy distribution media that cannot be transformed into electronic transmission facilities. They are also perceived by users as "too slow."

- Other existing communications systems such as the DTS and telephone system are being upgraded at the initiative of the Department of State, but these two systems can only satisfy a limited range of AID's telecommunications requirements.

- Although there have been some notable advances in providing telecommunications support to AID/W and the USAIDs, these enhancements have been implemented on a case-by-case basis and do not provide connectivity between all staff who wish to communicate electronically.

- To recap, AID's current communications facilities, including the ADP terminal network and the incipient point-to-point telecommunications system being implemented on OA equipment, do not fully satisfy AID's user requirements (see Exhibit III-1).

3. NEW TECHNOLOGIES HAVE THE POTENTIAL TO MEET AID'S TELECOMMNUNICATIONS REQUIREMENTS IN THE LONG AND SHORT-TERM

The new technologies described above have the potential for meeting AID's telecommunications system requirements:

- Provide connectivity for users regardless of geographical location, e.g., provide a solution for AID/W and the USAIDs.

- Provide a network that will handle AID's projected traffic, including peaks.

- Permit expansion as AID's space requirements change, e.g., modularity.

- Provide a network that can satisfy the most pressing user needs, while at the same time maximizing existing equipment (see Chapter II).

- Provide tangible, immediate benefits to users.

- Provide a network that meets short-term needs, but also has a value-added dimension and potential for migration to a more sophisticated system as new technologies emerge.

Providing mere physical connectivity is not sufficient. These technologies are attractive because extensive customized protocol conversion is not required to permit information exchange:

- All Wang equipment, plus IBM PC/XT equipment, can exchange information.

- The Dimension 85 and Wangnet will support SNA/SDLC protocols, although some protocol conversion may be required.

EXHIBIT III-1

TODAY'S COMMUNICATIONS FACILITIES VS. USER REQUIREMENTS

USER REQUIREMENTS \ CURRENT COMMUNICATIONS FACILITIES	AID USER AUTOMATION			OTHER FACILITIES				
	ADP TERMINALS	WANG WORKSTATIONS	PERSONAL COMPUTERS	TELEPHONE	CABLE	AID MAIL	POUCH	PERSONAL DELIVERY
• INFORMATION EXCHANGE	PARTIAL			LIMITED (VOICE)	LIMITED	SLOW	SLOW	COSTLY
• ELECTRONIC MAIL	NA	LIMITED		NA	NA	NA	NA	NA
• ACCESS TO MAINFRAMES	FULL	LIMITED		NA	NA	SLOW & LIMITED (HARDCOPY)		
• ACCESS TO EXTERNAL DATA BASE	LIMITED			LIMITED (VOICE)	NIL (AID ONLY)			COSTLY

4. AID'S TELECOMMUNICATIONS SYSTEM REQUIREMENTS POINT TO THE NEED FOR A BACK-BONE NETWORK TO SUPPORT INFORMATION EXCHANGE, AS WELL AS VALUE-ADDED COMPONENTS

- In translating user needs into telecommunications system or network requirements, there is a need for:
  - A back-bone network
  - Value-added components
- The back-bone network is defined as the basic transmission medium to connect the Agency's office automation equipment to facilitate information, i.e., document and file exchange.
- Providing connectivity between OA equipment (VS and OIS workstations and microcomputers) would produce the most immediate tangible benefit, since it is estimated that over 95% of the Agency's equipment base will consist of OA equipment by FY86.
  - Connectivity would result in faster communications
  - Distance would become transparent, as would geographic location
- The value-added component would include all other system enhancements and additions, such as increased access to the AID main computer, access to external data bases, electronic mail and electronic distribution of cables with AID/W.
- Value-added components can be added to the system incrementally, in any order desired.

5. THE BENEFITS THAT WOULD RESULT FROM A NEW TELECOMMUNICATIONS NETWORK THAT SATISFIES BASIC USER NEEDS CONSIST OF THREE TYPES

The benefits that would result from a new telecommunications network integrating data and office automation equipment can be grouped into three broad categories:

- Cost Savings
- Cost Displacement
- Intangible.

(1) Cost Savings of $2 Million per Year Would Result by Reducing Operating Costs

These savings were substantiated by our users requirement surveys both in AID/W and USAID's and fall into the following categories, as shown in Exhibit III-2:

- Commercial Telephone Services (18%)
- FTS (12%)
- Commercial Telegram and Courier Services (1%)
- Pouch (4%)
- US Postal fees (1%)
- TDY (60%).

The percentages in parenthesis represent the respective component of the $2 million savings and not absolute savings. Exhibit III-3 details these direct cost savings savings. The largest component of savings fall in the TDY's category. Most USAIDs felt that the capability of having direct links to their respective regional bureaus, enabling them to transmit drafts of project papers and other documents in an efficient way, would reduce the need of three to five TDYs per year. See Exhibit III-4 for details on TDY cost savings.

(2) Cost Displacement of $4-7 Million by Increasing White Collar Productivity

These estimates are based on a judicious and very conservative execution of a productivity model developed by Booz, Allen and Hamilton. BA&H consultants sampled Fortune 500 corporations and large government agencies studying how a professional allocates time among several activities. Exhibit III-5 represents this distribution. By introducing a telecommunications system integrating data and OA equipment the predicted impact on each professional activity is illustrated in Exhibit III-6. The model predicts potential savings of 15% per year. Savings for each activity are shown below:

- Analysis (1%)
- Creating Documents (2%)
- Communicating (3%)
- Less Productive (9%).

By using only half of these percentages and normalizing to obtain a present and predicted staff count of professionals, the resulting potential benefits per year are of 110 to 164 staff years, thus resulting in an estimated value of $4 to $7 million.

EXHIBIT III-2

BENEFITS — ESTIMATED DIRECT COST SAVINGS

$2 MILLION PER YEAR

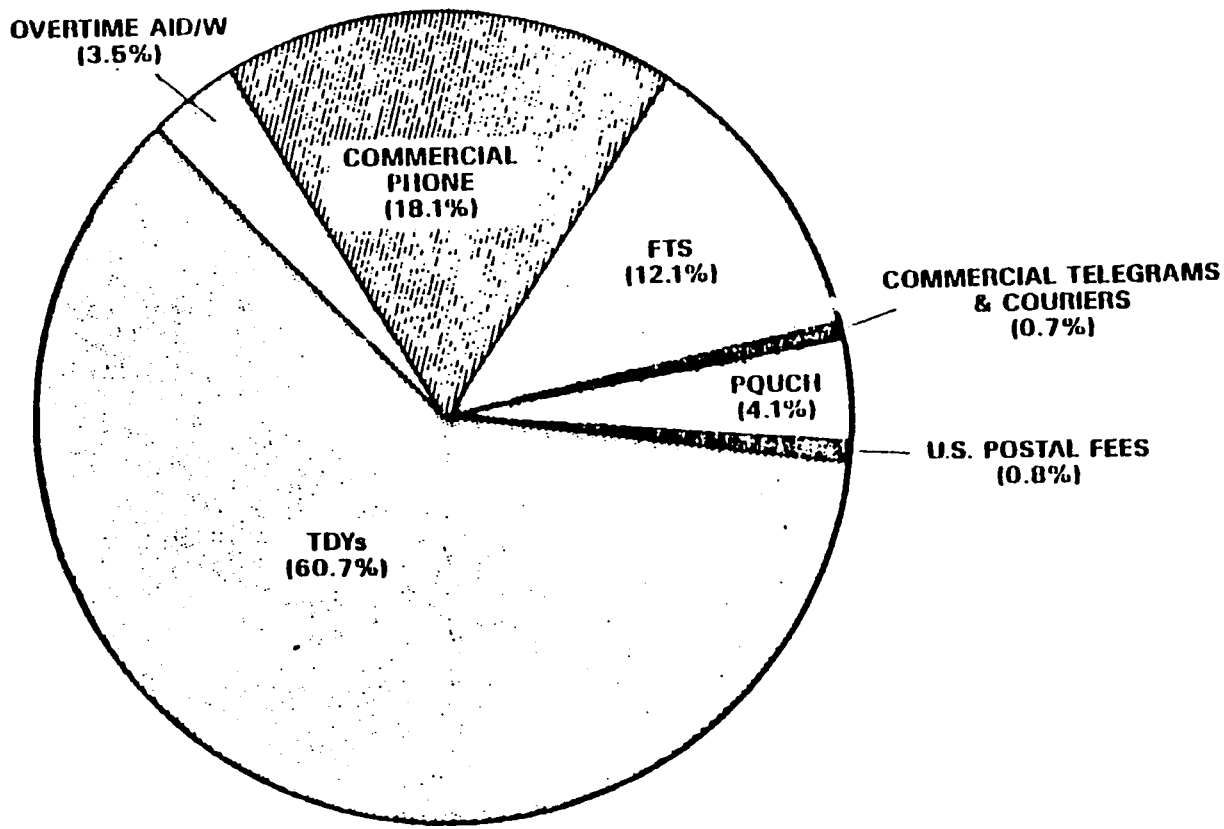


EXHIBIT III-3

Direct Cost Savings*

Category	AID/W	USAIDs	Total
TELEPHONE			
. LONG DISTANCE	$ 180k	$ 180K	$ 360k
. FTS	$ 240k	$ ---	$ 240k
COMMERCIAL TELEGRAMS	$ ---	$ ---	$ 11.1k
COURIERS			
(LOCAL, DOMESTIC & INTERNATIONAL)	$ ---	$ ---	$ 3.3k
POUCH	$ ---	$ ---	$ 81k
OVERTIME	$ 69k	$ ---	$ 69k
US POSTAL FEES	$ 16.5k	$ ---	$ 16.5k
TDYS	$ 408k	$ 800k	$ 1,208k
	$ 913.5k	$ 980k	$ 1,988.9k

* BASED ON FY85 ESTIMATES AND ESTIMATED 15% COST SAVINGS

EXHIBIT III-4

TDY Cost Savings

TDY COST SAVINGS ESTIMATES

- INFORMATION SUPPLIED BY AID STAFF INDICATES GREAT POTENTIAL SAVINGS IN TDY TRAVEL
- THE M BUREAU ESTIMATES THE AVERAGE COST OF A TDY @ $4,000
- THE NUMBER OF TDYS WAS APPORTIONED BY SIZE OF USAID AND OFFICE, AND THE FOLLOWING CALCULATIONS WERE MADE:

USAIDS

10 large USAIDs X 5 TDYs each @ $4k	=	$200k
50 smaller USAIDs x 3 TDYs each @ $4k	=	$600k
		$800k

AID/W

7 large Bureaus X 10 TDYs each @ $4k	=	$ 280
16 smaller Bureaus X 2 TDYs each @ $4k	=	$128k
		$408k

AID/W = $408k
USAIDs = $800k

Total $1,208k, or $1.2 million per year

EXHIBIT III-5

ALLOCATION OF PROFESSIONAL TIME

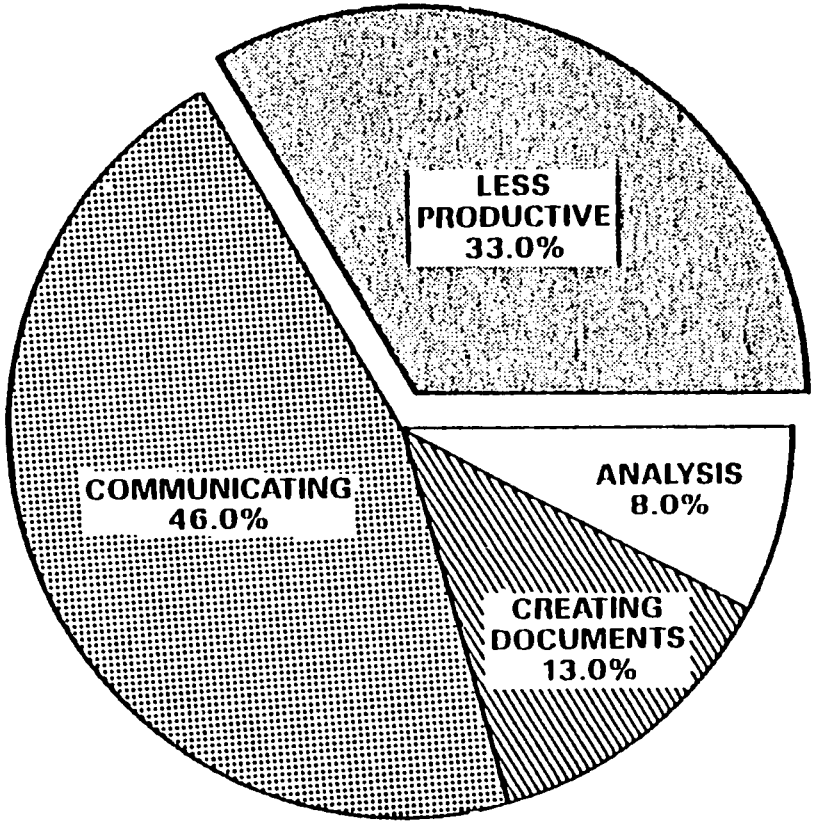
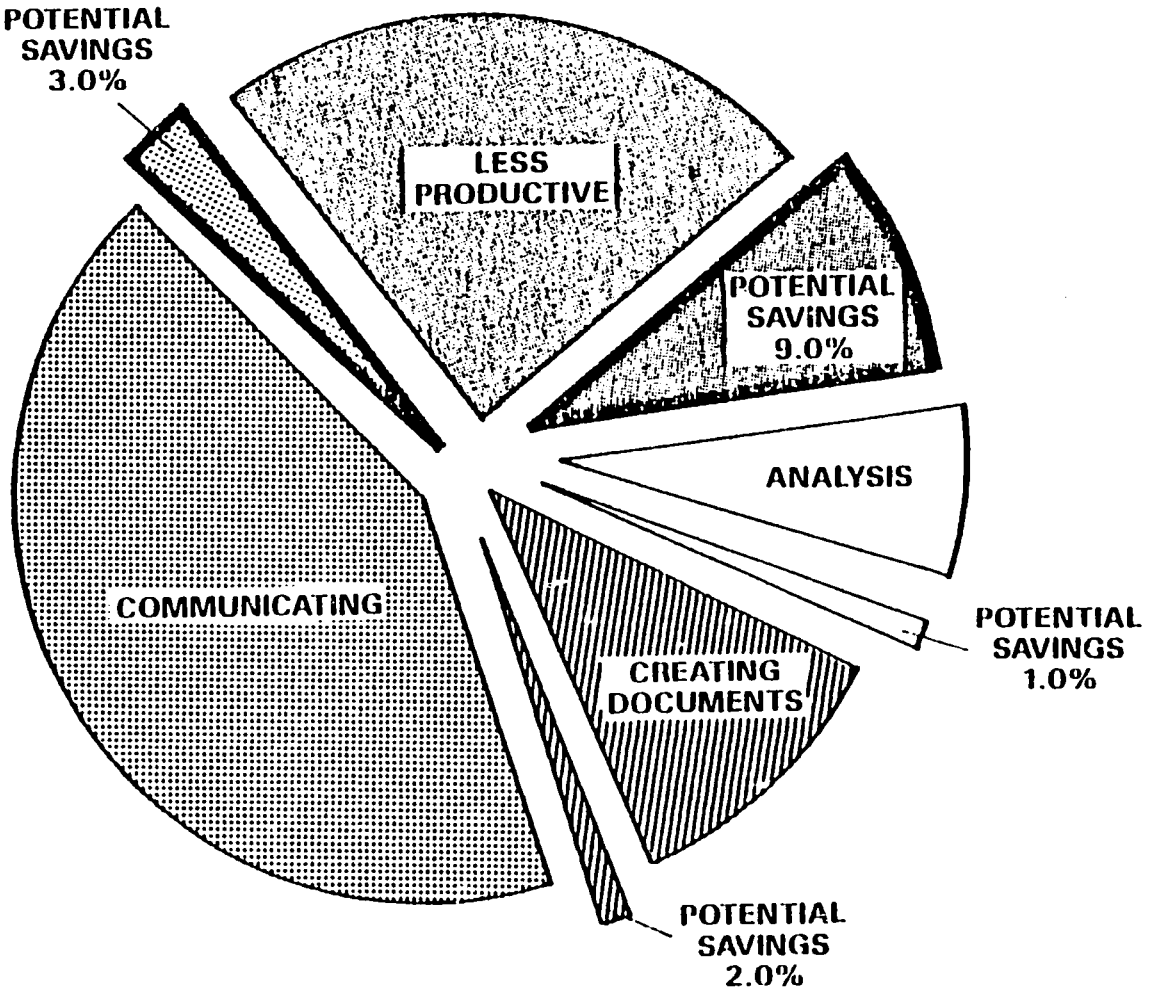


EXHIBIT III-6

BENEFITS — REALLOCATION OF PROFESSIONAL TIME

ESTIMATED BENEFIT PER YEAR { 110 TO 164 STAFF YEARS / VALUE: $4.7M TO $7.0M



(3) Intangible Benefits Fall into Program/Projectand Reform 88-Related Categories

- Program/Project-Related Benefits: Increased telecommunications capabilities would as perceived by the user community both in AID/W and USAID's to have the following positive effects:

  - Reduce the design/approval phase of an AID project by 1-3 months.

  - Reduce the life cycle of the PIO/T, PIO/P, PIO/C process by 1-4 weeks.

  - Allow speedy access to information residing in federal databanks (e.g. USDA, CDC, Commerce), thus assuring program and project officers critical information needed for the successful implementation of their projects.

  - Speedy access to legal data banks (e.g. Westlaw) from any mission, thus offering legal and contract officers access to information with potential savings of millions of dollars in possible litigation (according to some legal officers).

- Reform 88 Related-Benefits: The ability of speedy transactions between the field and among AID/W would result, according to AID controllers, in the following benefits:

  - Improved cash management

  - Speedier debt collection

  - Prompt payment

  - More effective procurement

  - More timely audits

  - Improved management information systems with a certain degree of integration.

6. THREE KINDS OF REQUIRED CONNECTIVITY

User needs, at the highest level of consideration, reflect the need to construct an integrated telecommunications system, or network. A telecommunications network is a communications system which connects users to applications and to each other. It is not an end in itself, but rather a means to an end. That is, it exists in order to channel data and information in an understandable form from one point, such as a data base, a device, or a person, to another.

The required telecommunications network will have to achieve connectivity of three fundamental types:

- Between and among the five buildings which will comprise AID/W in 1986--the "trunks" of the network
- Intra-building connections to link users and their devices to each other and to the trunks
- External gateways of several types to connect users on the network with other sources and channels of communications:
  - The USAIDs through leased lines and some dial-up connections
  - The cable system
  - Value-added data bases, such as DIS and those of other agencies and networks such as Telenet

Although the missions will be connected by three means--the cable system, dial-up connections and the leased lines (actually satellite facilities provided by State)--for planning purposes they have been visualized as being located in a "sixth building" in AID/W. In other words, the goal is to keep time and distance transparent to them and to provide the same degree of access to other users and data bases as AID/W users will enjoy. For example, the goal is to make their access to electronic mail as easy and virtually as rapid as for users in AID/W.

Another need, along with required connectivity, is for protocol conversion. Communications protocols, now different for the different classes of automation equipment used by AID, need to be converted in order for different devices to successfully use the

transmission facilities of the network. Thus, along with connectivity, the network needs to have devices and software to convert protocols. Without conversion, electronic transmission will not be able to retain the format of the documents or messages and will incompletely "read" characters upon receipt.

7. THESE PARAMETERS HELPED LIMIT THE NUMBER OF TELECOMMUNICATIONS OPTIONS TO A BASIC SET OF THREE

The need to provide certain kinds of connectivity and satisfy basic system requirements imposed certain constraints in the assessment of available technologies. A detailed description of the technology assessment appears in Appendix A. The findings of this assessment as they impact on the traffic flows and geographical constraints within which AID operates are described below.

(1) Local Area Networks

The Local Area Network (LAN) alternative for AID/W is a distributed type of network or transmission medium that connects information processing devices such as word processors, computers, printers, ADP terminals and other equipment. Control of the various network elements may be distributed throughout the network, at the point where each device connects to the network, or it may be centralized at some network head-end location, such as the mainframe.

- Network Topology: the network topology is the spatial pattern formed by the components of the physical backbone of the network, e.g., the cable, amplifiers, splitters, combiners and taps. In a coaxial cable LAN, for example, the backbone consists of a trunk cable running along the hallways and hidden in the ceiling. At various points the cable is split, signals are simplified and connections are made to the user's office.

  The transmission medium recommended for AID/W buildings consists of two broadband coaxial cable networks, one connecting Main State and SA-1 and another in Rosslyn (SA-18), with twisted-pair wiring connecting SA-15 and SA-16 to the Rosslyn network. The use of Broadband in the three buildings is warranted by the high density terminal/workstation population. The two LANs would be tied together via leased lines crossing the river and would require time division multiplexing of several medium and low-speed data channels. The broadband system linking Main State and SA-1 would provide complete transparent connectivity for users in those two buildings, because all devices would be on one network (see Exhibit III-7).

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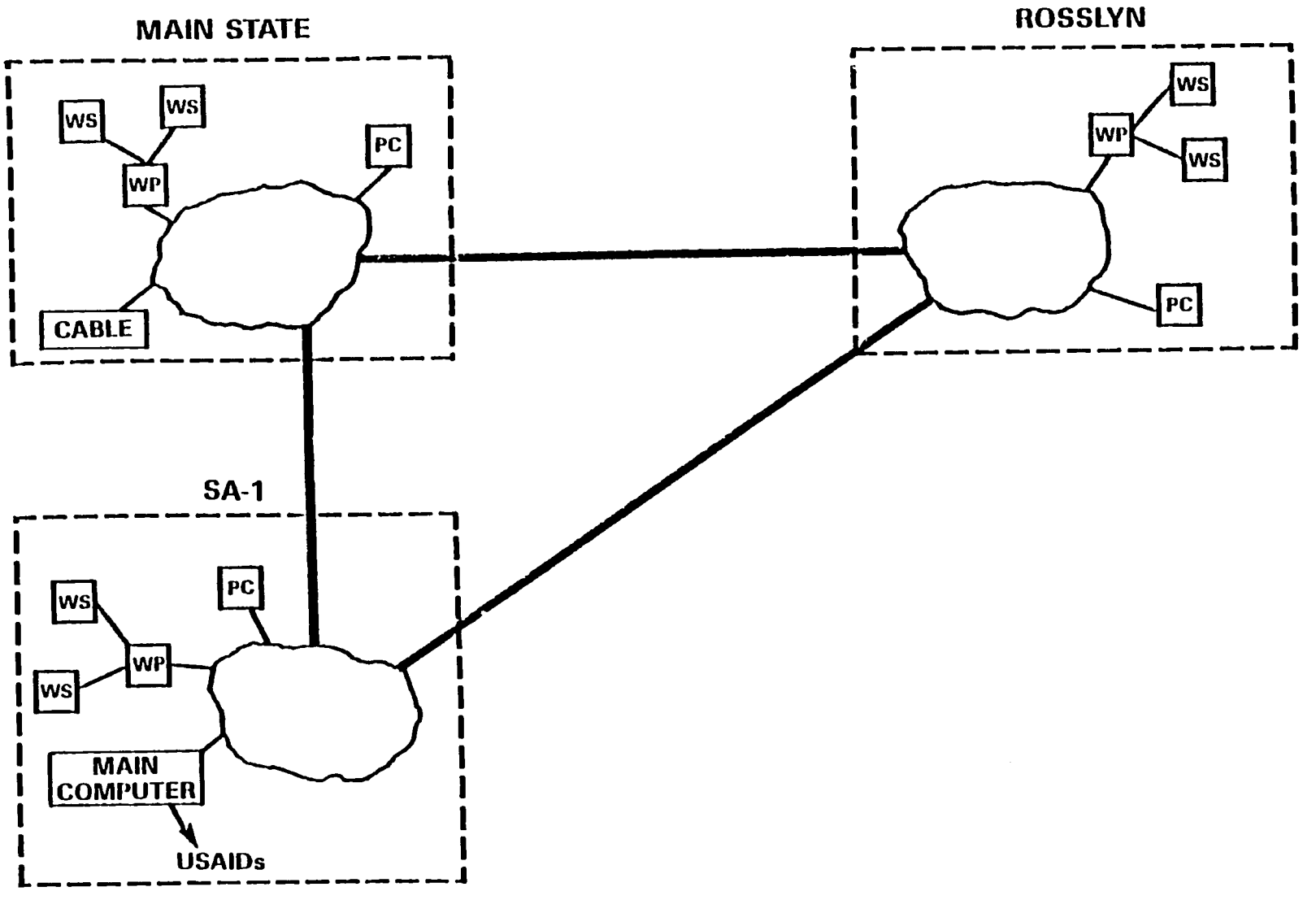
EXHIBIT III-7

LOCAL AREA NETWORK OPTION



A Broadband network can be visualized as a loop containing connections for all the kinds of automated equipment AID uses. Each such point of connection is a "node" on the network, including the mainframe, and link to the cable system.

For technical reasons, the leased circuits being installed between the USAIDs and AID/W would be connected through the mainframe computer, rather than tied directly into the network, via a modem-pool. ADP terminals could be connected to the LAN, if desired, or a separate ADP terminal network could be maintained.

If the proprietory Wang broadband network (Wang System Networking, WSN) is used, some protocol conversion would be required to connect Wang equipment and IBM PCs, which comprise the majority of AID's office automation equipment. Additional protocol conversions would be required to connect other vendor products, such as the ADP terminals and other processors, such as the cable computer and DIU.

Typically, broadband LANs can carry data, voice and video transmissions, and can provide connections for up to 65,000 nodes (or users), far in excess of the estimated 2,000 nodes AID/W and the USAIDs will have by FY86. The transmission speeds supported by a broadband network also exceed AID's current traffic volume requirements. Broadband LANs can support traffic at the rate of 4×10^8 bps (bits per second). AID's heaviest traffic flows occur within Main State and can easily be accomodated by the network.

- <u>Advantages of the LAN Approach in AID/W</u>

  - A Broadband LAN can support many high-speed data channels simultaneously, allowing OIS cluster controllers to appear like a single OIS system to the user.

  - Workstations or terminals can be located anywhere on the network and can be easily moved as the need arises.

  - Since the LAN uses a packet-switching access method, as well as both permanent and switched circuits (as desired), a single transmission can be directed to a large number of terminals simultaneously.

- Can support graphics and video transmissions.

- Lends itself to value-added applications and connections to wide-area or metropolitan area networks, or X.25 networks.

Disadvantages of the LAN Approach

- Increased complexity of design.

- A LAN is simply a transport mechanism and cannot support communications between incompatible devices, just because the devices are physically tied together on the same network.

- Existing protocol incompatibility problems arising from the use of different vendor products are not solved by connecting the devices to the same cable.

(2) Private Branch Exchange (PBX) Approach

The most centralized of the technology alternatives available to AID is the Private Branch Exchange, or PBX, a private, on-premises switching system originally designed to handle telephone communications. The digital PBX marketed by AT&T, the Dimension 85, that AID is acquiring for voice communications, also has some limited data switching capabilities. There are obvious advantages to AID if the PBX could be used to handle both data and voice traffic.

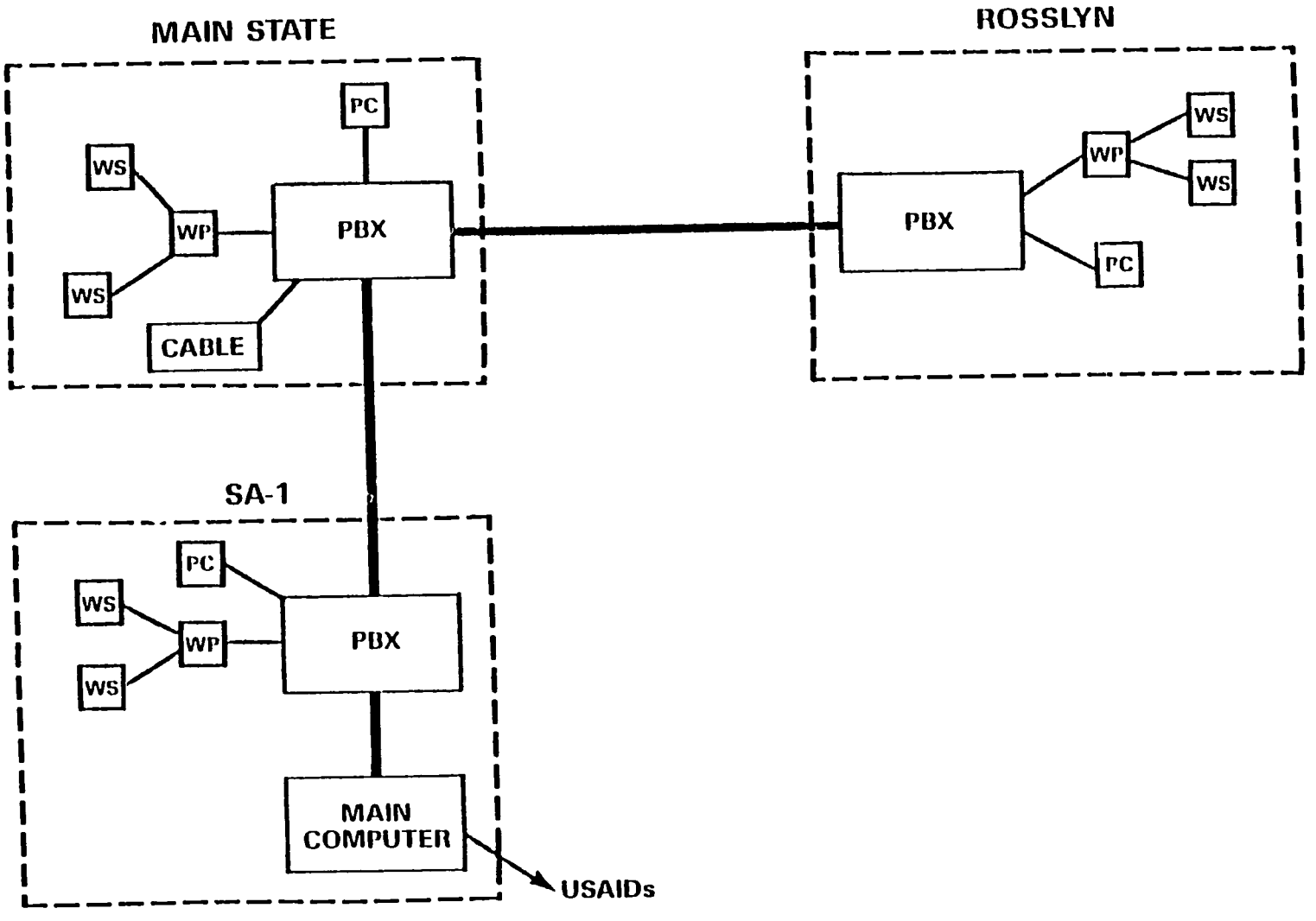
- PBX Topology

The PBX option connects almost all devices through digital PBX switches. The network consists of three digital PBX switches, distributed across three buildings, Main State, SA-1 and SA-15. The switches are interconnected via T1 circuits that support both voice and data transmissions. Intra-building PBX lines consist of multiple twisted-pair lines connected to outlets in each office. The intra-building topology is that of a star network architecture (See Exhibit III-8).

All external access to the PBX is through the switch located in Main State, including cable and USAID traffic, as well as access to external data bases and the public switched network.

EXHIBIT III-8

PBX OPTION



Advantages of the PBX

- Capable of interconnecting geographically dispersed dissimilar terminals and workstations (up to several thousand).

- A single vendor might be made responsible for operation of the network, including installation, maintenance and configuration. Such an approach might minimize risk if the vendor delivers what is promised on time.

- If the PBX can handle AID's traffic and provide protocol conversion through its special applications processors, using the PBX would save re-wiring for a LAN and would eliminate the need for many of the existing lines and modems.

Disadvantages of the PBX (Dimension 85)

- All data switching is circuit-oriented. Each connection must be established like a phone call and each connection is a point-to-point link made through the PBX.

- The current generation of PBX switches have only limited data handling capabilities, although AT&T has announced a LAN packet switch interconnect with the Dimension 85 for late 1984.

- Software to support AT&T's digital multiplexed interface has not yet been developed and current plans do not call for it to be compatible with IBM computers, although the HP, Wang, Data General and Honeywell products will be compatible.

- Protocol conversions would have to be performed at the mainframe, since it does not appear that the AT&T applications processors will be able to perform this function in the near future.

(3) Point-to-Point Communications

This type of communications corresponds most closely to present arrangements for AID/W telecommunications. Connectivity between devices is achieved only when needed (although lines may be dedicated for this purpose), and a circuit must be established for each communications session through switching.

In the AID environment, by far the most practicable form of point-to-point communications would use a mainframe computer as the central switch. (This does not mean that the mainframe on which data processing is performed would play this role, only that a large computer is required to switch and route communications). Connectivity between devices, such as a PC in Rosslyn and a PC in Main State, would be through the independent connection of these devices to the communications controller of the mainframe. Connectivity could be achieved by coaxial cable or twisted pair. Besides connectivity, the mainframe would have software to convert communications protocols which characterize the devices connected to it.

Advantages of a point-to-point network, as shown in Exhibit III-9, include:

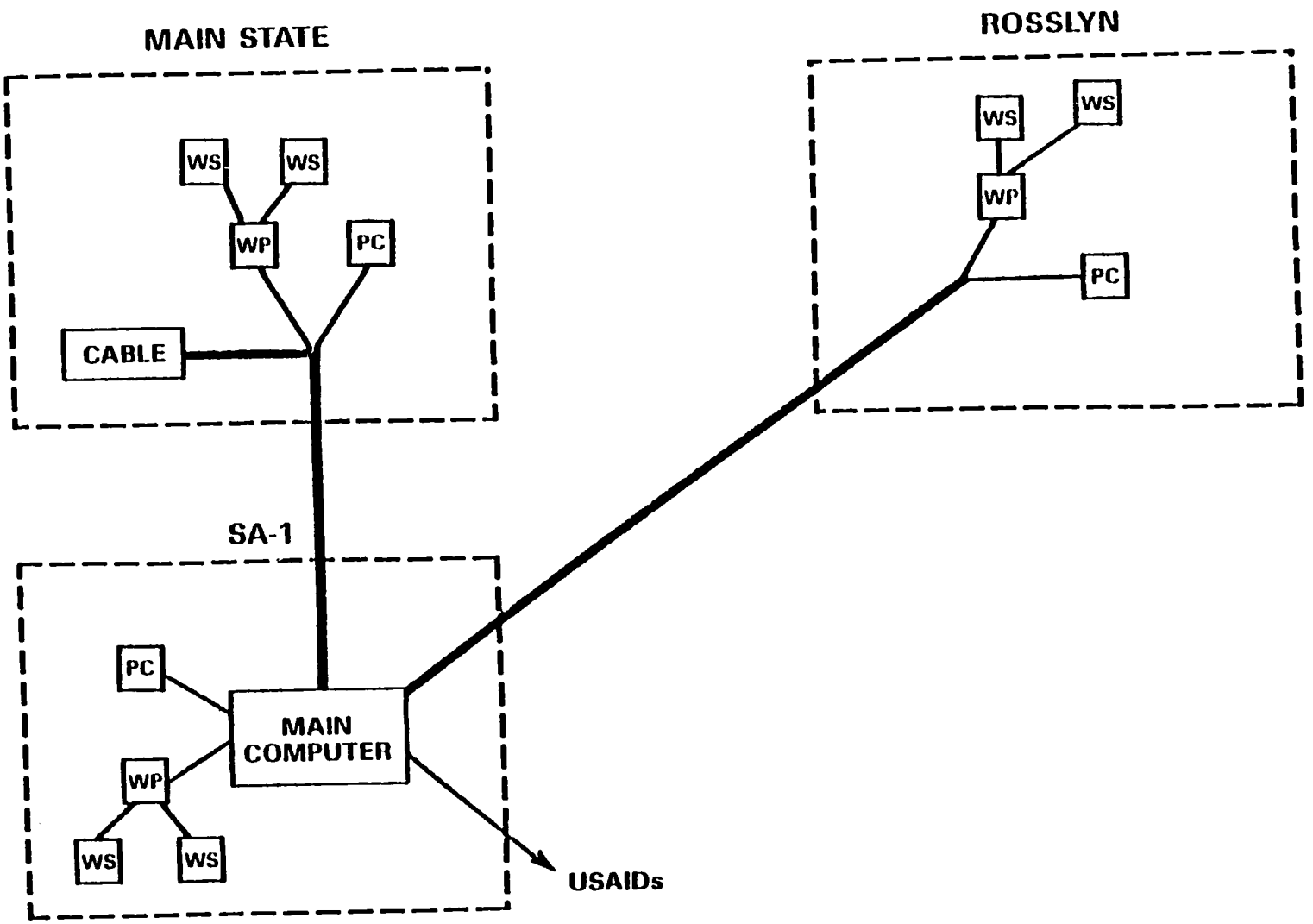
- From a planning and acquisition perspective, it requires the least commitment, as it reflects largely today's telecommunications arrangements.
- It is relatively low-risk in that it allows the introduction of other network technologies, e.g., for a network within one or more AID/W buildings.

Disadvantages include:

- The approach permits little flexibility for expanded telecommunications functions (short of adopting a LAN or PBX for part of the distributed network).
- Office re-locations and moves are costly and disruptive--with each one new wiring or re-wiring is required.
- Data transfer rates are relatively low-speed, limiting rapid file transfers, such as those required by graphics.
- A considerable amount of unique, originally developed communications software will be required, given the many different kinds of devices which need to be connected.
- Connectivity does not insure the capability of sending and receiving documents and/or files that are "readable" in terms of format and meaning of the data. Higher-level protocols must coincide for any real communications to take place.

EXHIBIT III-9

POINT-TO-POINT OPTION



8. THESE THREE APPROACHES TO DEVELOPING A TELECOMMUNICATIONS SOLUTION FOR AID WERE SUBJECTED TO A RIGOROUS TECHNICAL EVALUATION AND THE FINDINGS POINT TO A LAN-TYPE APPROACH AS THE OPTIMAL CONFIGURATION FOR AID/W

- Each of the three generic approaches was considered in light of its capabilities for satisfying the requirements for AID/W, in terms of:

  - System requirements (back-bone and value-added)
  - Traffic projections
  - Types of connectivity required
  - Interface with existing AID equipment and systems
  - Technical soundness (maturity and risk trade-offs)
  - Costs

- The transportability of the recommended technology for replication, with modifications, in the USAIDs was also a major factor influencing the technical evaluations.

- The findings and conclusions of this evaluation are presented in the next chapter, as part of the discussion of the recommend configurations for both AID/W and the USAIDs.

IV. EVALUATION AND RECOMMENDATIONS

Given the users requirements analyzed in Chapter II and the available technologies options assessed in Chapter III, this chapter presents a synthesis including:

- Telecommunications goals for the agency
- Strategies
- Objectives:
  - AID/W Network
  - AID/W Cable system links
  - USAID's Telecommunications
  - Value-added functions (e.g. Electronic Mail)
- Technical selection methodology for AID/W network
  - Criteria
  - Weighting and scores
  - Costs
- Functional Comparison of options vis-a-vis AID's requirements
- Cost comparison
- Recommendations
- Budget
- Implementation Plan
- Management Issues
- Conclusions

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1. TELECOMMUNICATION GOALS OF THE AGENCY

The implementation of this or any technology has as it's purpose to solve problems and/or increase the ability of the organization to accomplish its work in a more efficient and economical manner.

Thus the proposed telecommunication goals of the Agency were developed in support of the Management Bureau strategies and goals - as interpreted by the study group - to assist in resolving several management issues at the planning, control and operations level.

(1) Implement a Local Area Network in AID/W Which Would Interconnect all Office Automation OA Equipment

This use of automation would increase white collar productivity which would allow the Agency to service a larger portfolio while maintaining constant the head-count in AID/W and even reduce the number of foreign FTE in Posts.

(2) Assure Access to AID/W Maincomputer From Any Point Within the Agency (Both in AID/W and USAIDs)

By increasing the availability and timelines of information available to project and financial managers, their ability to make better and quicker decisions increases.

(3) Implement Links From/To AID/W LAN From/To to USAID's

Faster interchange of text/data between geographically removed points within the Agency will result in:

a) Decreasing the approval life cycle of a project

b) Increase the efficiency of the PIO/T/P/E process

c) Decrease or displace some operating costs

- Please see the Benefits Section 5, Chapter III

d) Provide project and financial managers with more timely information on obligations

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e) Standardized and streamline payment process in support of Reform 88.

(4) Interconnect AID/W LAN to Public Data Network and Other Federal Data Networks

Project officers and other staff (e.g., regional officers) will be able to tap commercial and Federal databases, enabling them to have up-to-date information when making decisions.

(5) Implement Electronic Mail

This in combination with the upgrade of the telephone system will increase the productivity of the staff.

(6) Interconnect Cable System to AID/W LAN

This will enable cables to be cleared faster and be received faster at the desk of action officers, thus increasing the effectiveness of AID/W in supporting USAID's.

(7) Interconnect the DIU System to AID/W LAN

By allowing easy on-line access to the DIU system AID/W and USAID's staff are able to query the institutional memory, thus increasing their effectiveness while formulating new projects, programs or managing existing ones.

2. STRATEGY

The overall strategy in selecting a set of solutions for the telecommunications requirements of the Agency is one of integration.

(1) Integration is the Cornerstone of AID's Telecommunications Strategy

Since a good part of the information needed is in text form, as well as data in the main computer, the selected network should maximize the integration between office automation and data processing equipment.

The solution is not only to facilitate access from many terminals to one central processor, but to provide distributed communications for OA equipment throughout the Agency.

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(2) Other Components of AID's Strategy are Also Critical to its Success

- The DTS (cable system) remains the cornerstone for official telecommunications between USAID's and AID/W. It is a key node in any network built in AID/W.

- Complement the cable system by providing:

  - An electronic mail system in AID/W to allow fast, informal communications among individuals, and as a medium to distribute cables as well as general information (e.g. notices) to AID/W.

  - A system that supports bulk transfer of text (five pages or more) among any OA equipment within the agency worldwide.

- Use of Department of State provided links with USAIDs, complemented when needed by international carriers.

- In the USAIDs, minimize dependence on local telecommunications agencies (PTT's) and reduce to a minimum localized dial-up services. The policy should be to hardwire USAID links to embassy equipment, when economically feasible. Whenever possible, AID must avoid transborder dataflows issues by avoiding connections to PTT's.

(3) A Major Constraint in Developing a Strategy was the Need to Use Existing Equipment

Because one of the key assumptions of this study was to maximize the use of present office automation and data processing equipment, the following parameters were set:

- No solution would be considered that necessitates replacing terminals, OA or DP equipment.

- Maximize the use of off-the-shelf software to maintain development costs at a minimum.

- Solutions would be proven, and not have a high-risk factor associated with them. They should be obtained from reputable vendors.

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- Solutions would have a relatively short implementation cycle and short learning curve, so that any return in investment in the form of productivity benefits can be realized as soon as the solution was implemented.

(4) Objectives

To accomplish the stated goals, with these parameters in mind, the following objectives were defined:

- Establish a network in AID/W which will interconnect all OA equipment in all the buildings in AID/W. In addition, allow any terminal to access the main computer, and external value-added networks (e.g. Tymnet or Telenet).

- Establish a link from the AID/W cable system to State for outgoing cables, and also make the cable system a node in the AID/W network so that a cable can be received and/or transmitted from any word processing machine.

- Equip and interconnect all OA/DP equipment in the USAIDs, with telecommunications facilities, so they can be treated as nodes on the AID/W network.

- Establish an electronic mail function.

3. AID/W NETWORK

The technology selected in implementing an AID/W network will be a long-term pivotal resource, thereby determining directly or indirectly how the Agency controls and utilizes a critical Agency resource - information.

- Therefore, the selection methodology was carefully defined to assure not only a viable technical solution, but one that was in accordance with the Agency goals, strategies and mode of operating. Cost was determined to be an important selection criteria, but not the only one.

- The selection process was developed by Agency management and technical staff, complemented by two independent consultant firms, and was an iterative process.

- As described in Chapter III the final three options were:

  LAN, the broadband type that Wang supports

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- PBX, where the new telephone switch (Dimension 85) would switch data

- Point-to-Point, where the IBM main computer plays the role of central switcher.

4. EVALUATION METHODOLOGY FOR AN AID/W NETWORK

(1) Technical Criteria were of Paramount Importance

- The methodology was based on the following criteria, shown by the weight determined by IRM:

  - Performance, 15%
  - Compatibility, 20%
  - Ease of use, 20%
  - Flexibility, 20%
  - Cost, 25%

- The absolute scores were 1 (low) through 5 (high). Several factors were considered for each criteria as shown in Exhibit IV-1. Both the raw and weighted scores for each of the criteria are shown. The LAN scored highest, followed closely by the PBX. These criteria are described below for each option.

- The LAN scored very high on performance, compared to the other options.

  - LAN -- With the broadband architecture, load capacity and transmission speed are more than traffic estimates require. The LAN provides "room" to grow so that new users and services, (e.g. image transmission), can be added in the future. Security - high.

  - PBX -- Since voice/data switchers are a new technology, there is no guarantee that vendors can deliver promised capabilities. In general, high data usage would impact the load capacity of the switch, thus affecting the quality of voice traffic. While the Dimension 85 PBX being installed is capable of handling the short-range data volumes (estimated 1000 users), the system would be processing at/or near capacity with this workload. Consideration would have to be given to what "data" workload the Department of State would be adding.

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EXHIBIT IV-1

A Set of Five Major Criteria for Selection of Alternative Solutions for AID's Telecommunications System

	Weight	Raw Score			Weighted Score		
		LAN	PBX	Pt-to-Pt	LAN	PBX	Pt-to-Pt
1. Performance o Reliability (design margin, vendor reputation) o Load Capacity (traffic) o Transmission Speed/time response/delays o Error characteristics (fault correction, soft degradation, recovery) o Measurement capability (for maintenance, control) o Security	15	4	3	3	60	45	45
2. Compatibility o With exiting procedures o With each existing system o With real-world environment o With different data systems (IBM, Wang, cables)	20	4	3	3	80	60	60
3. Ease of Use o Learning/training o Ongoing operation o Maintenance (various options)	20	3	3	2	60	60	40
4. Flexibility/Adaptability o For geographic expansion o For increased traffic flow o For new/improved functions o For wide-area networking o To many different protocols o For moves and changes o For reconfiguration (new peripherals)	20	4	3	2	80	60	40
5. Cost	25	2	3	1	50	75	25
	100				330	300	210

AT&T consultants suggest that growth beyond 1000 +- users would require migration to AT&T's LAN for future growth. Security - medium.

- Point-to-Point -- Although the load capacity and transmission speeds afforded by this option are adequate, error handling capacity and maintenance and control are cumbersome and inadequate. Security - almost none.

The LAN also appears to be most compatible with the existing AID environment.

- LAN -- The broadband network supports Wang and IBM equipment. Furthermore, the utility band permits AID to add other equipment. The LAN scored highest in compatibility.

- PBX -- Supports most IBM compatible protocols, but not Wang protocols. Hence, the Wang equipment would be excluded or require extensive software development and maintenance. This incompatibility is not acceptable.

- Point-to-point -- Although the Point-to-Point version is compatible with AID's present equipment, any new additions (e.g., cable system) would require tailor-made solutions and would entail high development and maintenance costs.

- Both the PBX and LAN promise greater ease of use than Point-to-Point.

  - LAN -- The broadband solution, with its menu-oriented architecture, is probably the most user friendly. Furthermore, the AID user community because of its exposure to OA equipment has, in a sense, already been trained. However, in the scoring the LAN and PBX were rated equal.

  - PBX -- Again a layer of application software would have to be developed to create a user friendly environment. However, from a maintenance point of view, the PBX option is more than adequate and roughly equivalent to the LAN.

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- Point-to-Point -- Is the least user friendly of all the options. There is not a common language and the user must learn each equipment protocol.

. The LAN and PBX are Seen as Equally Flexible

- LAN -- Although initially more costly than the PBX, once a building is wired, changes are economical. Increasing the number of workstations and terminals would not affect the network.

- PBX -- The PBX by its nature is highly flexible, changes require minimum rewiring. However, an increase in the number of terminals can seriously affect the capacity of the data/voice switch as discussed earlier (under performance). Because this capacity issue relates more closely to performance, it did not affect the scoring for PBX here.

- Point-to-Point -- This option is the least flexible and most costly to respond to changes. Any displacement of terminals or machines implies new costly wiring. Furthermore increases number of terminals and micros would directly increase load on the main computer.

5. CAPABILITY OF OPTIONS TO MEET REQUIREMENTS

(1) Each Alternative had to be Able to Meet AID's Needs

. In addition to the above factors, a second set of criteria were developed in which each option was scored as to how well it would respond to the Agency's telecommunications requirement. These functions and/or services were categorized in Chapter II under the following headings. The weight assigned by IRM for each requirement for purpose of this comparison are shown below:

. Mainframe access, 30%
. Communications between office automation equipment, 40%
. Cable distribution, 10%
. Access to external data bases, 10%
. Electronic mail, 10%

Exhibit IV-2 shows the raw and weighted scores for each requirement. The local area network option. The functional adequacy of each option is described below.

(2) Mainframe Access

- LAN -- Since all Wang equipment can emulate at least two IBM protocols for mainframe access, the LAN was rated as high as the Point-to-Point.

- PBX -- Mainframe access with the PBX would be more problematic, depending on terminal equipment used. A protocol conversion would have to take place.

  In the case of ASCII terminals, ATT has modified its strategy and maintains that a new "cluster controller" which would also do protocol conversion is more economical and efficient than the Applications Processor. In the case of Wang equipment it would be more difficult since the State/AT&T contract does not call for Wang protocol conversion.

- Point-to-Point -- By definition since all terminal equipment is connected to the mainframe, this option scored high, in mainframe access.

(3) Communications Between Office Automation (Text Transfer)

- LAN -- By definition the Broadband scored highest in OA interconnectivity. No protocol conversion is necessary for Wang equipment.

- PBX -- Again since PBX does not support Wang protocols interconnectivity between Wang terminal would be poor.

- Point-to-Point -- Text from one OA machine would be routed by the mainframe using IBM protocols, thus a delay and some limitation would be present (e.g., lines would have to be 80 characters or less) Scored medium.

(4) Electronic Mail (EM)

- LAN -- The proposed broadband network vendor has announced a product, Wang Office, which can support AID's needs.

EXHIBIT IV-2

ESTIMATED CAPBILITIES OF OPTIONS
TO MEET USER REQUIRMENTS

REQUIREMENTS	WEIGHT	RAW SCORE			WEIGHTED SCORE		
		LAN	PBX	PT-TO-PS	LAN	PBX	PT-TO-PS
. Mainframe Access	30	3	2	3	90	60	90
. Communic Actions Between OA Equipment	40	3	1	2	120	40	80
. Access to External Data Base	10	3	3	2	30	30	20
. Electronic Mail	10	2	2	1	20	20	10
. Electronic Cable Distribution (AID/W)	10	3	3	1	30	30	10
				TOTAL	290	180	210

Key: 1 = Less Than Adquate
2 = Adquate
3 = More Than Adquate

- PBX -- Dimension 85 EM was announced to run on an applications processor. This is a micro with one disk drive. It is doubtful that it could hold the messages and files for 2000 addressees.

- Point-to-Point -- Scored low, those electronic mail packages running in the mainframe are designed for a relatively small number of addressees (200-300). It would not be adequate for AID's 2,000 to 3,000 addressees.

(5) Electronic Cable Distribution

- LAN -- Using a VS as a gateway/bridge the cable can be treated as any other WP document which can be transmitted/received/ to/from any other OA equipment.

- PBX -- In this case applications processor software would have to be written to convert protocols from Data general or VAX equipment and to create "envelopes."

- Point-to-Point -- It would be difficult to implement unless all the cables are transferred to the main computer and message forwarding/storage software is written for the mainframe.

(6) Access to External Data Bases

- LAN -- In this case the LAN solution is no better or worse than the PBX solution. A gateway with a bank of modems has to be installed somewhere in the LAN.

- PBX -- Less costly since a bank of modems to serve all data terminals can be connected to one of the switches.

- Point-to-Point -- Costly, since all terminals would have to have modems for dial-up service. In addition every single CPU would here to have TTY simulation software.

6. COST EVALUATION

(1) LAN

- Key Assumptions

  - Only those buildings where the number of terminals and the predicted traffic is large enough would be wired (total of 3 loops), with the other buildings connected via point-to-point or the PBX data modules.

  - Most of the software will be off-the-shelf and not developed from scratch.

  - Present workstations already connected to OIS would not be directly connected to the network, but would remain connected to OIS CPU then to the network.

  - Hardware costs include the cost of a VS system to serve as gateways for intra-building connectivity.

- The cost data are shown below, in thousands of dollars:

Capital Costs

1.	Hardware	$1,500
2.	Software	500
3.	Installation	1,000
4.	Development	400
5.	Training	100
	Total	$3,500

Recurring Annual Costs

1.	Interconnect	$ 50
2.	Maintenance	300
3.	Training	50
4.	Manpower	300
	Total	$700

(2) PBX

- Key assumptions

  - Because the number of projected terminals, workstations and micros per PBX switch, the cost of an applications processor for each switcher was included.

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- No costs are included for a network control center since that service would be part of the voice network.

- Since the State contract with AT&T does not support Wang protocols, tailored software would have to be developed for Wang protocol conversion.

. The costs are shown below, in thousands of dollars:

Capital Costs		
1.	Hardware	$1,100
2.	Software	800
3.	Installation	100
4.	Development	400
5.	Training	200
	Total	$2,600

Recurring Annual Costs		
1.	Interconnect	$ 50
2.	Maintenance	400
3.	Training	100
4.	Manpower	200
	Total	$750

(3) Point-to-Point

. Key assumptions

- Since the main computer plays a critical role as switcher or router, an upgrade to serve additional telecommunications functions would be necessary.

- Costs are included for the purchase of a dedicated mini to support a network communications center.

- All software to handle routing would have to be developed from scratch.

- Those terminals already connected will not be re-wired.

- The cost data are shown below, in thousands of dollars.

Capital Costs			Recurring Annual Costs		
1.	Hardware	$2,000	1.	Interconnect	$100
2.	Software	1,000	2.	Maintenance	600
3.	Installation	500	3.	Training	200
4.	Development	400	4.	Manpower	300
5.	Training	300			
	Total	$4,200		Total	$1,200

For ease of comparison, Exhibit IV-3 provides cost comparison data for capital and recurrent costs, as well as total costs for the system over the five-year planning period.

7. RECOMMENDATIONS

This section describes the recommended telecommunications enhancements in the following categories:

- AID/W
- USAIDs
- Cable link to State
- Cable distribution to central points in AID/W
- Electronic mail
- Access to external data bases

(1) AID/W

- AID/W Intra-Building Connectivity -- A broadband Local Area Network (LAN) is recommended to be installed in the three buildings (under the AID/W five building scenario) where the traffic volumes and/or the terminal density warrants it as shown in Exhibit IV-4:

  - New State - 1 loop with 1 VS as a gateway
  - SA-1 - 1 loop with 1 VS as a gateway
  - SA-18 - 1 loop with 1 VS as a gateway.

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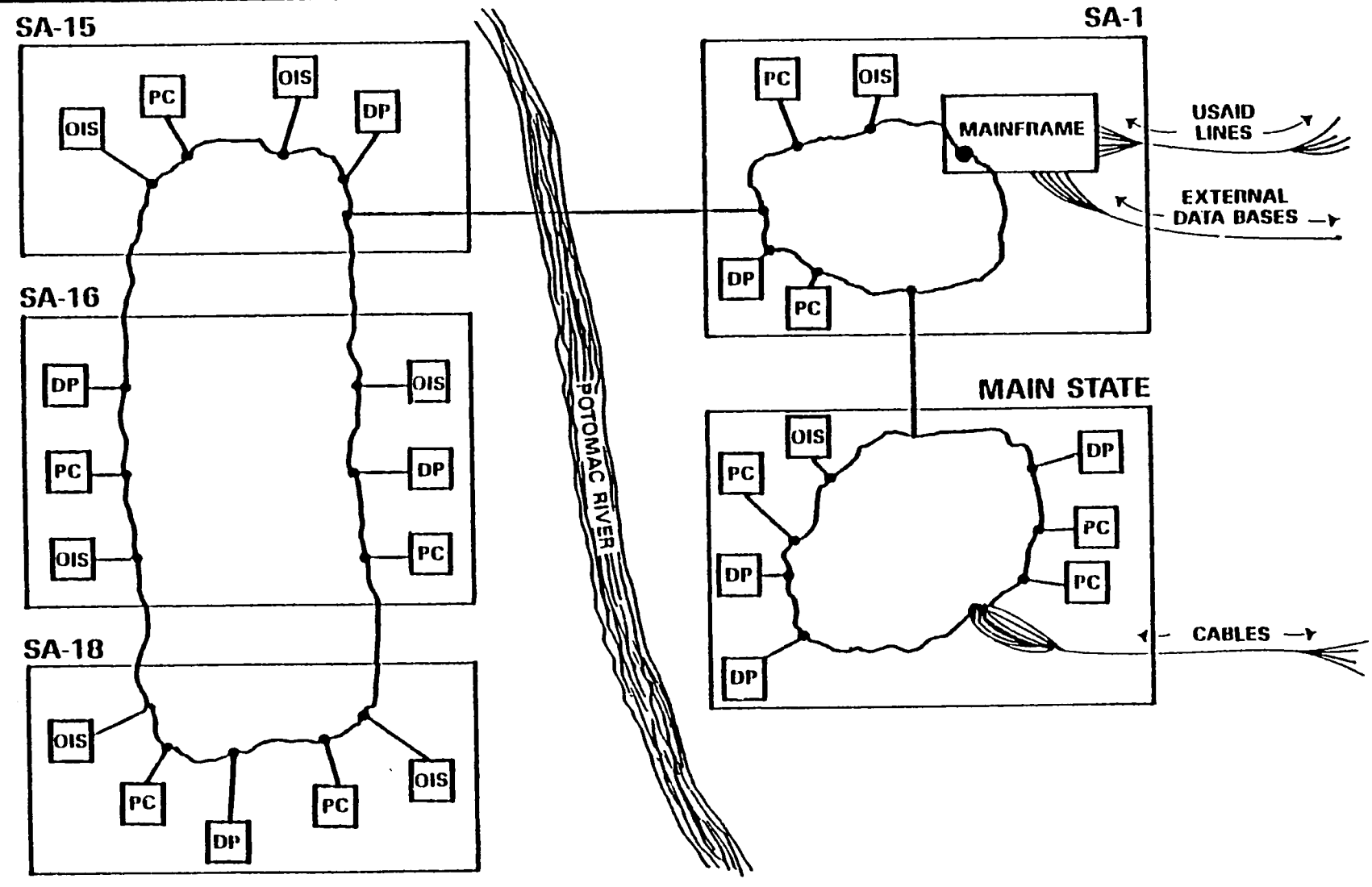
EXHIBIT IV-3

Cost Comparison
(Shown in Thousands of Dollars)

CAPITAL	LAN	PBX	POINT TO POINT
Hardware	$1,500	$1,100	$2,000
Software	500	800	1,000
Installation	1,000	100	300
Develop	400	400	400
Training	100	200	300
TOTAL	3,500	2,600	4,200
RECURRING ANNUALS			
Intl Connect	50	50	100
Maintenance	300	400	600
Training	50	100	200
Manpower	300	200	300
TOTAL	$700	$750	$1,200
FIVE YEAR	$3,000	$3,000	$4,800
GRAND TOTAL	$6,500	$5,600	$9,000

EXHIBIT IV-4

RECOMMENDED AID/W NETWORK



- AID/W Inter-Building Connectivity -- Inter-building traffic between the loops described above will be switched by the mainframe, using a software package like Wang's IDS. The VS gateway minicomputer would be directwired to the mainframe.

- OIS Equipment Will Become File Servers in the LAN Configuration -- With the installation of a local area network, the OIS, in addition to serving as a word processor will begin to play the role of file server. Thus, it is recommended that each AID/W organization have at least one OIS, and that all stand-alone Wang 5 systems and non-Wang word processing equipment be replaced by OIS's.

- There Will Be a Need for Additional High Speed Printers -- Receiving bulk text (5 pages or more) will necessitate having high speed printers attached to each OIS system, or as stand-alone terminals.

- Minicommunications Center -- Large AID/W organizations (e.g., regional bureaus, PPC, FM, etc.) could benefit from setting up of a Minicommunications Center. This center would become the focal point of automation and telecommunication services.

  - It could contain a VS and/or one or more OIS systems, a high-speed printer, micros, and ADP terminals. Additionally, cluster terminals, RJE equipment, Telefax machines, etc., if required could be located in the Minicommunications Centers.

  - It would require at least one FTE, permanent staff member in each minicommunications center.

  - In the future, this Minicommunications Center could also contain peripherals which could be shared by several users. These peripherals might include file servers, letter-quality printers, plotters, and micrographics readers. The center might also support video communications, and a one-of-a-kind software library with self-instruction packages.

  - These centers should not be confused with the Information Center planned by IRM to support users needs.

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- The Large 4341 IBM Computer Can Serve as a Router/Switcher/File Server -- With the upgrade of the present maincomputer, the present IBM 4341 could be retained for use as a telecommunication router/file server. There are several advantages with this proposal:

  - The new mainframe would not have its resources drained by the telecommunications system.

  - From a security point of view production data could not be easily accessed by casual network users.

  - The 4341 could serve as file server for:

    .. Queries of the proposed cable data base.

    .. Routing of messages for the USAID-AID/W message system.

    .. Interface for the DIU system to the network as well as gateways to other value added systems (Telenet, Tymenet, etc.).

(2) USAIDS

- Links From USAIDs to AID/W Will Vary, Depending on the USAID Equipment Base -- A three-pronged approach is recommended for implementation of the USAID-based telecommunications system, depending on the level of automated support the USAID enjoys, as shown in Exhibit IV-5.

  - Posts with VS equipment will use State's circuits, where these exist. While awaiting State's circuits, international carriers would be used for initial testing and start-up of USAID telecommunications.

  - VS posts will be linked to the local Embassy Office of Communications by direct-wire, when distances are short enough to allow it; else, dedicated links can be provided. The end points of the State link will be multiplexed to the AID/W main computer.

  - Those posts which do not have VS's, and only have OIS or PC equipment could be connected to the mainframe or a VS System located in AID/W or one of the regional missions via dial-up lines. However, these

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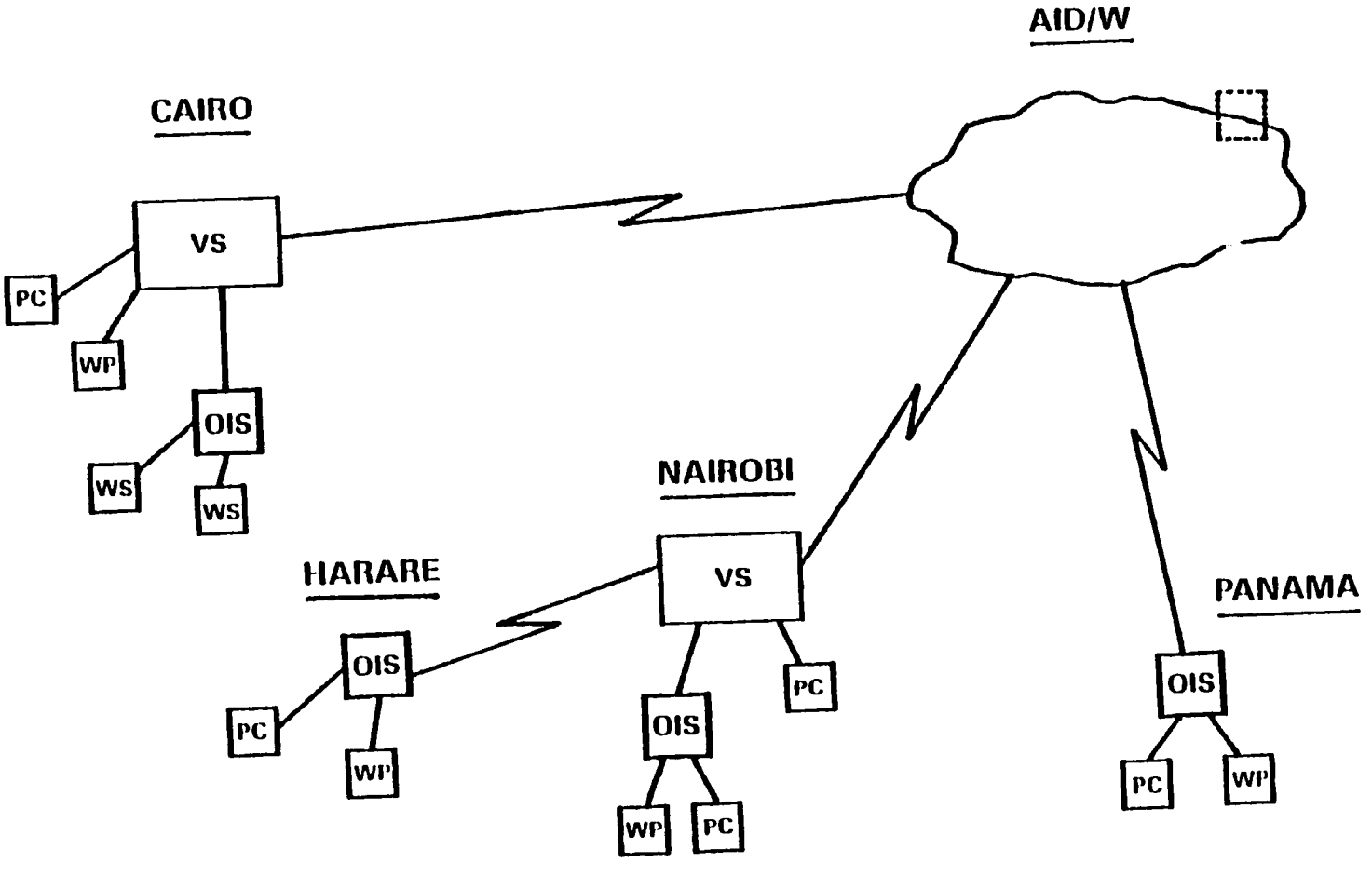
EXHIBIT IV-5

RECOMMENDED OVERSEAS NETWORK



missions can only become virtual nodes in the AID/W network after special software is provided.

- Communications Within USAIDs -- In this case the recommendation is to equip all VS, OIS and PC equipment with their corresponding T/C boards and software so that all equipment within a post can be connected to the VS in a star configuration. Posts with more than one OIS can use the WISE switch to connect users on the two systems. In either case, micros should be able to communicate with Wang VS and OIS systems within the Missions.

- USAID Regional Networks -- Although some posts, particularly in East Africa, have been testing telecommunications between posts, using dial-up services from international carriers, it is the recommendation of this study group that regional networks be implemented only after the following implications are studied carefully:

  .. M/SER/FM determination if transactions between USAIDs would by-pass AID/W central systems and result in costly inaccuracies, or if regional networks can be integrated into AID's financial accounting cycle.

  .. Regional communications networks would be expected to follow prior establishment of a mission as a "regional center" as opposed to a mission being "regional" because of telecommunications.

(3) Cable Link to State

- Our primary recommendation is for AID to consider openly the cost vs benefits of providing a fully automated cable interface to the State Department.

  - Outbound cable traffic from AID offices to the State Department is low volume, with approximately 160 pages of cables transmitted per day.

  - Therefore the actual professional productivity increase to be gained by automating this number of cables is also relatively small. In addition, the present process works and is capable of handling projected workload increases for the next 3 to 5 years.

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- The cost of automating this AID-to-State portion of the cable flow is high, with one-time costs ranging from $400,000 to $450,000, in conjunction with increased recurring costs.

- Taken independently of any other possible productivity improvement efforts, this automated link would not be cost-justified.

- However, taking the concept of electronically receiving and sending cables in AID/W via a LAN directly to/from the word processing terminals, the automated link to the Department of State would preclude the need for a duplicate OCR scanner and/or the increased manpower within the cable area to print and deliver the outgoing cables. If AID wishes to automate the AID-to-State portion of the cable flow, then the existing incoming telecommunications link should be maintained and a new outgoing link should be developed.

  - The existing incoming link works well today and supports the present and projected traffic volume well.

  - The new outgoing link should be run from the AID REARCS system to the State ATSERP terminal computer.

  - The existing REARCS systm will require same level of augmentation to provide for the new telecommunications port and possibly increased memory and power supplies.

  - Functionally, all reformating, routing and control should remain with State, with only the minimum level of editing, format conversion and header modification performed by AID.

  - The one-time cost for this option is estimated at $400,000-450,000 with recurring costs of $350,000 to $400,000 per year.

- Again, AID can attach its future Local Area Network to the cable system if fully automated cable creation and transmission is desired.

  - Attachment of the future WANG local area network to the cable system can best be accomplished through a WANG VS minicomputer.

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- The WANG VS would terminate at the WANGNET and would interface the REARCS system.

- The WANG VS and its associated software would cost approximately $100,000 to $150,000 more.

(4) Cable Distribution to Central Points Within AID/W

. To interconnect the minicomputers from the AID/W cable system to the local area network, and to protect the system from access from a non secure network, it is recommended that a small VS be used as bridge and file server. This VS would be under the administration of M/SER/MO and would be linked both to the cable system and the LAN.

. It's role would be two fold:

  - As a virtual protocol converter
  - As a file server/router

. Non-classified incoming cables would be converted into WP documents, their address identified and routed to the corresponding organization's OIS via the LAN.

. Once an outgoing cable was cleared, it would be sent to the cable VS, where it could be examined by M/SER/MO staff, and then forwarded to State via an electronic or manual cable link. The cost of this VS has been included in budget.

(5) Electronic Mail

Because of the extraordinarily high interest in Electronic Mail among the user community, a two step approach is recommended:

. Step One -- While the LAN is being designed and implemented, a pilot EM project should be conducted, using a commercial service like Dialcom, Telemail, MCJ Mail, etc., for a limited and controlled number of users. Gradually additional users would be brought into the EM system.

. Step Two -- once the LAN is implemented, the commercial EM service would be phased out and replaced with an in-house version.

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(6) Access to External Data Bases

- It is recommended that the LAN have a gateway to a public data network (X.25 protocol).

- This gateway could be the AID/W main computer.

  - For occasional users in AID/W, dial-up lines or even the Dimension 85 voice/data switch could be used.

  - For USAID's, it would be more economical to access continential USA data banks by going through the LAN and then into the public data network.

8. IMPLEMENTATION PLAN

The overall strategy is a stepwise approach to implementing the network in a 3-4 year span. See Exhibit IV-6 and Appendix E for details.

- FY 85 -- In year 1, design and formulation of detailed implementation plan (including identification of software) takes place. Concurrently we progress with establishment of links to USAID's. When a post is ready to be linked but State has not made available such a link, the strategy would be to use dial up service from an international carrier. Also in FY 85 a pilot electronic mail would take place, with 100-150 users in AID/W. Finally, the first pilot regional network with Nairobi as a hub would begin to be installed. Of course all RFP's for equipment and services would be completed.

- FY 86 -- In year 2, vendors are selected, contracts signed, the hardware and packaged software is acquired. Concurrently, the State Department and SA-1 buildings are cabled. The router/gateway minicomputers are installed. Development of custom software for the mainframe and VS environment starts. Plans for training are formulated. By the end of FY 86 text transfer from VS to VS both in AID/W and USAID's is implemented.

- FY 87 -- By year three OIS word processors begin to be connected to the Network in buildings Main State and SA-1. Concurrently, Rosslyn buildings are cabled. By mid 87 all workstations attached to the VS and some of the OIS workstations can access data and execute queries in mainframe data bases. Also those Wang PCs directly connected to an OIS or VS could download/upload data to the

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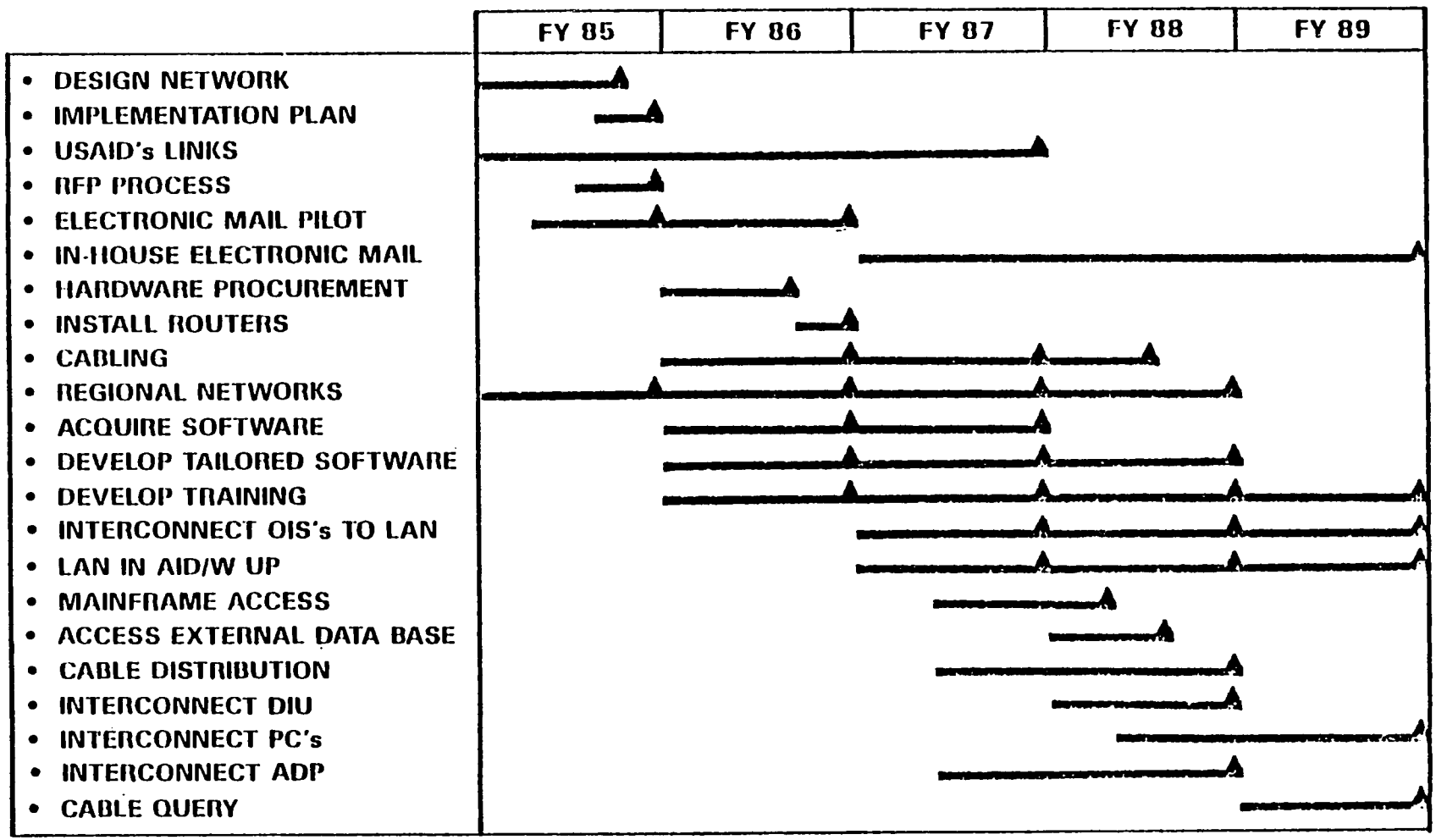
EXHIBIT IV-6

AID TELECOMMUNICATIONS SYSTEM IMPLEMENTATION PLAN



*LINES WITH MULTIPLE MILESTONES REPRESENT DIFFERENT PHASES, E.G., BY BUILDING, MISSION, ETC.

mainframe or the VS. In-house electronic mail version is available for 50% of users.

- FY 88 -- All AID/W OIS CPUs are interconnected to the LAN. Each has a high speed printer and bulk transfer of text can take place from any point to any point within the Agency. Also access to a public data network, and hence external databases, is available from any point. The cable system gateway VS is connected to the network. The first pilot case to distribute cables to/from the OIS takes place in AID/W. The DIU HP 3000 computer is connected to network. Also some IBM PCs are connected to network for file transfers and sharing terminal equipment. The ADP terminals attached to cluster controllers are added to LAN.

- FY 89 -- The query system for accessing old cables is implemented. All PCs are connected. All value-added functions are in production mode. Full Network Control Center is implemented. Data/text can be transmitted from any terminal in any point of the Agency to any other terminal regardless of distance. Pilots for new services and functions are planned. One possible candidate is image transfer in AID/W.

9. BUDGET

The major thrust for telecommunications work in FY 85 and 86 falls into several categories, as outlined in the attached budget narrative. While these line items are set aside as individual projects, a comprehensive approach to the overall network design is necessary to assure the best possible service to the users of telecommunications service at AID over the next five years. The different projects have very direct dependencies and relationships with each other and therefore should be viewed as a package. Any modifications to individual tasks must be scrutinized closely to effectively migrate the changes to any related schedules in the other projects. Exhibit IV-7 is a synopsis of the projected budget for 5 years. For further details see Appendix II

(1) AID/W LAN

- Development -- An estimated development cost of $290K includes for FY 85 design (both general and detailed), the implementation planning phase includes clear identification of both off-the-shelf software and software that must be developed from scratch. The procurement process (RFP's and evaluation) is included. However, awarding of the contracts is not included.

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EXHIBIT IV-7

ESTIMATED BUDGET

	FY85	FY86	FY87	FY88	FY89	Total
AID/W BASE NETWORK						
One Time Cost						
Development	200	260	80	0	0	540
Hardware	50	680	420	0	0	1,150
Software	50	200	50	50	50	400
Installation	0	600	300	100	100	1,100
TOTAL	300	1,740	850	150	150	3,190
Recurring Costs*						
Maintenance/Operation	0	150	220	300	300	970
Training	0	100	50	50	50	250
Manpower	200	500	430	350	350	1,830
TOTAL	200	750	700	700	700	3,050
AID/W TOTAL	500	2,490	1,550	850	850	6,240

* Recurring costs include maintenance, training, and implementation for all components of the T/C project. Other functions represent development, pilots, and initial installations only.

EXHIBIT IV-7 (2)

OTHER FUNCTIONS

	FY85	FY86	FY87	FY88	FY89	Total
USAID'S Message System						
Development	50	200	150	100	50	550
Hardware	40	90	40			170
Software	30	50	30			110
Training	50	50	50	50	50	250
	170	390	270	150	100	1,080
Cable System Distribution						
Development	0	150	260	0	0	410
Hardware	0	125	0	0	0	125
Software	0	25	40	0	0	65
	0	300	300	0	0	600
Electronic Mail	150	250	50	0	0	450
Development	50	150	50			250
Service	100	100				200
GRAND TOTAL	820	3,430	2,170	1,000	950	8,370

- Hardware -- Most of the costs of hardware would occur in FY 86 and 87. It includes the cost of 3 Wang VS to perform the routing and gateway functions. Two VS would be acquired in FY 86 and one in FY 87.

  - It also includes the cost of the telecommunications boards for present and future OIS in AID/W. The plan is to have T/C in 30 OIS in FY 86 and 10 additional ones in FY 87.

  - The cost of executive workstations have been estimated based on the Wang 4230-VS. These are intelligent workstations that can be expanded to full micro if the executive desires to start using decision support software tools like Lotus 1, 2, 3, etc. The plan is to have 40 in FY 86, and additional 50 in 87 and 50 in 88.

  - High speed printers connected to the OIS will be needed as bulk text transfer of project papers occurs. The plan calls for 20 in FY 86, 10 in 87 and 10 in 88.

  - In addition Wang boards are needed to allow the IBM PC (estimated 30% of all micro) to be fully integrated to the network.

- Software -- Software falls in two categories: off-the-shelf and tailored. Off-the-shelf software consists of:

  - The JDS package in the mainframe to perform routing functions among each VS

  - VS software to route OIS and bridge to the mainframe

  - OIS software for interoffice traffic.

  Tailored software consists of:

  - "Pass through" software in the management for the VS to access both mainframe applications and Public Data Networks

  - "Pass through" software on the VS to allow OIS's to access the database in the mainframe.

- Installation -- Cabling of the Main State building and SA-1 would occur in FY 86. Rosslyn buildings would be cabled in FY 87. The CIU (Cable Interface Units) would interconnect the OIS to the network. The FAM (Frequency Agile Modems) or FFM (Fixed Frequency Modems) would connect the IBM PCs to the network. The Wang PCs are assured to be connected to OIS or VS as workstations.

- Implementation -- The network would be implemented in FY 87. Some consulting cost is added for tuning the system. Thus by FY 87 as the AID/W LAN is implemented the following functions would be available.

  - Text transfer among OA equipment (Agency wide)
  - EM
  - Access to mainframe
  - Access to external data bases.

- Recurring Costs -- The introduction of new technology will necessitate a careful training plan and extensive training of the user community.

  - Thus, $100K is allocated for FY 86 which includes training plan and $50K for each subsequent year.

  - Maintenance and operation are base on an estimate of 15% of hardware software cost plus the cost of leasing lines to connect the VS's to the mainframe.

  - In addition we estimate that the creation of the network and increased number of telecommunications functions and capabilities will necessitate the addition of three additional staff members.

(2) USAID's Links to AID/W

- Hardware -- Assuming that the VS 45 becomes the CPU for medium sized mission due to the Massive Accounting System (MACs). The average cost or telecommunications hardware/software per mission would be $11,000 (not included in budget for AID/W.)

- Software -- In addition to packaged software for the VS, the cost of developing in the mainframe is a software package to allow the VS to access

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mainframe data and access external database through a public data network would be about $150K.

- Training Training will be required. This estimate assumes 30 TDYs for a 3 year life cycle for installation and 30 TDYs for training of rod-staff.

(3) Electronic Mail

For the first year electronic mail would be a service. Once the network is implemented, it would be an in-house value-added function. For the first year we assure 150 user at $75 a month per user (including storage charges) with an additional 100 the following year.

(4) Cable System Distribution

To protect the cable system (a secure system) from the network (a non-secure sytem) and at the same time link both, a dedicated Wang VS under the administration of SEM/MO/CRM is recommended. This VS may have to be a secure system.

- This VS would produce an "envelope" for each cable to be distributed and routed to the proper address.

- Since Wang is already working on a similar package for State (in a secure mode), the software cost includes old modification of this package, instead of the cost of developing it from scratch.

10. MANAGEMENT ISSUES

During the course of this study, a number of management issues have been identified. These issues need to be considered and acted upon in conjunction with the detailed design of a telecommunications network, the procurement process, and the phased implementation of the system.

Some of the issues are familiar, but take on new meaning and importance in an environment of more widespread telecommunications within the Agency. Others emerge only as a consequence of the new environment.

(1) Information Resources Management

Because the establishment of an AID telecommunications network will vastly increase the access of users to automated data, as well as the ease and speed of transmission, it will also tend to heighten the importance of some existing concerns in the information resources management area. Although the Agency, in a corporate sense, "owns" all of the data and information which could be sent over the network, the refinement and execution of policies and procedures in the area of information resources management will require re-doubled attention by management.

- Users with new capabilities to tap internal data bases will want access to them, and any concerns about restricted or broadened access by the "proprietors" of the data (an office or an individual) need to be resolved

- Telecommunications will probably spur the proliferation of new data bases, using existing mainframe data bases as the foundation.

- The "official" standing of these new data bases needs to be determined.

- Data base administration issues, such as standardization of data elements, will require renewed attention as the number of data bases proliferates.

(2) Cable-Related Issues

With the establishment of leased lines connecting missions with AID/Washington, a new channel for messages and other communications will come into existence. It can be expected that these leased channel facilities will tend to draw some of the traffic from the cable system, although the bulk is anticipated to be information that would have been transmitted by pouch, APO, and courier or hand-carried materials. With the leased lines as an additional channel of communication between the field and AID/W, management will need to consider the following issues:

- What kinds of communications must be sent via the cable system because of its official and for-the-record character?

- For traffic on the leased lines, what procedures are needed to provide reference numbers or other identifiers for retrieval, and what storage and retrieval policies for such traffic, if any, need to be set up?

Another set of cable-related issues concerns the clearance and control of cable traffic, once cables can be originated on user terminals in automated form and electronic distribution can occur:

- What procedures are necessary to handle clearance of outgoing cable traffic from AID/W for a totally electronic document?

- Is there a satisfactory form of "electronic signature"?

- For messages incoming to AID/W, how will distribution and assignment of action responsibility within recipient offices be designated?

- What provision is required for electronic storage of cables in recipient offices, as opposed to a centralized cable data base?

- Will limited access of any type be imposed on the cable data base (for unclassified messages only)?

(3) System Management Issues

In some respects, a new AID telecommunications network will be an overlay on the existing set of automated systems of all types. However, due to the technology used, it will require the performance of new discrete central management responsibilities, such as software maintenance, standards-setting, performance measurement and the like. In addition, as for the recently installed shared-logic office automation configurations, there is a need for "local management" to provide direct assistance to users. These features of the network raise the following issues:

- Where will the central telecommunications function be established and how will it be organized and staffed?

- What is the most desirable arrangement for "local" management of telecommunications in AID/W offices and missions?

- How will the centralized telecommunications management function relate to and support the local user organizations in the areas of:

  - Training?
  - User help and other operational assistance?
  - Applications design and development?

(4) User Training and Support

Just as the widespread introduction of office automation required the establishment of suitable user training and support capabilities, the addition of sophisticated telecommunications to the existing AID's information processing technology will require comparable efforts. The issues are:

- How, and where, will introductory and continuing training in telecommunications be provided to users?
- Will training be in-house or contracted?
- To what extent will IRM provide applications support in telecommunications for users with a requirement for new or modified applications?
- How much resources should be allocated initially and on a continuing basis?
- How will the potential "retrofitting" of telecommunications features to existing ADP, microcomputer, and advanced word processing applications affect IRM's work load?
- What special arrangements may be necessary to provide effective support to the missions?
- What are the specifications for a "clearinghouse" function for telecommunications applications to fully exploit, and not re-invent, useful applications for the widest possible number of AID users?

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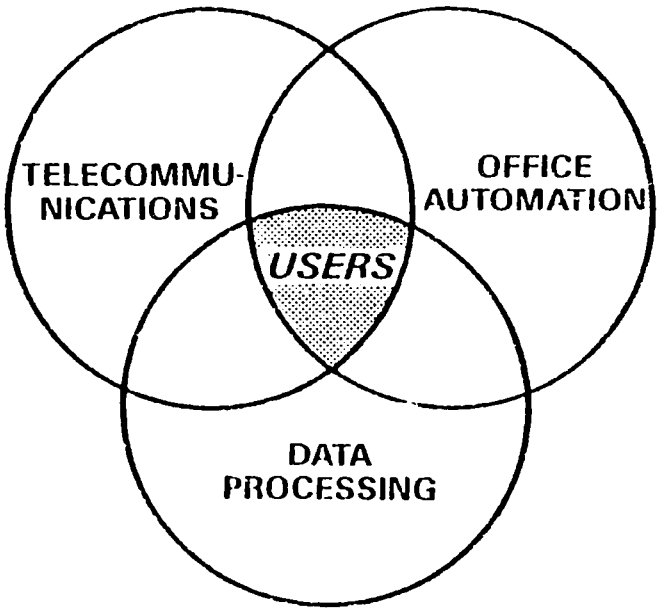
APPENDICES

AID

TELECOMMUNICATIONS



STRATEGY FOR THE FUTURE

M/SER/IRM, SEPTEMBER 1984

APPENDIX A

TELECOMMUNICATIONS TECHNOLOGY ASSESSMENT

TELECOMMUNICATIONS TECHNOLOGY ASSESSMENT

The telecommunications technology assessment was performed prior to the selection of the candidate technology options. This appendix discusses the technologies assessed for three of AID's topological categories:

- Communications within buildings (intrabuilding topology)
- Communications between buildings (interbuilding topology)
- External gateway communications (between AID/W and the USAIDs and other outside resources).

Each technology assessed is discussed in terms of its relevance to the AID/W environment. For the intrabuilding topology, the following technologies were assessed:

- Private Branch Exchange (PBX)
- Local Area Networks (LANs)
- Hybrid PBX-LAN Networks
- Dial-up Communications
- Leased Lines
- Hardwired Connections.

For the interbuilding topology category, the following technologies were assessed:

- PBX/Data Switch Trunks
- Leased Lines
- Broadband LAN
- Dial-up Connections
- Radio.

Two technologies were assessed for external gateway communications:

- Dial-up Gateways
- Value-added Network Service Points (VAN) (X.25).

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This preliminary assessment guided network architects in limiting the scope of the technological options considered suitable for the AID environment, and in determining which technologies might be used in conjunction with one another to best meet AID's requirements.

1. COMMUNICATIONS WITHIN BUILDINGS

Communications within buildings refers to the capability of transmitting documents and files created on office automation equipment, e.g., word processors and microcomputers, to other users within the same building, regardless of physical location. Although the Wang VS and OIS shared-logic capability permits the exchange of documents among all users attached to the same CPU, AID wants to provide this transmission capability for all OA equipment, regardless of which CPU a workstation may be attached to, and for microcomputers (stand-alones, as well as those serving double-duty as OIS and VS workstations). Intrabuilding topologies may also support the ADP terminal network. The implications of data transmissions are discussed in relation to each technology assessed.

The features of each technology are described below, and the discussion applies to both AID/W and the USAIDs, unless stated otherwise.

(1) PBX

- The Private Branch Exchange (PBX) is a private, on-premises switching system originally designed to handle voice communications. In recent years, PBX manufacturers have developed the digital PBX, which treats all communications being switched or handled by it as a string of binary digits, or bits. Instead of handling a telephone call as an analog signal routed over a circuit-switched path, the PBX digitizes the incoming voice signal, stores it quickly and temporarily in system memory, and then indicates to a receiving device where in memory it should read the bits to taken them out to a corresponding telephone on the other end of the circuit. The telephone on the other end of the connection is pointed to a memory block where it stores its incoming digital stream.

  The effect to the user, it should be noted, is unchanged from a regular, analog telephone system, except the PBX may add extra telephone functions. These advanced phone functions may include automatic redialing, least-cost routing, trunk group selection, conference calling, wait-on busy, and other features.

With the widespread use of computer terminals, communicating word processors, communications for personal computers, and other digital devices in the same environment as the PBX, it became natural for PBX manufacturers to seek to exploit this opportunity to switch data as well as voice through the PBX. Newer digital PBXs offer connections for data terminals, personal computers, and other devices, and offer the same device-to-device communications for terminals that are offered for telephone-to-telephone communications.

The result has been the use of what is still essentially a switch (the PBX) that is able to handle both data and voice traffic. The advantage of using the PBX for both applications is that there is no need to install a separate network for data devices. In many cases, a PBX uses the existing telephone system wiring to provide data paths for the data devices connected to it.

- In addition to providing paths for data devices to communicate with each other, the PBX may also provide other, application-level services. The typical configuration involves a separate computer, sometimes called an applications processor, or AP, that is interconnected with the PBX.

  The AP can provide a number of application-level functions, such as an electronic mail service, and document or file format conversion. It may also provide certain transport-level functions, such as protocol conversion, speed matching, and data buffering. In addition, some may also provide data link level services, such as providing gateway communications ports for connectons to outside resources.

- It is becoming common for PBXs to also offer interfaces to local area networks. One of the major thrusts of the digital PBX marketplace today is to cast the PBX as a local area network, as well as a switch for data and voice traffic, in that it provides connectivity for all devices connected to it. Some manufacturers are providing physical and data link-level interfaces to popular local area networks. This can allow an organization's already existing local area network to be linked to the PBX's data switching and long-haul trunk access ports quickly, easily, and, most important, transparently to the users.

- One of the disadvantages of the PBX, with regard to data switching, is that all connections made over it are circuit-oriented. That is, each

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connection must be established just like a phone call, and each connection made through the PBX is a point-to-point link. This has implications for the types of devices that are connected through the PBX, and the types of data they are capable of transmitting.

Common data switching speeds for a PBX are 64,000 bits per second for voice, and 9600 baud to 19.2 kilo baud for data. Although the connections are circuit-oriented, the actual transmission method used from a data device or telephone to the PBX may be a form of packet switching. The actual protocols and data formats used will vary from manufacturer to manufacturer. The protocols and data formats may also be proprietary.

The physical system components of a PBX system are:

- Telephone instruments/data terminals - These may be either telephones with internal codecs (to digitize voice signals), or data terminals connected to a digital transmission interface, which digitizes signals before transmission to the PBX switch.

- PBX switch - This is the main component of the system. It provides the system memory into which incoming digital streams are written, and from which outgoing digital streams are read. In effect, the PBX makes logical connections between devices, instead of the kind of physical connections a standard telephone system makes to complete calls.

- Physical connection wiring - a PBX uses twisted pair telephone wiring to carry signals from a data terminal or a voice instrument to the PBX and back to a corresponding data terminal or voice instrument on the other end of the connection. Some PBXs utilize the existing building four-pair telephone wiring, while others will require eight-pair telephone wiring. After a building is re-wired to utilize the data and voice-switching capabilities of a PBX, it will tend to reduce the potential cost saving of the PBX, when compared to the cost of installing separate cabling for a local area network.

- PBX system software - The PBX system software provides the mapping of telephone numbers to devices, and may also provide connection of devices to system services through specification of a service name, rather than a telephone number. The system software would also serve

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as the operating system of the PBX to manage its internal functions, provide system monitoring, least-cost routing, call management and accounting, and any extra voice handling features the system provides.

- Applications Processor and AP services software - The AP can provide additional communications and data handling services. The AP may function solely as a communications processor, or it may provide other services, such as electronic mail, file storage, and document format conversion.

. Relevance of the PBX to AID environment

- Only AID/W will be acquiring the PBX

- AID/W has requirements for the transmission of both data and voice in all of its locations. A PBX should be considered as a potential solution for telecommunications networking. AID/W is scheduled to have an AT&T System 85 (S85) PBX installed next year (1985), which will be used initially for voice switching. It may be feasible to use the S85 for data switching purposes.

- Since the S85 has an AP as an available option, the S85 AP may be capable of providing the types of user services AID has indicated that it requies, such as electronic mail, document and file storage, document and file format conversion, speed matching, and protocol conversion.

- Many of the announced S85 capabilities, however, have yet to be demonstrated. It would prove worthwhile for AID to investigate the parallel capabilities of other PBX systems. While it is doubtful that it would be practical to have two PBX systems in the same organization, if another PBX proves more suited to its needs, AID/W may consider the possibility of another PBX in place of the S85. However, the feasbility or practicality of this option would have to be determined by IRM before it was seriously explored. A PBX could be a strong contender for AID's networking strategy.

- The potential reduction it could offer in telephone service charges and the value of the added services the PBX could provide indicates that it can be an attractive, technical and economical investment for AID/W.

(2) Local Area Networks

- The multiplication of different types of computer and word processing systems in AID organizations has led to a desire for those systems to communicate with each other, both within the organization and inter-organizationally.

  - Users desire systems to have communications functions, so they can share information, files, and data more easily. Too often a document or file created on one system cannot be transmitted to or used on another system.

  - System developers desire more flexible communications systems, so they can build organization-wide interconnected networks of personal computers, minicomputers, mainframe hosts, terminals, and other specialized devices. Because many systems demand the use of expensive peripherals, system developers also desire some way to share peripherals among multiple devices.

  - In recent years, local area networks, which are common communications systems within a single location, have been developed to address some of these user desires. A local area network is a specialized communications system for high-speed, high-capacity, computer-to-computer communications in a local environment. A local area network usually operates on its own communications medium, which may be twisted pair wiring, coaxial cable, or optical fiber.

- Unlike point-to-point communications systems, in which each device has a separate circuit to another device, the devices connected to a local area network usually share the use of the same transmission medium. That is, they are all connected to the same piece of cable, or to branches of that cable or wire.

- Local area networks fall into two broad categories: baseband and broadband. In a broadband network, the entire bandwidth capable of being used

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on the channel is separated into many separate subchannels. Each subchannel may operate at a different speed, depending on the bandwidth demands of the service operating over it.

- For example, a broadband local area network may have several operating channels of video signals (for such applications as closed-circuit television, and security monitors), several computer-to-computer data channels operating at 9600 baud, and several hundred voice channels. All signals are modulated onto carriers at appropriate frequencies, which establish the division of one signal from another into separate channels.

- A baseband network, which is designed to carry all-digital (unmodulated) signals, operates over one, high-speed channel. System rates of 1 to 10 Mbs are common for baseband networks, which provide all users with access to a single, shared channel. The data rate of the baseband network is generally higher than that of a single channel of a broadband network, and it offers physical connectivity among all devices attached to it. That is, because all devices are attached to the same channel, and all devices share that channel by multiplexing their transmissions across the channel, separating them by time division multiplexing (TDMA), all devices on the network have physical connectivity to each other.

- Local area networks can use several different types of network topologies, depending on the characteristics of the signaling used on the network. Some of the more common topologies are: the ring network, in which one end of the network closes in on itself to form a ring; the bus network, in which the network is merely a straight line cable, with branches coming off the main trunk; and the star, with a central controller that manages transmissions on branches radiating from it.

- There are also many variations in the way devices gain access to a local area network. In some broadband networks, a central controller may be used to allocate bandwidth, and to determine the means for one device to connect to another over the channel. Other common network access schemes include token passing and Carrier Sense Multiple Access and Collision Detection, (CSMA/CD).

- In token passing, the devices on the network pass a software abstraction called a "token" to each other. Only the device with the token is allowed to transmit on the network. That station gives up the token to the next device when it is done, passing network control to the next station.

- In a CSMA/CD network, access to the network is determined independently by the devices connected to it. If a device wants to transmit, it may do so if it determines that the network is not in use. If two or more devices happen to transmit at the same time, both stop transmitting, then begin to transmit again a randomly selected a short time later, after once again determining the network is not in use.

- Since many organizations have facilities in several locations, each of which may be in a different city, state, or country, local area network vendors and suppliers also offer communications devices that connect local area networks together into a multi-location network. A multi-location local area network, or inter-network, implies that the devices on each network also have a means to address and communicate with devices on other networks. Local area networks may also have connections to wide-area or metropolitan area networks, or to PBX systems or to X.25 networks that serve the same purpose.

- In some locations, because of operational or equipment reasons, there may be a need to install both a baseband and a broadband local area network. In that case, devices on one network may be isolated from devices on the other, unless the vendor offers a bridge between the two networks.

- Local area networks provide physical connectivity. That is, they offer the possibility of communicating across a shared communications medium. Whether or not two devices can actually communicate useable information depends on the compatibility of their communications protocols.

  - In order to connect to a local area network, a particular vendor's workstations, computers, and peripherals must also have a physical, data link, and network level interface to a local area network for network compatibility.

- The devices communicating must "agree" on protocols that determine the format and meaning of the data, as well as the nature of the transactions and communications that occur across the shared channel.

When two devices are on the same local area network they may be able to communicate, but higher-level session, presentation, and applications protocols must coincide for any real communications to take place. In order to use a commercially available local area network users must find one that uses protocols their existing systems understand.

- Vendors of local area networks utilize certain standard sets of protocols. Many, however, are incompatible with those from any other vendor.

- Standards-making bodies, such as the IEEE and, in Europe, ECMA, have been developing standards for local area networks. The goal of these standards is to develop well-defined, widely available, and consistently applied protocols for different types of local area networks.

Relevance of LANs to AID environment

- The existence of personal computers, independent word processing systems, and other devices that currently do not communicate with each other, or do not have communications paths available, indicates that AID/W could benefit from the implementation of a local area networking strategy.

- Consideration should be given to local area networks and their associated shared resources (files, printers, communications, and computing devices), in developing an AID telecommunications strategy.

- One factor that must be assessed in a local area network strategy is the installed equipment base in AID. IBM and WANG, both major vendors at AID/W, plan to offer their own LAN approaches.

- The current applications AID utilizes and those projected for the future depend heavily on communications functions. A local area network that supplies the kinds of connections normally provided by point-to-point links would satisfy many of the communications functions AID/W requires.

- An advantage of the local area network approach is that multiple functions and services could be shared. This would reduce the cost of incremental services as new users or applications are added to the system.

(3) Hybrid PBX-Local Area Networks

- In many cases, a combination of a PBX with connections to a local area network provides the kind of organization-wide integrated communications system need to fulfill communications needs.

  In such integrated facilities the PBX would handle all voice communications and some simple, low-speed, connection-level data transport services. Simultaneously, a local area network, which is well suited to high-speed data transfer among computers, personal computers, and word processing systems connected to it, coexists with the PBX.

  - In such an arrangement, communications among intelligent devices within a building would occur via the local area network. If there were a need for device-to-device communications between buildings, or from one device to another device outside the organization, the transmission could be routed from a communications interface device on the local area network to the PBX. The PBX could then route the transmission either to the correct device on another local area network in the organization, or to a port through which communications would be established to a device outside the organization.

  - Many PBX and local area network vendors are developing interfaces to each others' products. The advantage to the vendor is that they can propose a complete, integrated communications solution to their customers. The benefit to the customers is that they can choose a PBX that meets their voice and some data needs, and select a local area network that meets their high-speed, high-capacity data needs. If an interface exists between the local area network and the PBX, the customer has a reasonable degree of assurance that the PBX can be used for routing and transmission control between the organization's local area networks. This reduces transmission costs, and simplifies the development of a complete communications system.

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Relevance of hybrid networks to AID environment

- As previously mentioned, AID/W is scheduled to become attached to the State Department's AT&T System 85 PBX. AID/W also has an installed base of Wang equipment. AT&T and Wang have announced an agreement to develop an interface between Wang systems and the System 85 PBX. The interface includes a T1 link between the S85 and a VS computer that will multiplex transmissions across the link.

- The exact nature and applications utility of this link is not yet clear. It does, however, indicate the direction that Wang and AT&T, like many other vendors, are taking regarding future compatibility between their products.

- Compatibility between Wang and AT&T products has not yet been demonstrated. AT&T has announced that it will offer document format conversion to Wang word processing document format, but it remains unclear if this means that it will convert foreign (non-Wang and non-AT&T format) documents to Wang format, or just a specific type of document. It is most likely that the latter is the case, given the wide variety of foreign document formats.

(4) Dial-Up Communications

. The most commonly used kind of communications between devices, regardless of location, is dial-up communications. Each device - the sending device and the receiving device - is equipped with a compatible modem, and appropriate communications software. To operate, the user dials the telephone number corresponding to the telephone at the other device, and the connection is made over the public telephone system.

  - Transmission rates are usually between 300 and 1200 bits per second and is asynchronously (i.e., one character at a time). Synchronous communications, conducted under a more efficient communications protocol, such as 2770, 2780, 3780, or a vendor-specific synchronous point-to-point protocol, usually occurs faster (2400 to 9600 baud), offers more efficient use of the communications line, transfers data transparently, sustains a higher data transfer rate along with a lower error rate, and offers better error detection and recovery

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mechanisms. However, synchronous communications equipment usually costs more than asynchronous equipment.

- Dial-up communications is a practical way to establish occasional communications without incurring the overhead associated with more permanent types of connections, such as leased lines. The tradeoff for this flexibility is that the connections are only point-to-point. They must be established and dis-established for each communications session, and the public phone line usually provides only a low-grade, low-speed transport mechanism.

Relevance of dial-up communications to AID environment

- Dial-up communications are used widely within AID/W for communications between word processing systems, personal computers, and RJE terminals and the host computer.

- It is reasonable to expect that dial-up communications will continue to be used within AID/W for occasional communications between devices. However, 1) as the need for communications becomes greater, 2) as users require a wider variety of capabilities on their systems, 3) and as the need increases to communicate with a wide variety of devices in quite different ways, dial-up communications may become less advantageous than other communications methods.

(5) <u>Leased Lines</u>

- In situations where a particular system or terminals require continuous communications to another point, and where those communications must be high-speed, a leased line is appropriate.

- A leased line is a permanently open, high-quality connection between two devices. Leased lines are expensive, but they are more economical than dial-up connections for heavily-used communications paths. They are also essential for communications where there must be ready and instant access to another device, not access on a switched data path through a telephone system.

- A leased line is usually run at a relatively high speed, depending, of course, on the capabilities of the modems on either end of the line. The

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protocols used on the leased line depend upon the protocols running on the devices on either end of the line. Common protocols on a leased line are 3270 BSC and 3270 SDLC, HDLC, and other vendor-specific point-to-point protocols.

- Leased lines are obtained from local or long distance telephone companies. Communications technologies used between buildings includes the various types of communications systems used to access a device in another location. Because leasing involves the controlled communications environment of one building, inter-building communications may have to be carried over publicly available communications paths, such as those provided by the telephone company, a private communications supplier, or a value-added network. The speeds, communications capacities, supported protocols, physical facilities used, access methods, and switching technologies used by any of these service suppliers will usually vary from supplier to supplier.

- In some locations, because of operational or equipment reasons, there may be a need to install both a baseband and a broadband local area network. In that case, devices on one network may be isolated from devices on the other, unless the vendor offers a bridge between the two networks.

  - Because the physical medium, transmission method, and other technical details of the leased line are under the control of the service provider, the user only sees the effect of the connection, not its details. That is, the leased line may be a twisted pair, coaxial cable, fiber optic, microwave, or satellite link, or some combination of all.

  - Another common use of leased lines is trunk routing between communications systems nodes, such as PBXs in different locations, local area network-to-local area network communications, and host-to-terminal controller communications.

- Relevance of leased lines to the AID environment

  - There are currently a number of leased lines in use within AID/W. Leased lines connect the 327x cluster controllers with the host computer system. Leased lines run from several of the OIS systems and the VS system and provide terminal users with 3270 terminal emulation.

- In short, AID/W already uses a number of leased lines for communications within the organization, and between system elements that are located in remote sites. It may be possible, in many situations, to eliminate many of the leased lines (and their associated costs), or to provide the same kind of function through a different type of communications, such as a shared communications interface unit on a local area network.

(6) Hardwired Connections

- Permanent, hardwired connections between system elements serve the same purpose as leased lines, but are more practical and economical over relatively short distances. The communications protocols and access methods used vary according to the application for the connection.

  - For example, the terminals of a shared logic word processing system may be hardwired to the central logic controller. The reason for doing this is that the controller needs to have a permanent connection to each of its terminals, and the connection must be of such quality and type to support the kind and speed communications the host controller expects to have with its terminals.

  - The speeds, transmission methods, access control schemes, and protocols used on hardwired connections will vary as much as they will with leased lines, because each will be used in a vendor or application-specific instance.

- Relevance of hardwired connections to AID/W environment

  AID/W currently is using hardwired connections to link two OIS systems. The WISE (Wang Inter-System Exchange) box essentially serves as a modem eliminator to establish non-switched hardwired communication between two OIS systems.

2. COMMUNICATIONS BETWEEN BUILDINGS

The second telecommunications topology category examined involves communications between buildings. Although consideration must be given to the specifics of the service provided by a particular supplier, the objective should be to use a service capable of

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handling the expected volume and type of inter-location traffic, while making it as transparent as possible to the users and to the network as a whole.

(1) PBX/Data Switch Trunks

- In a multi-location environment, where each location has its own PBX, multiplexer, or data switch, there will probably be a requirement for a high-speed, high-capacity trunking between one or more of the nodes. The purpose served by the inter-node trunk is to carry the traffic expected to flow between the nodes of the network. There may also be a corresponding requirement to provide processing, switching, or buffering capacity in each of the nodes.

- The configuration of the trunks that link nodes are determined by the amount and type of traffic expected to flow as well as the nature of the peak demands communication elements would place on such a system.

- The protocols and switching methods employed on these inter-node trunks would vary from application to application, and from vendor to vendor. The transmission medium would vary, too, depending on the volume of traffic the link was expected to carry, and the physical distance and obstacles between the nodes.

  For example, if the nodes were relatively close together, and if the organization that was providing the linkage between nodes had control of the property between the two nodes, a private fiber optic or coaxial cable link, with communications multiplexed over the physical path, might be feasible. Over greater distances, or across as simple an obstacle as a city street, the most economical approach to link two nodes together might be to lease appropriate facilities from the telephone company or another service carrier that provided communications in the area.

  - The speed and capacity requirements imposed on such a link could be met by a T1 carrier, capable of carrying about 1.5 Megabits. In other cases, where there are high volumes of traffic between PBX nodes transmitting digitized voice, several TI carriers might be required. It is not uncommon for inner-node PBX links to be composed of up to 24 T1 carriers multiplexed to provide the bandwidth necessary to carry the requisite traffic.

- Relevance of PBX data wwitch trunks to AID/W environment

  That an AT&T System 85 is being installed in AID/W's locations in 1985 indicates that PBX-to-PBX trunk links may be available for inclusion in an overall telecommunications AID/W network. Some questions that must be answered before such trunks are specified are: how much capacity the trunks will have, which nodes will they connect, and what type of physical medium is going to be used. The AT&T contract with the State Department for the AID/W 85 specifies the location of the S85, and will indicate switches, as well as the number and capacity of their inter-node links.

  One partial interbuilding solution for consideration (assuring the PBX is suitable for data transmission) is to lease appropriate additional trunk facilities from the telephone company, if the planned PBX trunks are not sufficient.

(2) <u>Leased Lines</u>

- Leased line are a commonly-used communications path for establishing point-to-point communications links between two system elements. The system elements may, of course, be PBX or multiplexer nodes, but are most likely to be a host computer and an associated cluster controller, or a host and another host that provides a specialized type of service or application for the user of the network.

- If the communication link must span more than one location, and be connected across a relatively long distance, and serve as a high-speed, high-capacity data link, the most common and most practical way to provide that link is through leased facilities.

  - As has been noted previously about leased lines, they can use a variety of transmission media, and support a variety of transmission speeds and protocols, depending, of course, on the types of devices connected at either end of the line.

  - Leased lines are usually point-to-point links, although many devices may be connected to the same leased line channel by multidropping the line.

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Generally speaking, leased line facilities are expensive, but they become cost-effective above a certain level of usage per day. For example, a leased line typically becomes cost-effective (compared to a dial-up connection) when usage of the line exceeds three hours a day.

- Relevance of leased lines to AID/W environment

  Given the five locations planned for AID/W, there will be a need for inter-building communications. Assuming the continued use of the IBM 327x terminals to access the data processing applications on the IBM host, it would be appropriate either to continue to provide leased line facilities for those terminals, or to route interbuilding traffic using through the PBX linkage lines. Alternatively, it is also possible for the 327x terminals to be attached to a local area network, particularly if broadband is used as an interbuilding transmission technology.

(3) Broadband Local Area Network

- A broadband cable (coaxial or fiber optic) is capable of spanning much greater distances than a baseband cable. A broadband line could be used as a trunk over which othre network-to-network or node-to-node communications could be carried.

- A prime consideration in utilizing the broadband cable for interbuilding communications is the practicality of using the broadband local area network as an intrabuilding transmission technology. This will be determined by the applications for the network, as well as the availability of interfaces for equipment to be connected to the network.

- A broadband network extension to more than one location would extend the same data-handling characteristics as it had in the first location, not any new ones. It would however assure connectivity of all devices across multiple locations connected to the same broadband channels.

- A broadband network could extend for several miles, making several channels of its total bandwidth available to users in each of the areas it covered. Although it would be in more than one location, the users and device connected to it would, in effect, be part of the same network. The protocols and access methods it would support would depend on the types of

devices connected to it, and the uses to which they expected it to be put. A broadband trunk between two locations would offer a tremendous amount of bandwidth, which could be subdivided into several separate channels, just as a broadband local area network's bandwidth could be.

Relevance of broadband LAN to AID environment

- If there are two nearby AID/W locations where it is deemed appropriate to have a broadband local area network, it may be practical to connect the two buildings via a broadband cable to provide system transparency.

- For example, the installed base of Wang equipment in AID/W can be connected to WangNet, a proprietary broadband local area network. It may be appropriate to extend a WangNet (or similarly configured network) installed in one location to another location, e.g., uniting two buildings via one broadband network.

(4) Dial-up Connections

. The need for a simple, flexible, but low-speed connection between devices in different locations is served simply and quickly by dial-up communications. Both AID/W and the USAIDs use dial-up communications.

. Generally speaking, the same conditions, transmission media, access methods, protocols, and hardware considerations are available for inter- and intra-location dial-up connections. In either case, the user is connecting to another device over a point-to-point circuit established through the public telephone network. In addition, interbuilding relevance for the AID/W environment is the same as for intrabuilding.

(5) Radio

. The term radio includes all forms of wireless communication, typically, terrestrial microwave and satellite for data transmission. These two media offer very high-speed, very high-capacity communications channels, either between two points or from one to many points. Both of these communications technologies were first exploited by telephone companies looking for ways to carry greater amounts of voice traffic.

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- Both terrestrial and satellite communications systems operate in some of the same frequency ranges, from 4 to 6 GHz (terrestrial and satellite), and 10 to 12 GHz (satellite). Terrestrial microwave also operates in the 23 GHz bandwidth. In either case, a signal is modulated onto a carrier, which is multiplexed with other signals and transmitted at high radio frequencies to a receiver. In the case of terrestrial microwave, the receiver is another microwave dish located in the line-of-sight fashion, the transmission is sent to a satellite, which rebroadcasts the signal to a receiving dish on earth.

- One of the main considerations in evaluating the appropriateness of a microwave link is the cost of competing terrestrial communication technologies, the electrical and physical interfaces between the devices originating the transmissions, and whether there is enough demand for the volume of communications which the technologies can carry.

- Relevance of microwave radio to AID/W environment

  If the data transmission load is heavy enough, it may be possible to justify a microwave link for interbuilding communications within AID/W. There would have to be sufficient data traffic to justify the expense of establishing the link, and the devices on either end of the link would have to be capable of buffering and handling the data at the speeds at which the microwave link could transmit or deliver it. Reliability and security of information transmitted are among other factors that must also be evaluated in considering this interbuilding technology.

3. EXTERNAL GATEWAY COMMUNICATIONS

- Communications to and from devices on a network must often be augmented by communications with devices and services that are not part of the network.

  - For example, a user of a PC that normally communicates with a host computer through some inter- or intra-location communications path, may need to transmit a report to a user at a PC in another agency, state, or overseas post.

  - In another situation a user of a terminal on a word processing system may need to communicate with a host on a public time-sharing system through

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TTY terminal emulation to extract information from the host data base for inclusion in a report.

- These types of inter-campus communications can be accomplished by routing the communications from the local network through an external gateway.

  - The gateway serves as a communications port through which a user gains access to the transport functions of outside communications networks, e.g., the long-distance telephone system.

  - A gateway may also serve other, application-level functions, such as speed, protocol and format conversion.

- The functions the gateway performs are determined by the capabilities of the devices that use it and the applications they expect to perform.

- Other gateways provide for foreign devices to communicate with devices on the network. That is, if a particular word processor on a network commonly sends documents to devices that are not part of the network, it may be necessary to design a custom gateway that will serve the communications device the network user expects to access.

(1) <u>Dial-up Gateways</u>

- One of the most common types of gateway is the dial-in or dial-out port. If it is likely that many nodes on a network will communicate with a variety of terminals across variety of locations off the network, a practical kind of gateway is one that services dial-in and dial-out functions.

- Dial-up communications is so named because connections are established through the public telephone network. These connections, once established, may utilize a variety of communications protocols, depending on the capabilities of the devices connected through them and the nature of the information being transmitted.

- For example, a dial-out gateway established for allowing PCs to connect to time-sharing services may only support a simple, character-oriented protocol, such as TTY. The equipment requirements for such a port would be correspondingly simple, too. Autodial modems would be necessary, as would

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asynchronous communications software. Corresponding, compatible modems and software would also have to exist at the other end of the connection.

In another instance, it may be useful to have batch terminals at remote locations submit jobs for batch processing. In this case, the modems on either end of the connection would have to be capable of supporting synchronous communications, and the devices on either end of the connection would have to be capable of handling a synchronous, batch-oriented protocol, such as 2770.

A user at a word processing terminal may be able to transmit a word processing document to another word processing system in another location through a gateway established to handle that type of transaction. The connection may be established through a dial-up port. In order for the communication to work, both devices would have to agree on a common communications protocol. Establishing a common document format for both devices, so that a document comprehensible to the sending system would be comprehensible to the receiving system, would be another matter that would probably be beyond the scope of the gateway or its communications parameters.

Relevance of gateways to the AID/W environment

Users in AID already use a variety of point-to-point communications methods to send and receive information from a variety of external sources. The HP3000 is maintained by CDSI in Bethesda, and is accessible through dial-up communications. AID has established a test link to the AID overseas mission in Cairo and has performed bi-directions transmissions between the VS equipment in San Salvador and Cairo and the IBM mainframe and the VS in IRM. Other AID/W have also indicated a need to transmit reports and documents directly to USAIDS.

All of these would be applications for external network gateways and many would utilize dial-up or leased line connections. Considerations would have to be made for the types of communications the gateways would support, the protocols that would be used, and the cost of the equipment and transmission facilities used to establish the gateways.

(2) Value-Added Network Service Points (VAN)(X.25)

- Many of the external databases that users want to access are accessible through dial-up public data networks like Telenet and Tymnet. Telenet and Tymnet are value-added carriers, in that they lease communications lines from the phone company and other long-distance carriers, and then resell a public packet-switching service that uses those facilities.

- A user who wants to access an external databank may do so from an ASCII terminal, using standard, character-at-a-time asynchronous protocols (e.g., TTY), routed through a low-speed asynchronous modem. The user dials a local access number that he or she associates with the host computer, but which is actually a Telenet or Tymnet port into its network.

- The port switch or concentrator answers the call, and, after authenticating user identification, connects the user to the appropriate service through the Telenet or Tymnet network. To the user it appears as though a regular asynchronous protocol is being used. However, what is actually happening is that the transmitted text is being put into data "packets", and shipped across the network to the recipient. At the destination, the packets are reassembled into an asynchronous data stream, and acted upon by the end host.

- In this fashion, simple terminals have simple, economical access to a number of external data services, all of which are available through dial-up ports.

- In addition, the value added network vendor may also provide other services to the end-user, such as file storage, remote computing, and electronic mail services. Each service is available for an additional fee, and the charge depends on usage, amount of disk storage used at the host site, or some combination of both.

- Relevance of VAN's to AID/W environment

  Systems users, both in AID/W and at AID overseas missions, have indicated an interest in gaining access to external databanks, as well as in using some of the services provided by VAN vendors.

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AID/W should consider experimentation with an X.25 public data network service such as a mail service, a prototype electronic mail system. This approach would introduce AID users to VAN gateway, while set-up costs and the overhead would be minimized (see Appendix G -- Electronic Mail).

The VAN gateway may also be a good test bed to experiment with file transfer operations, and to determine if the kind of service provided would meet AID requirements.

Value-added carriers such as Telenet and Tymnet also have access points to overeas locations (most of which are in Europe), through which users at AID mission overseas may gain access to external databanks in the United States.

* * * * *

APPENDIX B

AID CABLE LINK TO STATE

AID CABLE LINK TO STATE

1. THE AGENCY FOR INTERNATIONAL DEVELOPMENT (AID) IN THE FULFILLMENT OF ITS MISSION GENERATES AND/OR RECEIVES APPROXIMATELY 318,000 CABLES PER YEAR, ALL VIA THE STATE DEPARTMENT AUTOMATED CABLE SYSTEM

   - These cables are sent to and received from AID missions and other installations in many countries throughout the world.

   - This total cable traffic is segmented as follows:

     - Approximately 230,000 incoming cables, of which approximately 68,000 are classified

     - Approximately 88,000 outgoing cables, of which approximately 8,000 are classified.

   - All existing cable traffic, both incoming and outgoing, is processed by the automated facilities of the State Department

     - Incoming cable traffic (both classified and unclassified) is forwarded from State to AID in an electronic fashion (from the ARCS to the REARCS systems) via existing telecommunications links and then hardcopy printed by AID for manual distribution

     - All outgoing AID cable traffic (both classified and unclassified) is typed in optical character recognition (OCR) font and then manually (via pneumatic tube) sent to State for data entry and transmission.

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2. ALTHOUGH THE EXISTING AUTOMATED/MANUAL CABLE INTERFACE TO THE STATE DEPARTMENT DOES WORK, IT FAILS TO EFFECTIVELY CAPITALIZE UPON AVAILABLE TECHNOLOGIES TO IMPROVE EMPLOYEE PRODUCTIVITY WITHIN AID

- AID is aggressively moving forward with an office automation (OA) program designed to improve professional and clerical productivity.

- The office automation program is based primarily upon the installation of Wang word processing systems and IBM and WANG personal computers.

- AID would like the existing and planned OA equipment to increase the speed of cable generation and receipt and to improve the productivity of staff members associated with the cable process.

- In light of this goal, AID wishes to define a totally automated process for the generation and transmission of all cable traffic which operates in conjunction with the existing and planned office automation systems.

- The specific goal of this report is to address the State to cable room AID telecommunications center segment of this automated process. The existing AID telecommunications study is addressing the remaining segments.

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3. THE PRESENT AID-STATE CABLE INTERFACE CONSISTS OF AN AUTOMATED LINK FOR DIRECTLY ADDRESSED AND INFORMATIONAL INCOMING CABLES AND A MANUAL OCR INTERFACE FOR ALL OUTGOING

(1) The State Department Portion of the Present Cable Interface Consists of Telecommunications Control Panels, Cable Switching Systems, an AMADS System for Cable Routing, and an ARCS System for Cable Dissemination

- The present State configuration as it interfaces with AID is shown in Exhibit I, following this page.

- Incoming cables (both classified and unclassified) enter the State system through the telecommunications control panel and are forwarded to the ATSE relay.

  - The telecommunications control panel provides for line termination, isolation and fallback control.

  - Cryptographic devices are also employed in conjunction with the control panel.

- The ATSE relay stores (for short duration only) a copy of all cable traffic and forwards it to the ATSERP terminal computer for cable reformatting (to the electronic subscriber format) end verification of the message continuity number.

  - The Message Continuity Number (MCN) is sequentially assigned by source and is used to account for all cable traffic between any specific source point and the State Department.

  - The purpose of the MCN is to identify the lost transmission of any cable traffic.

- Subsequent to its processing, the ATSERP terminal computer forwards the cables to the AMADS system for automated routing or to the message analyst terminals for manual message routing. It is in this process that the cables addressed to AID are identified and marked for forwarding.

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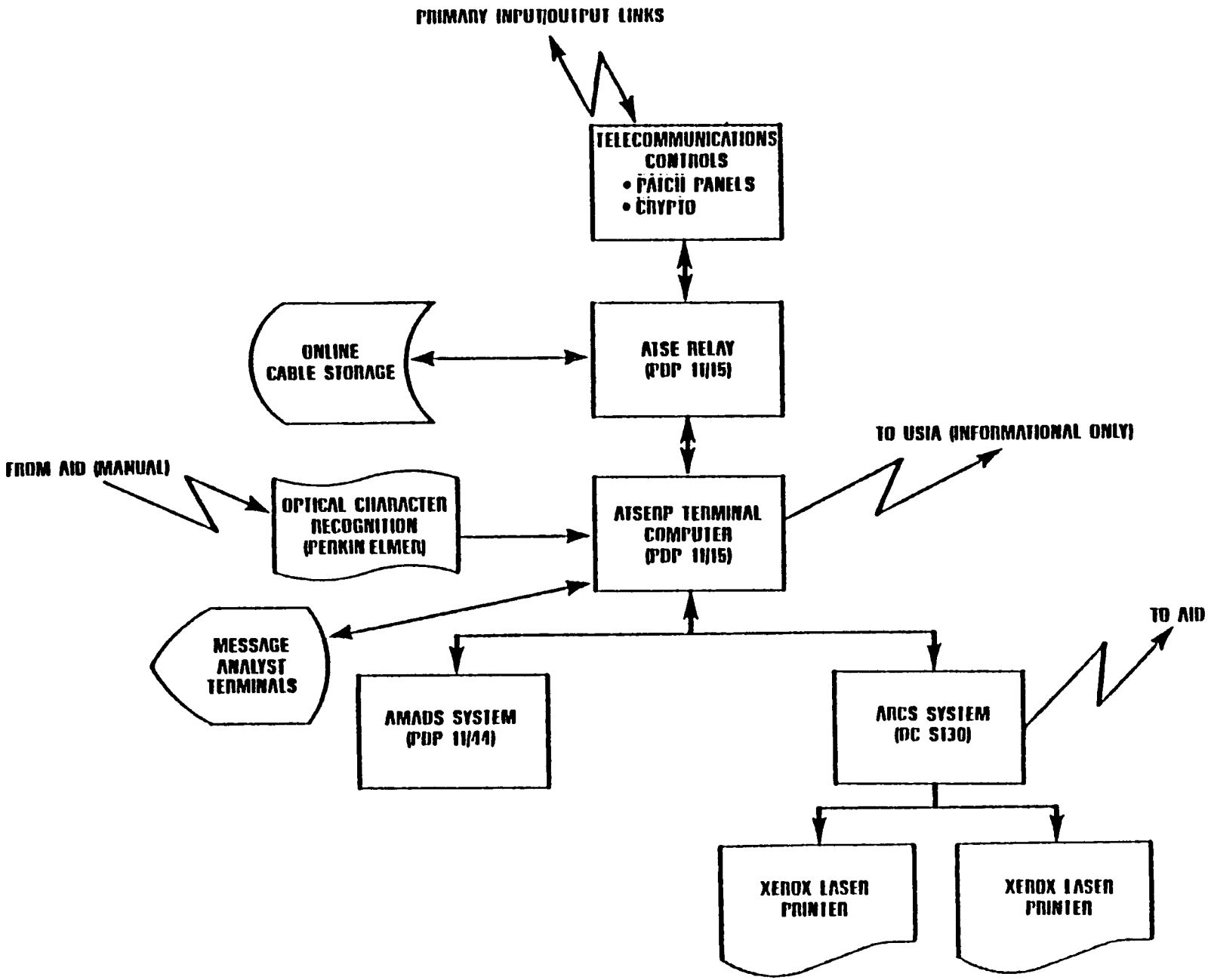
EXHIBIT I
AID STATE INTERFACE
PRESENT STATE ENVIRONMENT



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- The cables are then sent back through the ATSERP terminal computer to the ARCS system within State and from there electronically forwarded to the REARCS system within the AID telecommunications center.

- With this configuration, the State Department routinely processes and reviews all incoming AID cable traffic and may, when desired, establish a copy of any desired cable for their own use or for forwarding to another agency or organization.

(2) <u>The AID Portion of the Cable Interface Consists of a REARCS System Similar to the State ARCS System, and an AMADS System, Similar to But Currently with Less Functionality Than the State AMADS System</u>

- The REARCS system forwards the cables (both classified and unclassified) to the AID AMADS system for automated internal AID routing and then the cables are returned to the REARCS system for printing and manual distribution. Refer to Exhibit II, following this page.

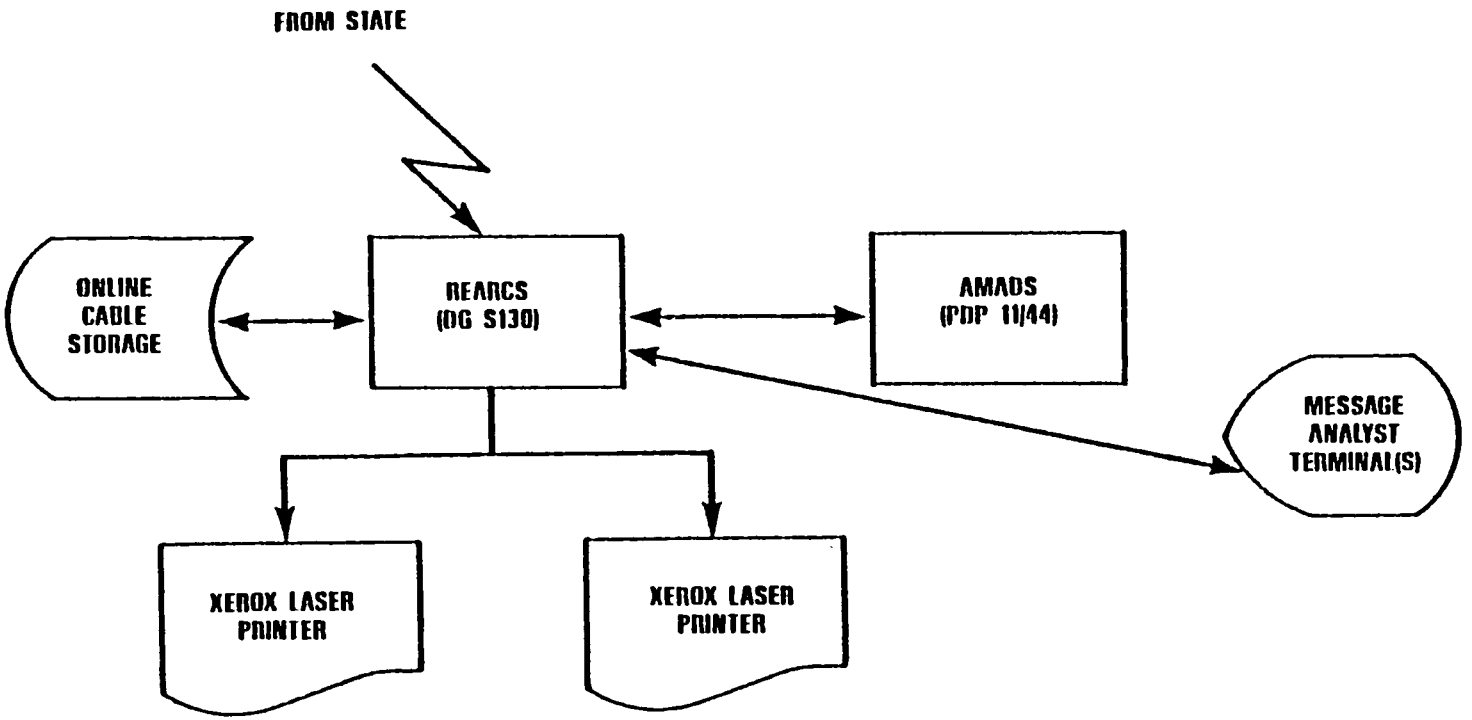
- Approximately 10 percent of AID's cables are routed in an automated fashion by the AMADS system today. The other 90 percent are forwarded by the AMADS system (back through) to REARCS message analyst terminals for manual routing. However, AID is actively working to increase the number of cables which are routed in a fully automated manner.

- AID outgoing cables are sent to the AID telecommunications center verified for appropriate signature and format and forwarded by pneumatic tube to the State Department.

- The State OCR scans the outgoing cables into the ATSERP terminal computer which in turn, passes them to the AMADS system or message analyst terminals for routing (again, refer to Exhibit I).

- The routed cables are then transmitted back through the ATSERP terminal computer and ATSE relay and out through the telecommunications control panel, with a copy transmitted back to AID through the ARCS/REARCS connection. The returned copy is the positive cable acknowledgement from the State system which shows the system acceptance, MRN, and the time of day.

EXHIBIT II
AID STATE CABLE INTERFACE
PRESENT AID ENVIRONMENT



- If an outgoing AID cable is rejected by the State system, the cable is not transmitted and the original typed hardcopy is returned to AID.

- In addition to the aforementioned functionality, the State system reformats each outgoing cable, augments the cable header to contain the MCN and message reference numbers, the origin, destination, etc., and affixes the signature of the Secretary of State.

- The Message Reference Number (MRN) is a sequential number, reset to zero at the beginning of the calendar year that is assigned to each outgoing cable passing through the State system.

- As with incoming cables, the State Department can review and establish a copy of any desired AID outgoing cable.

- The primary exception to the aforementioned flow are the incoming and outgoing informational cables, where the cable is not specifically addressed to an agency or department, but is forwarded to them by a third party for informational purposes only.

  - Informational cables from State to AID are electronically transmitted by means of the aforementioned systems.

  - However, AID informational cables to State are manually delivered.

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OPTION I — MAINTAIN THE STATUS QUO

OPTION II — BIDIRECTIONAL INTERFACE WITH REFORMATTING, ROUTING AND CONTROL BY STATE

OPTION III — BIDIRECTIONAL INTERFACE WITH REFORMATTING, ROUTING AND CONTROL BY AID

4. THREE PRIMARY OPTIONS EXIST FOR SUPPORTING THE AID CABLE INTERFACE TO AND FROM THE STATE DEPARTMENT

- Maintain the status quo
- Employ a bidirectional automated interface with the functions of cable reformatting, routing and control remaining with the State Department
- Employ a bidirectional automated interface with AID performing its own cable reformatting, routing and control.

*Option I -- Maintain the Status Quo

Option II -- Bidirectional Interface with Routing and Control by STATE

Option III -- Bidirectional Interface with Routing and Control by AID/W

(1) <u>By Far the Simplest Alternative, Option 1, Is to Maintain the Status Quo Since the Present Automated/Manual Interface Works and Appears to Adequately Support the Present and Near-Term Projected AID Cable Volume</u>

- The primary impetus for the research documented within this report is the desire by AID to increase the productivity of its employees by means of a fully automated cable processing network employed in conjunction with an advanced office automation network.

- Although no fatal functional shortcomings have been noted with respect to the present AID cable environment, the manual storage of large volumes of hardcopy cables and persistent intervals of sporadic hardware/software failure are causing significant operational problems.

  - The manual storage of significant numbers of hardcopy cables is not only time consuming and demanding of floor space, but it also makes the retrieval of any specific cable a manually intensive effort and prohibits the effective, real-time retrieval of large numbers of cables.

  - The intervals of sporadic hardware/software failures, at times, prohibits the servicing of high priority cables and contributes to a significant operational backlog.

- The hardcopy cable storage problem is presently being addressed by the consideration of a Targer (302 MB) magnetic disk subsystem for the AID REARCS system.

- The hardware/software reliability issue, although not catastrophic at this time, is presently being addressed by the review of a verbal quote from the Xerox Corporation to provide a fully redundant hardware/software configuration for installation within the AID telecommunications center.

Option I -- Maintain the Status Quo

*Option II -- Bidirectional Interface with Reformating, Routing, and Control by STATE

Option III -- Bidirectional Interface with Reformating, Routing, and Control by AID/W

(2) <u>The Simplest Fully Automated Option, Option II, Is Built Upon Two Unidirectional Links Between the State System(s) and the AID System(s), While Maintaining the Status Quo for Cable Routing and Control Functions</u>

- Refer to Exhibit III following this page, for an overview of this option.

- Incoming cable traffic would be reformatted, routed and controlled by State and transmitted to AID over the indicated link, the same as it is done today. The simplest solution would be for the incoming link to remain exactly as it is today.

- Outgoing cables could be typed and sent to the AID telecommunications center where they would be verified for format and signature, entered into the REARCS system, possibly via OCR, and subsequently transmitted to State. Refer to Exhibit IV, following Exhibit III.

  - Outgoing cables would continue to be typed in OCR font, as they are today.

  - Note that manual verification and review of outgoing cables would occur just as it does today since the cables remain in hardcopy format.

  - Augmented versions of the existing Data General S-130 minicomputers should prove to be adequate, as measured by acceptable processing response time, but would require detailed throughput analysis to affirm this adequacy.

  - The required system augmentation to implement this option would be specifically to the hardware to support the OCR interfac and to the software to support the OCR interface, outgoing telecommunications links, and cable queueing.

- As a variation to this option, outgoing cables could be received in the AID telecommunications center electronically via an office automation local area network attached to the Wang office automation systems, verified for format and electronic signature, and then released for forwarding to State. (Refer to Exhibit V, following Exhibit IV).

EXHIBIT III
AID STATE CABLE INTERFACE
OPTION II, FUTURE STATE ENVIRONMENT

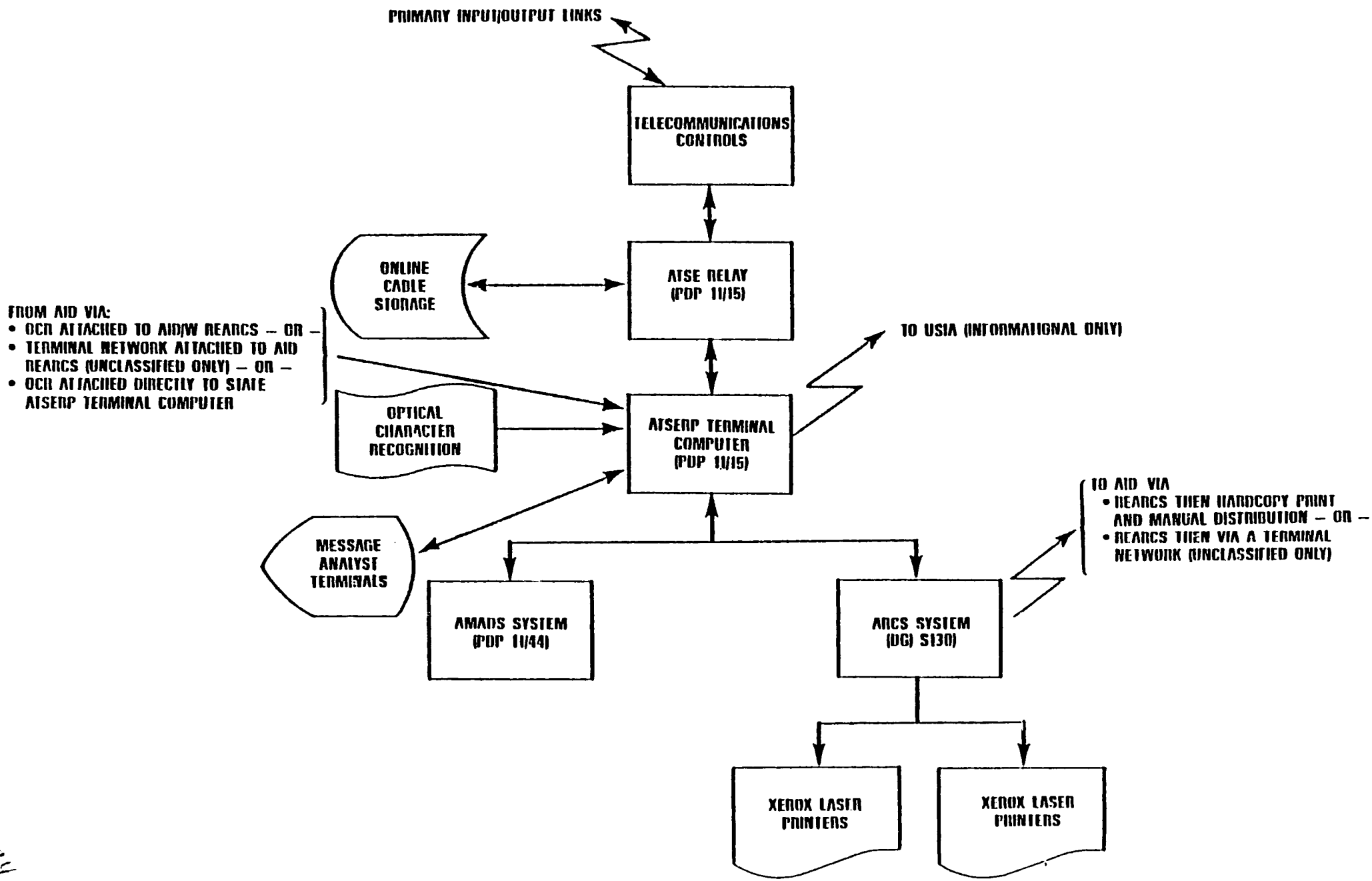


EXHIBIT IV
AID STATE CABLE INTERFACE
OPTION II, ALTERNATIVE AID/W ENVIRONMENT

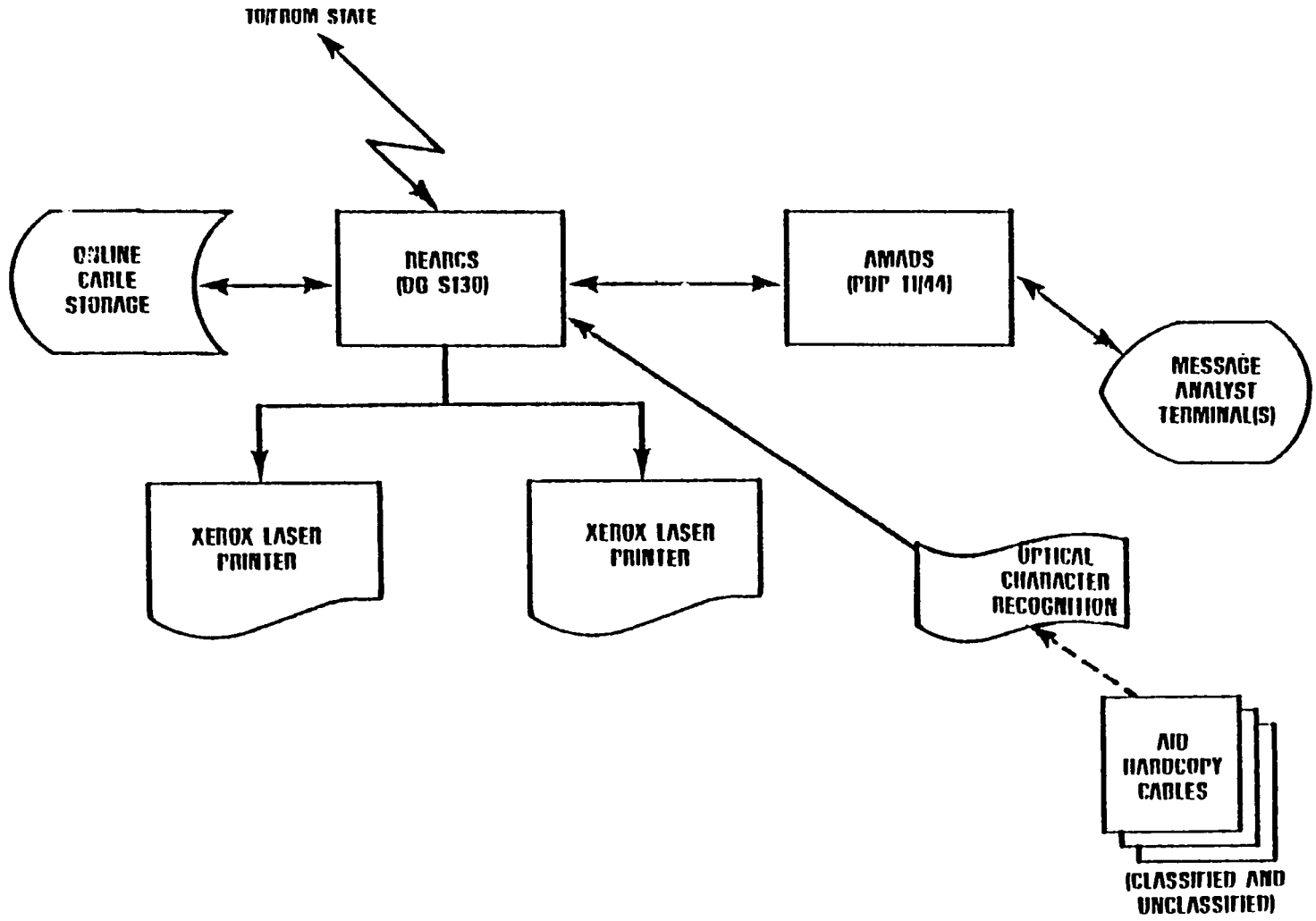
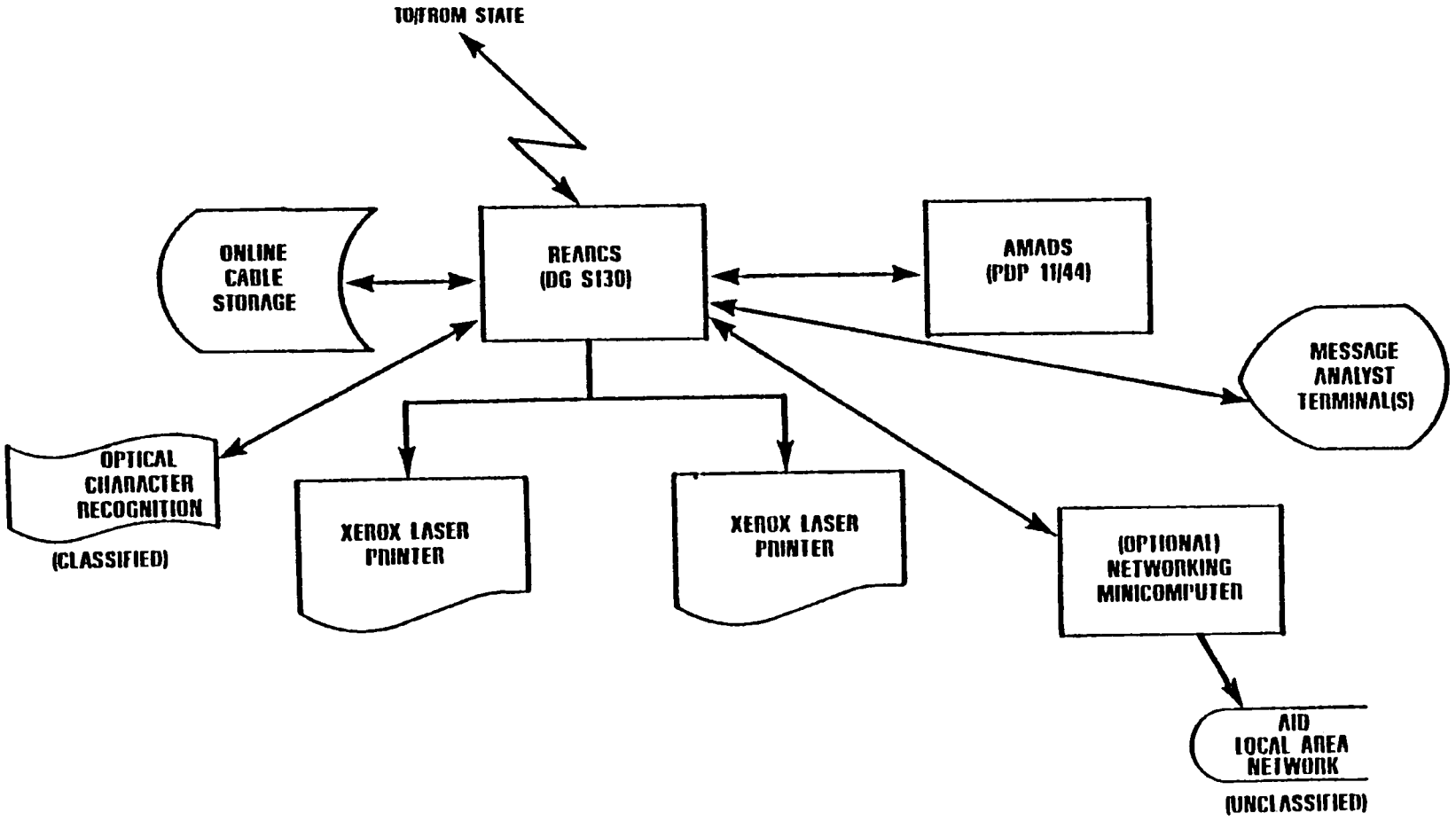


EXHIBIT V
AID STATE CABLE INTERFACE
OPTION II, ALTERNATIVE AID/W ENVIRONMENT



- With this approach, all unclassified cables could be processed in a completely automated fashion.

- However, classified incoming cables would be received at the AID telecommunications and printed for manual distribution within AID and correspondingly outgoing classified cables would be manually transported to the AID telecommunications center for OCR entry into the system and subsequent transmission.

- With this local area network approach the existing Data General S-130 minicomputers may likely prove to be inadequate and therefore would certainly require more throughput analysis to identify their saturation point.

- Hardware augmentation to implement this local area network version of Option II would be required to the minicomputers to support the local area network interface, the OCR interface, and the outgoing telecommunications link. Software modification would be required to support the aforementioned plus to support cable queueing.

An additional variation of Option II would have outgoing cables received in the AID telecommunications center, verified for signature and entered into an OCR which is remotely attached to the State ATSERP terminal computer (refer to Exhibit VI, following this page).

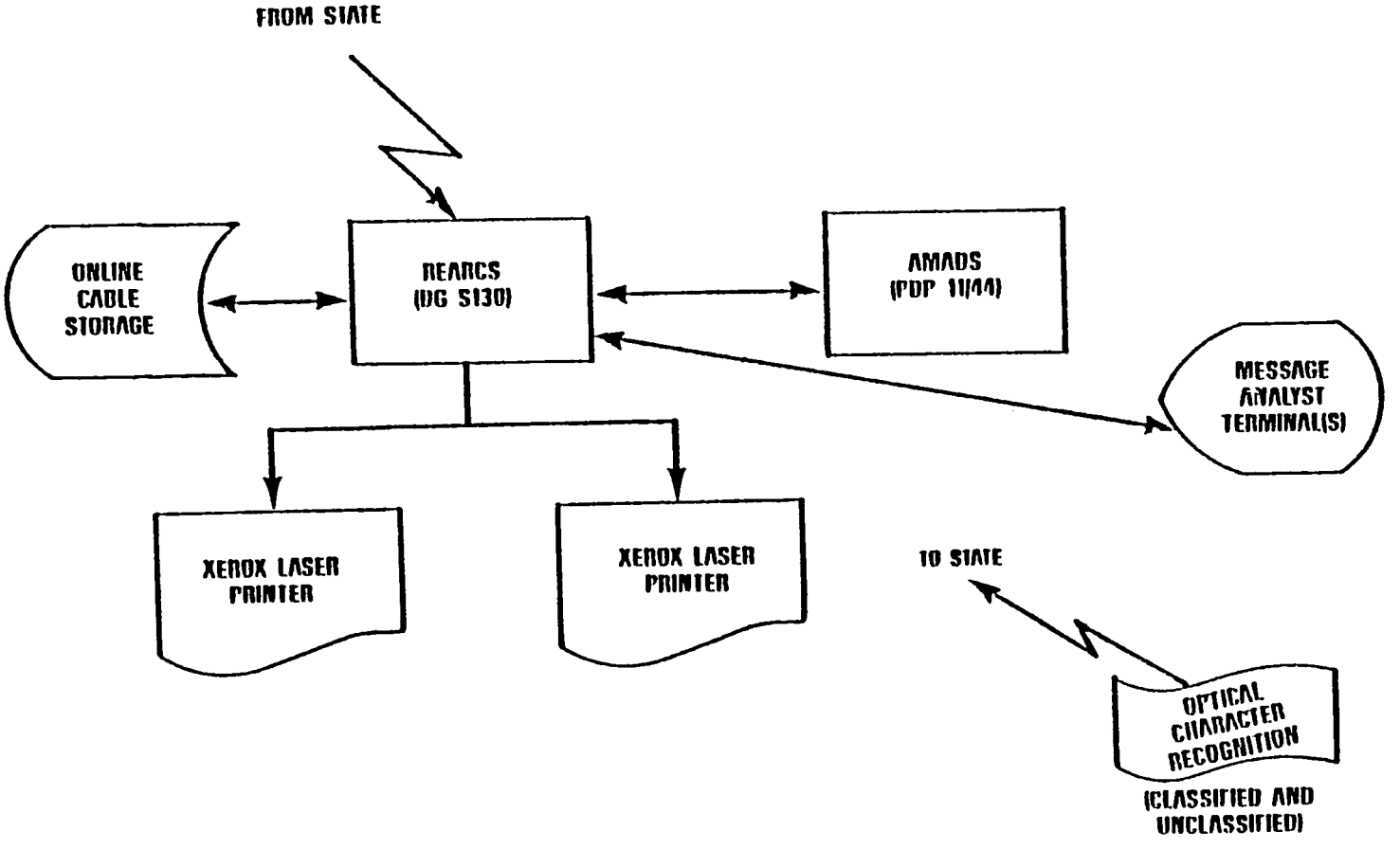
- All classified and unclassified outgoing cables would enter the State system via an AID based OCR which is configured as a slave to the State system.

- All incoming cables would be hardcopy printed and manually distributed just as they are today.

- No modification to the existing Data General minicomputers would be required for this SLAVE OCR version of Option II.

The implementation of Option II, in any form, will require modification to the existing AID REARCS (DATA GENERAL) system hardware and software and slight modification to the State ATSERP Terminal Computer to support the

EXHIBIT VI
AID/W-STATE CABLE INTERFACE
OPTION II, ALTERNATIVE AID/W ENVIRONMENT



new telecommunications links. In addition, AID may choose to employ a new minicomputer to perform the interface between the local area network and the AID REARCS system.

Any of these alternatives for Option II will technically work, therefore the deciding factor is simply the desires of AID and State.

- The primary point to be considered by AID is whether or not it wishes to employ the future office automation telecommunications network for cable traffic, whether it wishes to undertake the necessary hardware and software modifications (whose cost is estimated later in this document) and whether it wishes to cope with the required process of electronic signature.

Option I -- Maintain the Status Quo

Option II -- Bidirectional Interface with Reformating, Routing, and Control by STATE

*Option III -- Bidirectional Interface with Reformating, Routing, and Control by AID/W

(3) The Real Issues Which Must Be Addressed by AID, As Expressed in Option III, Is Whether or Not to Assume the Responsibility for Reformatting, Routing, and Control of AID Cables

- The assumption of reformatting, routing and control responsibility would require AID to significantly augment the automated/manual assisted cable routing capability within its own environment.

- A representative system flow for Option III, the automated message routing capability, is as follows:

  - A cable would be received from State into the AID REARCS system for reformatting and validation of MCN, and forwarded to the AID AMADS system.

  - The AMADS system would internally route the cable and return it to the REARCS system for printing and/or electronic distribution via local area network and possibly messsage storage for inquiry and/or backup.

  - For outbound traffic, a cable would be received by the REARCS system via OCR or local area network, reformatted, assigned an MRN and MCN, affixed with the signature of the Secretary of State and forwarded to the AMADS system.

  - The AMADS system would perform routing and return the cable to the REARCS system for transmission to State.

  - When the cable is received by State it will simply be switched out to the outbound telecommunications links and a copy stored for a short term on the ATSE relay itself.

- The key aspects of a system of this nature is that AID formats the cable, assigns MRN and MCN numbers, performs automated/manual assisted message routing, affixes the signature of the Secretary of State, and optionally stores all message traffic on-line for inquiry/ archival use.

The existing REARCS (DATA GENERAL) an AMADS (Digital) systems would both require significant hardware and software enhancements to support Option III. The REARCS system would require significant enhancement to reformat cables, assign MRN and MCN numbers and to affix the proper signature, and the AMADS system would require greatly enhanced user profiles.

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5. THE MOST VIABLE APPROACH FOR AID TO EMPLOY AT THIS TIME FOR PROCESSING CABLE TRAFFIC IS OPTION II WITH TWO UNIDIRECTIONAL AUTOMATED LINKS AND THE RESPONSIBILITY FOR CABLE REFORMATING, ROUTING, AND CONTROL REMAINING WITH THE STATE DEPARTMENT

- The summary analysis supporting this conclusion is shown in Exhibit VII, following this page, and a brief discussion of the thoughts supporting each conclusion, by category, is presented below.

- Employee productivity -- The ease and quantity of manual labor required for any employee to generate and/or receive one or more cables.

  - The status quo approach (Option I) currently requires manual labor to type the cable, deliver it to the AID telecommunications center, review the cable for signature and format, transport the cable to State, and enter the cable into the State systems.

  - Option II, at minimum eliminates the manual transport of cables to the State Department and at best fully automates the AID portion of the cable generation/receipt process.

  - Option III fully automates not only the AID portion but also the State portion of the cable generation/receipt process.

- Reliability -- The percent of time that the automated portion of the AID cable system is operational and available for the generation and transport of cables.

  - The reliability issue is not significantly different for Option I, II or III. The key to reliability is redundancy, and the automated portion of any of these options can be made redundant if the need warrants.

  - As previously stated, AID does feel the need for high reliability within the cable system, and therefore is currently reviewing the possibility of implementing a fully redundant hardware and software system.

- Maintainability -- The degree of difficulty in maintaining the automated portion of the AID cable system in fully operational mode.

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EXHIBIT VII
ALTERNATIVE AID CABLE SYSTEM EVALUATION

	EMPLOYEE PRODUCTIVITY	RELIABILITY	MAINTAINABILITY	ABILITY TO HANDLE CABLE VOLUME	ABILITY TO SUPPORT FUTURE CABLE INQUIRY	COST TO AID/W	COST TO STATE	OVERALL RATING
OPTION I: • MAINTAIN THE STATUS QUO	○	●	●	◐	○	●	○	◐
OPTION II: • AUTOMATED INTERFACE; STATE ROUTING	●	●	◐	●	◐	◐	◐	●
OPTION III: • AUTOMATED INTERFACE; AID/W ROUTING	●	●	○	●	●	○	●	○

● BEST

◐ BETTER

○ ACCEPTABLE

- Option I has a high degree of maintainability simply because it is well known hardware and software technology of little complexity and a high degree of knowledge on the part of the operational staff.

- Option II will require enhanced hardware and software, of moderate complexity, both of which will be new to the operational staff.

- Option III will require enhanced hardware and software, with high complexity within the software functions. Therefore, the operational and maintenance staffs will face a significant learning curve.

Ability to handle cable volume -- This criterion is simply the ability of any particular option to process the present and projected future AID cable volumes.

- All three options can handle the present and projected future AID cable volumes; however, Option I is more sensitive to workload bottlenecks due to its significant manual intensity.

Ability to support future cable inquiry -- This criterion is the flexibility of an augmentation required to the proposed configuration to support the processing of future on-line cable inquiry.

- Option I is the least flexible and would require significant augmentation to both hardware and software to support future on-line cable inquiry.

- Option II and Option III are both moderately flexible and since they may have local area network attachment, provided an ideal basis of support for on-line cable inquiry.

- Cost to AID -- These are the one-time and recurring costs to AID to fully implement the selected option

  - Option I is the least costly simply because it changes nothing from the present environment.

  - Option II may require limited hardware augmentation and will definitely require telecommunications and queueing software augmentation.

- Option III will require hardware augmentation and sophisticated telecommunications, queueing, and message handling software augmentation. In addition, this option will require operational augmentation, in the form of communications equipment operators within AID.

- Refer to Exhibit VIII, following this page, for summary cost data.

Cost to State -- This is one time and recurring costs to State to fully implement the selected option.

- Option I, the status-quo, will require State to continue to provide computer processing support for cable formatting, routing, etc., message analyst support for cable routing, and operational support for cable entry.

- Option II will eliminate the operational support for cable entry at State.

- Option III will eliminate from State the majority of processing and operational burden except for limited processing time for cable routing.

An analysis of all of these findings with respect to the three options leads to the conclusion that Option II is clearly the most beneficial to AID.

EXHIBIT VIII
ALTERNATIVE AID CABLE SYSTEMS
SUMMARY COST ESTIMATES

	OPTION I: MAINTAIN THE STATUS QUO	OPTION II: AUTOMATED INTERFACE; STATE ROUTING	OPTION III: AUTOMATED INTERFACE; AID/W ROUTING
AID COSTS*			
• ONE-TIME	$60,000–$80,000 (1)	$400,000–$450,000 (3)	$1,000,000–$1,300,000 (5)
• RECURRING	$250,000–$300,000 (2)	$350,000–$400,000 (4)	$600,000–$700,000 (6)
STATE COSTS*			
• ONE-TIME	— (7)	$10,000–$20,000 (8)	$20,000–$30,000 (9)
• RECURRING	— (7)	—	—
TOTAL COSTS			
• ONE-TIME	$60,000–$80,000	$410,000–$470,000	$1,020,000–$1,330,000
• RECURRING	$260,000–$300,000 $250,000–$300,000	$350,000–$400,000	$600,000–$700,000

6. WITHIN THE BOUNDS OF OPTION II, THE MOST VIABLE IMPLEMENTATION STRATEGY FOR AID TO EMPLOY IS A LOCAL AREA NETWORK FOR USER TERMINAL TO AID TELECOMMUNICATIONS CENTER AUTOMATION (UNCLASSIFIED ONLY) AND A FULLY AUTOMATED COMPUTER-TO-COMPUTER LINK FROM AID'S CABLE PROCESSING SYSTEM TO THE STATE SYSTEM (CLASSIFIED AND UNCLASSIFIED)

- The local area network is already under study and being designed to support AID's office automation functions; and therefore, its design, implementation, and associated costs are not directly driven by this cable application.

  - If the network were not to be put in place for office automation applications, its associated costs could not be directly justified by this cable application.

  - However, since some form of network will be put in place, it can provide an ideal opportunity for a symbiotic relationship between the office automation and cable processing functions.

- The telecommunications links between AID and State would be composed of two unidirectional links; an incoming link, just as it is today, from the State ARCS system to the AID REARCS system and a new outgoing link from the AID REARCS (or front-end processor) to the State ATSERP terminal relay.

- Therefore, AID generated unclassified cables would be transmitted from user terminals through the local area type network to the AID cable room for appropriate review and then computer-to-computer to the State system for reformatting, routing, control, and ultimate transmission. Incoming cables would follow the same process, but in reverse.

  - Classified cables would be typed and hand carried to the AID cable room for review and then manually transported to State for OCR entry into the State system.

  - In the longer term, an OCR could be placed in the AID cable room for entry of classified cables at that point

- The implementation of this strategy will provide the maximum benefit of automation to AID per dollar of investment.

7. THE NEED FOR HARDWARE BACKUP SUPPORT IN CONJUNCTION WITH THE IMPLEMENTATION OF OPTION II IS INCONCLUSIVE, BUT NONETHELESS, IS RECOMMENDED AT THIS TIME

- As the AID cable system becomes more and more automated, the need for improved hardware reliability will become more acute.
- Present hardware reliability is marginally acceptable with intermittent periods of downtime of as much as one or two days at a time.
- This intermittent downtime becomes a serious problem when high priority cables are in the queue and cannot be forwarded to their destination.
- In addition, the intermittent downtime will become inhibiting to workload throughput as the cable process becomes more automated by being tied to an advanced office automation network.
- Therefore, the prudent step to take is to provide redundant hardware for the cable system at the same time that the system is upgraded.

APPENDIX C

REQUIREMENTS ANALYSIS METHODOLOGY

REQUIREMENTS ANALYSIS METHODOLOGY

In order to conduct the AID Telecommunications Study, a survey was conducted to identify current and needed AID telecommunications functions. This appendix describes the steps taken to collect, compile, and analyze the data from that survey.

1. The Purpose of the AID Telecommunications Survey Was To Determine The Current Flow of Information In AID And Identify Areas Where Alternative Systems Might Improve Communications

The AID Telecommunications Requirements Survey was conducted to collect two types of information:

- The current telecommunications interactions and systems capabilities of each AID office
- Potential use by each office of new telecommunications systems.

These data were anaylzed to identify the current volume of information flow throughout AID and to identify areas where alternative systems might better meet user needs.

2. Two Surveys Were Conducted in AID To Collect The Needed Data

The Information and Resources Management Division (IRM) of AID/W coordinated two surveys of AID offices to collect data on telecommunications needs and priorities. One survey was of 23 AID/W offices. The other was of 33 AID missions. The missions surveyed were selected by AID/W Bureau Chiefs as the USAIDs with most interest in telecommunications. For the most part, these USAIDs already have office automation equipment. Both surveys queried the respondent on such areas as which offices they communicate with most, telecommunications functions they desired and typical volume of information transmitted. Questionnaires used to collect this information are on file with M/SER/IRM.

Information other than that collected from survey questionnaires was also used in the study. This information included:

- A computer printout of the number of personnel in each AID office by job classification, supplied by M/SER/MO
- A computer printout of the number and type of typewriters in each AID office, supplied by M/PM
- Equipment projections for AID/W and the USAIDs, supplied by M/SER/IRM
- Projections of staff and building space to be occupied by AID by FY86, provided by M/SER/MO
- Telecommunications hardware inventories for AID/W and the USAIDs.

Information from the questionnaires and computer printouts were organized onto a series of charts, or "working papers." Usually, each working paper represented the responses to one survey question or one printout; occasionally, however, data from several sources were combined on a single working paper. A schematic of the steps taken in this requirements analysis can be seen in Exhibit C-1, following this page. A more detailed description of the compilation of each working paper is given in the sections that follow.

3. Eight Working Papers, Organized In A Five-Building Scenario, Were Created From AID/W Survey Questionnaire Data

Eight working papers were compiled from AID/W data, using both the questionnaire responses and the computer printouts. On each working paper, AID/W offices were organized in the 5-building scenario; i.e. the expected distribution of AID/W offices into 5 buildings by FY86. A description of each of the working papers is given below.

1) Use of AID Telecommunications Functions (AID/W Survey, Question #1; W1F2-2/21)

This set of working papers was created to show the distribution of personnel in each office who need each telecommunications function, and compares these estimates to the staffing patterns on the computer printout supplied by

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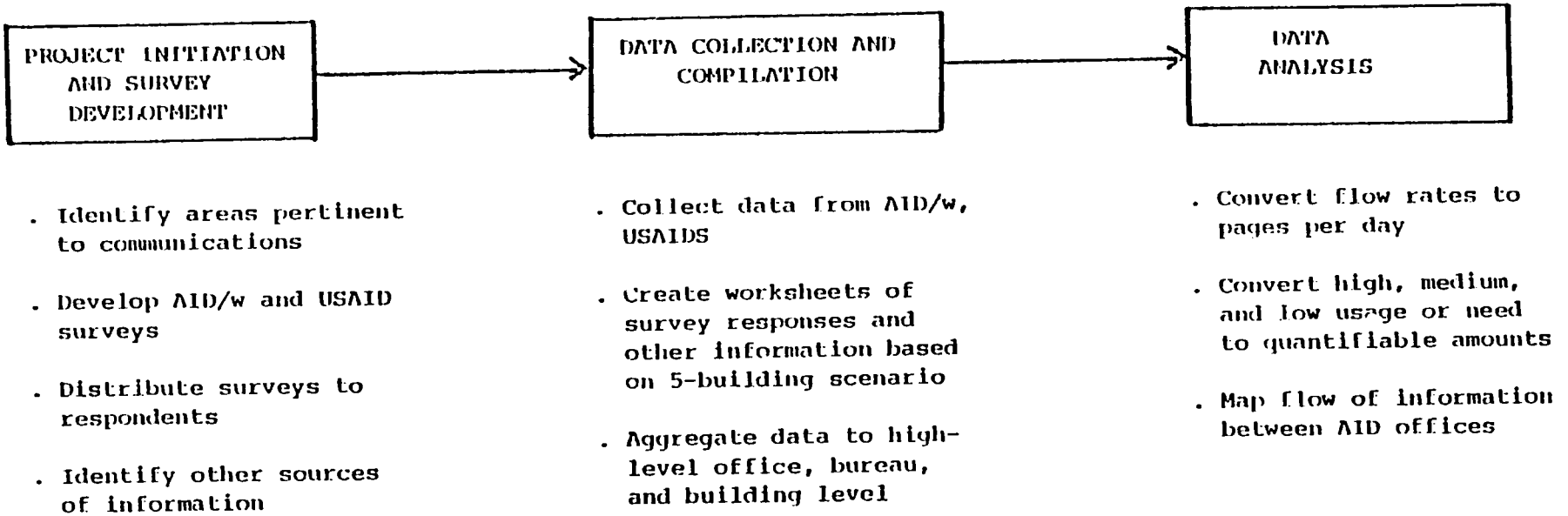
EXHIBIT C-1
REQUIREMENTS ANALYSIS METHODOLOGY



M/PM. Each working paper represents an individual AID/W bureau or high-level office. The responses to "number of personnel who need each function" are divided into three professional levels:

- Senior -- Bureau/Office or Division Directors and Deputies
- Mid-level -- Project Managers and other professionals
- Support -- Secretarial and other support staff.

These estimates are compared to the actual staffing patterns of full-time, permanent employees per office, as supplied by M/PM. These staffing patterns are divided into four professional levels:

- Senior Managers -- EX, ES, FE, and GS-16 and above
- Middle-Level Managers -- AD, GS, GM 13-15, and FS 1-3
- Other Professionals -- AD, GS 9-12, and FS 4-6
- Secretarial/Support -- AD, GS 1-8, FS 7-9

This detailed set of working papers is on file with M/SER/IRM, and can be used for subsequent analysis of equipment needs for electronic mail.

2) <u>Source and Volume of Information Sent And Received by Each AID/W Office (AID/W Survey Questions #2 and #3)</u>

This working paper (W1F3-23) is a matrix showing the estimates of volume, in pages per day, of information sent and received by each AID/W office to the other AID/W offices. Answers were organized in a matrix of the 5-building scenario, with the office responding on the y-axis, and the office with which they send or receive information from on the x-axis.

Several adjustments were made to this working paper in order to present the data in a more workable format. These adjustments include:

- Combining the volume "sent to" with the volume "received from" in order to obtain a "total flow of information" between offices.

- Converting all data to pages-per-day (if presented in other units)

- Normalizing the data by adjusting responses to account for those offices from which no response was received.

In addition, totals were calculated of the flow of information between one AID building and each of the others. A second version of this same matrix was constructed (W1F3-24/25), this time estimating the volume of information flow for offices whose responses were incomplete.

3) Use of Facimile Equipment (AID/W Survey Question #4; W1F4-26)

This working paper displays the volume of information, in pages per day, transmitted by facimile equipment to and from AID/W offices. The responses are to four potential uses of facimile equipment:

- Outgoing to other AID/W offices
- Outgoing to recipients other than AID/W offices
- Incoming from other AID/W offices
- Incoming from senders other than AID/W offices.

The last column of the matrix shows total daily use per office of facimile equipment.

4) Distribution and Copies of Cables (AID/W Survey Question #5; W1F5-27)

This working paper shows the number of people in each AID/W office who typically must see a cable, the number of copies made of each cable, and the percent of traffic that could potentially flow through a non-secure inter-building cable system in AID/W. This analysis displays two types of data:

- Typical number of people who must see a cable (for incoming and outgoing), and number of copies made of these cables

- Potential rates of use of a cable link system.

These counts and rates were used to estimate the amount of traffic that could flow along a non-secure automated cable link, if one existed.

5) Automated Link Between AID/W and USAIDs (AID/W Survey Question #6; W1F6-28)

This worksheet presents the volume of information each office estimated would be sent over an automated link between that office and AID missions, and how much of the information that is currently sent via cables could be sent by this automated link.

6) Electronic Mail (AID/W Survey Question #7; W1F7-29)

This working paper presents the prioritization each AID/W office gave to the various uses of electronic mail systems, and the category of personnel most likely to be involved in an electronic mail system. Responses were presented according to individual bureau or high-level office within the 5-building scenario.

Ranks of each use of electronic mail were presented on a scale of 1 to 5, 5 being the most desirable. All responses to each use were then totalled and averaged to identify the average need of each electronic mail function. A similar procedure was used, using a scale of 1 to 3, to rank the personnel category most likely to be involved at each level in an electronic mail system.

7) Typewriter Count (W3F1-1)

This working paper (Exhibit C-2) presents the number of electric and manual typewriters in each AID/W bureau or high-level office, and arranges them according to the 5-building scenario. The source of this information is the computer printout of the number of each type of typewriter per AID/W office, supplied to IRM by M/SER/MO.

8) Staffing Patterns (W4F1-2)

The distribution of staff by professional level was determined for each AID/W office in the 9- and 5-building scenarios. Exhibit C-3 shows the staffing levels by office/building for AID/W FTE's in the 5-building scenario for the first four levels. The 9-building scenario (W4F1-2) shows staff organized into 5 levels:

- Senior Managers -- EX, ES, FE, and GS-16 and above
  - Full time
  - Part time
- Middle Level Managers -- AD, GS, GM 13-15, and FS 1-3
  - Full time
  - Part time

EXHIBIT C-2

Number of Typewriters Per Office
(5-Building Scenario)

Office/ Building	# Electric Typewriters	# Manual Typewriters
Main State		
M/SER/MO	3	-
A/AID	7	1
ES	13	-
PPC	67	17
AA/M	-	-
SAA/S&T	7	2
AFR	94	35
ASIA	76	23
LAC	71	22
NE	81	21
XA	32	7
LEG	14	1
IG	12	6
GC	18	5
OFDA	19	3
BIFAD	7	2
AA/PRE	10	2
Total MS	531	147
SA-1		
M/SER/IRM	11	-
M/FM	86	17
M/PM	163	13
PRE	19	-
FVA	56	5
EOP	9	-
Total SA-1	344	35

EXHIBIT C-2(2)

Number of Typewriters Per Office
(5-Building Scenario)

Office/ Building	# Electric Typewriters	# Manual Typewriters
SA-15		
M/SER	335	59
SA-16		
IG	35	16
SCI	4	-
Total SA-16	39	16
SA-18		
PPC E & DIU	43	4
S&T	190	31
Total SA-18	233	35

EXHIBIT C-3

Staffing Levels By Office/Building For AID/W FTE's
(5-Building Scenario)

Building/ Office	(1) Senior Mgrs	(2) Mid-Level Mgrs	(3) Other Prof	(4) Secty/Supp
Main State				
M/SER/MO	-	4	23	19
A/AID	5	3	6	-
ES	1	2	9	2
PPC	10	56	14	26
AA/M	2	-	-	2
M/SER/MO	-	2	13	18
SAA/S & T	3	2	3	3
AFR	20	110	20	53
ASIA	10	49	8	32
LAC	10	60	10	28
NE	10	61	7	36
XA	1	16	15	9
LEG	1	9	4	5
IG	2	8	2	1
GC	7	29	3	13
OFDA	1	9	1	6
BIFAD	1	2	4	5
AA/PRE	3	3	3	1
Total Main State	87	425	145	259
SA-1				
M/SER/IRM	2	45	21	10
M/FM	4	41	50	51
M/PM	7	48	32	49
PRE	2	23	2	10
FVA	5	41	20	14
EOP	1	4	2	1
Total SA-1	21	202	127	135

EXHIBIT C-3(2)

Staffing Levels By Office/Building For AID/W FTE's
(5-Building Scenario)

Building/ Office	(1) Senior Mgrs	(2) Mid-Level Mgrs	(3) Other Prof	(4) Secty/Supp
SA-15				
M/SER	7	73	51	42
EOMS	1	8	8	2
Total SA-15	8	81	59	44
SA-16				
IG	3	55	9	19
SCI	-	2	-	1
Total SA-16	3	57	9	20
SA-18				
PPC E & DIU	2	12	8	6
S&T	18	129	29	52
Total SA-18	20	141	37	58
Total/AID/W	139	906	377	516

(1) Senior Managers = ES, EX, FE, GS-16 and above
(2) Mid-Level Managers = AD, GS, GM 13-15, FS 1-3
(3) Other Professionals = AD, GS 9-12, FS 4-6
(4) Secretarial/Support = AD, GS 1-8, FS 7-9

- Other Professionals -- AD, GS 9-12, and FS 4-6

  - Full-time
  - Part-time

- Secretarial/Support -- AD, GS 1-8, FS 7-9
  - Full-time
  - Part-time

- Intermittent Staff and Others -- Experts, consultants, IPA, PH, WG, XP, YV and YW

  - Intermitent
  - Full-time
  - Part-time

The source of this information was a computer printout of current staff size for each AID/W office (broken out by division), supplied by M/PM. Data were aggregated up to the high-level office or bureau level.

4. Three Working Papers Were Created from the USAIDs Survey Data.

Three working papers were compiled from the survey responses of the USAIDs. These working papers are described in the following sections.

1) USAID Hardware Inventory (USAID Survey Question #1; W2F2-2)

This working paper describes the hardware in each of the USAIDs surveyed. It describes the number of units, printers, and workstations for:

- Minicomputers
- Office systems
- Word processors
- Microcomputers

2) Volume of Information Exchanged Between USAIDs and AID/W (USAID Survey Question #4; W2F3-3)

This working paper shows the estimates, in pages per day, of the volume of information sent and received from each AID mission to AID/W high-level offices and bureaus. In addition, totals from each region to each AID building in the 5-building scenario were tabulated.

3) Rank Priority of Telecommunications Functions (USAID Survey Question #6; W2F4-5)

This working paper displays the priority each telecommunications function was given by each USAID that responded to the survey. The need for each function was measured on a scale of 1 to 5, 5 being the most desirable. Responses were totalled and then averaged to obtain the average rank for each function. Also, responses were shown separately by missions with OIS and missions with VS equipment, and the averages of those responses were calculated. Averages were also supplied for each USAID, irrespective of the distinction between those with OIS and VS equipment.

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APPENDIX D

CABLE TRAFFIC ANALYSIS

CABLE TRAFFIC ANALYSIS

This appendix describes the objectives and findings of the analysis of AID's cable traffic and supplements the discussion provided in Chapter II of this report. The appendix is divided into four sections:

- Purpose of the cable traffic analysis
- Overveiw of cable handling procedures
- Strategy to sample and analyze cable traffic
- Findings of the cable traffic analysis.

A detailed series of working papers from the analysis of AID's cable traffic patterns is on file with M/SER/IRM. These working papers support the findings and analysis presented in this report.

A. PURPOSE OF THE CABLE TRAFFIC ANALYSIS

This section describes the purpose, scope and methodology of the cable traffic analysis.

1. The Purpose of the Cable Traffic Analysis was to Provide Information on the Volume and Distribution of AID/W Cable Traffic.

The cable traffic analysis was designed to supply information needed to map and size existing cable traffic patterns. AID's two major patterns were traced:

- Between AID missions (USAIDs) and other diplomatic posts and the AID/W communications center.

- Between the AID/W communications center and AID/W offices.

The information was collected to help determine the amount of traffic that could be expected on any given day, in the event that the cable distribution process was to be automated. System engineers need this information to size the electronic distribution system required to carry cable and other information in, out, and within AID/W.

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Three types of cables were examined in this analysis:

- Incoming - A cable sent to AID/W via the Diplomatic Telecommunications System from an AID mission (USAID), or other diplomatic post.

- Outgoing - A cable sent from AID/W over the Diplomatic Telecommunications System to USAIDs or other diplomatic posts

- Comeback copies - Copies of outgoing AID/W cables returned to AID/W offices.

Only unclassified cables were included in this analysis. Classified cables accounted for approximately 24% of AID's total cable traffic. The majority of these are information copies of State Department cables. Since less than 3% of AID's total cable traffic are classified cables originating in AID/W or the USAIDs, it was not felt that the cost of providing a completely secure automated cable network for AID was justified.

Booz, Allen used a three-step process to collect and analyze data on AID cable traffic. Exhibit D-1, on the following page, identifies these steps:

- Identify and interview key personnel in AID's Communications Center (M/SER/MO/CRM), the Department of State's Communications Center (OC/T) and the vendor maintaining the cable processing equipment; review pertinent AID handbooks on policies and procedures on cable processing.

- Develop and implement a cable sampling strategy to provide data on AID's cable traffic to/from its missions, AID/W offices and buildings.

- Compile data collected from the cable sample and extrapolate it so that the distribution of cables handled by AID on any given day can be determined.

B. OVERVIEW OF CABLE HANDLING PROCEDURES

This section provides an overview of the processing and distribution of AID cables.

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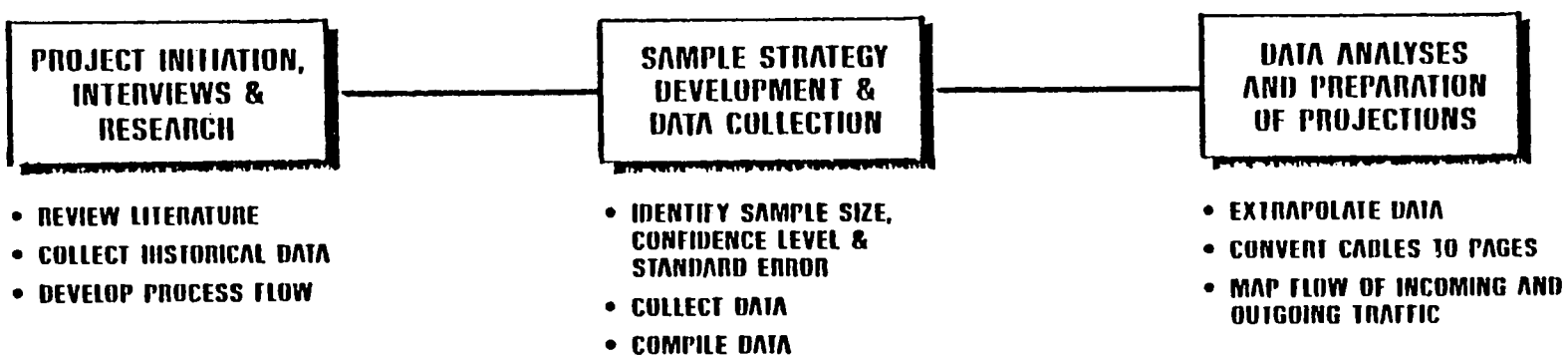
EXHIBIT D-1
CABLE ANALYSIS METHODOLOGY



1. Cables for AID/W are Currently Received and Transmitted by the Department of State's Communications Center.

The State Department's Communications Center (OC/T) is reponsible for receiving and transmitting all incoming and outgoing AID cables. AID's Communication Center (M/SER/MO/CRM) is a branch of the Communications and Record Management Division of the Office of Management Operations. Its responsibilities include maintaining AID's Remote Automated Reproduction and Collating System (REARCS). REARCS is a customized cable-processing system that performs the following functions:

- Receives cables electronically from the Department of State
- Assigns distribution to AID/W addresses and other federal agencies
- Prints required number of copies of each cable.

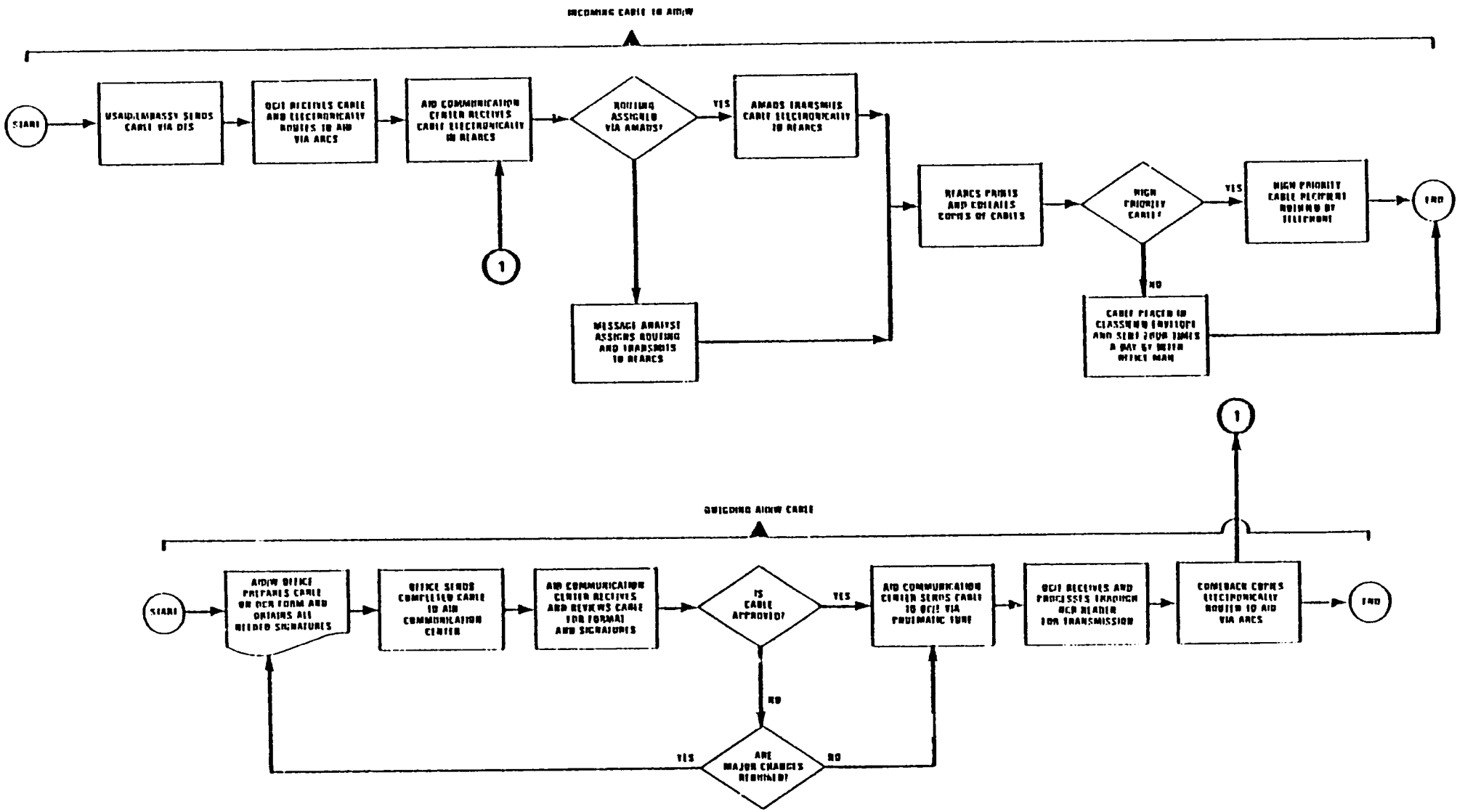
The Center is also responsible for reviewing the format of all outgoing cables prior to their transfer to OC/T for transmission.

The process by which incoming and outgoing cables are handled is detailed in Exhibit D-2. Briefly, cables are processed as follows:

- Incoming Cables are received electronically by M/SER/MO/CRM from OC/T. AID determines distribution, prints and distributes the cables in a classified envelope as part of AID's inter-office mail.
- Outgoing Cables are received by M/SER/MO/CRM, reviewed for format and sent by pneumatic tube to OC/T for transmission.
- Comeback copies of outgoing cables are sent by OC/T electronically to AID (like an incoming cable) where they are processed for distribution.

The AID communications center is a secure facility and all cables are handled as if they were classified.

EXHIBIT D-2
PROCESSING OF AN AID INCOMING AND OUTGOING CABLE



DEFINITIONS

AMADS	AUTOMATIC MESSAGE ANALYSIS AND DISTRIBUTION SYSTEM
ARCS	AUTOMATED REPRODUCTION AND COLLATING SYSTEM
DIS	DIPLOMATIC TELECOMMUNICATIONS SYSTEM
OCI	DEPARTMENT OF STATE COMMUNICATIONS CENTER
REARCS	REMOTE AUTOMATED REPRODUCTION AND COLLATING SYSTEM

C. STRATEGY TO SAMPLE AND ANALYZE CABLE TRAFFIC DATA

This section describes the methodology used to sample AID's electronic cable file.

1. To Determine Distribution Patterns by Office/Building, a Stratified Random Sample was Selected from AID's Electronic Cable File.

Booz, Allen used a stratified random sample of 692 unclassified cables to estimate the size, flow and distribution of AID's cables. The sample was selected to provide a level of precision of ± 25% (of the mean percentage) at a 90% confidence level. The sample selected from AID's electronic cable file represented approximately five months of classified and unclassified cables. The sample was stratified in order to ensure adequate representation of both incoming and outgoing cables. A sample of 346 incoming and 346 outgoing cables was selected.

Given the study's budget, time and manpower constraints, it was not feasible to select a cable sample at the office level with the same level of precision. Instead, the sample was selected to be representative at the building level, the next highest level of aggregation. This approach optimized existing resources, and provided information at the office level that can be used for comparative purposes. Hence, the findings at the office level lacks the precision of the inter-building analysis of cable flow.

2. The Data Collected from the Cable Sample Provided the Basis for Projecting AID/W's Daily Cable Traffic

Each of the 692 cables was analyzed to determine the following characteristics:

- Agency of origin
- Action office and number of copies
- Information offices and number of copies
- Embassy/mission of origin or destination
- Date and time of receipt/transmission in OC/T
- Length of cable measured, in lines
- Level of priority (precedence)

The data were collected at the cable stop level and aggregated to provide office-level summary data. This information was then used to estimate AID daily cable traffic patterns. To obtain the daily cable traffic patterns, the survey data was first extrapolated to show annual traffic and then divided by the approximate number of work days in a year.

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D. FINDINGS OF THE CABLE ANALYSIS

This section presents the major findings of the analysis of the cable sample.

1. The Cable Sample Provided Valuable Data on the Volume and Patterns of AID Cable Traffic

The findings of this analysis are presented in seven summary-level exhibits described below. Although the cable volume data were originally collected in numbers of lines, for our purposes, lines of cable transmissions were converted to a page equivalent. The measure used was the average number of lines contained on a page printed on a standard Wang printer.

(1) Office/Building Traffic Patterns -- Exhibit D-3 presents AID/W estimated daily cable traffic in numbers of pages of cables. The exhibit shows AID's offices in the five building configuration proposed by M/SER/MO. AID's offices in Main State receive over 70% of AID/W incoming/comeback copy traffic and produce over 50% of AID's outgoing cable traffic. Secondary distribution of cables (those made by offices for internal use), was projected using multipliers developed by IRM analysts, based on requirements survey data.

(2) Geographic Destination Patterns -- Exhibit D-4 presents the number of pages of cables AID/W sends overseas, grouped by geographic regions. Over 40% of AID/W outgoing cables are sent to USAIDs in the Africa region, with the other geographical regions receiving between 4% and 22% of AID/W outgoing cables.

(3) Geographic Origination Patterns -- Exhibit D-5 presents the number of pages of cables received by AID/W from the geographic regions. Over 30% of the incoming traffic received by AID/W is from USAIDs in the Africa region. The other regions contributed between 15% and 18% to AID/W's incoming cable traffic.

(4) Precedence of AID/W Cables -- Exhibit D-6 presents the estimated distribution of AID unclassified cables according to four precedence codes:

- Flash (Z) -- Processed and delivered without delay no matter what time of day or night.

- Immediate (O) -- Processed and delivered as soon as possible during normal duty hours

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Exhibit D-3

DAILY INCOMING, OUTGOING, COMEBACK AND
SECONDAY DISTRIBUTION OF CABLES TO AID OFFICES AND
BUILDINGS MEASURED IN PAGES OF CABLES

Building/Office	Incoming Cables: No. Pages Cables	Incoming Cables: Secondary* Distribution	Outgoing Comeback Cables: No. Pages Cables	Outgoing Comeback Cables: Secondary** Distribution	Actual Outgoing Pages of Cables
Main State					
A/AID	-	-	2	6	-
ES	110	550	11	33	1
LEG	10	50	4	12	2
XA	2	10	1	3	-
AFR	2,363	11,815	1,064	3,192	35
ASIA	848	4,240	386	1,158	25
LAC	751	3,755	406	1,218	7
NE	1,032	5,160	416	1,248	8
IG	9	45	7	21	-
GC	275	1,375	60	180	1
OFDA	41	205	13	39	2
BIFAD	2	10	1	3	1
AA/PRE	80	400	12	36	-
SAA/S&T	201	1,005	51	153	1
M/SER/MO/CRM	949	4,745	469	1,407	-
AA/M	-	-	-	-	-
PPC	481	2,405	51	153	2
TOTAL	7,154	35,770	2,954	8,862	85
Percent of Total	73%		69%		50%

Exhibit D-3(2)

Building/Office		Incoming Cables No. Pages Cables	Incoming Cables Secondary* Distribution	Outgoing Comeback Cables No. Pages Cables	Outgoing Comeback Cables Secondary** Distribution	Actual Outgoing Pages of Cables
SA-1						
	M/SER/IRM	12	60	11	33	3
	M/FM	384	1,920	189	567	6
	M/PM	175	875	247	741	13
	PRE	27	135	30	90	3
	FVA	224	1,120	32	96	3
	EOP	-	-	-	-	-
	TOTAL	822	4,110	509	1,527	28
	Percent of Total	8%		12%		16%
SA-15						
	SER	778	3870	398	1990	14
	Percent of Total	8%		9%		8%
SA-16						
	IG	13	65	17	51	8
	SCI	11	55	1	3	1
	TOTAL	24	120	18	54	9
	Percent of Total	002%		004%		5%

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Exhibit D-3(3)

Building/Office		Incoming Cables No. Pages Cables	Incoming Cables Secondary* Distribution	Outgoing Comeback Cables No. Pages Cables	Outgoing Comeback Cables Secondary** Distribution	Actual Outgoing Pages of Cables
SA-18						
	PPC	156	780	16	48	-
	S&T	908	4,540	381	1,143	34
	TOTAL	1,064	5,320	397	1,191	34
	Percent of Total	11%		9%		20%
SUM TOTAL		9,842	49,210	4,276	12,828	170
PERCENT OF TOTAL		100%		100%		100%

* A standard multiplier of five was used based on IRM analyst estimates
**A standard multiplier of three was used based on IRM estimates

Exhibit D-4

GEOGRAPHIC DESTINATION OF UNCLASSIFIED AID/W CABLE TRAFFIC

Region	Daily No. Cables	Daily No. Pages	Percent of Total
Africa	215	203	41%
Asia	91	86	17%
Latin America	117	110	22%
Near East	61	58	12%
Europe	22	21	4%
Other	23	22	4%
TOTAL	529	500	100%

Exhibit D-5

GEOGRAPHIC ORIGIN OF UNCLASSIFIED AID/W CABLE TRAFFIC

Region	Daily No. Cables	Daily No. Pages	Percent of Total
Africa	203	211	33%
Asia	113	117	18%
Latin America	100	104	16%
Near East	103	107	17%
Europe	91	95	15%
Other	5	5	1%
TOTAL	615	639	100%

Exhibit D-6

AID/W ESTIMATED DAILY INCOMING/OUTGOING UNCLASSIFIED CABLE TRAFFIC BY PRECEDENCE INDICATOR MEASURED IN NUMBER OF CABLES

Precedence Indicator	Incoming		Outgoing		Combined Total	
	Daily Total	Percent	Daily Total	Percent	Daily Total	Percent
Flash (Z)	-	-	-	-	-	-
Immediate (O)	111	21%	39	15%	150	19%
Priority (P)	118	22%	83	32%	201	25%
Routine (R)	303	57%	138	53%	441	56%
TOTAL	532	100%	260	100%	792	100%

- Priority (P) -- Processed and delivered during normal duty hours usually within two hours of receipt

- Routine (R) -- Processed and delivered during normal duty hours usually within 24 hours of receipt.

The precedence codes show the priority of a cable for processing and handling purposes.

Almost 60% of AID/W incoming and outgoing cables are marked "routine." For those USAIDs which are slated to receive direct lines to AID/W, these cables could be taken out of the cable system and transmitted via the new, non-secure lines being provided by the Department of State to the USAID's.

(5) Copies of Cables Produced for Distribution by AID's Communications Center -- Exhibit D-7 shows the estimated number of copies produced for both incoming and outgoing unclassified AID/W cables. A single distribution point may receive multiple copies of a cable. On the average, 20 copies of each incoming and comeback cable are made for distribution to AID offices. In some cases, copies (included in the estimate) are also produced for other federal agencies. These are currently being delivered in envelopes marked "classified" by inter-agency mail.

(6) Time of Receipt and Transmission of AID Cables -- Exhibit D-8 presents an estimate of the time of day when an AID cable is received or transmitted from Washington, D.C. Over 25% of AID's cable traffic is sent on received between midnight and 3 AM. If the AID communications center is not open when a cable is received, the cable is queued until such time as the center opens. Emergency cables can always be received or sent by OC/T, which operates 24 hours a day.

(7) Five Year Projected Cable Traffic -- Exhibit D-9 presents an estimate of the projected daily cable traffic over the next five years. The projections were made on data extrapolated from the cable sample, based upon M/SER/MO/CRM's estimate that cable traffic grows at eight to ten percent per year. This analysis uses a nine percent growth rate. These projections indicate that by the year 1989, AID's communications center will handle over 22,600 pages of cables per day, over 1 1/2 times what they currently are handling.

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Exhibit D-7

ESTIMATED NUMBER OF COPIES PRODUCED BY AN INCOMING/OUTGOING UNCLASSIFIED AID/W CABLE

Type of Cable	Total in Sample	Copies Made			Average No. Copies
		Action	Information	Total	
Incoming	346	882	6,486	7,368	21
Outgoing	346	1,057	5,285	6,342	18
TOTAL	692	1,939	11,771	13,710	20

EXHIBIT D-8

ESTIMATED DAILY SUMMARY BY TIME PERIOD WHICH AN UNCLASSIFIED CABLE WAS RECEIVED OR TRANSMITTED

Hours*	INCOMING CABLES Total Estimated Daily	INCOMING CABLES %	OUTGOING CABLES Total Estimated Daily	OUTGOING CABLES %	COMBINED CABLES Total Estimated Daily	COMBINED CABLES %
12 Midnight to 3 AM	118	22%	81	31%	199	25%
4 AM to 7 AM	160	30%	22	9%	182	23%
8 AM to 11 AM	129	25%	19	7%	148	19%
12 NOON to 3 PM	69	13%	45	17%	114	14%
4 PM to 7 PM	40	8%	62	24%	102	13%
8 PM to 11 PM	13	3%		12%	44	6%
TOTAL	529	100%	260	100%	789	100%

*Hours shown in Eastern Standard Time.

Exhibit D-9
Five Year Projected Daily Cable Traffic*
(Shown in Number of Pages)

Cable Traffic	1984 Base Year	Year 1985 1	1986 2	1987 3	1988 4	1989 5
From USAID	650	710	770	840	920	1000
To USAID	500	550	600	650	710	770
To AID/W						
- Incoming	9,830	10,720	10,800	11,770	12,830	13,990
- Comeback	4,280	4,670	5,090	5,550	6,050	6,590
Subtotal	14,110	15,390	15,890	17,320	18,880	20,580
From AID/W offices to AID Communications Center	160	170	190	210	230	250
Total Cables Handled By M/SER/MO/CRM	15,420	16,820	17,450	19,020	20,740	22,600
Secondary Distribution	62,830	68,480	74,640	81,360	88,680	96,660

* Based on an estimated 9% per year growth in cable traffic.

APPENDIX E

AID TELECOMMUNICATIONS SYSTEM IMPLEMENTATION PLAN

AID TELECOMMUNICATIONS SYSTEM IMPLEMENTATION PLAN

1. FINALIZE CONCEPTUAL DESIGN

. Receive management/budget input . Refine final report . Refine network conceptual design	. 2 AID . 2 Contractor	2 5	$50K

- AID/W
- USAIDs
- AID/W-USAID Links

. Get management approval of conceptual design

- Make necessary budget adjustments
- Identify final set of functions to be supported
- Close all outstanding issues

2. DEVELOP THE GENERAL DESIGN

. Develop background and introduction . Identify define user functions to be supported . Develop (refine) network concept	. 2 AID . 3 Contractor	2 10	$100K

- AID/W
- USAIDs

. Identify and define:

- All system inputs
- Major system processes
- Pilot projects

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	Staff Requirements	Man Months	Consultant Cost
. Define:			
- System security requirements/procedures			
- Network data bases, data elements, System/network directories			
- System operational characteristics			
- Required system response			
- Required system maintenance			
. Identify and define:			
- All component interfaces			
- All external interfaces (Gateways)			
. Identify and present all traffic volumes/speed requirements for			
- AID/W intrabuilding			
- AID/W interbuilding links			
- International and USAID regional links			
- USAIDs			
3. DEVELOP THE DETAILED DESIGN			
. Include all components from general design, but describe in detail/document	. 2 AID	6	
. Develop hardware specifications	. 5 Contractors	30	$300K
. Develop software specifications (program specifications)			
- Consider microcode (boxes)			
- Applications			
- Protocol conversion			
- Bridges			
- Gateways			

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	Staff Requirements	Man Months	Consultant Cost
4. DEVELOP DETAILED IMPLEMENTATION PLAN			
. Develop implementation plan (hardware/software) . Identify and define phases of implementation, including pilots	. 2 AID . 2 Consultants	2 6	$60K
. Identify timeframes for phases and pilots - AID/W - USAIDs			
. Identify candidate users for pilots and phases . Identify and draft system/user policies and procedures			
5. IDENTIFY/ACQUIRE PACKAGED SOFTWARE			
. Conduct market survey of available software . Select packaged software based upon software programming specifications . Procure identified packages . Install and test selected packages ("benchmarking")	. 1 AID . 2 Consutants	2 15	$150K
6. DEVELOP TRAINING PLAN/MATERIALS			
. Collect all existing system/user training materials . Identify training materials to be developed . Develop all training materials . Develop training program (courses) . Select training candidates	. 3 AID . 2 Contractors	6 10	$100K

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	Staff Requirements	Man Months	Consultant Cost
7. HARDWARE PROCUREMENT/INSTALLATION			
. Develop RFP(s) . Develop candidate vendor list . Distribute RFP(s) . Evaluate proposals and select vendor(s) . Procure identified hardware . Plan for all hardware installing - Phase I - Phase II - Phase N . Install and test hardware	. 1 AID . 2 Contractor	6 15	$150K
8. DEVELOP/TEST SOFTWARE			
. Update program specifications to reflect package interfaces . Develop custom code and test . Perform subsystem and system testing (integrate packages and custom software) . Perform acceptance testing . Develop appropriate documentation	. 2 AID . 6 Contractors	8 24	$240K
9. DEVELOP NETWORK DATABASES			
. Design directories and data bases . Identify available data and collect . Implement directories and data bases . Test and integrate all directories and data bases - Within AID/W - Between AID/W and USAIDs - Within USAIDs	. 1 AID . 1 Contractors	1 10	$100K

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	Staff Requirements	Man Months	Consultant Cost
10. PROVIDE PROJECT/TECHNICAL ASSISTANCE & Implementation			
. Quality assurance team . Provide project oversight . Provide technical review of project outputs . Help coordinate and schedule project activities . Implementation Teams	. 2 AID . 2 Contractor	60 90	$900K
11. MAINTENANCE/OPERATIONS			
. Ongoing implementation after pilots and first-site activities . Operations . Maintenance	. 1 AID . 3 Contractor	15 140	$1430K
	Total Consultants	Year 1	$ 500
		year 2	$1260
		year 3	$ 970
		year 4	$ 450
		year 5	$ 400
	Project Totals		$3580

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APPENDIX F

TEXT TRAFFIC ANALYSIS

TEXT TRAFFIC ANALYSIS

This appendix describes the methodology used to obtain reliable estimates of the text traffic patterns within AID/W. The findings of this analysis are presented in detail, to supplement the description of AID's traffic flows in Chapter II of this report.

1. THE PURPOSE OF THE TEXT TRAFFIC ANALYSIS WAS TO DETERMINE HOW MUCH TRAFFIC A TELECOMMUNICATIONS SYSTEM WOULD HAVE TO CARRY

The purpose of this analyis was to determine how much text materials are currently circulating within AID/W. Network engineers need this information to determine the volume of text documents, that will be exchanged between buildings, as well as within buildings.

(1) Some Of This Information Was Collected By Other Members Of The Study Team

The text traffic study was one of several activities carried out by the study team to determine existing volumes and patterns of information exchanged within the Agency. A separate study was made of cable traffic (see Appendix D). AID/W and USAID staff also supplied estimates to IRM in response to questionnaires administered throughout AID/W and in selected USAIDs (see Appendix C).

None of the individual components provided the comprehensive view of text traffic required. All of the information was used in the analysis to trace information flow patterns within the Agency and to provide estimates of volume of flow, but additional information was required.

(2) In The Absence Of A Readily-Quantifiable Measure Produced From These Activities, Other Indicators Were Examined

Producing reliable estimates of text traffic volumes and patterns proved difficult. No one source was satisfactory. Some of the information collected from the user questionnaires proved useful, but in the absence of a reliable, quantifiable measure of text traffic, additional indicators were used:

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- Workstation utilization statistics
- Copier utilization statistics
- Measurements of inter-office mail flows.

The methodology used to provide estimates of text flow is described below.

(3) <u>The Methodology Employed Was To Take "Snapshots" Of Various Stages Of The Text Production And Distribution Process And Compare Those Snapshots To User-Supplied Estimates</u>

The methodology developed for the text flow collection activities was as follows:

- Since materials have to be transmitted in electronic form, they must be created in electronic form, e.g., keyed in on a word processor or typed for conversion of electronic form via an OCR reader. Therefore, the first order of business was to determine how many electronically-originated materials AID/W offices produce daily.

  - A management statistics software package was used to obtain production-level statistics for five representative offices.

  - These production levels were then extrapolated to produce estimates of the numbers of pages printed per day in all automated AID/W offices (see Working Paper W5F1-1 for the extrapolation worksheet).

  - A discard rate of 75 percent was applied to these office-level production estimates. (This estimate was produced from summary-level data obtained from Management Statistics Reports. It represents the number of revision pages, compared to originals, and provides an estimate of throw-away pages produced daily.)

- The second step in the process was to determine how many copies of each document are typically made by AID/W offices.

- Thirdly, AID/W inter-office mail was measured to determine how much information AID/W offices were actually receiving on any given day.

(4) The Information Obtained From The Snapshots Had To Be Evaluated And Apportioned By An Acceptable Distribution Pattern

The "snapshots" produced a somewhat disjointed view of different stages in the daily production, reproduction and distribution of AID/W documents. These snapshots were taken of the source (electronic origination and photocopying) and destination (inter-office mail) of AID/W text traffic (see Exhibit F-1). The limitation of this approach was that there was no way of determining patterns of information exchange from these snapshots alone.

Information exchange patterns had to be derived from information on the patterns of exchange between AID/W offices obtained from the user requirements questionnaire.

- AID/W offices provided estimates of the numbers of pages they sent and received daily from other AID/W offices. This information was organized as a matrix showing inter-building and intra-building distribution patterns (see Working Papers W1F3-25).

- These distribution patterns derived from information supplied by AID/W offices, were converted to percentages, as shown in Exhibit F-2 on the following page.

- These percentages were then applied to the measurements of electronic origination, photocopying, and the inter-office mail flow; and matrices showing inter- and intra-building flows were produced (see Working Papers, W5F4-5, W5F2-2C, W10F10-21).

- Because each matrix consists of nearly 1,000 cells, the data were aggregated at the inter-building level for purposes of comparison. It was assumed that:

  - When offices did not agree on the volume of information they exchanged, that the higher of the two volumes was used.

  - Although an office might send more information than it received from any one office, it was assumed for purposes of designing an input/output matrix that the proportions were the same.

  - Data on information flows from the requirements analysis questionnaire were also aggregated in this fashion.

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EXHIBIT F-1

AID/W Data Collection Plan
--Text Traffic--

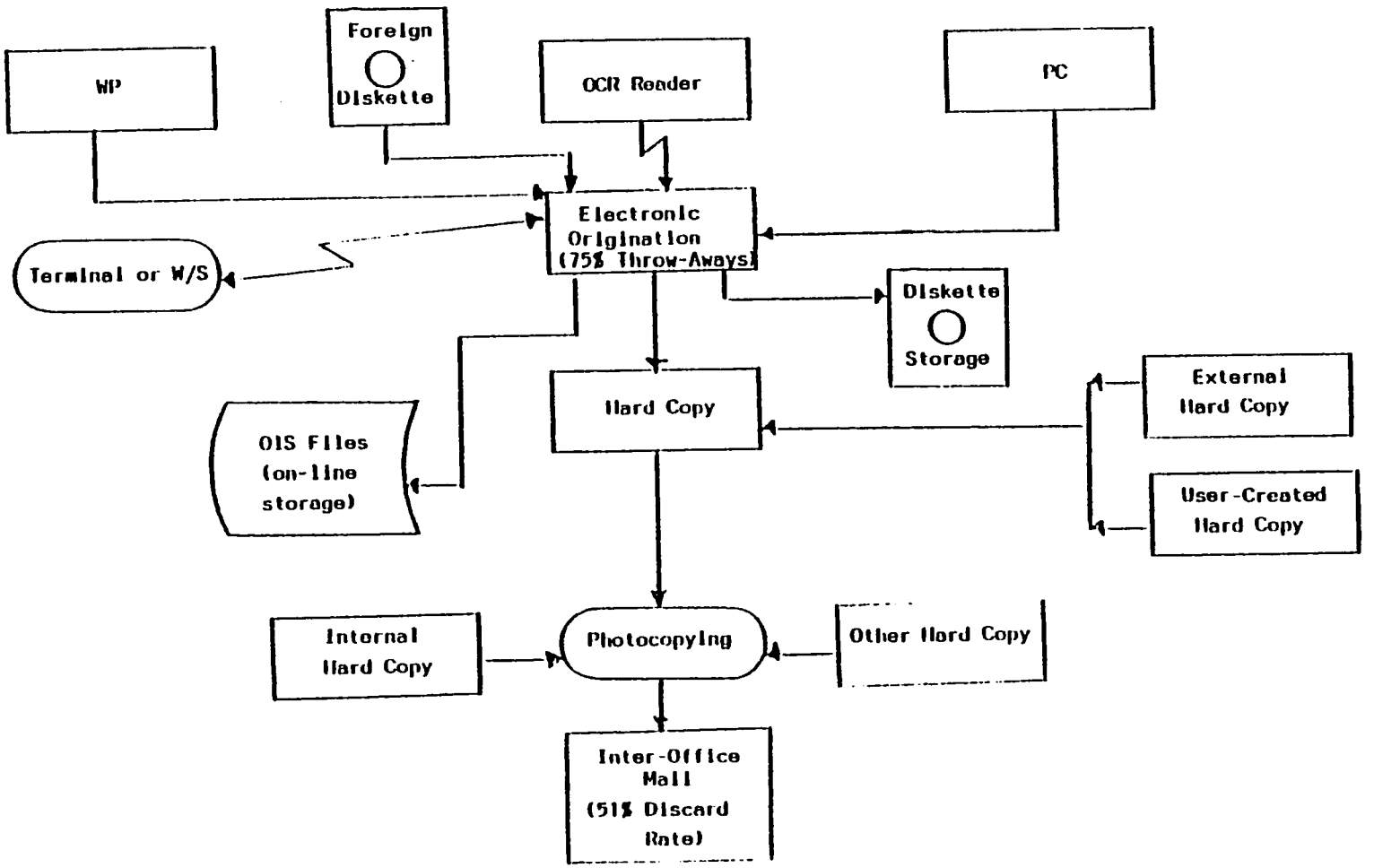


EXHIBIT F-2

Proportions of Information Exchanged Between AID/W Offices
(Grouped by Building)

	Main State																SA-1								SA-15	SA-16		SA-18		Other
	A/AID ES	PPC	AA/ H	AA/ PPE	AFR	ASIA	LAC	NE	XA	LEG	IG EXEC	GC	GAA/ S&T	OFDA	DIFAD	CDM	IRM	FM	PM	PRE	FVA	EOP	PM/ TD	SER	IG	SCI	PPC/ E&DIU	S&T	OTHER
Main State																														
A/AID-ES	11.2	20.2	6.7	-	10.7	7.0	5.6	8.4	2.0	11.2	0.6	5.6	-	0.6	1.1	0	0	1.1	2.0	1.1	2.0	0	0	0.6	0	0	0	3.9	0
PPC	3.7	40.7	-	-	1.9	0.2	4.6	2.6	0.2	1.6	0	0.1	-	0	0	0	0	0.6	1.0	0.4	0.4	0	0	0.4	0	0.1	7.5	0.4	33.6
AFR	2.3	2.2	-	-	48.4	0.1	0.1	0	0	0.2	0	0.6	-	0	0	0	0	7.3	3.0	0.6	0.1	0	0	1.7	0	0	0.1	16.3	16.9
ASIA	1.7	0.7	-	-	0.3	51.2	0.3	0.3	0	0.3	0	0.7	-	0	0	0	0	6.8	6.0	7.5	0	0	0	2.4	0	0	0.3	20.5	0
LAC	0.7	3.7	-	-	0.1	0.1	62.5	0.1	0.2	3.5	0	1.4	-	0.1	0	0	0	0.7	0.7	0.9	0.7	0	0.4	1.0	0	0	0.4	5.3	10.0
NE	2.4	26.6	-	-	0	0.2	0.2	23.7	0	0.3	0	7.0	-	0	3.3	0	0	4.0	1.6	1.6	0.2	0.2	0	3.2	0.3	0	0.3	24.4	0
XA	8.1	2.7	-	-	0	0	4.1	0	13.5	6.8	0	0	-	4.1	0	0	0	0	1.4	0	0	2.7	0	33.8	4.1	0	0	13.5	5.4
LEG	10.5	7.9	-	-	1.1	0.5	25.7	1.1	2.6	5.2	0	1.1	-	0.5	0	0	0	1.1	0	0	0.5	0	0	0	0	0.5	0.5	0.5	40.0
IG	0.8	0	-	-	0	0	0	0	0	0	0	1.7	-	0	0	0	0	13.3	6.7	0	0	0	0	17.5	33.3	0	0	1.7	25.0
GC	6.5	0.7	-	-	3.3	1.3	12.4	32.0	0	1.3	1.3	19.6	-	0	0.7	0	0	0	0.7	9.8	1.3	0.7	0	6.5	0.7	0.7	0	0.7	0
OFDA	14.1	0	-	-	0	0	0.2	0	0.7	0.2	0	0	-	2.2	0	79	0	0.9	1.3	0	0.2	0	0	0.2	0	0	0	0	0.9
DIFAD	4.8	0	-	-	0	0	0	50.0	0	0	0	2.4	-	0	23.8	0	0	0	0	0	0	0	0	11.9	0	0	2.4	4.0	0
SA-1																														
IRM	0	0	-	-	0	0	0	0	0	0	0	0	-	0	0	0	5.4	5.4	1.1	0	0	0	1.1	15.1	0	0	0	5.4	66.7
FM	0.4	0.8	-	-	3.9	2.4	2.0	2.0	0	0.4	3.2	0	0.4	0.8	0	0	1.0	3.9	15.8	0.2	0	0.2	0.2	39.8	0	0	0.2	19.7	2.0
PM	1.2	2.4	-	-	5.9	4.0	2.4	2.4	0.2	0	1.9	0.2	-	1.4	0	0	0.2	19.0	4.8	0.7	0.2	0.2	0.2	2.9	4.0	0	0	24.7	19.0
FVA	7.8	6.3	-	-	1.6	0	15.6	1.6	0	1.6	0	3.1	-	1.6	0	0	0	0	1.6	0	23.4	0	0	31.3	1.6	0	3.1	0	0
EOP	0	0	-	-	0	0	0	5.3	10.5	0	0	5.3	-	0	0	0	0	5.3	21.1	0	0	10.5	0	10.5	0	0	0	0	31.6
PM/TD	0	0	-	-	0	0	35.3	0	0	0	0	0	-	0	0	0	5.9	5.9	5.9	0	0	0	29.4	5.9	0	0	5.9	5.9	0
SA-15																														
H/SER	0.1	0.4	-	-	1.5	0.7	1.5	2.1	2.6	0	2.2	1.1	-	0.1	0.5	0	1.5	25.6	1.3	0.1	2.1	0.2	0.1	4.2	12.0	0.2	2.1	21.5	15.5
SA-16																														
IG	0	0	-	-	0	0	0	0.8	1.5	0	15.4	0.4	-	0	0	0	0	0	7.7	0	0.4	0	0	46.9	7.7	0	0	0.4	10.9
SCI	0	3.5	-	-	0	0	0	0	0	1.7	0	1.7	-	0	0	0	0	0	0	0	0	0	0	3.5	0	0	0	17.2	72.4
SA-18																														
PPC/E&DIU	0	61.0	-	-	0.9	0.9	5.1	1.7	0	0.9	0	0	-	0	0.9	0	0	0.9	0	0	1.7	0	0.9	17.0	0	0	4.2	4.2	0
S&T	0.1	2.2	-	-	7.4	5.7	1.3	2.8	0.7	0.0	0.0	0.0	4.6	0	0.0	0	0.1	1.6	1.7	0.0	0	0	0.0	3.3	0.0	0.2	0.1	39.9	20.0

- This aggregation produced three input/output matrices, showing the numbers of pages sent and received for each building, and the totals per building (see Exhibits F-3, F-4 and F-5).

- Comparison of these summary-level matrices revealed that the most reliable estimates were those obtained by extrapolating the mail room sample.

  - The number of pages exchanged per building shown in that matrix (Exhibit F-5) was approximately three to three-and-a-half times greater than the estimates provided by users (Exhibit F-3).

  - An exception was the volume shown for SA-18, which is almost identical in both samples, indicating that S&T provided more accurate estimates than did most other offices.

  - The statistics collected on word processing production levels for AID/W were found not to be realistic measurements of the volume and patterns of information exchanged, even when photocopying multipliers were factored in.

- Use of photocopying equipment within AID/W substantiates the assessment that the mail room (or inter-office mail) study provides the best estimate for text traffic. Analysis of printer utilization statistics supplied by M/SER/MO/CRM for the month of March, the period when the mail room sample was conducted, shows that approximately four copies were made per original.

- This information provides an multiplier of four, which when applied to the user traffic estimates, is almost identical to the volume of mail measured in the mail room sample.

2. THE MAIL MEASUREMENT STUDY PROVIDES THE BEST BASELINE DATA FOR DETERMINING THE TEXT TRAFFIC FLOW

It has been shown that the mail room sample provides the best baseline data for purposes of this study. Information taken from the analysis of the mail room has been used in Chapter II to describe the most probable patterns of inter-office traffic flow.

The intra-building mapping, however, is too complex to present in its entirety in the report. This detailed, thousand-cell breakout is presented in Exhibit F-6, on the following page. This matrix provides information that is valuable during the detailed

EXHIBIT F-3

AID Text Document Distribution Patterns
(Shown by Number of Pages Sent & Received Daily
at the Inter-Building Level)

Received \ Sent	HS	SA-1	SA-15	SA-16	SA-18	External
HS	1669	174	61	26	797	415
SA-1	174	164	147	11	108	101
SA-15	61	147	40	62	113	74
SA-16	26	11	62	10	6	46
SA-18	797	108	113	6	1249	895
EXTERNAL	415	101	74	46	895	1531
Total Per Bldg	4811	1043	537	171	4417	4593

EXHIBIT F-5

AID Inter-Office Mail Distribution Pattern
(Shown by Number of Pages Sent and Received Daily
at the Inter-Building Level)

Received \ Sent	MS	SA-1	SA-15	SA-16	SA-18	External
MS	5918	981	453	161	1889	1674
SA-1	981	419	500	20	239	407
SA-15	453	500	60	105	334	220
SA-16	161	20	105	27	15	119
SA-18	1889	239	334	15	926	692
EXTERNAL	1674	407	220	119	692	3191
Total Per Bldg	16,994	3153	1892	562	5021	9574

EXHIBIT F-6

Intra-building Information Flow within AID/W*

(Shown in Number of Pages Sent/Received Within Each Building and Between Buildings)

	Total	MAIN STATE																		SA-1							SA-15	SA-16	SA-18		Other
		A/AID ES	PPC	AA/ M	AA/ PPE	AFR	ASIA	LAC	NE	XA	LEG	IG EXEC	GC	SAA/ S&T	OFDA	H/SEC DIFAD	CRS	IRM	FM	PM	PRE	EVA	EOP	PM/ TD	SER	IG	SCI	PPC/ E&DIU	S&T	OTHER
Main State																															
A/AID-ES	709	79	143	48	-	76	20	40	60	20	79	4	40	-	4	9	-	-	9	20	9	20	-	-	4	-	-	-	28	-
PPC	2122	79	864	-	-	40	4	98	55	4	34	-	2	-	-	-	-	-	13	21	8	8	-	-	0	-	2	159	8	713
AA/M	1564*	2	6	-	-	23	11	23	33	41	-	34	17	-	2	8	-	23	400	20	2	13	1	2	66	200	3	33	316	242
AFR	3360	77	74	-	-	1626	3	3	-	-	7	-	20	-	-	-	-		245	101	20	3	-	-	57	-	-	3	548	568
ASIA	1681	29	12	-	-	5	861	5	5	-	5	-	12	-	-	-	-	-	114	114	126	-	-	-	40	-	-	5	345	-
LAC	3026	21	112	-	-	3	3	1091	3	6	106	-	42	-	3	-	-	-	21	21	27	21	-	12	3	-	-	12	160	545
NE	2828	68	752	-	-	-	6	6	670	-	8	-	221	-	-	93	-	-	113	45	45	6	6	-	90	8	-	8	690	-
XA	1206	98	33	-	-	-	-	49	-	163	82	-	-	-	49	-	-	-	-	17	-	-	33	-	408	49	-	-	163	65
LEG	721	76	57	-	-	8	4	105	8	19	17	-	8	-	4	-	-	-	8	-	-	4	-	-	-	-	4	4	4	294
IG	101	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	13	1	-	-	-	-	18	34	-	-	2	25
GC	1075	70	8	-	-	35	14	133	344	-	14	14	211	-	-	8	-	-	-	8	105	14	8	-	70	8	8	-	8	-
SAA S&T	3097	3	68	-	-	229	177	40	87	22	-	-	-	142	-	-	-	3	50	53	-	-	-	-	102	-	6	3	1236	892
OFDA	325	46	-	-	-	-	-	1	-	2	1	-	-	-	7	-	257	-	3	4	-	1	-	-	1	-	-	-	-	3
DIFAD	319	15	-	-	-	-	-	-	160	-	-	-	8	-	-	76	-	-	-	-	-	-	-	-	38	-	-	8	15	-
Total	22134															11,835								1962	905		322		3778	3347
SA-1																															
IRM	629	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	34	7	-	-	-	7	95	-	-	-	34	420
FM	1776	7	14	-	-	69	43	36	36	-	7	57	-	7	14	-	-	18	69	281	4	-	4	4	707	-	-	4	350	50
PM	231	3	6	-	-	14	11	6	6	.43	-	4	.43	-	3	-	-	.43	44	11	2	.43	.43	.43	7	11	-	-	57	44
PRE	1075	84	68	-	-	17	-	160	17	-	17	-	33	-	17	-	-	-	-	17	-	252	-	-	336	17	-	33	-	-
EVA	130	-	-	-	-	-	-	-	7	14	-	-	7	-	-	-	-	-	7	27	-	-	14	-	14	-	-	-	-	40
EOP	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PM/TD																															
Total	3841															793							830		1159		20		478	974
SA-15																															
SER	2833	3	11	-	-	42	20	42	59	74	-	62	31	-	3	14	-	42	725	37	3	59	6	3	119	363	6	59	609	419
Total	2833															361								875	119		369		660	419
SA-16																															
IG	685	-	-	-	-	-	-	-	5	10	-	105	3	-	-	-	-	-	-	53	-	3	-	-	321	53	-	-	3	329
SCI	150	-	5	-	-	-	-	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	26	109
Total	835															134								56	126		53		29	210
SA-18																															
PPC/E&DIU	336	-	205	-	-	3	1	17	6	-	3	-	-	-	-	-	-	-	3	-	-	6	-	1	57	-	-	14	14	-
S&T	4806	5	106	-	-	356	274	62	135	34	-	-	-	221	-	-	-	5	77	82	-	-	-	-	159	-	10	5	1918	1104
Total	5142															1430								176	216		10		1951	1104

network design phase for determining the capacity of the intra-building network that AID/W buildings require.

3. THE MAIL TRAFFIC ANALYSIS PROVIDES THE BASIS FOR THIS COMPONENT OF THE AGENCY-WIDE TRAFFIC ANALYSIS

This section describes the sampling methodology and mail handling procedures of AID/W, and also presents some of the first-level findings, e.g., the analysis of major recipients of mail.

(1) The Purpose Of The Mail Traffic Analysis Was To Provide Information On The Volume And Pattern Of AID/W Inter-office Mail

The mail traffic analysis was designed to supply information needed to map and size existing daily inter-office mail flows between AID/W offices. The analysis traced the flow of mail through AID's main and satellite mail rooms to recipient AID/W offices. The information was collected to help determine the amount of traffic that could be expected on any given day, in the event that inter-office mail was automated. System engineers need this information to size the electronic distribution system required to carry inter-office mail and other information within AID/W. For that reason, an important aspect of this study was to examine the inter-building and office level flows.

(2) The Sample Included Only Those Materials That Could be Transmitted Electronically

Only AID/W unclassified inter-office mail was included in the analysis. Classified material historically comprises a small proportion of AID/W inter-office mail. It was not included in the analysis, since its delivery would not change in an automated environment. Mail excluded from the analysis included:

- All classified material, including cables, since they are mailed in envelopes marked "classified".
- Large packages and boxes that did not fit into the mail slot.
- Standard AID documents including Agency phone books, large computer print-outs, such as CP's, ABS's, CDSS's, etc.
- Books, newspapers and magazines.

EXHIBIT F-7

Mail Traffic Analysis Methodology

PROJECT INITIATION, INTERVIEWS AND REVIEW OF POLICIES AND PROCEDURES

- Identify and interview key personnel
- Review AID regulations, policies and procedures
- Develop mail process flow

DEVELOP AND IMPLEMENT STRATEGY TO MEASURE INTER-OFFICE MAIL

- Develop measurement strategy
- Collect data
- Summarize mail stop level data

ANALYZE DATA AND DEVELOP PROJECTIONS

- Validate data
- Convert volume in inches to pages
- Aggregate at office/building level
- Calculate peak traffic

(3) A Three Step Process Was Used to Develop Daily AID/W Inter-Office Mail Patterns

Booz, Allen used a three step process to collect and analyze data on AID/W inter-office mail volume and patterns. Exhibit F-7, on the following page, identifies these steps:

- Identify and interview key personnel in AID's mail centers, review pertinent handbooks, policies and procedures and develop a process flow on AID's mail system

- Develop and implement a strategy to measure mail volumes and patterns through AID's mail rooms

- Analyze the data and develop projections on AID's daily volume and pattern of mail to AID offices and buildings, as well as possible daily peak load.

4. OVERVIEW OF AID/W MAIL PROCESSING

This section presents an overview of the AID/W mail handling process.

(1) Inter-Office Mail is Received, Sorted, and Distributed Four Times a Day by AID's Mail and Motor Branch

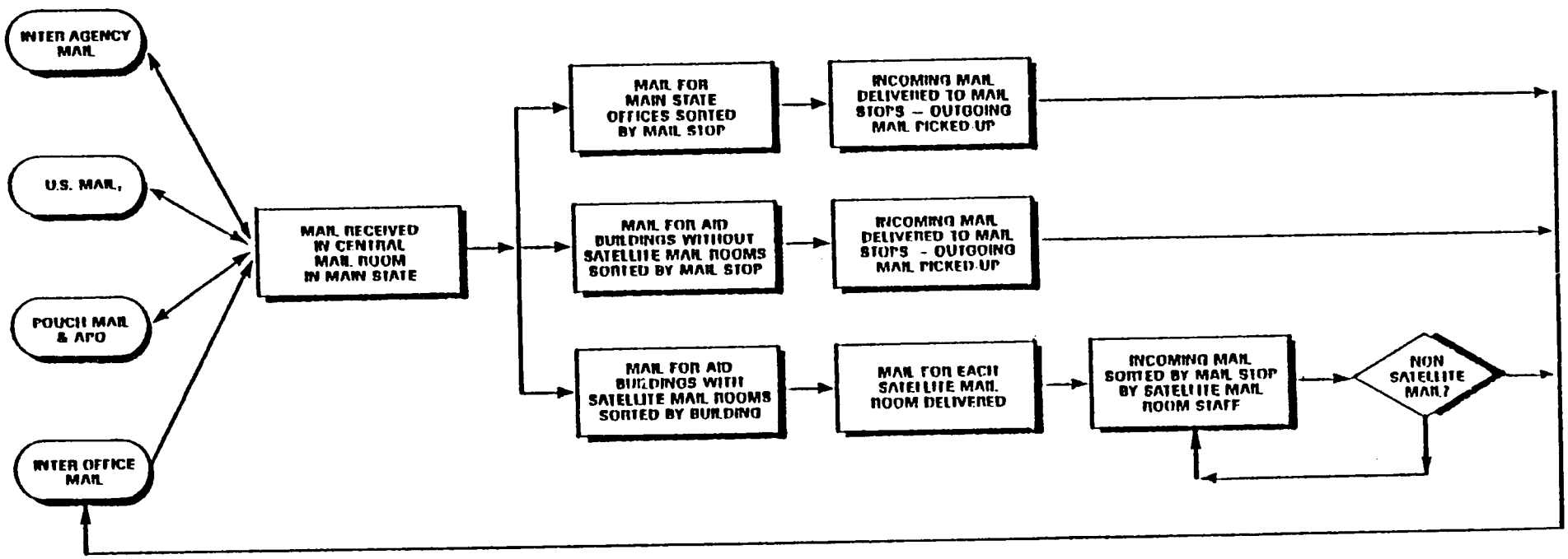
AID's mail and motor branch, a part of the Communications and Record Management Division of the Office of Management Operations is responsible for processing all of AID/W's mail. Exhibit F-8, on the following page presents the flow of mail through AID/W's mail rooms. The processing of AID's mail is highlighted by three steps:

- Pick-up and Receipt of Mail -- Mail is picked up at each AID/W office four times a day and brought to AID's main mail room in Main State. Mail, especially large quantities or rush pieces, are delivered directly to the main or satellite mailrooms by the originator.

- Sorting of Mail -- Mail is sorted by office (mail stop) and building four times a day. This follows the regular pick-up and also occurs as mail is received during the day in the mail room.

- Distribution of Mail -- Mail is distributed four times a day by AID mail clerks to each AID office and satellite mail room. It takes an average of

EXHIBIT F-8
CURRENT AID/W MAIL FLOW



two to four hours for mail to be processed and delivered by AID mail staff to recipient AID offices.

5. MAIL ROOM STUDY METHODOLOGY AND FINDINGS

This section describes the mail measurement methodology and some of the findings.

(1) To Determine Mail Volumes And Patterns By Office/Building, Measurements Were Taken Of The Morning Mail Delivery Periods And Extrapolated

The approach developed to obtain information on the volume of AID/W's inter-office mail flow was the following:

- Actual measurements of the inches and fractions of inches of mail in each mail stop were taken for a period of a week in each mail sorting room, for the two primary mail sorting periods.

- These measurements were then converted to pages, the standard measure used to size text traffic in this study, by the page-per-inch ratio (1:113) determined by the study team.

- A discard rate was developed for each AID building to eliminate that proportion of mail that was not a candidate for electronic transmission. The corresponding "keep" rate was applied to the page measurement, aggregated at the office level. (The average "keep" rate was 49 percent.)

- These data, collected for two of the Agency's four daily mail sorts, were then extrapolated to obtain an estimated daily mail flow, per office, per building. (M/SER/MO/CRM estimated that the period sampled represented two-thirds of the daily mail flow.)

(2) Analysis Of The Findings From The Inter-Office Mail Measurement Revealed The Volume And Patterns Of Text Traffic Within AID/W

The findings of this analysis were utilized in conjunction with other data to estimate the volume and pattern of text traffic within AID/W.

- Estimated Average Daily Mail By Office/Building--Exhibit F-9 presents the estimated average daily page volume by office and building given SER/MO's five building configuration. Main State has the largest daily traffic

Exhibit F-9

Estimated Average Daily Page Volume Of Inter-Office Mail
Received By AID/W Offices
(Grouped by Building)

BUILDING/OFFICE	Main State	SA-1	SA-15	SA-16	SA-10	Warehouse
MAIN STATE						
A/AID, ES	710					
PPC	2,120				340	
AA/M	130					
AFR	3,360					
ASIA	1,680					
LAC	3,030					
NE	2,830					
XA	1,210					
LEG	720					
IG (Exec)	100			690		
GC	1,080					
SAA/S&T	3,100				4,810	
OFDA	330					
DIFAD	320					
M/SER/MO/CRM	1,430					
TOTAL	22,150			690	5,150	
PERCENT OF TOTAL	55%			2%	13%	
SA-1						
IRM		630				
FM		1,780				
PM		230				
PRE						
FVA		1,080				
EOP		130				
PM/TD						
TOTAL		3,850				
PERCENT OF TOTAL		10%				
SA-15						
M/SER			2,830			
TOTAL			2,830			
PERCENT OF TOTAL			7%			

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Exhibit F-9 (2)

BUILDING/OFFICE	Main State	SA-1	SA-15	SA-16	SA-18	Warehouse
SA-16						
IG						
SCI				150		
TOTAL				150		
PERCENT OF TOTAL				.004%		
SA-18						
PPC E&DIV					340	
S&T					4,810	
TOTAL					5,150	
PERCENT OF TOTAL					13%	
Warehouse						
H/SER						240
TOTAL						240
PERCENT OF TOTAL						.006%
TOTAL*:	22,150	3,850	2,830	840	10,300	240
PERCENT OF TOTAL:	55%	10%	7%	2%	26%	.006%

* Total estimated daily pages of inter-office mail is 40,210 pages/day.

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with over 55 percent of the total, while the warehouse building has the smallest with less than one percent The Bureau of Science and Technology was the largest recipient of traffic (about 4,800 pages) while the IG Executive office was the smallest (about 100 pages).

- Variation Of Mail During Peak Periods--Exhibit F-10 presents multipliers extrapolated from the mail room survey used to determine AID's peak daily mail traffic. AID's daily mail flow as shown in Exhibit F-10 could increase by a factor of four. Individual multipliers for AID offices ranged from one to twelve times the average estimated daily mail flow.

- Five-Year Mail Flow Projections -- Exhibit F-11 presents an estimate of the projected daily inter-office mail flow for 1984-1989. These projections are based the mail flow measurement and a three percent growth rate per year, estimated by M/SER/MO. These projections indicate that AID's inter-office mail will total over 46,000 pages per day by the year 1989, or about 1.2 times the current inter-office mail volume.

The AID/W inter-office mail measurement was made over a five day period in March 1984. According to AID's mail room staff, mail flow does not have major weekly or daily fluctuations. Mail is received at a constant rate from October to May, but declines by approximately 15 percent from June to September.

Exhibit F-10

Peak Daily Mail Estimates
(Measured in Inches)

Organization	Period One Inches of Mail Average	Period One Inches of Mail Peak	Period One Multiplier	Period Two Inches of Mail Average	Period Two Inches of Mail Peak	Period Two Multiplier	Average Combined Multiplier
AA	5.25	10.00	1.91	3.10	5.75	1.86	1.89
PPC	1.30	5.50	4.23	1.46	11.37	7.79	6.01
S&T	5.81	22.25	3.83	1.55	8.00	5.16	4.50
M	4.36	32.11	7.37	3.40	21.50	6.18	6.78
FVA	1.23	2.75	2.24	.79	3.25	4.11	3.18
PRE	1.79	5.00	2.79	1.61	4.50	2.80	5.59
AFR	2.19	15.50	7.08	1.81	8.50	4.70	5.09
ASIA	1.29	5.00	3.88	.94	4.50	4.79	4.34
LAC	2.34	12.25	5.24	1.53	22.45	14.67	9.96
NE	2.48	19.75	7.96	1.73	26.60	15.42	11.69
EXRL	.77	2.75	3.57	.22	.50	2.27	2.92
LEG	6.00	16.50	2.43	1.80	2.75	1.53	1.98
OPA	3.95	13.00	3.29	2.69	9.50	3.53	3.41
IG	2.86	12.00	4.20	2.09	8.00	3.83	4.02
GC	8.00	11.56	1.45	4.77	10.74	2.25	1.85
EOP	.90	2.25	2.50	1.05	1.50	1.43	1.97
OFDA	2.75	5.25	1.91	1.12	3.75	3.35	2.63
SCI	1.40	5.00	3.57	.50	1.00	2.00	2.88
DIFAD	2.35	5.00	2.13	1.45	2.50	1.72	1.93
Average Multiplier			3.77			4.70	4.39

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EXHIBIT F-11

Five Year Projected Daily Inter-Office Mail
(Shown in Pages of Mail/Distributed)

	Base Year* (1984)	1985	1986	1987	1988	1988
Number of Pages of Mail Handled Daily in AID/W	39,970	41,170	42,410	43,680	44,990	46,340

* Excludes AID/W warehouse.

APPENDIX G

ELECTRONIC MAIL

ELECTRONIC MAIL

One telecommunications requirement that can be met by a network is Electronic Mail (EM). Electronic Mail is a requirement to be met by any recommended AID/W telecommunications technology. This appendix explores several alternative means of implementing such a service and identifies representative vendor offerings. Both short- and long-term approaches for implementation within AID/W are suggested.

1. ELECTRONIC MAIL DEFINED

- For purposes of this study electronic mail is defined as a utility that allows the creation, transmission and reception of messages ten pages in length or less, where an electronic mailbox functions as an interface between a message sender and receiver.

- An electronic mail utility service augments telephones and traditional mail services. It is a method of moving, storing, and retrieving textual information electronically. Its purpose is to fill the gap left by our two major forms of communication, not to replace them.

- The function of electronic mail is to allow users to prepare and send notes, memoranda and short documents, as described below.

  - A single transaction typically includes a header that serves as envelope, carrying the document address, and a body that comprises the text or message to be conveyed. The transmission can be within offices, buildings, campuses, or across the nation.

  - EM is often used when delays inherent in the use of the telephone or the U.S. mail cannot be tolerated.

  - Similarly, it is used when short inquiries or responses normally concluded via telephone are required.

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- A typical electronic mail utility has the following features:

  - Capability to create a message on an electronic terminal by following a set of standard procedures

  - An electronic out-basket that is associated with a given user, where messages can be stored and easily retrieved

  - The ability to send messages to one or more recipients, virtually simultaneously

  - An electronic in-basket that is associated with a given user, where messages can be received and stored until accessed

  - A notification system whereby senders and recipients are notified of the status of messages transmitted

  - The capability to access messages on an electronic terminal, and print copies, if desired

  - Can perform time-shifting between users in different time zones -- does not require simultaneous access by sender and receiver

  - Can allow users to remotely query their mail to keep current with on-going developments and answer queries.

- In many respects the electronic mail utility is analogous to an automatic bank-teller system, where the message transfer is in the form of bank account debits and credits, and the transaction is quick and efficient.

- Electronic mail, as used in the context of this study, does <u>not</u> include:

  - Voice mail
  - Facsimile transmission
  - Computer-to-computer text transfers.

- The electronic mail utility refers to character-encoded messages intended to:

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- Support non-simultaneous interpersonal communications

- Reduce telephone tag and other time-wasting activities such as face-to-face meetings and waiting for delayed mail deliveries.

2. THE ROLE OF ELECTRONIC MAIL

Electronic mail represents a very small part of the overall telecommunications technology portfolio of the typical office. It represents a new generation of information-transfer technologies, one that is projected to be a main building block of the "paperless" office of the future.

- EM is currently used by over 60 percent of the Fortune 500 companies. Although estimates vary, all office automation projections indicate a rapid growth for electronic mail.

  - A total of 5,000 electronic mail boxes existed on EM systems in 1978. This number has jumped to well over 200,000 today, including private in-house and public commercial services. The total is projected to climb to 1.5 million by 1986.

  - If this growth does occur, EM will become a logical focal point for office automation programs and a major delivery mechanism for information-intensive activities.

  - This projected growth is reinforced by the fact that an estimated 80 percent of all electronic mail transactions will be initiated via personal computers by the early 1990s.

- The benefits of electronic mail are difficult to quantify. It is usually justified as an enabling service that increases office workers' productivity by:

  - Reducing communications ambiguity

  - Reducing time wasted on formalities and unnecessary dialogue

  - Providing a documented record of transactions

- Increasing communications between geographically dispersed people

- Organizing and scheduling meetings without the inefficiencies of telephone tag (where 70 percent of all calls are not completed on the first attempt).

Although there are not as yet any recognized EM industry standards, the Electronic Mail Association, was established in April 1983 to develop standards on such vital issues as privacy and access-charge legislation. The association includes telecommunications carriers, equipment manufacturers, users and software developers. Its overall goal is to promote the growth and use of EM worldwide.

3. ALTERNATIVE APPROACHES TO IMPLEMENTATION

Electronic mail is a utility or a set of communication applications. Like any other application EM requires an implementation strategy and plan. Two approches for establishing an electronic mail service are presented here:

- Establish an in-house system that is supported by privately-operated switching equipment, computer support resources and employees.

- Purchase EM as a utility from a company that provides such services to the public.

Each of these is described below in detail.

(1) Private In-House System

The telecommunications equipment base in AID/W lends itself to at least four alternative approaches to a private utility for electronic mail:

- A WANG-based system, MAILWAY or WANG Office, that utilizes software resident on a VS computer that connects office automation equipment, e.g., word processors and personal computers that have compatible communications capabilities.

- An IBM mainframe, computer-based system that can utilize the 4341 AID/W host with an installed software application licensed and supported by variety of vendors.

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- A System 85 PBX applications processor-based system.

- A system supported by a dedicated computer that is not presently part of the AID/W telecomputing environment.

Each of the four in-house approaches offers potential advantages and disadvantages. Each approach will require further investigation to fully determine its potential impact. Consideration of an in-house service should include the following:

- Ability to support user's intra-AID/W messaging requirements

- Availability of gateways to the USAIDs and external data bases

- Initial costs and operational expenses, and resources required for maintenance

- Ability to expand and be adapted to changing future AID/W requirements

- Ease of operation and integration into the overall AID/W telecommunications network.

(2) Public Network System

A growing number of vendors offer electronic message services. Some of the largest electronic mail systems and the offering companies include:

- MCI Mail
- GTE Telemail
- Western Union Easylink
- ITT Dialcom Service and
- Graphnet Freedom Network.

Other companies such as Federal Express are expected to enter the market shortly.

Typically, public network services utilize the public telephone system to interconnect terminals, word processors and personal computers within buildings. Worldwide, they use a mixture of private and public transmission facilities. Some

services, such as MCI and Western Union, interface their offerings with already established communication systems such as the U.S. Postal Service, telex and telegram services.

Sending and electronic mail message over a public network requires that the intended receiver must also be a subscriber to the same service. The industry has not sufficiently matured to provide the type of service we have become accustomed to with the telephone system. However, once the industry begins to approach the multi-million user base established for the telephone industry, vendors will be able to provide a more universal service that becomes vendor transparent to the user.

As in the case of the private in-house system approach, some vendor offerings for public electronic mail services have distinguishing features that will require further investigation to determine their suitability and compatibilty to AID/W's requirements and environment. Likewise, costs and issues of flexibility and growth must also be studied and evaluated.

4. ELECTRONIC MAIL SERVICE CONSIDERATIONS

The development and implementation of an electronic mail utility, whether it be a private or publlic network, must incorporate specific fundamental design features:

- Station Autonomy - the ability for a message to be sent or retrieved from any terminal within the network
- Simultaneous User Access - user access that is independent of the activities at other terminals
- Authentication Software - procedural and password safeguards against unauthorized entry into mailboxes or transmission of messages
- Protocol Layering - one that follows a hierarchical model which allows growth of both message volume and geographical area coverage, as well as full message communications management
- Simplicity of Use - operation with a simple set of non-intimidating commands

- Message Archiving - capability for maintaining permanent records of messages sent or received, and

- System Maintenance - diagnostic and statistical programs to maintain operations, and correct potential problems.

These design considerations are not all-inclusive. Additional features can be specified that are unique to a specific user population. Such a feature package will be the result of a detailed analysis of user-messaging requirements. Some additional feature requirements that may come to the forefront include:

- Storage redundancy

- Message forwarding with annotation

- Delayed-send capability

- Message broadcasting

- Revised, simpler user commands

- Help routines

- A host of administrative aspects such as departmentalized billing, file restrictions, and summary utilization reports.

5. APPROACH TO IMPLEMENTATION

The installation of an electronic mail system within an organization often faces resistance due to:

- Individuals' reluctance to change

- Lack of user familiarity with automated equipment such as terminals and word-processing stations.

Although postal mail system and public telephone are familiar communications vehicles for most users, adding an electronic mail system that depends on telecomputing devices will require extensive training and a phased program of implementation. The success of an electronic mail system will be heavily dependent on planning for its installation and user training. On-going training will be essential to enable users to fully utilize this new mode of person-to-person information interchange.

Within AID/W the introduction of an electronic mail system should start as a pilot project involving 100 to 200 people. The pilot stage could utilize a public network to minimize initial startup delays and software investment expenses. Participants in the pilot should be carefully selected. They should include staff who are already familiar with office automation equipment and who are already daily involved in communications-intensive work activities. Ideally, they should also have good typing, spelling and syntax skills.

An electronic mail pilot-program should include as many dispersed users as possible, to measure performance on simultaneous access features of the system.

Once the pilot has been tested and evaluated for three to six months, the initial user requirements can be revised and updated.

The pilot test results should indicate the overall advisability and value of an electronic mail utility for AID/W. If this application is found appropriate, the next level of decision making can be advanced towards the selection of a private versus a public messaging system.

One scenario for the installation of electronic mail within AID/W includes a gradual increase in the user base, once the pilot test is completed, accompanied by a migration away from a public network towards a private network. As the AID/W integrated telecommunications network is installed, the base can be expanded to include the entire Agency. This migration path would allow AID/W to learn how to use electronic mail and simultaneously explore the cost-benefit tradeoffs of one approach versus another. The gradual, phased build-up of a base of experience using electronic mail as an alternative for high-intensity communications will clarify its relationship to postal mail and the telephone, and help identify the features necessary to fully support the AID requirements.

APPENDIX H

AID TELECOMMUNICATIONS SYSTEM BUDGET

AID TELECOMMUNICATIONS SYSTEM BUDGET

This appendix presents the budget estimate for FY 85 and FY 86 as an input to the Management Bureau's Annual Budget Submission.

Final budget estimates cannot be provided until AID upper management approves the recommended LAN approach to telecommunications implementation within AID. At that time, during the first steps in the General and Detailed Design described in Chapter IV, final budget estimates can be provided.

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Title: AID TELECOMMUNICATIONS PROJECT

Background

Beginning in September, 1983 a telecommunications study encompassing AID/W and the USAIDS was undertaken. A broad based requirements analysis consisting of surveying the major bureaus and offices, as well as canvassing the USAIDS, both by cable survey and direct contact was accomplished.

The major thrust for telecommuniations work in FY 85 and 86 fall into several categories, as outlined in the attached budget narrative. While these line items are set aside as individual projects, a comprehensive approach to the overall network design is necessary to assure the best possible service to the users of telecommunications service at AID over the next five years. The different projects have very direct dependencies and relationships with each other and therefore should be viewed as a package. Any modifications to individual tasks must be scrutinized closely to effectively migrate the changes to any related schedules in the other projects.

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FY 85 Objectives: Telecommunications

1. Begin implementation including the general and detail design of the Agency Telcom Network based on the study completed in FY 84.

2. Select, install and conduct a pilot test of an Electronic Mail System.

3. Automation of AID's cable message system for incoming and outgoing cables. The FY 86 goal for this two-year project would include all steps necessary to conceptualize, design, and procure the hardware and software. Final programming, testing and implementation would occur in FY 87.

4. Complete installation of initial telecommunications links to all OIS equipment located in AID/W.

5. Complete message switching system, to support batch capability between first 10 USAIDs and corresponding bureaus.

AID TELECOMMUNICATIONS PROJECT
BUDGET SUMMARY

ACTIVITY	FISCAL 1985 CAPITAL	FISCAL 1985 AID D/H	FISCAL 1985 CONS.	FISCAL 1985 OPNS & MAINT	FISCAL 1986 CAPITAL	FISCAL 1986 AID D/H	FISCAL 1986 CONS.	FISCAL 1986 OPNS & MAINT	ACTIVITY DESCRIPTION
1. TELECOMMUNICATIONS AID/W NETWORK	$100K	24	$400K		$1,580K	7	$760K	$150K	THIS ACTIVITY CONSISTS OF SELECTING THE TELECOMMUNICATIONS SYSTEM OPTION TO BE INSTITUTED ACROSS AID'S FIVE BUILDING LOCATIONS AND THE PHASED IMPLEMENTATION ASSOCIATED WITH THE INTRA AND INTER-BUILDING TRANSPORT SYSTEM. THE TWO YEAR PERIOD OF THIS PLAN INCLUDES THROUGH PHASE 1, INTERCONNECTION OF TWO BUILDINGS AND THE PLANNING FOR PHASES 2 and 3.
2. ELECTRONIC MAIL	$100K	10	$ 50K		$100K	14	$150K		THIS ACTIVITY CONSISTS OF THE INSTALLATION OF A PILOT ELECTRONIC MAIL SYSTEM USING A PUBLIC SYSTEM AND THE PHASED MIGRATION OF THE PILOT SYSTEM TO AN IMPLEMENTED PRIVATE SYSTEM WITHIN AT LEAST TWO BUILDING OF AID BY THE END OF FISCAL YEAR 1986.

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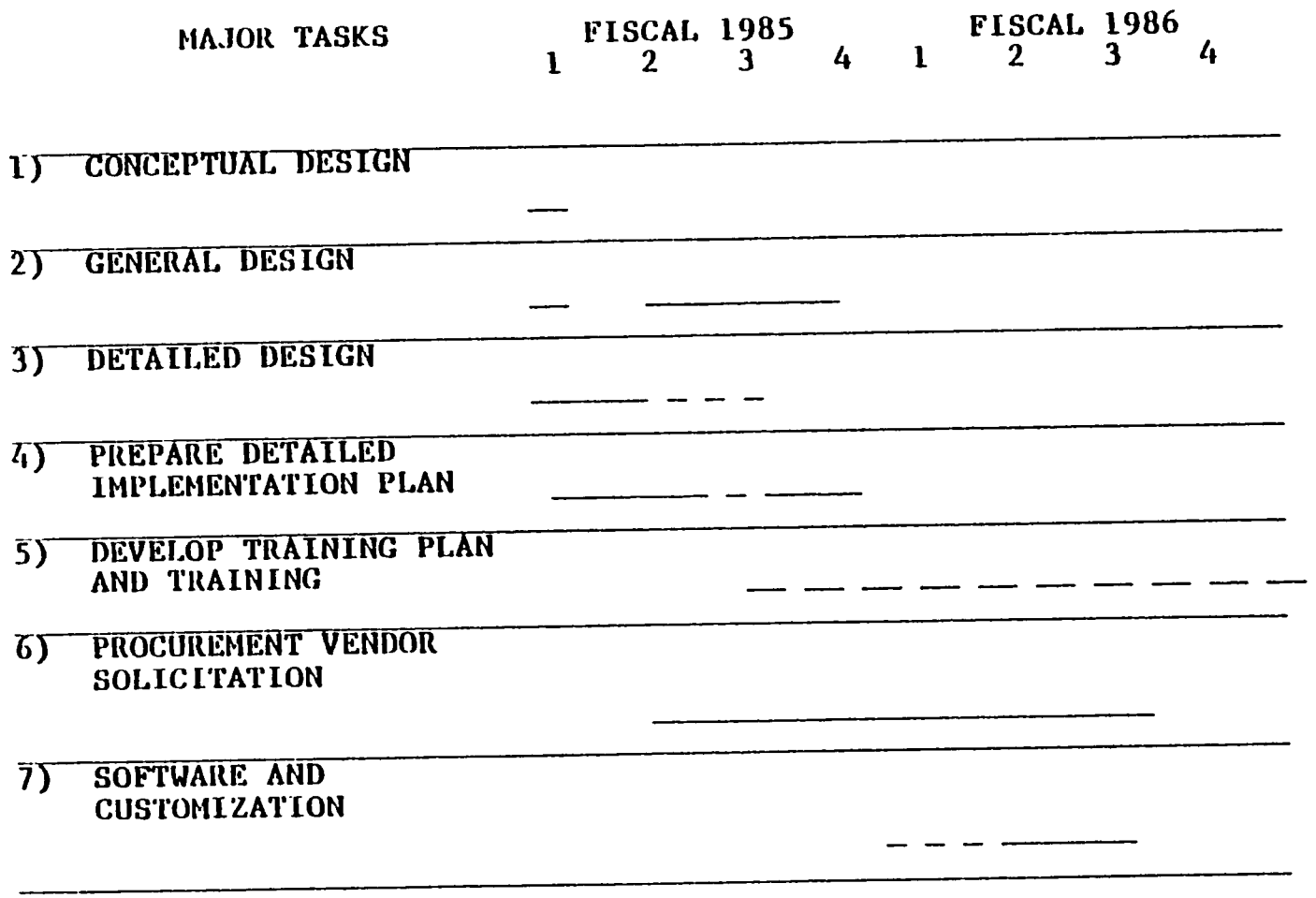
ACTIVITY	FISCAL 1985 CAPITAL	FISCAL 1985 AID CONS.	FISCAL 1985 OPNS & MAINT	FISCAL 1986 CAPITAL	FISCAL 1986 AID CONS.	FISCAL 1986 OPNS & MAINT		ACTIVITY DESCRIPTION
3. CABLE DISTRIBUTION				$150K	3	$150K		THIS ACTIVITY IS DE SIGNED TO SET UP A PRO-TOTYPE OF THE CABLE DISTRIBUTION SYSTEM. THE TEST WILL BE FOR THE LINKAGE BETWEEN THE AID CABLE ROOM AND SA-1
4. USAID-AID/W MESSAGE SYSTEM	$70K	24	$100K	$140K	24	$250K		THIS ACTIVITY IS DESIGNED TO CONTINUE IN A PILOT MODE, TO LINK USAID TO AID/W MAIN-FRAME FOR MESSAGE SWITCHING.
TOTALS	$270	58	$550K	$1970K	48	$1310K	$150	

1. AID TELECOMMUNICATIONS NETWORK IMPLEMENTATION

This activity consists of selecting the telecommunications system option to be instituted across AID's five building locations and the phased implementation associated with the intra and interbuilding transport system. The two year period of this plan includes through Phase 1, Interconnection of Two Buildings and the planning for Phases 2 and 3.

The chart below indicates the major tasks associated with this activity. The following page provides a discussion of key assumptions and considerations for each year.



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MAJOR TASKS	FISCAL 1985				FISCAL 1986			
	1	2	3	4	1	2	3	4
8) NETWORK DATA BASE								
9) IMPLEMENTATION, MAINTENANCE AND OPERATION								

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AID Telecommunications Network Implementation

Tasks through the first phase of implementation are covered in this activity. The scope of Phase 1 covers two buildings, both internal and the interconnection between the two; most probably Main State and SA-1 (Columbia Plaza). The capital cost of $1,700K through Phase 1 (Fiscal 1986) includes modem-like devices to connect 100 to 200 terminals to their hosts through the telecommunications network, and some costs for network transport hardware. Costs of the terminals are not included.

OTHER ASSUMPTIONS:

- The costs of two minis (WANG VS) are included, as router/gateway, for FY 86.
- Terminal costs are not included.
- 100 and 200 modem-like bus interfaces unit (CIUs) modules are included.
- Data communications and Protocol conversion software is included.
- Trunk data modules or T1 trunk costs between buildings are not included.
- Costs of two internal data transport networks in Main State and S-1 are included.
- Training costs and operating supplies for initial (limited) operations in FY 85 and FY 86 are included.
- Maintenance/operational costs for the entire T/C project are included in this category.

2. ELECTRONIC MAIL SYSTEM

This activity consists of the installation of a pilot electronic mail system using a public system and the phased migration of the pilot system to an implemented private system within at least two buildings of AID by the end of Fiscal Year 1986.

The chart below indicates the major tasks associated with this activity and the associated cost projections. The following page provides a discussion of key assumptions and considerations for each task.

MAJOR TASKS	FISCAL 1985				FISCAL 1986			
	1	2	3	4	1	2	3	4
1) SELECT PILOT SYSTEM VENDORS & TRAIN USERS AID PARTICIPANTS FOR EVALUATION	———							
2) INSTALL SYSTEM, INITIATE COLLECTION OF EVALUATION DATA	———							
3) CONDUCT PILOT TESTS & PREPARE PILOT CONCLUSIONS	— — —	———	———					
4) IDENTIFY/SELECT APPROPRIATE PRIVATE SYSTEM CONFIGURATION					———	———		
5) INSTALL PRIVATE SYSTEM, PHASE 1								———
6) PLAN FOR PRIVATE SYSTEM EXPANSION, PHASES 2 & 3					———	— — —	— —	—

2. Electronic Mail System

This activity included tasks through the first phase of electronic mail implementation. Initially a pilot phase is recommended involving a public system and 100 to 200 AID users. Then a private system phased installation is proposed.

If a mainframe system such as IBM's PROFS, on a 4341, Mailway on the Wang VS 100 or AT&T's S/85 PBX-based system are serious contenders, leasing of Electronic Mail systems may be considered. Although the pilot will explore Electronic Mail, consideration will also be given to the interfaces to outside Electronic Mail systems.

OTHER ASSUMPTIONS:

- Leased software costs for user on mainframe (e.g., IBM 4341) at $15K/year.
- Purchased software costs for minicomputer-based system are $15K.
- Upgrade costs to minicomputer (e.g., Wang VS-100 processor) can range from $50K to $100K for ultimate EM capability.
- All users will utilize their existing terminals for EM. Terminal costs are not included.
- EM costs assume that much of the telecommunications network is installed as a base. No transport costs are included.
- Facility and maintenance costs are included for period of pilot operation only.

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3. CABLE DISTRIBUTION WITHIN AID/W

MAY 1, 1984

This activity consists of setting up a prototype of the cable distribution system. The test will be for the linkage between the AID Cable Room and SA-1 in FY 87. It assumes the existence of an Electronic Mail System of the LAN type (intra-building).

The chart below indicates the major tasks associated with this activity. The following page provides a discussion of key assumptions and considerations for each task.

MAJOR TASKS	FISCAL 1985				FISCAL 1986			
	1	2	3	4	1	2	3	4
1) FEASIBILITY STUDY/ REQUIREMENTS ANALYSIS (CURRENT STUDY)								
2) EVALUATE AND TECHNICAL ASSISTANCE								
3) CONCEPTUAL DESIGN* CABLE SYSTEM*								
4) GENERAL DESIGN*								
5) DETAILED DESIGN*								
6) PROGRAMMING SPECIFICATIONS*								
7) HARDWARE PROCUREMENT AND INSTALLATION*								

* TC/SOFTWARE

MAJOR TASKS	FISCAL 1985				FISCAL 1986			
	1	2	3	4	1	2	3	4
8) PHOTOTYPE TESTING:								
. Module Test						———		
. Sub-system Test								
. System Testing								
. Acceptance Testing								

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3. Cable Distribution Within AID/W

This activity for FY 86 describes the tasks associated with setting up a pilot project to provide cable distribution to individual offices or desks within AID/W. The Cable distribution system could be a sub-set of an Electronic Mail system, but would require additional hardware and software.

The prototype will be set up for cable transmission between Main State and one other AID/W building, probably Columbia Plaza (SA-1). Hardware required is a minicomputer of the Wang VS-100 or Ungermann-Bass type to support a LAN (Local Area Network). Implementation of this pilot will require the development and testing of customized software.

OTHER ASSUMPTIONS

- Assumes that a LAN electronic distribution system is in place in test buildings.
- Assumes that this pilot could be tested in selected offices or bureaus within the test buildings, and that only certain staff would be included.
- Does not include terminal costs, nor software/hardware costs associated with communications boards and/or modems.

4. USAID-AID MESSAGE SYSTEM

This activity consists of supplying the software and T/C hardware to install a telecommunications link to the first two groups of USAIDs in FY 85 and FY 86. This task also includes upgrading the local communications to upgrade existing OIS systems in Washington to have the protocols necessary to interface with the USAIDs.

MAJOR TASKS	FISCAL 1985				FISCAL 1986			
	1	2	3	4	1	2	3	4
1) CONCEPTUAL DESIGN	———							
2) GENERAL & DETAIL DESIGN		———						
3) DETAILED IMPLEMENTATION PLAN			———					
4) TRAINING PLAN & TRAINING		— —	— —	— —		— —	— —	— —
5) SOFTWARE ACQUISITION AND CUSTOMIZATION		———	———					
6) EQUIPMENT PROCUREMENT			———			———		———
7) IMPLEMENTATION PHASES AND MAINTENANCE			———			———		———

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4. USAID-AID/W Message System

This activity consists of establishing a Message Switching System to support the routing of text and data from the Wang VS computers in 12 to 14 USAIDS to AID/W. This will be based on a centralized computer based system that receives, stores, and subsequently reroutes messages.

This activity also includes the equipment and logistics required to establish both the 2780 and 3270 Telecommunications protocols on all existing Wang OIS equipment in AID/W.

Other Assumptions

Software cost estimates are based on off-the-shelf package (WANG IDS) which runs on the mainframe.

Additional software to switch OIS are required.