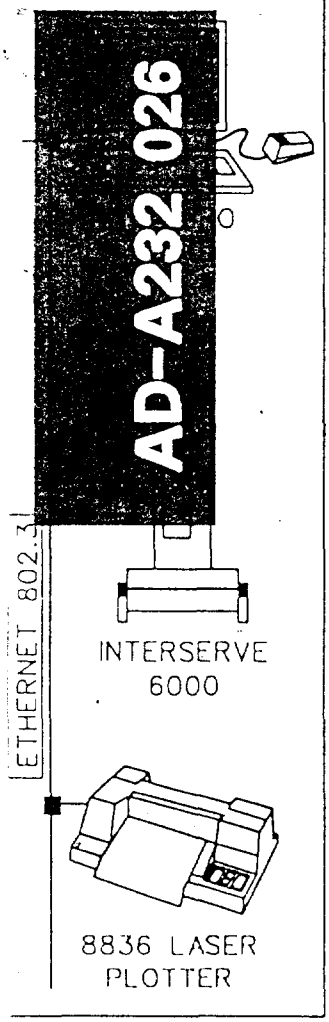
US Army Corps of Engineers



INFORMATION TECHNOLOGY LABORATORY

MISCELLANEOUS PAPER ITL-91-1

2

INTEGRATION OF AUTOMATED SYSTEMS IN THE DIRECTORATE OF ENGINEERING HOUSING

by

CADD Center

Information Technology Laboratory

DEPARTMENT OF THE ARMY
Waterways Experiment Station, Corps of Engineers
3909 Halls Ferry Road, Vicksburg, Mississippi 39180-6199

January 1991
Final Report

Destroy this report when no longer needed. Do not return it to the originator.

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	January 1991	Final report

4. TITLE AND SUBTITLE

Integration of Automated Systems in the Directorate of Engineering Housing

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

USAE Waterways Experiment Station, Information Technology Laboratory, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199

8. PERFORMING ORGANIZATION REPORT NUMBER

Miscellaneous Paper ITL-91-1

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Available from National Technical Information Service, 5205 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report recommends particular configurations of hardware and software for small, medium, and large Directorates of Engineering and Housing (DEH) offices. It also contains various other features of an integrated system including telecommunications, database management, and interaction between offices and disciplines.

The DEH Special Advisory Task Group (SATG) is an advisory task group of the Computer-Aided Design and Drafting Center (CADD) located in the Information Technology Laboratory at the US Army Engineer Waterways Experiment Station. It is organized to better inform the DEH community about CADD, transfer CADD knowledge contained within the Corps and to the DEH community, and to provide the CADD Center and other Corps offices information on how to better service DEH needs regarding CADD.

14. SUBJECT TERMS

15. NUMBER OF PAGES 21

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		

PREFACE

This documents describes the methods by which the Directorates of Engineering and Housing (DEH) should integrate existing automation systems. Specifically this document discusses the integration of Computer-Aided Design and Drafting (CADD) equipment with the Army's corporate database (IFS-M) and other programs such as RPLANS, HOMES, and the EMS systems. A standard hardware system configuration for a small system and a medium-large system is recommended. A standard non-graphic database software application and the acceptance of the Engineering Manual "Standards Manual for U.S. Army Corps of Engineers Computer-Aided Design and Drafting (CADD) Systems" are also addressed.

The authors of this report, members of the DEH Special Advisory Task Group (SATG) sub-committee on Integration, were:

Mr. Ron Niemi, CEHSC (chairman)
Dr. Sine Farrell, CERL
Ms. Debra Brinager, CERL
Mr. Gerald McClintock, USAREUR
Mr. Owen Estes, Fort Riley
Mr. Khiem Luu, EHSC
Mr. Carl Stephens, WES, Chief CADD Center
CPT Bob Felix, WES

Work on this document was performed under the direction of Dr. N. Radhakrishnan, Chief, Information Technology Laboratory, US Army Engineer Waterways Experiment Station (WES), and Dr. Edward Middleton, Chief, Computer-Aided Engineering Division.

Commander and Director of WES was COL Larry B. Fulton. Technical Director was Dr. Robert W. Whalin.

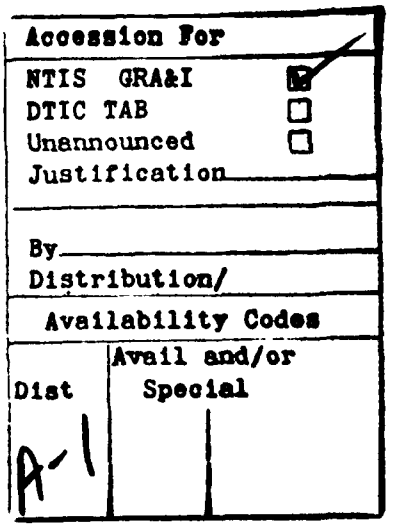


TABLE OF CONTENTS

INTRODUCTION

This paper discusses the need to integrate the various individual automated systems in the Directorate of Engineering and Housing (DEH). The concept is to share common data in a central database, thereby reducing the duplication of data that exists between current and in-bound systems. This paper also recommends a standard CADD hardware architecture for installations, Corps of Engineer CADD standards, and a standard database software.

The Directorates of Engineering and Housing (DEHs) on Army Installations are currently facing a most difficult and tremendously challenging period in trying to adequately manage their numerous missions. Among the most complex tasks to accomplish even during more prosperous times is information coordination, dissemination, and management. The technological advances in computer automation have made these tasks easier, faster, and improved the accuracy of performance. These technological advances, however, present significant challenges to conquer in order to efficiently and effectively utilize the technology.

The concern of the DEH Special Advisory Task Group subcommittee on Integration and Standardization is that numerous unrelated and incompatible automated computer programs have been generated by a variety of governmental activities and contractors and several more are programmed or under development. These programs have, by and large, been developed for a specific use and for specific computer platforms with usually little or no regard for compatibility with the DEH automated database of record, the Integrated Facilities System - Mini/Micro (IFS-M). Development of graphics and non-graphics databases is ongoing at many DEHs. To date there appears to have been little or no development towards integration or compatibility between the graphics and IFS-M databases. The bulk of these graphic databases appear to have been developed or are being developed in an Intergraph CADD format.

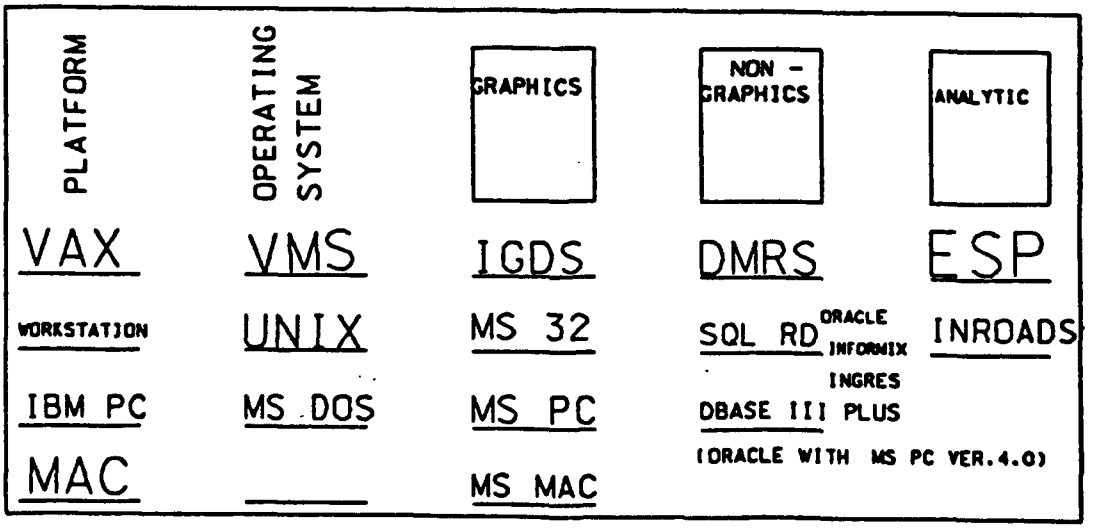
In today's economic environment, the DEHs are faced with severe resource restrictions and therefore must focus their efforts on working smarter than ever before. The DEHs cannot afford to purchase a variety of automated programs operating on multiple platforms/systems that often provide for duplicate information. With limited resources, the DEHs cannot afford to continually train numerous personnel on multiple computer platforms, nor can they afford the cost of the associated equipment maintenance. The DEHs must, therefore, be capable of maximizing their automation capability while minimizing their investment in equipment, personnel training, and equipment maintenance.

It is not the intent of the DEH SATG subcommittee on Integration and Standardization to limit automation development, but to promote automation compatibility and standardization by utilization of existing major equipment platforms to the maximum extent possible in developing future automation. Compatibility and standardization, not only within the DEH activity, but also between the DEHs and the Corps of Engineers, is paramount for efficiently transferring information to meet today's mission requirements as well as those in the foreseeable future.

DEFINING GRAPHICS AND NON-GRAPHICS

When the user draws a line in any graphical system, that line is defined with a starting xyz coordinate and an ending xyz coordinate. The line is further defined by a certain color, weight (or thickness) and style (ie. dotted or dashed line). All of this information resides in the graphical database for that particular line.

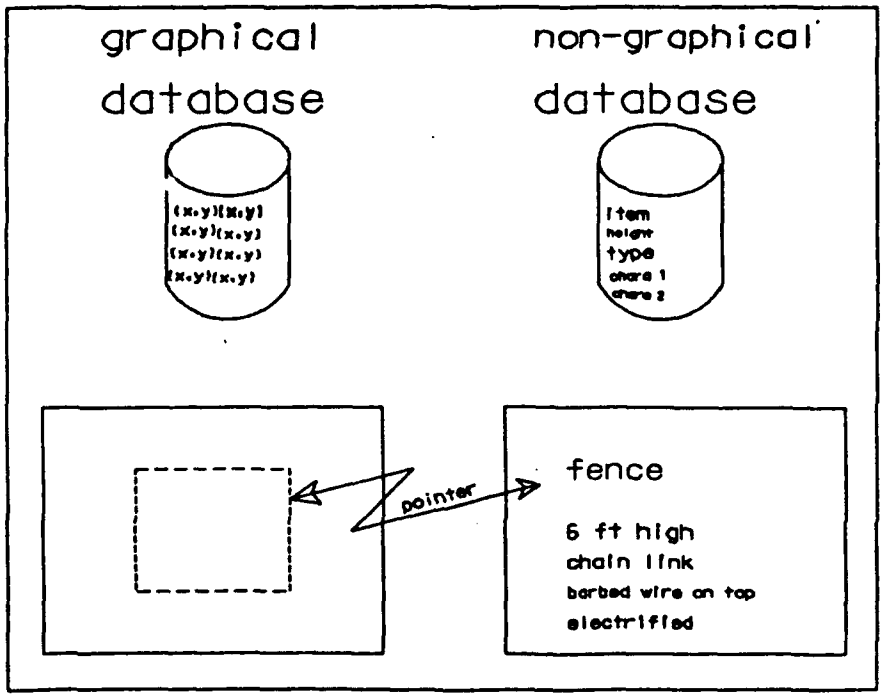
That line may represent a fence in the diagram. That fence may have certain characteristics we need to remember. We don't want to place those characteristics on the diagram because they would clutter the picture. Therefore, we place those characteristics in a non-graphical database. CADD has the ability to link the two databases together so that we connect the graphical database to the non-graphical database. What this allows us to do, while in the graphics mode, is point to the line that represents a fence and the non-graphical or attribute information appears on the screen.



There are three basic parts to Computer-Aided Design and Drafting (CADD): a graphics database, a non-graphics database and an analytical portion. Graphics is the human-to-machine interfacing controller of the three parts.

Graphics software for the VAX is IGDS (Integrated Graphical Design System). Microstation 32 is the graphics software for the Intergraph workstation, and Microstation PC is the graphics software for an IBM compatible PC.

Non-graphical software for the VAX is DMRS (Database Management Retrieval System). Non-graphic software for the Intergraph workstation is any of the SQL (Structured Query Language) Relational Databases such as Informix, Oracle and Ingres, and DBASE III Plus or Oracle for any IBM compatible PC.



Currently the Corps standard graphics system is Intergraph and the non-graphic system is IFS-M. By linking graphics to the IFS-M non-graphical database the DEH has access to the most powerful tool available - integrated graphic and non-graphic information.

INTEGRATION -- HARDWARE STANDARDS

In pursuit of database integration, hardware and software compatibility issues must be resolved. This section discusses hardware connectivity architecture standards for data sharing between graphic and non-graphic based automated information systems.

1. CADD System Platform Standards:

a) The current Corps-wide CADD system acquisition program embodies a wide range of products from Intergraph Corporation. This program provides a "total solution" support for the MACOMs/DEHs graphical information processing requirements. The "total solution" concept of a single source for hardware, software, and system support offers certain operational compatibilities between MACOMs and DEH organizations. Furthermore, Intergraph products support a distributed data processing capability that is in compliance with the International Standards Organization (ISO) Open System Interconnect (OSI) Protocols. Intergraph's conformity to the international OSI protocols is an advantage for the DEH organizations when networking to other government host systems using the proposed government OSI protocols (GOSIP). Currently, GOSIP is under development and will be based on the OSI standards.

b) Standard System Configurations: The following CADD system configurations are based on Intergraph Corporation and other vendor's products approved for the Corps-wide CADD system acquisition program (Reference Contract No: DACW87-87-D-0092). The server based system configuration is applicable for medium to large DEH installations, MACOM DEHs, and HQ DA activities. The UNIX workstation configuration is applicable for medium installations, and the personal computer system is applicable for small DEH's. A recommendation by the DEH SATG subcommittee on Integration and Standardization is also presented for system configuration purchasing.

1) Server Based System Configuration:

- Main System Processor: 10 MIPS RISC Processor, 48 MB Memory, 670 MB Disk Drive, 3 1/2" Floppy Disk Drive, UNIX V, Environment Level V (CLIX), NFS and TCP/IP Networking Software, and Interplot. Recommend: Interserve 6000 System.

- UNIX Workstation: 19" Color Monitor, 10 MIPS RISC Processor, 16 MB Memory, 180 MB Hard Disk, 3-1/2" Floppy Disk Drive, UNIX V, Environment Level V (CLIX), NFS and TCP/IP Networking Software, and either a Mouse or Digitizing Cursor and Tablet. Recommend: Interpro 6040 Workstation.

- Mass Storage Subsystem: Cartridge Tape Drive (QIC 6250 bpi format).

- Output System: Laser Plotter, 400 DPI Resolution. Recommend: Versatec 8836 Laser Plotter.

- Recommended CADD System Software: Microstation 32, Looking Glass Desktop Manager, DB Access, and Relational Interface System (RIS) Software (networking version), and ORACLE RDBMS.

2) Workstation Based System Configuration:

- Main System Processor: 10 MIPS Clipper Processor, 16 MB Memory, 180 MB Disk Drive, 3-1/2" Floppy Disk Drive, UNIX V, Environment Level V, NFS and TCP/IP Networking Software, 19" Color Monitor, Mouse or Digitizing Cursor and Tablet. Recommend: Interpro 6040.

- Mass Storage Subsystem: Cartridge Tape Drive (QIC 6250 bpi format).

- Output System: Hewlett-Packard Graphics Language (HPGL) based pen plotter. Recommend: HP 7595 Pen Plotter, or if high volume is anticipated, a 400 DPI Laser Plotter, recommend Versatec 8836.

- Recommended CADD System Software: Microstation 32, Looking Glass Desktop Manager, DB Access, Relational Interface System (RIS) Software, and ORACLE.

3) Personal Computer Workstation System Configuration:

- Main System Processor: 19" Color Monitor, 80386 or 80486 Processor with Math Coprocessor, 8 MB memory, 120 MB Hard Disk, 5-1/4" High Density Floppy Disk Drive, MicroStation PC compatible high resolution graphics card, Windows 3.0, PC/NFS networking software, and mouse or digitizing tablet and cursor.

- Mass Storage Subsystem: Cartridge Tape Drive

- Output System: Hewlett-Packard Graphics Language (HPGL) based pen plotter. Recommend: HP7595 Pen Plotter

- CADD System Software: MicroStation PC, ORACLE

2. Connectivity Architecture Standards:

a) The DEH organizations have many diverse operations. These operations are being supported by various Management Information Systems (MIS), such as IFS-M, FESS, HOMES, etc. These MIS systems reside on several types of hardware platforms and maintain their own unique and independent database system. Under the existing configuration, the IFS-M database system has been mandated by DA as the corporate database system to serve all other MISs operated by the DEHs.

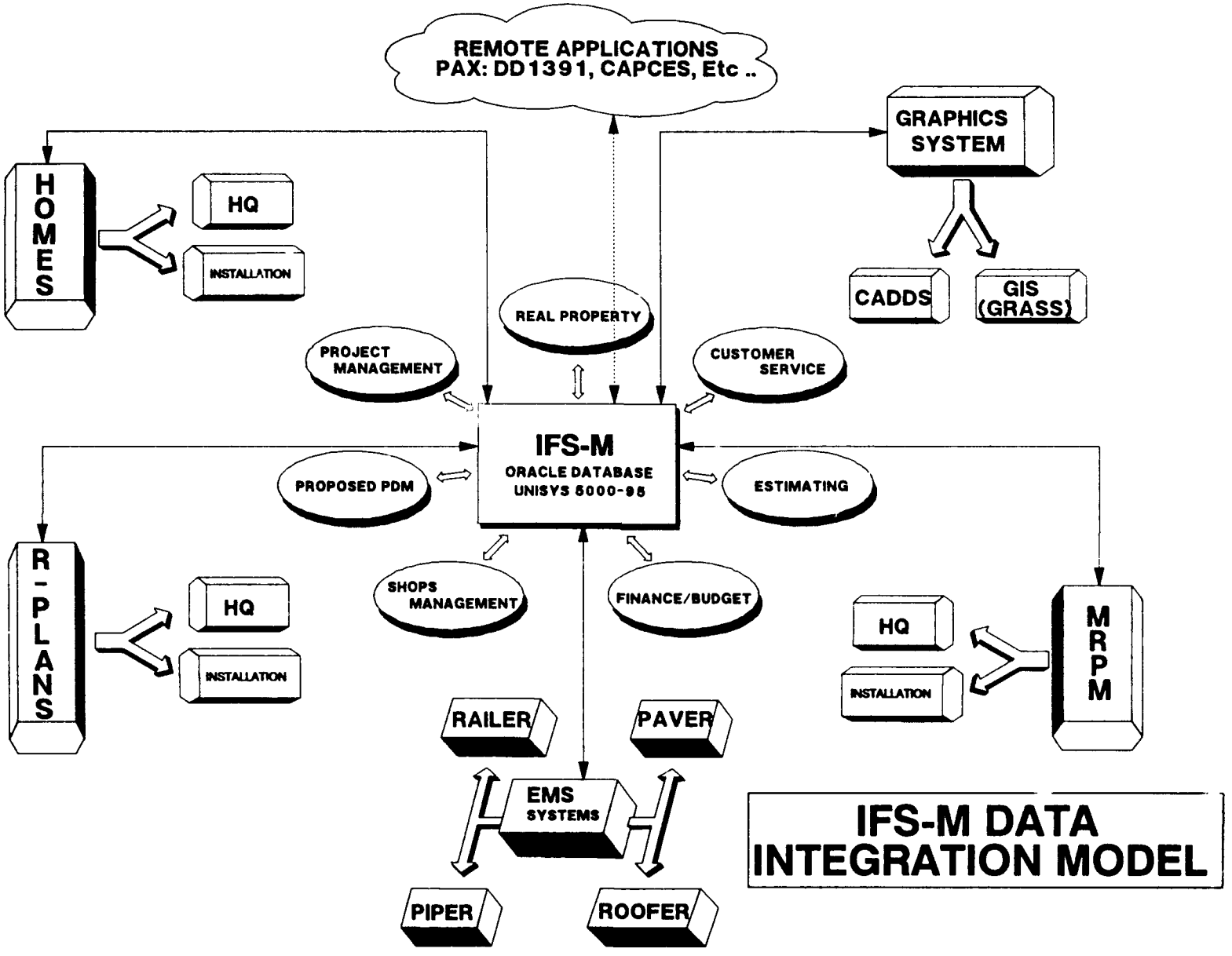
b) A system connectivity architecture is required to standardize the data distribution and processing tasks between the non-graphical based IFS-M corporate database system, and the graphical based Intergraph CADD system. The general framework for such connectivity architecture is modeled from three primary node connectivity groupings: Host Node, Communications Node, and Peripherals Node. The nodes connectivity grouping is necessary because of varying system characteristics of each MIS. Connectivity linkage of each group is described as follow:

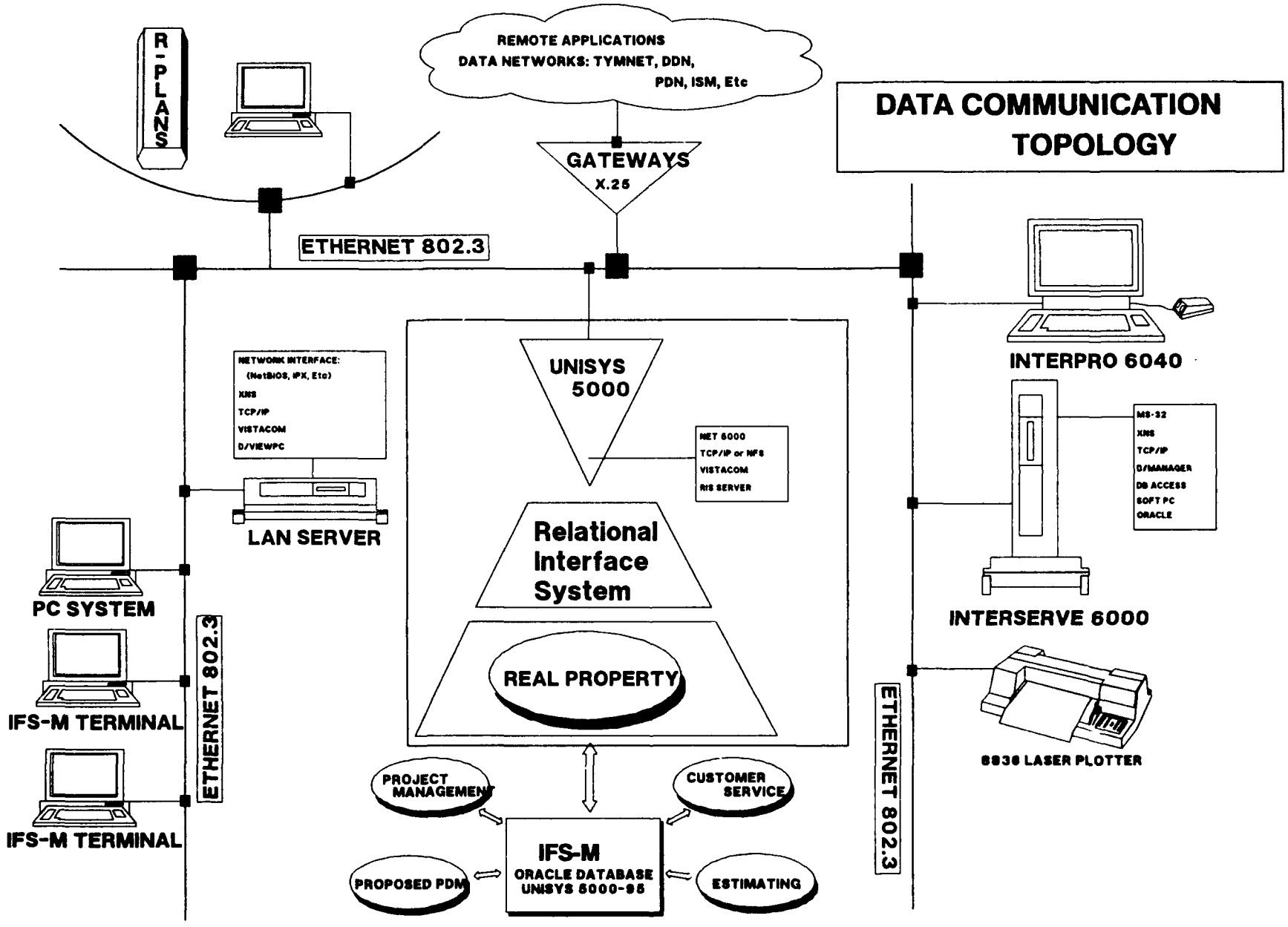
- Host Node consists of host processors that supply data, access method, and network control. This group contains the IFS-M corporate database system operating on the Unisys 5000 and Intergraph graphical database operating on the Interpro or the Interserve systems.

- Communication Node consists of communication and network controllers that provide connectivity between host and workstation. This group could contain several types of Local Area Network Systems, i.e., 3Com 3Plus, Banyan Vines, IBM Token-Ring, etc.

- Peripherals Node consists of hardware and software that supports end-user activity. This group contains terminal, workstation, applications software, distributed applications, plotters, etc .

The interoperability between these node connectivity groups depends greatly on the selection of a data transport protocol. Currently, the Unisys 5000 platform contains the corporate database and supports the Transport Control Protocol/Internet Protocol (TCP/IP) data transport protocol. Thus, it is crucial that TCP/IP protocol be implemented as the data transport standard for all three node connectivity groups in order to attain maximum interoperability between system platforms. The SATG Integration Sub-Committee recommends that Intergraph's TCP/IP optional network protocol and file sharing software be implemented as a standard requirement for all CADD system configurations.


REMOTE APPLICATIONS
PAX: DD1391, CAPCES, Etc ..
GRAPHICS SYSTEM
HOMES
HQ
INSTALLATION
CADDS
GIS (GRASS)
REAL PROPERTY
PROJECT MANAGEMENT
CUSTOMER SERVICE
IFS-M
ORACLE DATABASE
UNISYS 5000-95
PROPOSED PDM
ESTIMATING
R-PLANS
HQ
INSTALLATION
SHOPS MANAGEMENT
FINANCE/BUDGET
HQ
INSTALLATION
MRPM
RAILER
PAVER
EMS SYSTEMS
PIPER
ROOFER
IFS-M DATA INTEGRATION MODEL


DATA COMMUNICATION TOPOLOGY
R-PLANS
REMOTE APPLICATIONS
DATA NETWORKS: TYMNET, DDN,
PDN, ISM, Etc
GATEWAYS
X.25
ETHERNET 802.3
NETWORK INTERFACE:
(NetBIOS, IPX, Etc)
XNS
TCP/IP
VISTACOM
D/VIEWPC
LAN SERVER
UNISYS
5000
NET 6000
TCP/IP or NFS
VISTACOM
RIS SERVER
Relational
Interface
System
REAL PROPERTY
INTERPRO 6040
MS-32
XNS
TCP/IP
D/MANAGER
DB ACCESS
SOFT PC
ORACLE
INTERSERVE 6000
8836 LASER PLOTTER
PC SYSTEM
IFS-M TERMINAL
IFS-M TERMINAL
ETHERNET 802.3
ETHERNET 802.3
PROJECT
MANAGEMENT
CUSTOMER
SERVICE
IFS-M
ORACLE DATABASE
UNISYS 5000-95
PROPOSED PDM
ESTIMATING

INTEGRATION -- SOFTWARE STANDARDS

The sharing of common data between the Integrated Facilities System-Mini/Micro (IFS-M), the numerous stand-alone DEH related systems such as PAVER, CAMMS, RPLANS etc., and the CADD systems at the installation requires a thorough examination to determine the plausibility of either total system integration or interfacing at the data element level. In order to have compatible systems that can be easily and accurately interfaced to each other, current and future system hardware platforms, the various systems to be considered, and their supporting software must be identified and adhered to in the field as "standards". The previous section has described the hardware issues to be considered during the integration operation and this section outlines the similar system and software related issues.

The current efforts to integrate CADD systems and other non-homogeneous DEH related systems are in their infancy. Different systems have been developed for specific installation needs and have become essential tools for each DEH to conduct business. A coordinated effort must be made to interface all these systems so that they share the same database and data elements, and can be supported centrally for all different installations.

In their Criteria Search and Analysis Report (Jan 1990) for the TM 5-803-3 "Automated Map Data Base Standards for Army Installations", Dewberry and Davis summarize their findings regarding existing systems and applicable software being used in the field. Most of the systems which are being used by the DEH use either Dbase III+, Oracle, Intergraph, or AutoCad. In order for interfaces to be built and supported at the Army level, all systems need to be able to share data which is resident in IFS-M and its Oracle database. In order to accomplish integration, similar software will have to be adopted in the field, and a concerted effort will have to be made at all levels to develop the interface mechanisms between these packages. Finally, a successful technical transfer plan should be developed for each new system that identifies and outlines the steps to be taken for data exchange at the DEH level.

This portion of systems planning and development should guarantee that reference has been made to integration or interface issues to ensure maximum system integration at the DEH level. As all systems which are used at the DEH become more integrated, and duplication of data entry becomes non-existent, a single user interface should be developed to minimize the impact of the plurality of systems in use. This user interface should be tailored to the pertinent functional areas necessary for the individual to perform his/her job in the most efficient and effective manner. This single user interface implies offering a consistency of user input which would render the change of system

or application transparent to the user. The task of identifying the individual system areas for each functional user, and mapping these requirements into a schema or template, would help in the development of standard DEH interfaces to all systems. The critical task at that point would be to keep these interfaces and user templates current and expediently distributed to all DEHs.

INTEGRATION -- GRAPHIC DATABASE STANDARDS

A. Defining the graphics database standards

The Corps of Engineers has developed CADD standards through numerous Single Discipline Task Groups functioning in the Corps. The immediate benefits of standards are many: consistent quality products, consistent requirements for the local district and A/E deliverables, and efficiencies derived from organization wide sharing of techniques and products. For example, if one district has to design and construct a barracks for an installation but do not have a mechanical engineer, they can send the necessary electronic drawings to a sister district with a mechanical engineer. The mechanical engineer can then see what the architect and electrical engineers have done and whatever work he decides to do will be on the correct level and have the correct line weight and style. Sharing drawings or data like this would not be possible if the Corps did not use CADD standards.

Installations have the same need to share information. An automated facility management system has the water utilities on one level with the water lines a specific color and line weight. The same is true for each of the other utilities. Each of the other utilities are on a different level from each other and have a different line color and weight. Suppose a water line breaks and is in need of repair. After the repairs are completed, it is necessary to update the graphic database. By using CADD standards, the graphics file is easily maintained. The updating of the graphics file can be done at the foreman's shop then transferred to the master planning file. The maintaining and sharing would not be possible if CADD standards where not used.

Graphical standards allows the use of "templating" a new development for one system and having everybody use that template, thereby reducing the cost of creating multiple templates to achieve the same result. When an installation begins the development of an automated system, the use of standards will reduce the cost of the A/E firm by giving him a template to work from. When changes need to be made, the task becomes an automated task if standards are used. For example, suppose all the buildings in a drawing file are to be changed from level one to level two. A user command can be written as the template and the task is done automatically. On the other hand, if standards are not used each change becomes a major manual task.

B. Defining the CADD Standards

CADD standards define the exact level, line code, line weight and line color for each graphical entity in a drawing. For example, buildings and large structures are on level 4 and have a line code of 0, a line weight of 2 and a line color of 4. Roads and parking lots are on level 8 and have a line code of 0, line weight of 2 and a line color of 6. Landscape planting is on level 21 and has a line code of 0, a line weight of 2 and a line color of 2.

The DEH SATG subcommittee on Integration and Standards has reviewed the Dewberry and Davis "Automated Map Data Base Standard for Army Installations" contract efforts, as well as the WES efforts to define CADD standards. The sub-committee recommends that the standards (symbology, line weight, colors, levels, etc) being proposed by the WES CADD Center (as recognized by the Dewberry and Davis study) be evaluated by a DEH with strong CADD experience. The subcommittee also recommends that the SATG choose the DEH, and further, funding for this effort should be provided by the SATG.

INTEGRATION -- NON-GRAPHIC DATABASE STANDARDS

A. Defining the Non-Graphics Database Standard

Currently there exists many different kinds of non-graphic databases being used in the DEH. In the CADD environment, the non-graphic database software is generally determined by the type of workstation used. The VAX based Intergraph workstation uses the database package, Data Management and Retrieval System (DMRS), which is part of the core software delivered by Intergraph on the Corps contract. Typically, Informix and ORACLE are the non-graphic databases used with the Microstation 32 UNIX-based workstations, DBASE III/III+ is used with the P.C. DOS-based workstations. There are other non-graphic databases used with both of the workstations, but the software noted above seem to be the most common.

A non-graphic database standard should be established to facilitate the sharing of information between different factions and systems within the DEH and eliminate like-data residing on different databases. Standardized fields and data attributes should be developed so that other applications and/or systems can interface transparently with the standard database's environment.

The DEH SATG subcommittee on Integration and Standards recommends that the relational database ORACLE become the non-graphic database standard for the workstation environment. The prevailing factors that contributed to this recommendation are as follows: a) ORACLE database software can be used with the Microstation 32 workstation, b) ORACLE provides flexibility in

that it can run on different platforms and operating systems, c) ORACLE was the database chosen for several standard Army systems currently in development or deployment (i.e., Integrated Facilities System - Mini/Micro, IFS-M) and d) ORACLE is fast becoming an "industry standard".

B. Defining the Standardized Data Fields/Elements

With a standard database defined, standardized data fields/elements can be defined. Since IFS-M tracks all Real Property Maintenance Activities, it seems logical to use IFS-M's data elements as the "templates" from which standards can be developed. These non-graphics standards would facilitate the task of non-homogeneous system integration at the data element level. The standards would dictate data element attributes such as field name, length, and alpha-numeric designation, and would guide system developers to match their system data with that of IFS-M's. In this way, total system integration at the data element level is accomplished.

A case in point: there are currently data elements in USAREUR's Master Planning database that have a counterpart in IFS-M. The USAREUR's data element name and associated attributes may be different but the functional description of the data element matches IFS-M's description.

Some examples of common structural data elements from the two databases are listed below:

USAREUR Data element	IFS-M Data Element
INSTALL_NO	INSTALLATION_NUMBER
INSTALL_NAM	INSTALLATION_NAME
IFS_FAC_NO	FACILITY_NAME
CAT_CODE	CATEGORY_CODE

The above data elements have different attributes assigned to them in each system however they are synonymous in application. There is no need for the above information to reside in two databases. Thus, if the USAREUR data elements were defined with the same attributes as IFS-M, the information could reside on IFS-M and be linked to the CADD database when needed. This would also alleviate duplicate data taking up critical disk space on the CADD system.

The above constitutes only a small part of the data elements that have been identified as common between CADD - databases and IFS-M. It is not within the scope of this paper to identify and catalog all the common data elements between them.

STANDARD OBJECTIVES

The discussion thus far points out the current trend in the efforts of many organizations to automate the DEH. The DEH has many automation systems residing on many different machines. Each machine is designed to perform one specific task. The DEH should be able to perform his/her job utilizing all available automated tools on a single workstation. All automation products should be developed with existing Army/ Corps of Engineer/ defacto standards (e.g. ORACLE RDBMS, Intergraph, IFS-M, etc.). Efforts should be made to move existing products/ tools into the set standards.

SUMMARY AND RECOMMENDATIONS

The purpose of this document is to recommend standards which will aid in the integration of graphics and non-graphics based systems. Our goal is to define the hardware, software, telecommunications, and data standards required to provide the DEH with the most effective mix of automated products with which to accomplish their mission.

1. Medium to Large CADD Systems: We recommend that future procurement by medium to large CADD DEH customers be from the Corps contract and use the Intergraph 6000 series server.

2. Small Systems: We have recommended that future procurement by small CADD DEH customers be from the Corps contract and employ the Intergraph 6000 series workstation. For those very small DEHs with only a few masterplanning and/or design personnel and small budgets, we recommend 80386 or 80486-based PCs running MS-DOS, DBASE III and Microstation PC. PC's may also be used in conjunction with UNIX based systems through the use of NFS and PC/NFS.

3. Non-Corps Contract Packages: We feel it is of particular importance that use of non-Corps contract graphics packages should be avoided. Corps automation policy requires that the districts/divisions utilize the Corps CADD contract. Since our goal is to facilitate an interface between Corps districts and DEHs and avoid the difficulties encountered when transferring files between Microstation software and other vendor's products, we strongly recommend that DEHs use only the Intergraph Microstation graphics software.

4. Telecommunications: In order to improve telecommunications between all graphics and non-graphics hardware, we recommend the use of the TCP/IP protocols. This is most important to ensure the easy transition of data between the CADD equipment and the Unisys 5000 based IFS-M.

5. Graphic Data Standards: Graphic standards must be adhered to in areas such as CADD symbology, line weights, colors, levels, etc. The SATG is currently involved with the WES CADD Center's and Dewberry and Davis's efforts in the development of such standards. We recommend a DEH be selected to review and evaluate the Corps of Engineers standards.

6. Non-Graphic Data Standards: Non-graphic data standards, as delineated by the IFS-M data dictionary, must be complied with in order to facilitate accessibility by other DEH systems that share the same data elements.

Attaining the goal of an integrated graphic and non-graphic corporate database, the above recommendations must be considered and implemented in a Corps-wide effort to combine all DEH data elements into one large database. This will involve a major commitment by personnel at all levels since the cost and efforts involved will be significant. We should keep in mind the ultimate vision of a totally integrated information environment for Army and Corps personnel in the year 2000.

COMPUTER-AIDED DESIGN and DRAFTING (CADD) CENTER

MISSION

To enable the Corps of Engineers to achieve the best use of CADD within the shortest time frame.

PURPOSE

The CADD Center is the Corps vehicle for sharing information and development work and minimizing duplication of effort while retaining local automonies and decentralized organizational structures.

MODE OF OPERATION

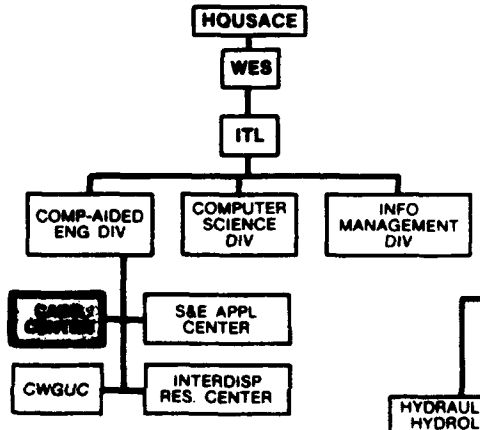
The Center is an end-user driven, technology transfer oriented organization. Single-Discipline Task Groups (SDTG) and Special Advisory Task Groups (SATG) are formed under headquarters guidance to get field office grass roots input into CADD activities. A Field Technical Advisory Group (FTAG) provides the guidance to the Center.

OBJECTIVE

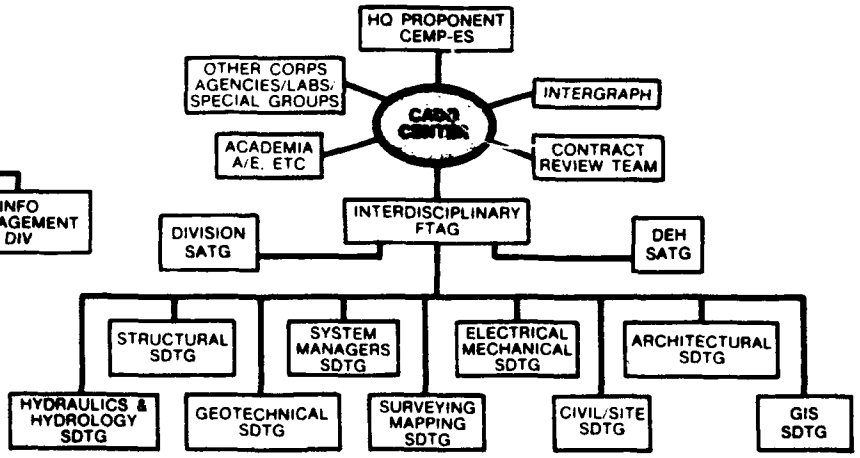
To integrate and implement CADD by:

- Furnishing technical advice
- Conducting training
- Evaluating products
- Providing advisory teams
- Initiating studies
- Promoting communications
- Distributing products

ORGANIZATIONAL CHART



FUNCTIONAL CHART



FTAG - FIELD TECHNICAL ADVISORY GROUP

SDTG - SINGLE DISCIPLINE TASK GROUP

SATG - SPECIAL ADVISORY TASK GROUP

CADD Center
Points of Contact

Information Technology Laboratory			**CEWES-IM-Z**
Chief, Dr. N. Radhakrishnan			(601) 634-2527
Computer-Aided Engineering Division			**CEWES-IM-D**
Chief, Dr. Ed Middleton			(601) 634-4020
CADD Center			**CEWES-IM-DA**
Chief, Mr. Sandy Stephens	(601) 634-2945	CPT. Robert Felix	(601) 634-2799
Mr. John Hood	(601) 634-3138	Mr. Toby Wilson	(601) 634-3604
Mr. Richard Bradley	(601) 634-2286	Mr. Steven Hatton	(601) 634-3509

"GUIDED BY THE FIELD"

US Army Corps of Engineers
CADD Center
Information Technology Laboratory
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, Mississippi 39180-6199

Office Symbol: CEWES-IM-DA
Ontyme: CEWES-IM-DA
(601) 634-4109
1-800-LAB-6WES
FAX (601) 634-2638

DIRECTORATE OF ENGINEERING AND HOUSING
SPECICAL ADVISORY TASK GROUP MEMBERSHIP

HEADQUARTERS PROPONENT

ED	RACHT	OCE	CEMP-ES	(202)272-0232

TASK GROUP CHAIRMAN

BRICK	WELLS	F01	FCEN-CDP	(404)362-7234

ACTIVE MEMBERS

BECKY	BEW	F03	AFZA-DE-P	(919)432-5300
JIM	DELK	A01	AMXEN-M	(309)782-6137
OWEN	ESTES	F19	AFZN-FE	(913)239-6653
SERGE	SALTIEL	T17	ATZR-EEP	(405)351-5708
JIM	SHAMBLEN	T01	ATEN-CI	(804)727-2554
LARRY	TOMAN	F08	AFZG-DE-MPB	(512)221-5251
LTC DAN	ROSSBACH		APEN-CP	(808)438-8995
GERALD	McCLINTOCK		AEAEN-IP-MP	01149-622-157-8184
JOHN	ANDERSON		EAFE-EPS-MP	
BOB	SMITH			
KENNETH	HOLLOWAY		ATZB-EN-E	(404)545-4936
JIM	THOMPSON		SMCRI-EH	(309)782-6137
RON	NIEMI		CEHSC-SP	(703)355-3938

ADVISORY MEMBERS

BILL	ALEY		CERL	1-800-USA-CERL
SINE	FARRELL	F03	FEMS	(217)373-7257
JIM	PERKINS	A01	MCDSWD1	(214)767-8660
SANDY	STEPHENS	WES	CEWES-IM-DA	(601)634-2945