PN-ACB-504

A.I.D. Document and Information Handling Facility

Transfer of the Development Information System (DIS) between AID/W and AID Missions: A Feasibility Study

Prepared as Partial Fulfillment to Work Specified in Amendment #15 to Contract DAN-0232-C-00-1088-00

September 15, 1983

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November 15, 1983

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Reference: Contract No. DAN-0232-C-00-1088-00
Mod No. 15 - $9,000 Phase III Feasibility Study

Dear Mr. White:

Enclosed is the final deliverable to be provided in response to the referenced contract modification. We have incorporated your comments and prepared an executive summary.

Yours truly,

Carlton Combs

Carlton Combs
Vice President

Enclosure

CC:lmd

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Executive Summary

At the present time, A.I.D.'s Development Information System (DIS) is not available onsite at any A.I.D. Mission. This study explored the feasibility of, and costs associated with, transferring data from the DIS (which operates on the HP3000 Model 44 configuration using MINISIS software) to equivalent or smaller systems at A.I.D. Missions. Such a transfer would provide Missions (and eventually LDC's) with an expanded capability to (1) manage local information resources and (2) contribute to the larger project information network, thus strengthening the DIS.

To this end, the study:

* describes the Development Information System;

* assesses existing hardware and software capabilities at the various Missions;

* surveys current applications that permit MINISIS-formatted data to be manipulated on smaller or different hardware configurations, as well as two pertinent data base development projects which use software other than MINISIS;

* compares alternative hardware and software, focusing, in the former case, on three manufacturers prevalent in the Missions (IBM, Apple, and Wang);

* discusses the advantages and disadvantages of various methods of information exchange (hard copy, fiche/hard copy, diskette, tape/disk pack, and telecommunciation-satellite tie-in);

* and presents recommended solutions and comparative cost information.

Review of Missions' ADP capabilities shows that while not all Missions currently have the capacity to accept the DIS, there does exist an installed base of familiarity with computer equipment. Of the 73 Missions, 10 have simple personal computer or word processing support, 16 have a WANG/OIS-130A or 140 office automation system (and another 3 have access to such a system), 7 have a WANG/VS-80, 1 has access to a WANG/VS, and 1 has an HP1000.

Further, the analysis of available hardware and software applications indicates that there are, at present, four major limitations on transferring an HP3000/MINISIS based system to the Missions: (1) telecommunications - this aspect must

be confined to downloading data to the appropriate media for mailing to the Missions; (2) data base size - data storage is the main limitation on downloading the DIS data base; (3) available technology - the technology for full support at the microcomputer level does not exist, therefore compromises with available hardware and software are necessary; and (4) cost - which is dealt with in the study's final section. Each limitation may be considered a current barrier only, for technological advancement is occurring rapidly enough to warrant continual review.

Due to the wide variation in Mission equipment and resources and the dynamic nature of microcomputer/software development, no single all-inclusive recommendation is possible. Therefore, it is suggested that A.I.D.:

(1) Provide the most appropriate level of information transfer to each Mission, based on its capacity to effectively use the information.

(2) Develop a series of packaged hardware/software/fiche systems that can be transferred to Missions having microcomputers or WANG/OIS systems.

(3) Provide a standard hardware/software/fiche package to Missions that wish to improve their information use but lack resources.

(4) Work out tape/fiche exchanges to Missions desiring to adapt these to their WANG/VS systems or who will enter into agreements with host country institutions that have compatible HP/MINISIS resources.

Three model hardware/software/fiche packages, representing progressive levels of automation support, are exhibited.

The basic cost of developing and implementing a program to transfer the DIS overseas is estimated to be $758,870 (plus travel and training expenses). This figure includes: (1) $92,000 in development-related costs; (2) $83,220 to provide Missions with computer output fiche of the DIS PROJECTS database, fiche readers and storage cabinets; and (3) $583,650 for converting the DIS, as follows:

Providing the 7 WANG/VS installations with tape plus fiche collection	$67,550
Providing the 16 WANG/OIS installations with software, fiche, and supplies	$133,600
Providing 50 Missions with microcomputers as well as software, fiche, and supplies	$382,500

Chart 1

SUMMARY OF RECOMMENDATIONS

A. Feasibility

ITEM	FEASIBILITY STATEMENTS
1. Improve Current Hard Copy	Feasible - least costly, least desirable - no conversion - more labor intensive.
2. Provide microfiche collections of paper copy indexes	Feasible - enhances user access, standard copy formats, cost-effective, substitutes one resource (fiche) for another (paper)
3. Provide micro software, data files and microfiche (Recommended solution-primary)	Feasible - utilizes current ADP technology, least labor intensive, versatile in terms of configuration (See Chart 2)

Chart 2

REPRESENTATIVE SOLUTIONS

B. Solutions

	CONFIGURATION ALTERNATIVES		
Attribute	A	B	C
Description	Microcomputer with less than 1 MB of storage	Microcomputer with 1040 MB of storage	Microcomputer with storage in excess of 40MB
Examples	IBM/PC (no hard disk Apple II Plus, IIe (no hard disk) WANG/PC (no hard disk)	IBM/PC (with hard disk) IBM/XT Apple II Plus, IIe (with hard disk) Apple III WANG/PC (with hard disk) WANG/OIS	WANG/VS HP1000,3000
Storage Media	Floppy disk only	Floppy and hard disk	Fixed disk and magnetic tape
Software (Examples)	SCIMATE dBASEII CONDOR	SCIMATE dBASEII CONDOR Golden Retriever Star	MINISIS INMAGIC BRS Search
Recommended File Size	2-4 floppies containing 1,280 records	10 MB containing 5,000 records	Full complement of the DIHF data base
Consolidations	Limited search/ sort capability downloaded from AID/W-DIHF	Search/Sort Capability	30,000 records project/technical docs Magnetic tape exchange
Development Costs	$92,000	$92,000	$92,000
Transfer COM/Fiche	$4,540 each	$4,540 each	$4,540 each
Variable costs Mission	$8,000	$8,000-9,000	$10,000

*Hardware supplied by host site

I. Objective of Study

PPC/CDIE is responsible for maintaining A.I.D.'s Development Information System (DIS) which contains documentation resulting from AID-funded projects. While this resource is readily available to AID/W personnel and others located in the continental U.S., the utility of the information diminishes significantly for A.I.D. personnel in overseas missions. These individuals are often in great need of DIS resources, yet time and distance inhibit A.I.D.'s ability to provide up-to-date information on project activities overseas.

The purpose of this study, therefore, is to investigate the feasibility and associated costs necessary to provide an information resource capability in each A.I.D. Mission. The study will address the current status of the DIS system and the existing ADP resources available in various Mission settings, discuss the technical and policy issues that need to be resolved, and present recommended solutions and comparative cost information.

Background

The present study surveys the current state of the art with regard to downloading, segmenting, or transferring data from the HP3000-based A.I.D. Development Information System to equivalent or smaller systems. Providing Missions (and eventually LDCs) with an expanded capability to manage their local resources and to contribute to a larger project information network will ultimately strengthen the A.I.D. project/document information system.

Major areas in which AID/W can support Mission institution of information services, include providing:

1) microfiche collection of project documents and/or research and development documents resulting from A.I.D. projects;

2) machine-readable project information system (including logframe and abstract) of A.I.D. projects funded through AID/W;

3) machine-readable document information system including citations/descriptors for project documents;

4) machine-readable statistical information files and software applications available through PPC/ESDS; and,

5) capability for Missions to create machine-readable records in MINISIS batchin format.

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There is a need within the Missions to maintain better control of local information resources. AID/W can provide "instant microfiche collections" of documents resulting from A.I.D. projects, including A.I.D. project documentation. Presently project documents are available in microfiche only at AID/W. Mission requestors wishing to receive design, evaluation, or other documents must request these services by going through the A.I.D. Development Information Center. Likewise, if a Mission is interested in identifying projects with similar components, local resources are used or the search request is forwarded to the AID/W Development Information Center.

Responses to these queries are prepared by A.I.D. professional staff who are well trained in the use of the DIS and make every effort to provide comprehensive information. However, there is an unavoidable delay, which may negatively affect the usefulness of the response. Also, long distance communication creates misunderstanding, uncertainty as to user needs, etc. It is with these considerations in mind that this study is being undertaken.

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II. Description of the Development Information System (DIS)

The A.I.D. Development Information System (DIS) is an automated online information storage and retrieval system which provides access to:

* Project experience memory for A.I.D. development projects, including project and program documentation;

* Technical research and development materials and publications;

* Organizations and institutions involved in designing, evaluating and implementing A.I.D. programs;

* Development thesaurus of A.I.D. terms used to index A.I.D.'s development experience found in program, project, and technical documentation which is AID-generated or AID-funded.

The A.I.D. project experience memory includes information on A.I.D. projects active in September 1974 or initiated since that date. Alternative project development approaches and lessons learned from the implementation of these specific project designs are recorded for DIS users, such as A.I.D. program officers, project designers, and evaluators.

The data captured for each project design consist of a project summary and the four narrative logical framework cells (goal, purpose, outputs, and inputs). A project summary describes the development problem, including: general strategy, activities, components, management, implementing agency, key assumptions, etc.

Each project evaluation is abstracted and includes a statement of the project purpose, type of evaluation, time frame covered, methodology, degree of attainment of project purpose and outputs, evaluation findings, and lessons learned.

The following project documentation is included in the system:

* design documents - project papers, non-capital assistance project proposals, loan/capital assistance papers, operational program grant proposals, etc.;

* evaluation documents - project evaluation summaries, special evaluations, project appraisal reports, audit reports, etc.;

* other major documents - feasibility studies, sector studies, and discussion papers.

Technical research and development reports produced as a result of AID-funded projects since 1962 are also identified in DIS. Many of these reports are abstracted and appear in the AID Research and Development Abstracts (ARDA), which is published quarterly.

The DIS also includes information on organizations and institutions performing a major role in designing, evaluating, and implementing A.I.D. projects. Institutional roles are described and coded to indicate their major area of development participation.

Subject access to the Development Information System is managed through the DIS development thesaurus, which is a controlled vocabulary containing concepts relevant to development-related projects and project documents. The thesaurus is currently in the final stages of development and when implemented during FY84 will provide unified control over the vocabulary used to index A.I.D. documentation.

The A.I.D. Development Information System is an integrated system consisting of several distinct data bases supported by MINISIS software.

> Projects Information System - Includes PBAR data (life of project cost, Status, Bureau, etc,), logframe, and project abstract.
>
> Documents Information System - Includes project documentation (PID, Project Paper, and other design/evaluation documents), and research and development documents resulting from funded projects, linked to the projects information system by the A.I.D. project number.

Either or both segments of this system can be packaged for placement in the Mission setting. Critical factors in determining what should be selected include: staff, hardware, software, support staff, space, etc.

AID/W realizes that additional project documentation is available in the field, especially for locally funded projects, which never finds its way into the PROJECTS data base. One assumption is that by improving communication between AID/W and the Mission a natural fallout will be a strengthening of the Project Information System.

AID/W Data Base Management System

The A.I.D. Development Information System (DIS) currently operates on an HP3000 Model 44 configuration using MINISIS software developed by the International Development Research Centre, Ottawa, Canada (See Exhibit II-1).

MINISIS software supports customized joining of data bases (data sub-models) depending on the intended purpose. For example, the PROJECTS data base is joined to the DOCUMENT data base on two levels through the project number. PRJDOC represents a join including all of the project record and only a partial document record. PRJDOC2 joins two complete data bases, providing complete project information and complete document citations (including abstracts and indexing). This MINISIS flexibility becomes a significant consideration in creating smaller subsets of data for placement in Mission/LDC settings.

The DOCUMENT data base contains bibliographic citations of project and research/development documents relating to AID-funded projects. DOCUMENT currently requires 114,000 sectors of disk storage (not including indexes or abstracts) or 228,000 sectors of space if indexes are included. (There are 256 characters per sector.) DOCUMENT includes variable length subfielded fields with multiple occurrences.

It is assumed that complete DOCUMENT records will not be used. Fields will be selected and possibly truncated to diminish the size of the data base. There are currently approximately 13,500 research and development (PN) documents in DOCUMENT.

Exhibit II-2 summarizes the size of the PROJECTS database. Due to the flexibility of MINISIS, minimum to maximum record lengths are indicated.

It is important to emphasize that the A.I.D. Development Information System is actually two integrated systems. The Project Information System contains valuable insights into the A.I.D. project experience and seems the natural primary target for transfer to the Mission setting. The Document Information System, which contains technical research and development literature resulting from AID-funded projects, is directly relevant to practitioners and those designing and implementing new projects. An important issue for Mission personnel to consider in any discussion of the transfer of the Development Information System to a Mission setting must address the problem of public access to sensitive project management documentation. The placement of technical research and development literature in Cairo does not involve this issue. However, there are existing guidelines which have been developed by CDIE regarding the distribution of project documentation outside the Agency.

Exhibit II-1

DEVELOPMENT INFORMATION PROGRAM SYSTEM CONFIGURATION

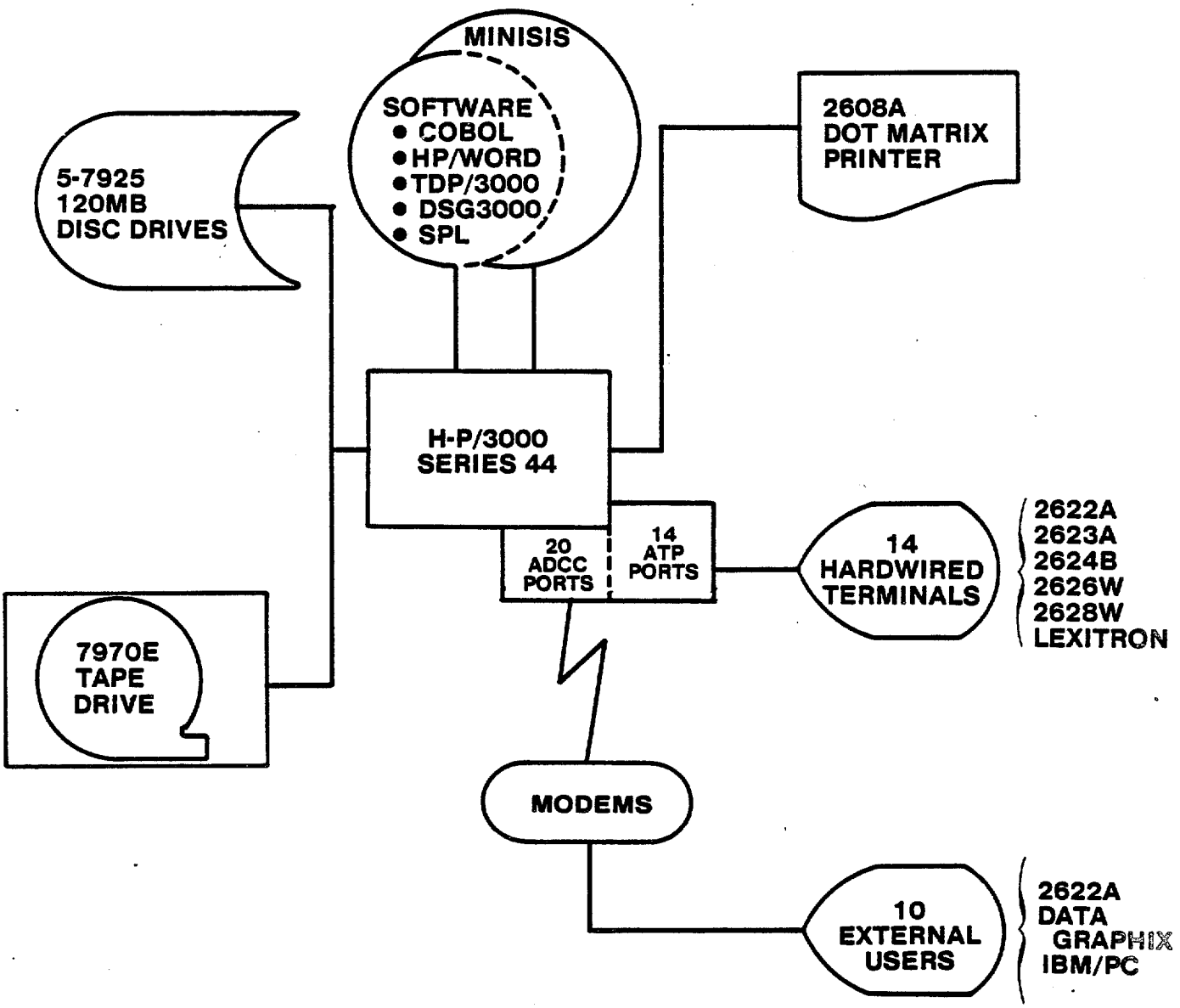

EXHIBIT II-2

Size of PROJECTS database

(There are 4,265 project and subproject records on PROJECTS as of 83-10-16)

Level of information	Sectors	Bytes[8]	Average Bytes Per Record[9]	Maximum Bytes Per Record
1. Minimum (Project database, w/o logframes, w/o abstracts)	12704	3.3M	774	2000
2. Medium (Project database, w/ logframes, w/o abstracts)	33728	8.6M	2016	4000
3. Maximum (Project database, w/ logframes, w/ abstracts)	39063	10.0M	2345	8000

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[8] These figures will increase by about 400 bytes per record when the old DIS Thesaurus terms are converted to the longer length A.I.D. Thesaurus terms.

[9] Bear in mind that the earlier project records are rather short and that the later project records are much longer, so this average may not be typical of very many records. For the later projects, the average record length is closer to the maximum record length.

III. Analysis of Mission Setting

A. Mission Requirements

A.I.D. Missions require better access to A.I.D. project and document information. A.I.D. experience and lessons learned are captured through the project funding, implementation, and evaluation process. At the present time the Development Information System (DIS) including the project information is not available onsite at any Mission. The Cairo Mission has a microfiche collection of technical research and development documents, and is currently the only Mission with any part of the DIS data base in machine readable form operating a WANG/VS system.

The wealth of information available in the Development Information System (DIS) is targeted for distribution to selected Missions during Phase III of this contract. CDIE will target 5 Missions to receive the A.I.D. project/document information system during the next 12 months.

Mission technical and project staff do not have readily available a resource which identifies relevant project information. Information is gathered from consultants, office files, AID/W, or personal contacts. The comprehensiveness of such data gathering efforts is doubtful and it is likely that valuable evaluation and design information is overlooked in such a scattered approach to reviewing previous AID-funded studies.

A.I.D. Mission libraries and information centers are known to be operating under conditions which provide available staff with little opportunity to explore new applications and automated techniques for information handling. Mission information centers need the capability to more efficiently organize their document collections for browsing, a policy for retiring older obsolete materials, and an effective means of providing documents in response to user requests. The Mission information centers look to AID/W for technical operations support. CDEI is responding to this need by developing various data base options which can be readily adapted to Mission capability and by providing technical assistance.

The following section reviews present hardware and software capabilities at the Missions, as well as existing available hardware and software. It can be seen from this survey that not all Missions have the capacity to accept the A.I.D. Development Information System. The Missions with available hardware have a broad range of computer resources and the question remains: if microcomputers are available at Mission sites, are they configured for and available for the heavy storage demands which the transfer of the A.I.D. DIS would require?

B. AID/IRM Report Summary/Analysis

A.I.D.'s Division of Information Resource Management (IRM) is actively involved in maintaining a clearinghouse of data on A.I.D. hardware, software, and users. CDIE should work closely with IRM to maintain awareness of new developments and issues of mutual interest. Since CDIE must rely on existing hardware for the placement of its Development Information System in the Mission environment, close collaboration with IRM seems advisable.

A recent IRM report on Mission computer capability indicates that 37 Missions have available some sort of hardware configuration. This July 1983 report was used to acquire an understanding of what processing capabilities the Missions currently have. The 37 Missions can be categorized into five groups of computer processing power (Exhibit III-1).

Exhibit III-2, "Analysis of IRM Survey of LDC Mission Computer Equipment," graphically shows the large percentage of Missions with the WANG/OIS processing support. Seventeen percent have access to a large processor like the WANG/VS, and 31 percent have personal computers for their support. The availability of this equipment to support a bibliographic data base was not a consideration of this study. What this does show is the installed base of potential computer equipment familiarity.

Analysis of Capability Levels

Overall, the A.I.D. Missions can be categorized into five capability levels. The first and simplest are those with no automation equipment. Information is acquired from hardcopy reports and microfiche.

The first level of automation are those sites with personal computers using floppy disks for data storage. Sites with Apple, IBM/PC, TRS80, and WANG/PC computers fall into this category.

The second level of data storage capacity includes those Missions with one to 40 megabytes of storage. An ever increasing number of sites are obtaining IBM-XT and Corona personal business computers. The sites with WANG/OIS systems fall into this category as well as any site that may have connected hard disks to their IBM/PC or Apple computers.

The highest level of processing power currently resides at those sites with minicomputers. The HP1000 and WANG/VS computers fall into this category.

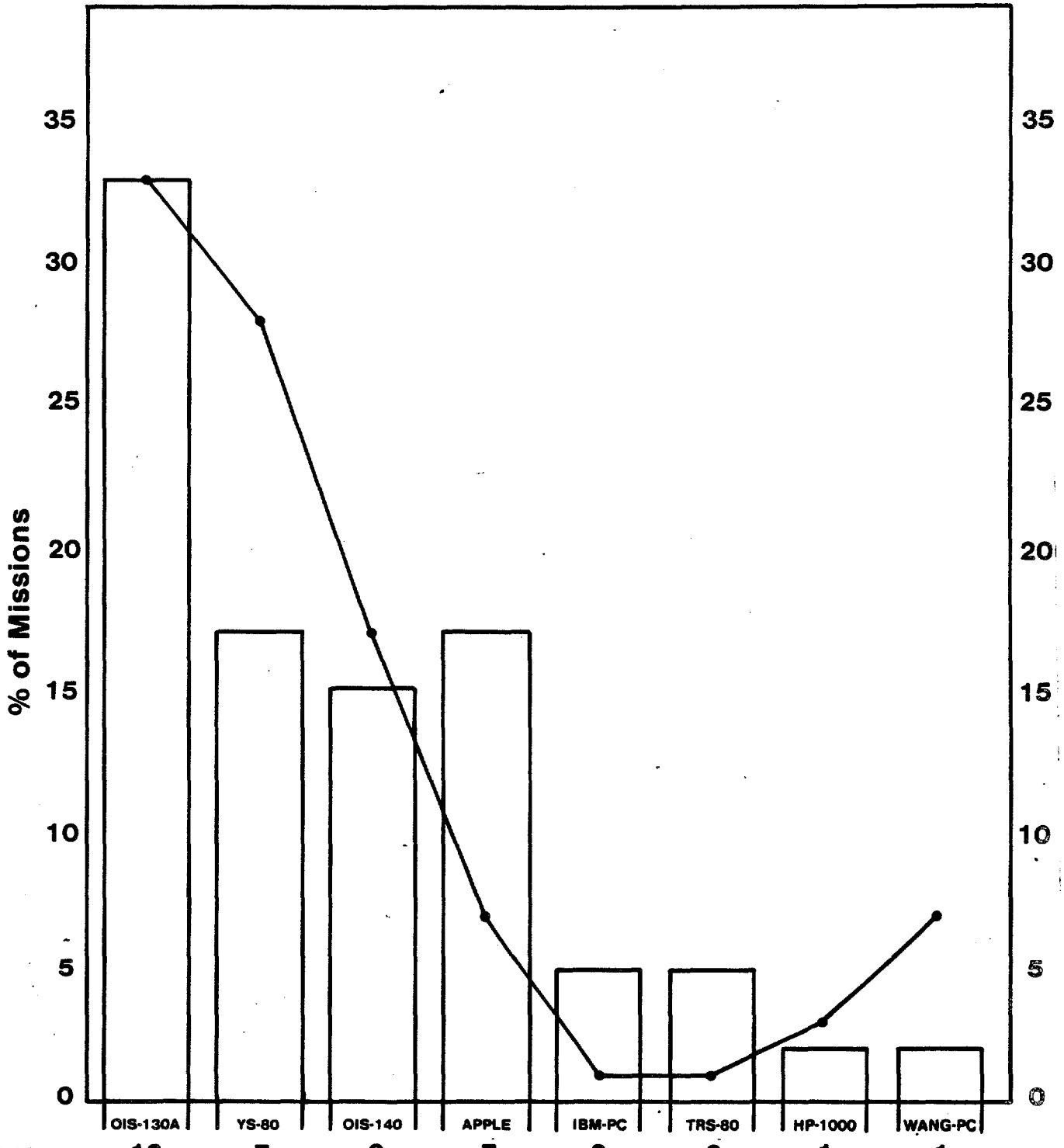
EXHIBIT III-1

MISSION COMPUTER PROCESSING POWER

Group	Mission	Level of Processing
A	Abidjan Cairo Guatemala Nairobi Santo Domingo San Salvador Tegucigalpa	These Missions have a WANG/VS-80; Cairo in particular is currently interfacing with the DIHF data base and has the minimum processing capability that all Missions need.
		Total: 7
B	Bangkok Bridgetown Dakar Harare Islamabad Jakarta La Paz Lima Mogadishu New Delhi Niamey Panama City Quito San Jose Tunis Yaounde	These Missions have a WANG/OIS-130A or 140 office automation system.
		Total: 16
C	Kingston Kinshasa Mexico City	These Missions have access to either a WANG/OIS-130A or 140 office system.
		Total: 3
D	Colombo Dar Es Salaam Dhaka Khartoum Lome Managua Naples Ndjamena Port Au Prince Sanaa	These Missions have only simple word processing or personal computer support.
		Total: 10
E	(unique situations)	
	Manila	Mission has an HP-1000.
	Brazilia	Mission has access to WANG/VS.

EXHIBIT III-2

Analysis of IRM Survey of LDC Mission Computer Equipment (Extracted from report dated July 1983)



	OIS-130A	YS-80	OIS-140	APPLE	IBM-PC	TRS-80	HP-1000	WANG-PC
# Missions	13	7	6	7	2	2	1	1
# Work Stations	112	96	59	24	4	2	12	25

The last possible category involves actual telecommunications capabilities for downloading and uploading. This study found that this capability is currently being exercised only here in the United States. The feasibility is there, but the telecommunication capability at the Mission sites may not be sufficiently stable.

This study focuses on three currently exercised categories of ADP capability based upon storage capacity:

- sites with less than one megabyte of data storage;
- sites with one to 40 megabytes of storage;
- sites with more than 40 megabytes of storage.

It is recognized that technology advancements and changes at site environments are rapid. By categorizing various levels of capabilities, a system with growth potential is possible.

C. Survey of Current Applications

1. MINISIS Compatible Applications

The A.I.D. Development Information System, as it operates on an HP3000 minicomputer with MINISIS software, was chosen by A.I.D. with the idea of providing a mechanism for the simple exchange of data (using ISO Standard 2709) among participating institutions. There are currently over 50 institutions using the MINISIS software, many of them located in lesser developed countries. Among MINISIS users (and throughout the information community) there is a high level of interest in downloading data from a major data base to create smaller data base subsets which can operate on various microcomputers.

Considerable progress has already been achieved to allow MINISIS-formatted data to be manipulated on smaller or different hardware configurations.

Cairo Project	- For the last 3 years the Cairo Mission has received tapes from A.I.D.'s IBM/Inquire System for loading onto its local WANG/VS system; an HP/MINISIS compatible tape is now being readied.
Sahel Institute, Mali	- AID/IRM is working with RTI, INSAH/RESADOC, and IDRC to develop a MINISIS batchin format
DIHF SCIMATE	- Test records are downloaded from HP/MINISIS to IBM/PC using ASCOM as the communications package and SCIMATE software
DIHF dBaseII	- Test records are downloaded from HP/MINISIS to IBM/PC using dBaseII software
IDRC CENAGRI	- Phased plan to develop MINISIS capability for Brazilian-made microcomputers

These particular projects are discussed in more detail in the following paragraphs.

a. Cairo Project

A.I.D.'s bibliographic database of Agency-sponsored research and development reports was adapted for use on the Cairo WANG/VS minicomputer. The onsite availability at an overseas post of a database of citations meant ready access to reports through online searching, and was the basis for an automated catalog of the Mission's collection. The initial conversion from the A.I.D. IBM mainframe computer to the WANG/VS minicom-

puter required reducing the size of the data record, formatting an input screen to match the requirements of the WANG, and making additional record changes to suit the needs of the Cairo DIC. This project is well documented in the Manual for use of the Development Information Center database system, revised December 1982.

Phase II of the Cairo effort involves the creation of a tape from the HP/MINISIS system for use on the Cairo WANG/VS system. This conversion update capability is scheduled for completion in October 1983.

While technically the DIS R&D documents are available in Cairo, the system is not very "user friendly" and seems to function by the good graces of the computer center and the determination of the information center staff to make it work. Boolean searching is available, but very awkward and inefficient. Searching by subject terms requires searching each occurrence of the descriptor field, since one can not be sure in which place the term may appear. Searching by author, or other multiple occurrence fields, would result in a similar exercise. It should also be mentioned that the only project documentation available in Cairo is a locally maintained collection of hard copy documents.

b. INSAH/RESADOC

Of immediate interest is the project currently being funded by A.I.D. to provide assistance to the Institute of the Sahel (INSAH), RESADOC unit in Bamako, Mali. A.I.D. is providing RESADOC with a microcomputer-based system (with data entry and validation capability in MINISIS compatible batchin format) to enable RESADOC to enter its data on floppy disks which could then be taken to a MINISIS installation for extended processing.

The Research Triangle Institute (NC) is currently developing a MINISIS batchin capability in anticipation of supporting the regional documentation center, with an anticipated completion date of December 1983.

c. DIHF/SCIMATE

The A.I.D. DIHF facility used SCIMATE software in a downloading experiment from the HP3000 to an IBM/PC. Test records were downloaded from the HP3000/DOCUMENT data base to the IBM using ASCOM communications software or the passive terminal mode of the SCIMATE Universal Online Searcher. Data elements from DOCUMENT were preselected, similar to those selected for the Cairo project.

SCIMATE is a well-developed bibliographic retrieval package

which includes query, edit, modify, and sort capabilities. SCIMATE consists of two packages which can be purchased separately or together: (1) Personal Data Base Manager and (2). Universal Online Searcher. Users could create new records on the established template to enhance the data base with local information.

Uploading was not attempted but seems feasible. A test file in MINISIS compatible batchin format will be uploaded in the near future.

d. DIHF/dBase II

Efforts are currently underway to create and upload to the HP3000 in MINISIS compatible records on dBaseII from the IBM/PC.

e. International Development Research Centre (IDRC)

The IDRC is involved in several development efforts which include the development of a microcomputer-based data entry package, to produce machine-readable input for information systems, such as AGRIS and DEVSIS, which run on MINISIS or ISIS.

Centro Nacional de Informacal Documental Agricola (CENAGRI) of Brazil is cooperating with IDRC to develop MINISIS/ISIS compatible software on Brazilian minicomputers. CENAGRI and IDRC are sharing the work of designing and programming the microcomputer software. The first phase will produce a simplified data definition processor, a data entry processor which will contain modify/delete functions, a simple print module, and an exchange module which will produce output in BATCHIN format. The expected completion date of this phase is late 1984.

IDRC is continuing to upgrade MINISIS through system enhancements which will support current awareness capabilities, creation of SDI profiles, and circulation and serials control systems.

These developments will substantially affect the changing scenario in the coming months. If CDIE is unable to fund Phase III development efforts in the next fiscal year, the picture will be significantly different a year from now.

2. Non-MINISIS Capabilities

Several AID-funded institutions are involved in data base development projects. We examined two applications, both using an Apple/CONDOR configuration: VITA and the WASH project.

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a. Volunteers in Technical Assistance (VITA)

VITA is currently converting 2 data bases to its Apple/CONDOR configuration:

Bibliographic Data Base

* contains approximately 20,000 records with a maximum length of 900 characters
* records are being converted from card files
* data are being keyed onto floppies using 4 leased Apples for subsequent transfer to hard disk;

Skills Bank

* downloading 4,600 records from BRS private file to the Apple
* current emphasis is on this conversion since the contract expires September 1983.

To overcome hard disk storage limitations, records are being split and stored in 4 separate data bases. Current CONDOR record size limit is 1,000, with 32K capacity, but future enhancements are expected for up to 64K. Condor, however, has 4 MB maximum file size.

b. Water, Health and Sanitation Project (WASH)

The WASH Project is using an Apple microcomputer to track AID-funded projects during the last 10 years that include a water component.

CONDOR (Version 2.10) is being used without modification on a CP/M-based Apple microcomputer to capture data in 28 fields. Much of the data captured is coded (using A.I.D. subcat/purpose codes). The data base contains approximately 700 records.

WASH decided on CONDOR after experimenting with, reviewing, and rejecting VISICALC and VISIFILE. There are plans to establish a communications and networking capability through a new contract on Primary Health Care, to be awarded through the Office of Health in September 1983.

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IV. Discussion of Alternative Hardware/Software Solutions

A. Hardware Review

This study focuses on the three manufacturers that are prevalent in the Missions today - IBM, Apple, and Wang. Exhibit IV-1 shows a brief comparison between the various manufacturers and specific models. The memory is shown because it is an important factor when considering application software. The storage media and maximum capacity are the primary focus of attention in evaluating the potential support hardware. Restrictions on storage capacity and memory size are imposed by the selection of operating systems and support software. These considerations are addressed in the software analysis section.

IBM

The two models of IBM personal computers are becoming the predominant microcomputer in the Missions and LDC's. The PC model has two 5 1/4" diskettes, each holding 320,000 kB characters of data. Hard disks can increase storage capability from 1 MB to 40 MB (one million to 40 million characters). The recent addition of the XT model puts 10 MB of hard disk and 320 kB of floppy disk into a single packaged cabinet. This storage capacity on this model can be expanded to 20 MB.

Apple

The Apple Computers come in three practical models for the Missions -- II Plus, IIe and III. The professional Apple Lisa is currently not at any Mission and not included in the report. The Apple II Plus and IIe computers come with floppy diskettes with maximum capacity of 840 kB. Additional hard disk can be attached to gain 5 to 10 MB of storage. The Apple III has fixed disk with a maximum expansion to 20 MB.

Wang

Wang, a long-time office automation supplier, recently released a PC model with 5 to 10 MB of storage. The WANG/OIS models primarily support the word processing requirements of an office. However, a recent announcement whereby the OIS will run using the CP/M operating system, provides another option for this study. These systems can be easily expanded up to 80 MB of storage.

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EXHIBIT IV-1

Personal Computer Comparison

Manufacturer	Model	Memory	Storage
IBM	PC	16 - 512 kB	5 1/4" diskette, max 640 kB Fixed disk attachable, 10-12 MB
	XT	128-640 kB	5 1/4" diskette, max 720 kB Fixed disk, 10-20 MB
APPLE	II+ IIe	18-238 kB	5 1/4" diskette, max 840 kB Fixed disk attachable, 5-10MB
	III	128-256 kB	5 1/4" diskette, max 560 kB Fixed disk, 5-20 MB
WANG	PC	128-640 kB	5 1/4" diskette, max 720 kB Fixed disk, 5-10 MB

Currently Installed

Office Automation Computers

WANG/OIS 130	10 MB maximum storage capacity
WANG/OIS 140	80.4 MB maximum storage capacity

B. Software Review

The primary focus of this software review is to identify currently available application products that would best support Mission needs. The four major requirements in "linking" field installations with the AID/DIS data bases include the ability to:

* Download bibliographic citations from DIS to microcomputers;

* Manipulate and add local records - this requires searching, sorting, selecting, editing, and reporting the downloaded records;

* Upload locally produced or edited records in MINISIS compatible format;

* Process ESDS statistical information/applications locally;

Exhibit IV-2 summarizes the characteristics of the software we consider applicable for this project.

Downloading

Proceeding from the assumption that most Missions and LDCs will not have telecommunications facilities, downloading of MINISIS records to floppy disks, tape, or removable hard disk will be done at AID/W. During this feasibility study, small test files were downloaded to the IBM/PC, first using ASCOM, a standard communications software package, and then the SCIMATE Universal Online Searcher, a package developed specifically for downloading and manipulating bibliographic files (Exhibit IV-3 - Downloaded record). The fields were downloaded to floppy disks; any number of subsets of the data base could be provided in compatible formats (APPLE, IBM, WANG) for the various user groups.

Manipulating

Basic downloaded files are linear ASCII files permitting only line editing and global string searching when using standard text editing software such as WORDSTAR.

In order to permit more sophisticated searching, selecting, and sorting, a DBMS software package is required which structures the files into appropriate fields.

CONDOR, dBaseII, Superfile, WANG list processing and similar DBMS systems can be used to do limited manipulation of data; this will require development of software interfaces between the downloaded file and the new format.

The SCIMATE Personal Data Base Manager, BRS Search, the Personal Bibliographic System (PBS) and CLASS Golden Retriever

EXHIBIT IV-2

SOFTWARE CHARACTERISTICS

General Data Base Management Packages

CONDOR, dBase II, SUPERFILE, SENSIBLE SOLUTION, etc. - low cost, considerable custom software, programming, large number of records available, but severe limitations in size and field length. ($100 to $700)

Bibliographic Data Base Management Packages

SCIMATE - low cost, no custom software, no format changes. No more than 10,000 records; recommend less than that; 300 records sort maximum at the present time. ($500 to $900)

BRS Search - more records, no custom software necessary, runs under UNIX, not yet available for IBM/PC. Much more expensive than SCIMATE. ($10,000)

Golden Retriever - easy to use, moderate cost, needs hard disk, needs some custom programming for downloading and uploading. ($1,800+)

PBS - very low cost, handles only small files (several hundred records), easy to use, no custom programming. ($250)

STAR - full size, all capabilities, expensive ($15,000+)

EXHIBIT IV-3

DOWNLOADED RECORDS

WORK File Record Number 1

*AID R&D DOCS
AS AA50
ID PN-AAN-431
TI Microcomputers and programmable calculators for agricultural research in developing countries
AU Weber, Michael T.
AU Pease, James
AU et al.
PY 1983
PG viii, 114p.
LA En
CT DAN-1190-A-00-2069-00
DT 1983-08-11

WORK File Record Number 2

*AID R&D DOCS
AS AE30
ID PN-AAN-278
TI Proceedings from the practitioner workshop on microcomputers and agriculture management in developing countries
PY 1982-06
PG 7 p. + attachments
LA En
DT 1983-06-17

WORK File Record Number 6

*AID R&D DOCS
AS TC00
ID PN-AAM-892
TI Acquiring and using microcomputers in agricultural development: a manager's guide
AU Ingle, Marcus D.
AU Berge, Noel
AU Teisan, Marcia
PY 1983-04
PG iii, 147p. + 6 appendices
LA En
CR 11/3-031
DN /Agricultural development/ /Software/ /Computers/ /Rural development/ /Management/
DT 1983-05-06

produce Boolean logic searchable and sortable files. SCIMATE and Golden Retriever are currently operational on the IBM/PC and PBS can be used on the Apple and the IBM/PC. Records can be edited, fields can be added, modified, or deleted, and local records can be produced and added to the files.

Limitations regarding file size, record length, and operation systems are discussed below.

Uploading

Locally produced records can be transmitted by telecommunication or floppy diskette transfer. SCIMATE, BRS Search, and Golden Retriever record formats will need minimal adaptation to become MINISIS compatible. PBS, CONDOR, and dBaseII would need custom software modules for conversion.

Microcomputer-based software applications for future consideration

Microcomputer-based software suitable for the development of large bibliographic data bases is very much in the developmental stage. Dramatic changes are expected within the next year or two as the hardware scene solidifies, as applications software is tested and implemented, and as marginal products are shaken out.

This feasibility study is limited to specific hardware and to files created on the HP3000 under MINISIS. We are aware of a number of applications that currently do not fit into these constraints, but which bear watching as conversions from one operating system to the other become more routine and less labor-intensive, and as more standardization is achieved.

The following applications are mentioned as examples of such activities. They do not represent a comprehensive list.

BRS/Search

Operates under UNIX only. The apparent consensus among experts is that UNIX or UNIX-type operating systems will replace CP/M. BRS/Search provides all features needed for the desired functions, but cannot be operated under the specified hardware at the present time. SDC and other large data base vendors are developing similar programs which will be available within the next year.

INMAGIC

Warner-Eddison has offered INMAGIC on a mainframe-based bibliographic DBMS on a time-sharing basis for several years. They are working on a micro-based version for PC and WANG.

INQUIRE

Infodata is currently developing a microbased system for use with IBM Inquire software. Expected completion date is March 1984.

STAR

A sophisticated microcomputer-based bibliographic DBMS developed by Cuadra Associates, STAR could accommodate the entire data base and manage it satisfactorily, but is expensive and operates under a cumbersome configuration of Alpha microcomputers.

UNIFACE

This system uses IBM/PC's as interface between OCLC and the local mainframe-based integrated library system at the University of Washington to produce lists, cards, labels, etc. It provides a good model for downloading and uploading and sooner or later will allow data manipulation. Similar activities are under way at the University of Illinois and Michigan State.

C. Limitations

All of the functions of an HP3000/MINISIS based system cannot be transferred to the Missions because of four primary limitations: telecommunications, data base size, available technology support, and, finally, cost. Each limitation may be considered as a current barrier only; technological advancements is occurring rapidly enough to warrant continual review.

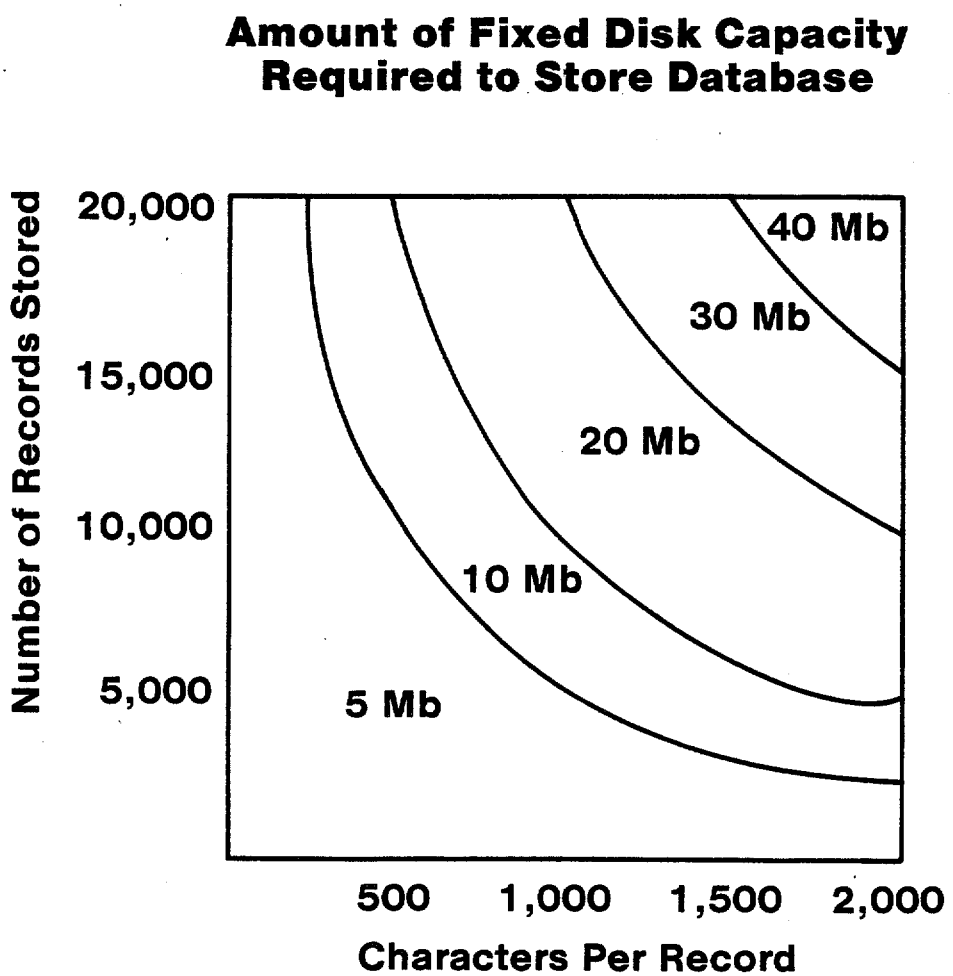
Telecommunications

Ideally, a Mission should be able to dial into the central data bank, retrieve information, and update files. However, international phonelines are expensive and slow. The telecommunications aspect of the resulting system development will be confined to the downloading of data to the appropriate media for mailing to the Missions.

Data Base Size

The initial scan of the computer equipment marketplace identified data storage as the main limitation of downloading the DIS data bases. Therefore an analysis of the currently installed bibliographic data base was conducted. Approximately 40 MB are required to store 20,000 records, with an average record length of 2,000 characters. Exhibit IV-4 shows the amount of storage that would be required if anything less than the full data base is utilized. For example, if

Exhibit IV-4


Amount of Fixed Disk Capacity
Required to Store Database
Number of Records Stored
20,000
15,000
10,000
5,000
40 Mb
30 Mb
20 Mb
10 Mb
5 Mb
500
1,000
1,500
2,000
Characters Per Record

a Mission only needs 15,000 records and the average record length is 1,000 characters, then a 20 MB storage capacity is sufficient at that Mission. These statistics are based upon the hard disk technology.

If floppy disks are the only option, then Exhibit IV-5 depicts the number of floppy disks required to store the data base. Assuming 15,000 records with an average length of 1,000 characters, 24 diskettes would be required.

Available Technology

The purpose of decentralizing the data base is to utilize existing hardware and software packages. It is recognized that MINISIS is on the leading edge of bibliographic technology residing on a minicomputer. IDRC has plans underway to build a data entry subset of the system onto a microcomputer. The technology for full support at the microcomputer level does not exist; therefore, compromises with available hardware and software are necessary.

Costs

Each Mission would have its own HP3000 with MINISIS, and a support staff, if cost was not a limitation. However, cost is important, and a primary objective of this study is to set the grounds for a cost-effective system of disseminating and collecting data. (See Section VII for a discussion of costs).

EXHIBIT IV-5

NUMBER OF DISKETTES REQUIRED TO STORE FILE

Number of Records

Length of Records (characters)	5000	10000	15000	20000
500	4	8	12	16
1000	8	16	24	32
1500	12	24	36	47
2000	16	32	47	63

Number of Diskettes

Note: One diskette stores 640,000 characters

V. Methods of Information Exchange

Several options are available for putting the A.I.D. Development Information System in Mission settings, not all of which require sophisticated computer technology and the accompanying technical support personnel. Given the fact that at the present time the valuable resources contained in the project information system are not available in the Missions at all, considerable progress would be realized just by transferring the information to the overseas site where it is readily available to project designers and implementors. It may very well be that a computerized data base and online retrieval is not the best first step in getting project information to those who need it most.

Certainly personal computers and office automation systems are a significant advance and allow manipulative capabilities that are not possible with paper copy indexes or microfiche collections. However, if the primary purpose is to disseminate information and decentralize the collections, all options must be taken into consideration whether the data are transferred in hard copy, or some combination of paper copy and fiche, or diskette, or tape, or eventually even telecommunication-satellite hook-ups.

In this section various methods of information exchange are examined, specifically:

* Hard copy
* Fiche/Hard copy
* Diskette
* Tape/Disk Pack
* Telecommunication-Satellite Tie-In

A. Hard Copy

This approach would be a variation on the existing condition. Project documents, technical reports, and related documentation would be maintained in paper copy. Improvements in how they are organized could be realized by improved records management/filing/retrieval systems, but would still result in a paper-based system with all its known limitations. This approach would also be the least expensive.

B. Fiche/Hard Copy

By converting the materials to microfiche and providing paper copy indexes, improvements are realized in that storage space to hold the information is reduced, and multiple indexes can be generated to permit access through a variety of concepts. A more permanent archival-quality record is created and fiche-to-fiche copying reduces the cost of further transfer activities.

This approach increases the cost of information exchange in that the filming costs as well as indexing must be factored in.

C. Diskette

Information that has been converted to or created originally in a machine processable mode can be exchanged via diskette, which is the industry standard for microcomputers or word processors. By adding descriptors or other information-enhancing tools, the utility of information on diskettes is increased since it can be retrieved individually or in relation to other information elements rapidly. Information captured in large computer systems can be downloaded and made available for further manipulation by the use of microcomputers. Diskettes can be used to hold complete information, selected data elements, or merely indexes to larger collections available in hard copy or fiche.

D. Magnetic Tape/Disk Pack

These approaches are used primarily to transfer large volumes of records that can be loaded on a mini or mainframe computer. Tapes can be formatted to run on a variety of equipment. This approach offers one of the most cost-effective ways of exchanging large collections of data. The problems associated with machine and systems compatibility offset the advantages, but these restrictions can be overcome by developing networks of users with systems that are compatible and facilitate information exchange. Again, costs of creating the systems are great, but the endless combinations of how the information can be related are the desired objectives of end users.

E. Telecommunications Network - Satellite Tie-In

This exchange process offers the greatest advantage of rapidly accessing large amounts of information in geographically disparate areas. In addition to the cost of creating the information in a machine-processable mode, the cost of transmission over telephone or via satellite channels must also be considered. Information users must also possess the equipment, systems, and resources to utilize these technologies, an additional cost consideration.

Data Tape Exchange with Minicomputer Systems and Fiche

While providing the most rapid means of transferring information, this approach can be realized only at those Missions possessing the capability to receive and process tapes. No Mission or other A.I.D. installation has an HP-3000/MINISIS configuration. Thus, a direct one-to-one tape transfer of records is not possible. However, many Missions do have close links to host country organizations with this kind of equipment e.g., Philippines, Tunisia, Indonesia, Malaysia, etc.). Other Missions with the WANG/VS or large WANG/OIS system, with tape drives could improve their operational efficiency by following this approach. The investment cost of providing/developing software for these large systems will be great, yet for those Missions with a need and sufficient demand, the investment will have to be made since the cost will be less than acquiring compatible HP automatic data processing equipment.

Our recommendations, therefore, are as follows:

1. Provide the most appropriate level of information transfer to a Mission based upon its capacity to effectively use the information (personnel, project activity, and information use being considered the most vital criteria).

2. Develop a series of packaged hardware/software/fiche systems that can be transferred to Missions with existing microcomputers or WANG/OIS systems. These systems would correspond to the options discussed in Section VI.

3. Provide a standard hardware/software/fiche package to those Missions that seek to improve their information use but currently lack the needed resources (those units falling between Recommendations 1 and 2).

4. Work out tape/fiche exchanges with Missions desiring to adapt the systems to their WANG/VS systems or who will enter into host country agreements with institutions possessing compatible HP/MINISIS resources. In both cases, complete sets of the fiche will be available.

Schedule of Implementation

The schedule which would govern when Missions would be slated for systems transfer would depend upon policy guidance from A.I.D. Emphasis would be given to those Missions where development activities will be on an upswing and planners and managers will likely require such support. These sites would be addressed first.

Next, Missions with existing microcomputer resources would be addressed. This would permit sufficient time to develop and test software, and to duplicate the fiche collections. Missions would also need to recruit and or train personnel locally to operate the system.

Simultaneously, arrangements would be needed to transfer the system to those Missions with minicomputers. Host country cooperative arrangements will probably take longer, but once agreed upon, the transfer could occur rapidly.

VI. Recommended Approaches and Schedule for Implementation

A variety of options exist to A.I.D. regarding the transfer of information between AID/W, Missions, and other organizations creating/using development-related information. These options are discussed below.

1. Improve Current Hard Copy Based Systems

While the least desirable in terms of utility, this approach is also the least costly in that no hardware/software or media conversion costs would be involved. Major costs would still be required to house and transport paper files, to maintain staff resources to access them, and to seek improved systems for managing paper files. While not desirable, this approach may be the most feasible for remote Missions that lack the resources or do not warrant the investment based upon the size of their information activity.

2. Provide Microfiche Collections and Paper Copy Indexes

The next level of transfer will be to use microfiche collections accompanied by indexes (in printout form or a copy of the indexes). The indexes will enhance user access to the information, which will be maintained in a standard format - an improvement in some instances. Since the fiche can be readily duplicated, this approach offers the most cost-effective method of transferring material and providing end users with access to information they do not currently possess. It may not be the best approach if it merely substitutes one medium (fiche) for another (paper). This approach is recommended for those sites that lack the resources or capacity to use automatic data processing equipment but have the need for information and where searching retrieval time is not a critical factor.

3. Provide Microcomputer, Generalized Data Base Management Software, Data Files, and Microfiche.

This approach combines the desired features of permitting Mission users to have access to new technology that can improve their use and creation of information which in turn can be provided in fiche. Due to the variety of possible machine/software combinations, and the constraints imposed by file-size limitations, various combinations are presented in Exhibit VI-1.

Exhibit VI-1

MODEL SYSTEM CONFIGURATIONS

Configuration	B		C
Description	Dedicated Microcomputer with less than 1 Mb of storage	Dedicated Microcomputer with 1-40 Mb of storage	Microcomputer with storage in excess of 40MB
Examples	IBM/PC (no hard disk Apple II Plus, IIe (no hard disk) WANG/PC (no hard disk)	IBM/PC (with hard disk) IBM/XT Apple II Plus, IIe (with hard disk) Apple III WANG/PC (with hard disk) WANG/OIS	WANG/VS HP1000,3000
Storage Media	Floppy disk only	Floppy and hard disk	Fixed disk and magnetic tape
Software (Examples)	SCIMATE dBASE II CONDOR	SCIMATE dBASEII CONDOR Golden Retriever Star	MINISIS INMAGIC BRS Search
Recommended File Size	2-4 floppies containing 1,280 records	10 MB containing 5,000 records	Full complement of the DIHF data base

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Exhibit VI-1 (cont'd)

Configuration A

This is the lowest level of automation support. This configuration can be used to process data provided by AID/W, as well as for maintaining a Mission's own project data. With a clear identification of what is needed from the central data bank, it can have 1,280 records with an average record length of 2,000 characters. The searching and sorting capabilities would be limited, but possibly not restrictive. The central data would be selected and downloaded to floppy diskettes at AID/W-DIHF and sent to the Mission. Likewise area project data could be created on a floppy at the Mission site and sent to AID/W-DIHF to update the central PROJECTS data base. A copy of all materials would be converted to fiche as well.

Configuration B

With a minimal increase in cost, the Mission could manage its project data and have ready access to 5,000 document records, each averaging 2,000 characters. The sort and search capabilities would be at an effective level to support inquiries. (The cost would be for the addition of an external hard disk, and a software package. Again, fiche would be generated and distributed along with the diskette(s).

Configuration C

This configuration requires a minicomputer comparable to the HP3000. The entire data base, or subset if desired, would be downloaded at AID/W-DIHF onto magnetic tape and sent to the Mission. Local project data would be sent to AID/W-DIHF also through the magnetic tape media.

VII. Cost Considerations

Due to the wide variation in Mission equipment and resources, and the dynamic nature of microcomputer/software development, no single recommendation that will meet A.I.D.'s conditions is possible. However, a series of graduated approaches can be taken which reflect the most appropriate solution at the present time according to each Mission's individual situation, vis-a-vis personnel, equipment, and need. It is assumed that the host site will provide hardware and staff resources.

The following recommendations are offered to enable A.I.D. management to better understand and plan for the costs and implications of transferring the DIS to overseas settings.

1. Development and Implementation

Regardless of the equipment or software that is selected, certain fixed development costs will be required to create procedures for downloading DIS files, for creating micro-based DBMS file structures compatible with DIS fields, for creating screen templates and report formats, and for preparing systems and user documentation. Additional costs will involve the time and materials needed to actually download the data, test the files, make copies, and distribute them. Since a support capability will be needed to check out each type of microsystem on which DIS will operate, the cost of acquiring and maintaining one of each must be included as well, since the most cost-effective way to create downloaded micro-based files is to execute diskcopy commands on the equipment on which the diskette will operate.

In addition, loading a hard disk with DIS files would be executed most efficiently, at present, by inserting and aggregating the contents of individual diskettes. Once the entire disk was loaded, future updates would be accommodated more readily by using diskettes containing only information added after the initial hard disk loading.

Details of these development-related estimated costs are as follows:

o Purchase of DBMS for testing (dBaseII, SCIMATE, Lotus 1-2-3, or Personal Bibliography)	$ 2,000
o Systems Analysis/Development	50,000
o Equipment Purchase (WANG/OIS, WANG/PC IBM/PC, APPLE IIe)	40,000
Total	$92,000

2. Variable Costs by System

As stated earlier, various options to transfer the DIS to Mission settings have been considered. Each option comes with a different price tag. The following cost estimates illustrate the potential financial resources A.I.D. can expect to expend, depending on the approach taken.

The following A.I.D. cost estimates are based on the assumption that Missions will contribute required equipment to receive the system. Missions will purchase equipment and absorb maintenance costs. An estimated $13,500 set up will be required, as seen below:

* Personal computer with minimum 20 MB+, hard disk, printer, electronic disk, cables, print spooling, etc.	$10,000
* Reader printer (microfiche)	2,500
* Supplies and materials per year	1,000
	$13,500

An additional $6,250 per year will be absorbed by this DIHF contract to reproduce and distribute fiche copies of new documents filmed. It is assumed 5,000 new fiche per year will be reproduced and 5 additional diazo copies made at a cost of $0.25 per diazo.

5,000 x 5 x $0.25 = $6,250

Provide all Users COM/Fiche of DIS (73 systems)

Provide all Missions (including USAID, AIDREP, AAO and other A.I.D. representatives) with a COM (Computer Output Microfiche) copy of the DIS PROJECTS database and standard microfiche copies of the technical reports. See Appendix for detailed discussion of this approach.

	Each Mission		Total No. of Missions		Total No.
o COM of DIS Projects Data Base/Indexes	$ 5		73		$ 365
o Fiche Readers	285		73		20,805
o Fiche Storage	850		73		62,050
TOTAL	$1,140	x	73	=	$ 83,220

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Options: Provide all Missions with diskettes of DIS data bases, instructions, system training, and a set of microfiche of Technical Reports and Project Documents.

Option 1: IBM/PC Based System (50 systems)	1 Mission
Hardware (PC, hard disk, printer, cables, etc.).....	N/C
Software (SCIMATE, & standard office automation).....	$ 2,000
Microfiche of Technical Reports.....	3,400
Microfiche Project Reports.....	750
Supplies/Materials (diskette duplication, expendibles, etc.).....	1,500
	$ 7,650

TOTAL: 50 systems = 50 x $7,650 = $382,500

Option 2: WANG/OIS (16 systems)	1 Mission	Total No. of Missions	Total
Hardware	N/C	16	$ -0-
Software (same as 2.1 above + CP/M operating system)	$2,700	16	$ 43,700
Microfiche of Technical Reports	3,400	16	$ 54,400
Microfiche Project Documents	750	16	$ 12,000
Supplies/Materials (diskettes, duplication, expendibles, etc.)	1,500	16	$ 24,000
16-System TOTAL =	8,350 x	16 =	$133,600

Option 3: Provide tape plus fiche collection to WANG/VS installations (7 systems).

	1 Mission	Total No. of Missions	Total
Hardware	N/C	7	$ -0-
Software	5,000	7	$35,000
Microfiche of technical Reports	3,400	7	$23,800
Microfiche of Project Documents	750	7	$ 5,250
Supplies/Materials	500	7	$ 3,500
7-System TOTAL	$9,650 x	7 =	$67,550

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3. Summary (Investment) Costs of Options

In addition to the estimated fixed software and microfiche costs for development and implementation, A.I.D.'s potential costs required to convert the DIS would be as follows for the 73 various A.I.D. operations overseas.

1. Transfer to 50 Missions using microcomputer based system	$382,500
2. Transfer to 16 Missions W/ WANG/OIS capability	$133,600
3. Transfer to 7 Missions W/ WANG/VS capability	$ 67,550
Totals 73 Missions	$583,650

4. Total Estimated Program Costs

The three major investment costs are development, COM/Fiche, and systems, as follows:

Development.....	$ 92,000
COM/Fiche.....	83,220
Systems.....	583,650
Total	$ 758,870

This total does not include related training or travel costs. Total costs to place these 73 systems are estimated to be about $1,750,000, including the $758,870 in investments. This represents an average cost of $24,000 to $27,000 per site.

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Appendix 1

Appendix 1

A. Data Subsets

Suggested approaches to creating subsets of the A.I.D. project/information system may include the following:

* providing COM of entire system without automated support
* providing projects by country
* selecting records by Agris categories
* field selection such as the Cairo project

Creating Subsets by Country

The selection of A.I.D. Missions below (See Table A-1) represents an analysis of creating subsets of project data by:

1) Missions already receiving microfiche and computer tapes of A.I.D. documents (Cairo);

2) Missions interested in acquiring machine-readable data (Honduras, Zaire, Costa Rica);

3) Missions located in countries with a high volume of requests for A.I.D. documents (India);

4) Missions with MINISIS facilities located in the same city (Zaire, Philippines, Mali, India, Indonesia).

An analysis of the projects/documents available for each of the included countries is presented in the following table.

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Table A-1

AID/DIS GEOGRAPHY/PROJECT/DOCUMENT SUBSET

COUNTRY	GEOCODE	NUMBER OF PROJECTS	TOTAL DOCS	PN DOCS	PD DOCS
Costa Rica	515	42	281	111	170
Egypt	263	82	610	299	311
Honduras	522	79	423	89	334
India	386	31	640	337	303
Indonesia	497	81	945	185	760
Mali	688	26	145	65	80
Philippines	492	72	837	370	467
Zaire	660	37	184	61	123

The totals above do not reflect 900 projects or regional projects which could be included to broaden the data base.

Creating Subsets by Agris Code

A.I.D. research and development reports are assigned an Agris code during the processing of the documents. Missions can be provided with a "shopping list" of documents by Agris code. Database subsets can be customized to correspond to Mission requests for subject relevant material. Since the Agris code is also used by many of the Missions to create browsing categories for shelf copies of documents, the Missions may prefer receiving Agris subsets. Some categories, as evidenced by Table A-2, may require further subdividing to achieve manageable subsets.

As soon as the A.I.D. Thesaurus is complete an additional enhancement is the capability of subdividing the data base by subject notation.

TABLE A-2

DOCUMENT DISTRIBUTION BY AGRIS CATEGORY

Class	Number of Documents	Subject
A	1700	Agriculture
C	60	Communications
D	2200	Development & Economics
J	700	Education
L	400	Urban Development & Housing
M	50	Libraries & Information Sciences
N	1000	Health
P	700	Population
S	250	Social Sciences
T	500	Science & Technology

Creating Subsets by Field Selection

Another option for creating manageable subsets is to select only major fields from the database, and then truncate them to a shorter length. Another option is to take only the first occurrence of a repeating field, such as author.

Table A-3 illustrates a correspondence between the DOCUMENT fields selected for the Cairo project and the downloading experiment for the IBM/PC (Exhibit IV-3).

TABLE A-3

CAIRO DOCUMENTS DATA BASE

Cairo Wang/VS System (Inquire)			IBM/PC Equivalent (MINISIS)		
Field Name	Mnemonic	Length	Mnemonic	Length	Document
Date entered	DT	6	DIN	10	D610
Docid	AW	8	ID	14	A000
Agris subject	SU	4	AG	4	D131
Language	LA	8	LA	25	B540
Title	T1,T2,T3	201	TI	375	B230
Author	AU	469	AU	60	*B210
Year	YR	2	YR	7	B630
Pagination	P	6	P	40	B641
Notes	N1,N2,N3	201	NOTE	240	B820
Keywords	KY	300	KEYS	700	C210
Contract No.	C	19	CONT	21	D060
ARDA Issue	AR	7	ARDA	10	D500
Bibtype	BT	2	BT	2	D010
Project No.	J	45	PROJ	9	D100

*Repeating field

EXHIBIT A-1

Field Display Table

The following table lists each field in the DIC database and gives major characteristics. Starting positon refers to actual location in the computer record; this positioning is evident when viewing a record in Display. All fields are character fields rather than numeric eventhough some values contain numerals. Length is number of spaces each field occupies on the record no matter how much room the actual value takes up. Number of occurrences indicates the maximum number of values each field can have in any one record. The keyed fields are those which are indexed.

FIELD NAME (Abbrev.)	STARTING POSITION	TYPE OF FIELD	LENGTH	NUMBER OCCUR.	KEYED?
DT--Date on file	1	C	6	1	No
AW--AID/W Doc. No.	7	C	8	1	No
DF--Format	15	C	2	1	No
ID--Doc. ID	17	C	8	1	Yes
SU--Subject	25	C	4	1	Yes
OC--Secondary	29	C	4	1	No
GC--Country Code	33	C	4	1	Yes
LA--Language	37	C	8	1	No
T1--Title1	45	C	67	1	No
T2--Title2	112	C	67	1	No
T3--Title3	179	C	67	1	No
AU--Author (1-7)	295	C	67	7	No
YR--Year	1032	C	2	1	No
P--Pagin	1034	C	6	1	No
N1--Notes1	1040	C	67	1	No
N2--Notes2	1107	C	67	1	No
N3--Notes3	1174	C	67	1	No
KY--Keyword (1-12)	1375	C	25	12	No
C--Contract	1875	C	19	1	No
CT--Contract Type	1896	C	1	1	No
AR--ARDA Issue	1897	C	7	1	No
BT--Bibtype	1904	C	2	1	No
J--Project Number	1906	C	45	1	No
RS--Record Status	1951	C	1	1	No

B. Target Sites

There are several approaches to selecting target sites to receive the A.I.D. Development Information System. The approach selected to compile the LDC institutions listed in Exhibit A-2 was to identify major stable international organizations which already are recipients of A.I.D. funding. PVO, governments, and university environments were not considered in the compilation of this group.

Other factors which should be taken into consideration before a final selection is made include the following:

*Is there a library or information services unit already existing within the organization?

*Does the organization already have an established clientele or audience which looks to the organization for support?

*Can the organization absorb the cost of this system? Will additional A.I.D. funding be necessary?

*Does the organization participate in an existing information services network? Regionally? Sectorally?

*Will the organization be able to absorb the additional traffic expected as a result of this system?

*Is there an A.I.D. Mission in the area?

The exhibited list is refined neither sectorally nor geographically, and does not take into consideration the proximity of A.I.D. Missions. Certainly these factors should also be considered in choosing the most effective placement of the A.I.D. Development Information System.

C. Documentation, Training, and Support

The success of any new system hinges heavily on the documentation and support provided by the parent institution. It is assumed that the plan which is implemented to place the A.I.D. Development Information System in Mission/LDC setting will be well documented.

Several options to be considered in training recipients may include:

* providing training and set-up at the Mission
* providing training at AID/W through a conference or workshop
* sending manuals, self-teaching materials, tapes, etc. to the Missions and LDCs without A.I.D. personal assistance

EXHIBIT A-2

LDC INSTITUTIONS TO RECEIVE A.I.D. DEVELOPMENT INFORMATION SYSTEM

BANGLADESH	Dhaka	International Center for Diarrheal Diseases Research
COSTA RICA	San Jose	Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE)
DOM. REP	St. Domingo	Council of American Development Foundations (Solidarios)
ETHIOPIA	Addis Ababa	International Livestock Center for Africa
GUATEMALA		Instituto Centro Americano de Investigacion y Technologia Industrial (ICAITI)
GUATEMALA		Instituto de Nutricion de Centro America y Panama (INCAP)
INDIA	New Delhi	Spines, Center for Study of Science, Technology and Development
INDIA	Hyderabad	International Crops Research Institute for Semi-Arid Tropics (ICRISAT)
INDONESIA	Bogor	National Library of Agricultural Sciences
PERU	Lima	International Potato Center Agriculture
PHILIPPINES	Manila	International Rice Research Institute (IRRI)
PHILIPPINES	Manila	International Center for Living Aquatic Resources Management (ICLARM)
THAILAND	Bangkok	Institute for Management Education

Appendix 2

Appendix 2

A. Development Information System on Computer Output Microfilm (COM)

Table A-4 shows some numbers regarding a COM version of the DIS. This set of COM fiche would basically be a printout of the PRJDOC2 database sorted by project number. Two print formats (PRJ44PF and PRJ45PF) and two reductions (24X and 48X) were evaluated. Using the PRJ44PF format at 48X reduction would require 34 fiche. The following section describes 6 companion indexes which would occupy 7 fiche, bringing the total number of fiche to 41. This would cost approximately $82 for the silver master, and $5 per diazo set. (Approximate prices from Zytron.)

Exhibit A-3 shows what the PRJ44PF looks like. It has a single column, 8 1/2 x 11 format. The superfluous blank paper along the right margin would not be part of the fiche frame.

Fiche of 48X can be produced from 8 1/2 x 11 sized images, packing them approximately 420 pages per fiche. Grid indexes for the fiche reader carriage, if available, would be more dense. Even if they are available, they probably would not be of much use. Each frame would have the grid number in it, much like a page number on the printout.

Exhibit A-4 was produced using PRJ45PF. It displays the same information in dual-column format on computer-sized (11 x 14) paper. The dual-column format of PRJ45PF can be hard to follow, especially with COM fiche which reads top to bottom (in a Z pattern) instead of left to right.

EXHIBIT A-3

PRINT FORMAT PRJ44PF

****

9310974 Technical Assistance
COMPUTERIZED AGRI INFO SYSTEM
FY 76 - 78 Status: C Total LOP Cost (x000): $ 215
Loan or Grant / Appropriation Code / LOP Cost: G / FN / 215

****

<<< DEVELOPMENT PROBLEM >>>

RESEARCH IN AGRICULTURE TENDS TO BE DECENTRALIZED AND TO SOME EXTENT FRAGMENTED OVER WIDE RANGE OF LOCATIONS AND ECOLOGICAL CONDITIONS. THIS LEADS TO UNNECESSARY DUPLICATION AS WELL AS NEGLECT OF PROBLEM AREAS FACING FOOD AND AGRICULTURAL PROGRESS IN DEVELOPING WORLD.

<<< STRATEGY >>>

SUPPORT LIMITED PILOT PROJECT ACTIVITY IN COMPUTERIZATION OF DATA TO DETERMINE APPROACHES AND METHODOLOGY NEEDED TO COLLECT, ORGANIZE, STORE, EVALUATE, RETRIEVE AND DISTRIBUTE INFORMATION QUICKLY AND ECONOMICALLY ON AGRICULTURAL RESEARCH ALREADY PERFORMED OR IN PROGRESS IN 14 AFRICAN COUNTRIES.

<<< LOGICAL FRAMEWORK >>>

GOAL: INCREASE PRODUCTION OF MORE NUTRITIOUS DISEASE-RESISTANT, HIGH YIELDING CROPS, AND ANIMAL AGRICULTURE FOOD PRODUCTS.

PURPOSE: STRENGTHEN WORLDWIDE NETWORK OF INTERNATIONAL AND NATIONAL INSTITUTIONS ENGAGED IN RESEARCH.

OUTPUTS: 1.INVENTORY MADE OF RESEARCH COMPLETED OR IN PROGRESS AT AGRICULTURAL RESEARCH STATIONS IN 14 COUNTRIES INVOLVED. 2.DOCUMENTATION SYSTEM ESTABLISHED TO RECORD RESULTS OF PAST AND ON-GOING RESEARCH. 3.DIRECTORY DEVELOPED OF INSTITUTIONS, STATIONS, ON-GOING RESEARCH PROGRAMS, PERSONNEL, AND SUBJECT MATTER. 4.DIRECTORY DISTRIBUTED TO PROVIDE COORDINATION AND CROP LINKAGES. 5.QUESTION AND ANSWER SERVICE ESTABLISHED. 6.QUALITY OF RESEARCH STATIONS AND WORK PERFORMED ASSESSED.

INPUTS: 1.FAO REGIONAL REPRESENTATIVES, FIELD STAFF AND CONSULTANTS. 2.FAO WORLD SOIL MAP AND SOIL CLASSIFICATION DATA. 3.LINKAGES ESTABLISHED WITH UN INTER-ORGANIZATIONAL BOARD ON MANAGEMENT INFORMATION. 4.INTERNATIONAL SYSTEM FOR AGRICULTURAL SCIENCE AND TECHNOLOGY LINKAGES. 5.COMPUTER EXPERTISE OF SSIE. 6.COUNTRY PARTICIPATION BY 14 AFRICAN COUNTRIES. 7.LINKAGES WITH INTERNATIONAL RESEARCH INSTITUTIONS.

<<< ABSTRACT >>>

COMPUTERIZED AGRICULTURAL RESEARCH INFORMATION SYSTEM (CARIS) PROJECT WAS FIRST BROUGHT TO ATTENTION OF AID IN 1971 WHEN PILOT PROJECT WAS INITIATED. AID CONTRIBUTED $15,000 TO PILOT PROGRAM. ON BASIS OF RESULTS ACHIEVED AND OF EXPERIENCE GAINED DURING PROJECT, INCLUDING ITS EVALUATION AND RESULTING CLARIFICATIONS OF NEEDS AND REQUIREMENTS OF USERS AND OBSERVATIONS AND RECOMMENDATION OF TECHNICAL ASSISTANCE COMMITTEE MEMBERS, IT IS PROPOSED TO ESTABLISH A CURRENT AGRICULTURAL RESEARCH INFORMATION SYSTEM (CARIS) WITH WORLDWIDE COVERAGE. CARIS PROJECT PROVIDES RESOURCE FOR IMPROVED COMMUNICATIONS BETWEEN INSTITUTIONS AND SCIENTISTS. INFORMATION DEVELOPED

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****
9310974 Technical Assistance
COMPUTERIZED AGRI INFO SYSTEM
FY 76 - 78 Status: C Total LOP Cost (x000): $ 215
Loan or Grant / Appropriation Code / LOP Cost: G / FN / 215
****

<<< DEVELOPMENT PROBLEM >>>

RESEARCH IN AGRICULTURE TENDS TO BE DECENTRALIZED AND TO SOME EXTENT FRAGMENTED OVER WIDE RANGE OF LOCATIONS AND ECOLOGICAL CONDITIONS. THIS LEADS TO UNNECESSARY DUPLICATION AS WELL AS NEGLECT OF PROBLEM AREAS FACING FOOD AND AGRICULTURAL PROGRESS IN DEVELOPING WORLD.

<<< STRATEGY >>>

SUPPORT LIMITED PILOT PROJECT ACTIVITY IN COMPUTERIZATION OF DATA TO DETERMINE APPROACHES AND METHODOLOGY NEEDED TO COLLECT, ORGANIZE, STORE, EVALUATE, RETRIEVE AND DISTRIBUTE INFORMATION QUICKLY AND ECONOMICALLY ON AGRICULTURAL RESEARCH ALREADY PERFORMED OR IN PROGRESS IN 14 AFRICAN COUNTRIES.

<<< LOGICAL FRAMEWORK >>>

GOAL: INCREASE PRODUCTION OF MORE NUTRITIOUS DISEASE-RESISTANT, HIGH YIELDING CROPS, AND ANIMAL AGRICULTURE FOOD PRODUCTS.

PURPOSE: STRENGTHEN WORLDWIDE NETWORK OF INTERNATIONAL AND NATIONAL INSTITUTIONS ENGAGED IN RESEARCH.

OUTPUTS: 1.INVENTORY MADE OF RESEARCH COMPLETED OR IN PROGRESS AT AGRICULTURAL RESEARCH STATIONS IN 14 COUNTRIES INVOLVED. 2.DOCUMENTATION SYSTEM ESTABLISHED TO RECORD RESULTS OF PAST AND ON-GOING RESEARCH. 3.DIRECTORY DEVELOPED OF INSTITUTIONS, STATIONS, ON-GOING RESEARCH PROGRAMS, PERSONNEL, AND SUBJECT MATTER. 4.DIRECTORY DISTRIBUTED TO PROVIDE COORDINATION AND CROP LINKAGES. 5.QUESTION AND ANSWER SERVICE ESTABLISHED. 6.QUALITY OF RESEARCH STATIONS AND WORK PERFORMED ASSESSED.

INPUTS: 1.FAO REGIONAL REPRESENTATIVES, FIELD STAFF AND CONSULTANTS. 2.FAO WORLD SOIL MAP AND SOIL CLASSIFICATION DATA. 3.LINKAGES ESTABLISHED WITH UN INTER-ORGANIZATIONAL BOARD ON MANAGEMENT INFORMATION. 4.INTERNATIONAL SYSTEM FOR AGRICULTURAL SCIENCE AND TECHNOLOGY LINKAGES. 5.COMPUTER EXPERTISE OF SSIE. 6.COUNTRY PARTICIPATION BY 14 AFRICAN COUNTRIES. 7.LINKAGES WITH INTERNATIONAL RESEARCH INSTITUTIONS.

<<< ABSTRACT >>>

COMPUTERIZED AGRICULTURAL RESEARCH INFORMATION SYSTEM (CARIS) PROJECT WAS FIRST BROUGHT TO ATTENTION OF AID IN 1971 WHEN PILOT PROJECT WAS INITIATED. AID CONTRIBUTED $15,000 TO PILOT PROGRAM. ON BASIS OF RESULTS ACHIEVED AND OF EXPERIENCE GAINED DURING PROJECT, INCLUDING ITS EVALUATION AND RESULTING CLARIFICATIONS OF NEEDS AND REQUIREMENTS OF USERS AND OBSERVATIONS AND RECOMMENDATION OF TECHNICAL ASSISTANCE COMMITTEE MEMBERS, IT IS PROPOSED TO ESTABLISH A CURRENT AGRICULTURAL RESEARCH INFORMATION SYSTEM (CARIS) WITH WORLDWIDE COVERAGE. CARIS PROJECT PROVIDES RESOURCE FOR IMPROVED COMMUNICATIONS BETWEEN INSTITUTIONS AND SCIENTISTS. INFORMATION DEVELOPED COMPLEMENTS NATIONAL, REGIONAL AND INT'L RESEARCH PROGRAMS.

(SOURCE: PD-AAD-218-B1)

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Exhibit

<<< DOCUMENTS RELATED TO PROJECT 9310974 >>>

PD-AAD-219-A1 Miscellaneous Project Documents ISN=21277
CURRENT AG RESEARCH INFORMATION SERVICE
, EN
9310974

PD-AAD-218-B1 Non-Capital Asst Project Proposal (PROP)
ISN=21276
CURRENT AG RESEARCH INFORMATION SERVICE
5 FEB 1972, 33P, EN
9310974

(See project description for abstract.)

PD-AAA-482-A1 Special Evaluation Report ISN=23630
SPECIAL EVALUATION; CARIS-CURRENT AGRICULTURAL RESEARCH INFORMATION SERVICE
BAIRD, GUY B.
1 FEB 1977, 4P, EN
DIC Call No: 630.72025B163
9310974

THIS SPECIAL EVALUATION CONSISTS OF TWO SHORT REPORTS WRITTEN IN FEBRUARY 1976 AND FEBRUARY 1977. IN THE FIRST REPORT, THE EVALUATORS WERE FAVORABLY IMPRESSED BY THE PROGRESS MADE TOWARD PUBLICATION OF THE THREE DIRECTORIES (A DIRECTORY OF RESEARCH WORKERS, A DIRECTORY OF RESEARCH INSTITUTIONS, AND A DIRECTORY OF RESEARCH PROGRAMS) PROJECTED WITHIN THE TWO-YEAR PERIOD UNDER CGIAR FUNDING,BUT THEY WERE DISCOURAGED WITH THE OUTLOOK OF SUPPORT FOR CARIS (CURRENT AGRICULTURAL RESEARCH INFORMATION SERVICE) WITHIN THE REGULAR FAO (FOOD AND AGRICULTURE ORGANIZATION) BUDGET. THEY CONCLUDED THAT FURTHER SUPPORT FOR CARIS SHOULD BE DEFERRED PENDING CLARIFICATION OF: (1)THE REQUIREMENTS TO COMPLETE THE DIRECTORIES AND INTENT OF FAO TO EMPLOY THE NEEDED CONSULTANTS; AND (2)THE POSITION OF FAO IN INCLUSION OF CARIS AS AN ACTIVITY IN THE REGULAR PROGRAM. ONE YEAR LATER, IN 1977, THE EVALUATOR FOUND THAT REASONABLY GOOD PROGRESS WAS BEING MADE TOWARD BRINGING OUT THE DIRECTORIES. HOWEVER, THE BUDGETARY POSITION FOR THE WORK LEADING TO AND INCLUDING PUBLICATION OF THE DIRECTORIES WAS NOT CLEAR. THE MAJOR PROBLEM WAS BELIEVED TO BE LACK OF CGIAR INTEREST IN THIS PROJECT. THE EVALUATOR CONSIDERED THE FAO BUDGET FOR CARIS FOR 1978/79 TO BE, AT BEST, BARELY ADEQUATE, AND HE STATED THAT THE FUTURE OF CARIS WAS UNCERTAIN AT THAT TIME.

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Indexes for the DIS fiche

The following indexes should be produced using COM to provide access to the set of 34 DIS fiche.

Title of index	# pages	# fiche
Geographic index	78	1
Project title index	78	1
Project title KWIC index	312	2
Subject category index	78	1
Purpose code index	91	1
Technical code index	91	1
	Total:	7
Additional, questionable indexes		
Primary descriptor index[1]	271	2
Descriptor index[2]	2249	9

Indexes for the source document (PD/PN) collection

The following indexes can be COM generated to support Missions with a source document fiche collection.

Title of index	# pages	# fiche
Title index[3]	3800	14
Title KWIC index[4]	7000	26
Primary descriptor index[5]	-	-
Descriptor index[6]	37622	139
Project index[7]	3000	11

---

1 Requires re-indexing: Assign average of 3.5 terms to each project, 1 man-year.

2 Estimate of 29 descriptors per project.

3 At 8.5 catalog entries per page.

4 At 40 entries per page (index contains KWIC key + DOCID only). Rough estimate of 8.5 words per title on the average.

5 Weighted indexing has only recently been instituted; re-indexing all of DOCUMENT database not feasible.

6 Estimated average of 10 descriptors per document (high because of past indexing practices). 8.5 catalog entries per page.

7 Would exclude the 19,000 documents with no project number. Seven entries per page.

Fiche reader equipment

Suggest a reader such as the Micron 770 or 775, with dual lenses and dual carriers. This reader is specially suited for both COM and source document viewing. Switching magnification is relatively easy. Unfortunately, COM fiche reads top to bottom and source document fiche left to right.

Micron 770 reader: (approx)	$235 retail	($185 - $200 when buying 30 units)
	10 dual carrier	
	40 dual lens feature	
	$285 Total	

APPENDIX 3

SOFTWARE DISTRIBUTORS

BRS Search	BRS 1200 Route 7 Latham, NY 12110 (518) 783-1161
Condor	Condor Computer Corporation 2051 S. State Street Ann Arbor, MI 48104 (313) 769-3988
dBaseII	Ashton-Tate 10150 W. Jefferson Blvd Culver City, CA 90230 (213) 204-5570
Golden Retriever	California Library Authority for Systems & Serials (CLASS) 1415 Koll Circle Suite 101 San Jose, CA 95112-4698 (408) 289-1756
Inmagic	Warner-Eddison Associates 186 Alewife Brook Parkway Cambridge MA 02138 (617) 661-8124
Inquire	IBM
Personal Bibliographic System	Personal Bibliographic Software, Inc. P.O. Box 4250 Ann Arbor, MI 48106 (313) 996-1580
Scimate	Institute for Scientific Information 3501 Market Street University City Science Center Philadelphia, PA 19104 (800) 523-4092
Star	Cuadra Associates 2001 Wilshire Boulevard Suite 305 Santa Monica CA 90403 (213) 829-9972
Superfile	
Uniface	Tacoma Public Library 1102 Tacoma Avenue South Tacoma, WA 98402 (206) 591-5654

Appendix 4

Individuals/Institutions Contacted

Brodart
Carol Rickert, Eastern Regional Sales Manager
500 Arch Steet
Williamsport, PA 19705
(800) 233-8467
(717) 326-2461

BRS
Jane Caldwell
1700 N. Moore St.
Suite 2100
Rosslyn Metro Bldg.
Arlington, VA 22209
(703) 527-4503

Gaylord Bros. Inc.
Box 4901
Syracuse, NY 13221
(800) 448-6160
(315) 457-5070

James E. Rush & Associates (JERA)
2223 Carriage Rd.
Powell, OH 43065
(614) 881-5949

Lynn McDonald, FLC
Bruce Miller, Fedlink

VITA
Gary Garriott
1815 N. Lynn St.
Arlington, VA 22209
(703) 276-1800

WASH Project
Jean Pease
CDM
243-8200

James C. Knowles
Research Triangle Institute
PO Box 12194
Research Triangle Park, NC 27709
(919) 541-6362

William Schauffler, AID/IRM/PS
Kathy Smith, AID/IRM
Pete Errington, AID/IRM

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APPENDIX 5

REFERENCES

Directory; yellow pages to the world of microcomputers. Fairfax, Va., PC Clearinghouse, 7th ed., 1983.

LIST, directory of software, September 1983.

Rorvig, Mark E. Microcomputers and libraries: a guide to technology, products and applications. New York, Knowledge Industry Publications, Inc., 1981. 135p.

Stilwell, Thomas C. Periodicals for microcomputers; an annotated bibliography. MSU Dept of Agricultural Economics. Working Paper No. 6, 1983. 67p.

Stilwell, Thomas C. Software directories for microcomputers; an annotated bibliography. MSU Dept of Agricultural Economics. Working Paper No. 9, 1983. 14p.

Walton, Robert A. Microcomputers: a planning and implementation guide for librarians and information professionals. Phoenix, Oryx Press, 1983. 96 pp. $18.50. Pt. 1 Hardware; Pt.2 Software; Pt.3 Procurement and management of microcomputer systems in libraries.

Weber, Michael T., et al. Microcomputers and programmable calculators for agricultural research in developing countries. MSU Dept of Agricultural Economics. Working Paper No. 5, 1983. 113p.

Weintraub, Susan G. Manual for the Use of the Development Information Center Database System. Washington, A.I.D. Document and Information Handling Facility, March 1981, Revised December 1982.

International Software Database, Dialog File 232, Search executed August 1983.

U.S. Agency for International Development. Division of Information Resources Management. Use of microcomputers within A.I.D. July 1982