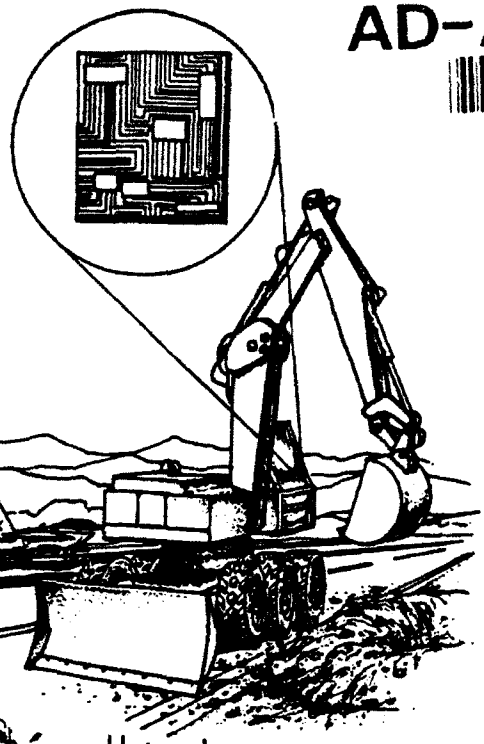

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Volume I

THE POST-DAM SYSTEM VOLUME I - INTRODUCTION TO THE POST-DAM SYSTEM

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Mission accomplishment in PACAF and USAFE depends on base recovery capability in a postattack environment. Base recovery includes identifying, analyzing, and repairing facility damage. For facilities critical to sortie generation, this process must be accomplished expediently.

In a postattack environment, field information on facility damage is collected and analyzed to determine structural integrity and usability. From this analysis, a repair schedule is developed. This is currently a time comsuming process that is shortened by using a computerized system.

The scope of this effort was to develop a computerized postattack damage assessment system that recommends repair strategies, keeps inventory of materials and equipment, and schedules repairs based on manpower and equipment availability.

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EXECUTIVE SUMMARY

A. OBJECTIVE

The objective of this report is to describe the software and hardware of the POST-DAM System, developed by Applied Research Associates, Inc., for airbase facility postattack damage assessment. This report contains descriptions of prototype software and hardware, and recommendations for full-scale development of both software and hardware.

B. BACKGROUND

In a postattack environment, field information on mission-critical facility damage is collected and analyzed to determine structural integrity and usability. From this analysis, a repair schedule is developed. This is a time-consuming process when done without the aid of a computerized system. Consequently, the POST-DAM System was developed to determine repair strategies with an expert system, keep track of materials and equipment with a relational database management system, and schedule repairs based on manpower and equipment availability with a project management system.

C. SCOPE

This technical report consists of nine volumes. Volume I describes software and hardware used with the prototype POST-DAM System, and recommends software and hardware for full-scale development. Volumes II through VIII are software user's manuals, which describe how to install and use the prototype software with the POST-DAM System. Volume IX is a field manual that contains diagrams of structures that are used with the POST-DAM system to locate damaged elements.

D. EVALUATION METHODOLOGY

The prototype POST-DAM System was developed using commercial, off-the-shelf (COTS) software and hardware. The system was constructed by integrating the software and hardware in such a way that a remote computer in the field can communicate with a host computer in the Base Civil Engineering (BCE) Damage Control Center (DCC). The POST-DAM system determines repair strategies, keeps track of materials and equipment, and schedules repairs based on manpower and equipment availability. This prototype system has been evaluated in-depth, and subsequent recommendations are made herein about software and hardware that should be used for full-scale development.

E. CONCLUSIONS

The prototype POST-DAM System is functional, but has limitations with respect to both hardware and software. The following problems were encountered:

1. The prototype remote computer is not portable, and cannot be used in the field. No satisfactory, hand-held remote terminal was available for this project.

2. The expert system cannot hold all the information required for full-scale development, because it cannot use extended memory.

3. Both the relational database management system and project management system require more human interaction than desired.

4. The communication system software is not compatible with the Survivable Base Recovery After Attack Communication System (SBCS) being developed for ESD by Sumaria Systems, Inc., with which the POST-DAM System is required to interface.

F. RECOMMENDATIONS

For full-scale development, the following features should be incorporated in the POST-DAM System.

1. Replace the prototype remote computer with a hand-held terminal unit having at least 2 Mb of random access memory, and which can run applications requiring 640 Kb of base memory.

2. Replace the prototype host computer with a system having at least 4 Mb of random access memory, IEEE 802.3 LAN ports, and able to support multi-tasking operations.

3. Replace the CLIPS expert system shell with an expert system shell capable of supporting applications at least twice as large as those developed for the prototype system.

4. Set the host computer up to interface with the IEEE 802.3 Ethernet local area network (LAN) used by SBCS.

5. Construct a single computer program to replace the relational database management system and the project management system, to minimize the required amount of human intervention. This system should be developed by personnel with a strong background in computer science.

PREFACE

This report was prepared by Applied Research Associates, Inc. (ARA), P.O. Box 40128, Tyndall Air Force Base, FL 32403, under Contract F08635-88-C-0067, for the Air Force Civil Engineering Support Agency, Tyndall Air Force Base, Florida.

This report (Volumes I though IX) summarizes work completed between 1 February 1989 and 1 March 1991. Lt. James Underwood (USN) was the HQ AFCESA/RACS Project Officer.

This report has been reviewed by the Public Affairs Office, and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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Project Officer

Felix Uhlik, Lt. Col., USAF
Chief, Engineering Research Division

William S. Strickland
Chief, Airbase Survivability Branch

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Director, Civil Engineering Laboratory

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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

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SECTION I

INTRODUCTION

A. OBJECTIVE

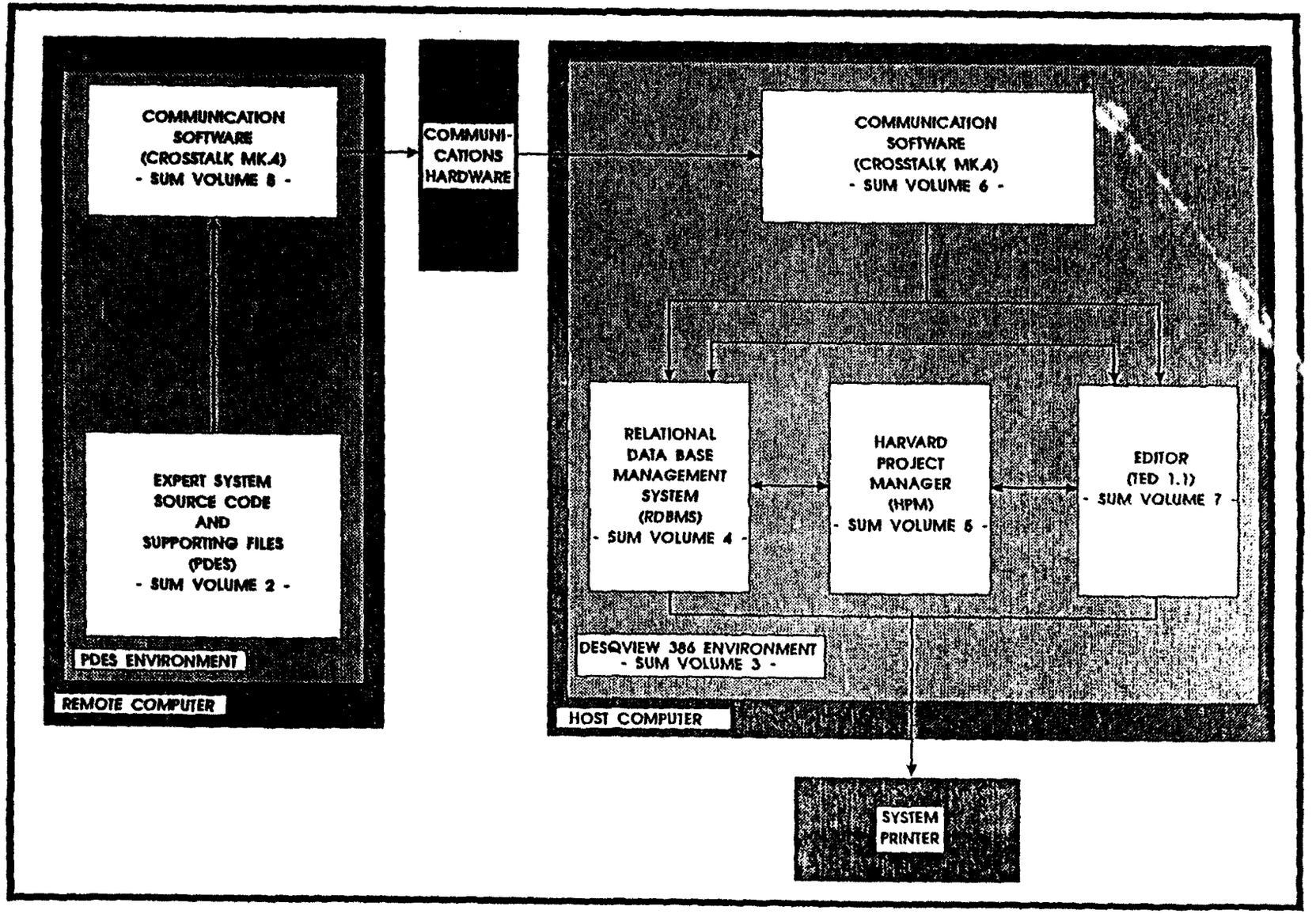
The objective of this report is to describe the hardware and software of the POST-DAM System, developed by Applied Research Associates, Inc., for airbase facility postattack damage assessment. This work was accomplished under Subtask 2.02, 2.02.1, and 2.02.2 (References 1, 2, and 3) of HQ AFESC/RDC SETA Contract F08635-88-C-0067. This report contains descriptions of the prototype software (in Reference 4 through 10) and prototype hardware (in this volume), and recommendations for hardware and software improvements that would be beneficial for full-scale development of the POST-DAM System.

B. BACKGROUND

Mission accomplishment in PACAF and USAFE depends on base recovery capability in a postattack environment. Base recovery includes identifying, analyzing, and repairing facility damage. For facilities critical to sortie generation, this process must be accomplished expediently.

After an attack, mission-critical facilities known to have been damaged are inspected by a Damage Assessment Team (DAT) to determine the nature and extent of damage. Next, a repair estimate for each facility is prepared. The repair estimate includes repair strategies, and required materials, equipment, and labor. At this stage, a manual damage assessment process can stall, often for lack of a structural engineer, or (even more often) for lack of time to do the structural analysis and/or resource availability accounting. When a structural engineer must correctly quantify and interpret the DAT's reports, the process can require more time than the Base Commander can afford before making crucial mission-essential expedient repair decisions. Consequently, the Base Civil Engineer (BCE) must either make a hasty mission-essential facility expedient repair recommendation, or even worse, essentially abdicate that decision to the Base Commander.

The POST-DAM System is a solution to the BCE's dilemma. This system consists of remote computers operated in the field by DAT's, and a host computer in the Damage Control Center (DCC) operated by a key member of the BCE's staff. The remote computers run a knowledge-based expert system, which contains mission-critical facility expedient repair strategies, and determines the required materials, equipment, and labor required for each expedient repair. The host computer processes the remote expert system data, by determining if repairs are possible, based on material, equipment, and manpower availability. It then schedules the possible repairs, based on equipment and manpower availability. Figure 1 is a schematic of the prototype POST-DAM System, showing the individual hardware and software components and giving references to the corresponding software user's manuals (SUM's).



POST-DAM SYSTEM

Figure 1. Prototype POST-DAM System.

C. APPROACH

In the postattack situation, the user (DCC computer operator) turns on the host computer and activates the multitasking, multiwindowing DESQview 386 program. From DESQview 386, the user activates the Crosstalk Mk.4 communications system, and waits to receive files from the POST-DAM expert system (PDES) programs run on remote computers in the field by the DAT's. After receiving the first damage assessment files from the field, the DCC user runs the POST-DAM Relational Data Base Management System (RDBMS) program, using DESQview 386, while the Crosstalk Mk.4 communications program runs in the background and receives files from remote computers in the field. Using the POST-DAM RDBMS program, the DCC user processes the first set of expert system data files, to determine whether the repairs required by the assessed mission-critical facility are possible, based on material, equipment, and manpower availability. After a number of possible repairs have been defined for a facility, the DCC user runs the Harvard Project Manager (HPM) program from the DESQview 386 program, to schedule possible repairs based on equipment and manpower availability. After scheduling possible repairs with HPM, the DCC user runs the TED 1.1 text editor from the DESQview 386 program to edit the final output. The output contains a list of all repairs, what they require in materials, equipment, and manpower, and also the start and finish times of each repair. The TED 1.1 editor is also used to edit the final output form, when a change has been made in the repair strategy, material requirements, or equipment and manpower requirements.

After processing the expert system data for a mission-critical facility, the DCC user submits a copy of the final output to the Base Commander in the SRC for approval, and begins processing expert system data for the next mission-critical facility. This process is repeated until all damaged, mission-critical facilities have been assessed. If an expedient repair is disapproved, or the repair strategy changed by the Base Commander, the DCC user reprocesses the assessment in question to reflect the changes.

Because of the amount of indentation required for computer software description, Volumes II-VIII will be presented using the decimal format.

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SECTION II

THE PROTOTYPE POST-DAM SYSTEM

A. HOST COMPUTER

1. Hardware

A Wang PC 380 personal computer obtained from AFESC/RDCS was used as the prototype POST-DAM host computer. A schematic of this computer system is shown in Figure 2. This system consists of a keyboard, enhanced graphics (EGA) color monitor, M7 mouse, and a PC 380 system unit.

a. Wang Keyboard

The Wang PC 200/300 keyboard has all the keys on the Industry-Standard IBM 84 key keyboard, plus some extra keys to increase the user friendliness of the PC 380 computer. This means the PC 200/300 keyboard has all the keys required to run any Wang or Industry-Standard application. Additional information about the PC 200/300 keyboard is included in References 11, 12, and 13.

b. Wang EGA Color Monitor

The Wang Professional Color Monitor has a 14 inch (13-inch viewable antiglare screen, and supports Enhanced Graphics (EGA), Color Graphics (CGA), and Professional Graphics (PGA) displays. Additional information about the Wang Professional Color Monitor is included in References 11, 12, and 13.

c. Wang M7 Mouse

The Wang M7 mouse moves a point or cursor on the computer screen (emulating curser keys), and also implements keyboard macros. The mouse can be used with all computer applications that support the Microsoft mouse driver, and with many other computer applications. Additional information about the Wang M7 Mouse is included in Reference 14.

d. Wang PC 380 System Unit

The PC 380 system unit contains an 80386 processor, 80287 math co-processor, 68 Mb hard disk drive, 1.2 Mb diskette drive, 360 Kb diskette drive, 1 parallel port, 2 serial ports, and 4 Mb of random access memory (RAM). With these features, the PC 380 system unit can support multitasking, which lets more than one computer program run at a time. Additional information about the PC 380 system unit is included in References 11, 12, and 13.

2. Software

The prototype POST-DAM System host computer uses a collection of commercial, off-the-shelf (COTS) computer programs to process the data produced by the PDES programs. The POST-DAM software determines whether repairs are

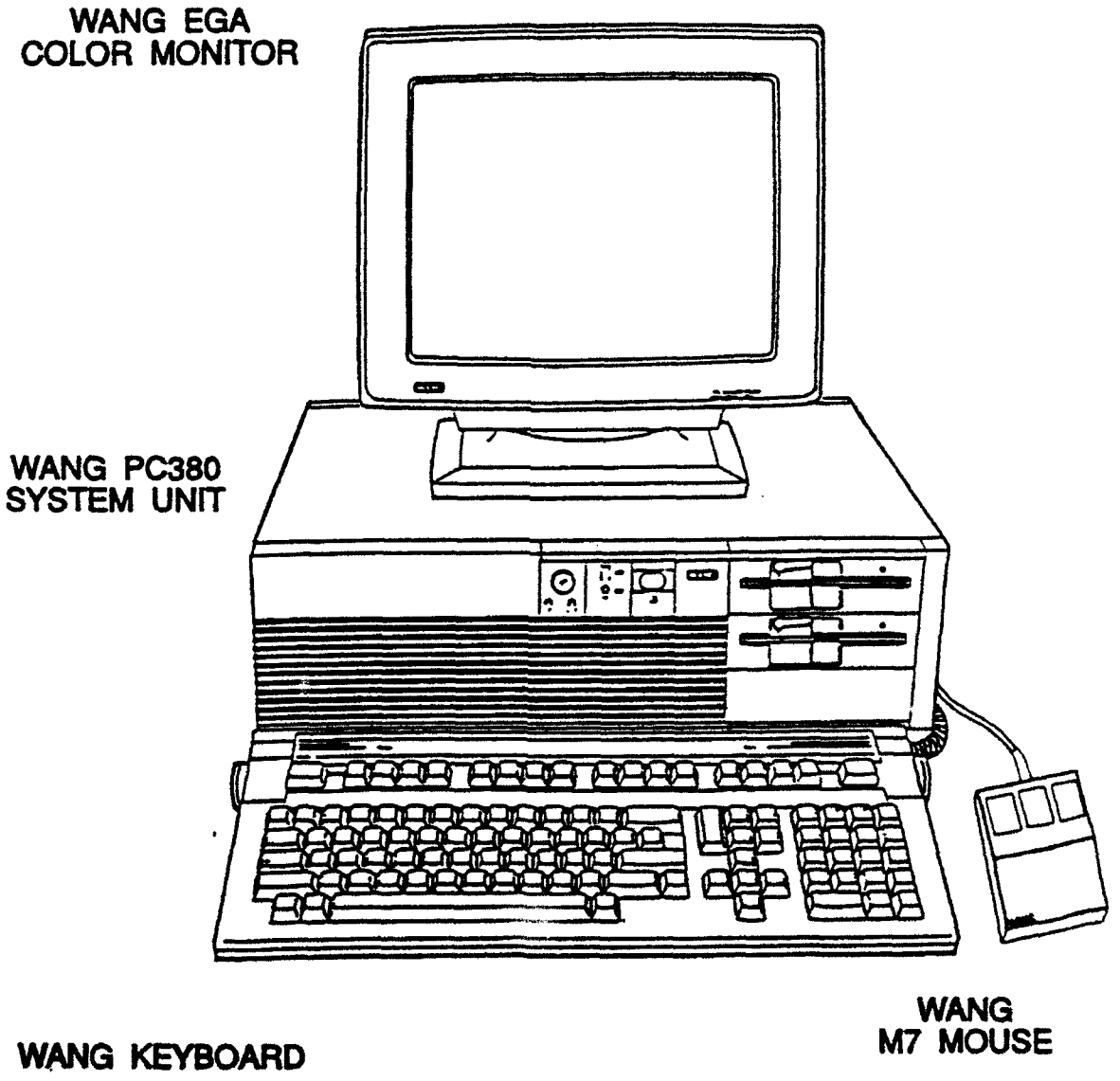

Figure 2. Prototype POST-DAM Host Computer.

possible, based on material, equipment, and manpower availability, then schedules possible repairs based on equipment and manpower availability. The prototype host computer uses the Microsoft Disk Operating System (MS-DOS) 3.3, with DESQview 386 as its control system. The DESQview 386 program runs in the MS-DOS 3.3 environment, and controls the POST-DAM RDBMS, HPM, Crosstalk Mk.4, and TED 1.1 programs.

a. MS-DOS 3.3

MS-DOS 3.3 was selected as the operating system for the prototype host computer. The operating system is a collection of computer programs that provide recurring services to other programs or to the computer user. These services consist of disk and file management, memory management, and device management. Further information about installing and using MS-DOS 3.3 with the POST-DAM System host computer is given in References 15 and 16.

b. DESQview 386

DESQview 386 is a multitasking, multiwindowing, control program for an 80386-based PC or PS/2 computer. DESQview 386 is menu-driven, and lets the user run several DOS programs simultaneously, switch between programs, run programs in the background, and transfer data between programs. Detailed information about installing and using the DESQview 386 program with the POST-DAM System host computer is given in Reference 5.

c. POST-DAM Relational Data Base Management System (RDBMS)

The POST-DAM RDBMS was constructed using the R:BASE for DOS programming language, then compiled with R:BASE for DOS RUNTIME. This process created an execute-only version of the R:BASE application, eliminating the need for the end user to install the entire R:BASE system. Detailed information about installing and using the POST-DAM RDBMS program with the POST-DAM System host computer is given in Reference 6.

d. Harvard Project Manager (HPM)

The HPM project-management system is a complete project management package for planning and tracking projects of any complexity. Detailed information about installing and using the HPM program with the POST-DAM System host computer is given in Reference 7.

e. Crosstalk Mk.4

Crosstalk Mk.4 is a complete communication package that provides: emulation of 21 different terminal types, 11 error-free file transfer protocols, unattended call-in access, and password protection in answer mode. Detailed information about installing and using the Crosstalk Mk.4 program with the POST-DAM System host computer is given in Reference 8.

f. TED 1.1 Editor

The TED 1.1 editor is an easy-to-use text editor. Detailed information about installing and using the TED 1.1 program with the POST-DAM System host computer is given in Reference 9.

B. REMOTE COMPUTER

1. Hardware

A Telxon PTC-755 hand-held computer with 1 Mb of RAM and an MS-DOS EPROM chip supplied by AFESC RDCS was examined as a candidate for use as the remote computer. By testing the PTC-755, it was determined that DOS programs can access no more than 340 Kb of the 1 Mb of RAM; only 16 characters per row and 21 rows will appear on the screen; and there is insufficient memory to store the PDES files and communication software. Because of these limitations, the Telxon PTC-755 was deemed unacceptable as the prototype POST-DAM System remote computer. Further information about the Telxon PTC-755 is provided in Appendix G.

The prototype POST-DAM System remote computer was eventually supplied by Applied Research Associates, Inc. It is a PC's Limited 286 keyboard, Mitsubishi XC-1430C enhanced graphics (EGA) color monitor, Logitech Serial Mouse, and a PC's Limited System 200 286 system unit. A schematic of this computer system is shown in Figure 3.

a. PC's Limited 286 Keyboard

The PC's Limited 286 keyboard has all the keys on the Industry-Standard IBM 84 key keyboard, plus 17 other keys used for a numeric keypad. This allows the PC's Limited 286 computer to run any Industry-Standard application. Additional information about the PC's Limited 286 keyboard is given in References 17 and 18.

b. Mitsubishi XC1430C Color Monitor

The Mitsubishi XC1430C Color Monitor is a 14-inch (13-inch viewable), medium resolution, color display monitor with Enhanced Graphics Adapter (EGA) 16-color capability. Additional information about the XC1430C Color Monitor is given in Reference 19.

c. Logitech Mouse

The Logitech mouse is used to move a point or cursor on the computer screen (emulate curser keys), and also to execute keyboard macros. The mouse can be used with any computer application that supports the Microsoft mouse driver, and also with many other computer applications. Additional information about the Logitech Mouse is given in Reference 20.

d. PC's Limited System 200 286 System Unit

The PC's Limited System 200 286 system unit contains a 80286 processor, a 80287 math co-processor, an 80 Mb hard disk drive, a 1.4 Mb diskette

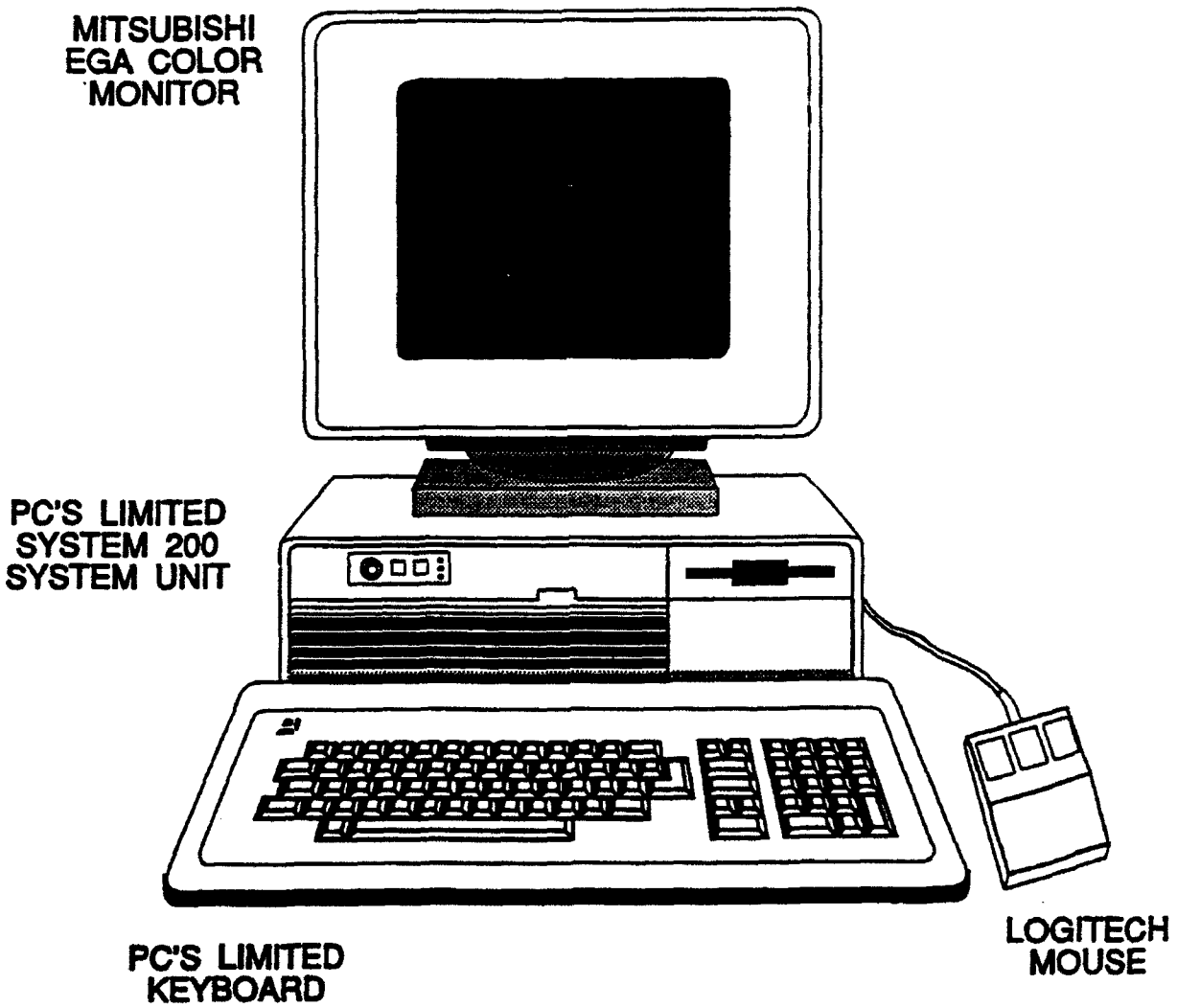

Figure 3. Prototype POST-DAM Remote Computer.

drive, a 360 Kb diskette drive, 1 parallel port, 2 serial ports, and 640 Kb of RAM. With these components the system unit can store all required PDES files on the hard disk, and also run the expert system. Additional information about the PC's Limited System 200 286 system unit is given in References 17 and 18.

2. Software

a. POST-DAM Expert System

The POST-DAM Expert System (PDES) is a knowledge-based system which uses an inference engine to select expedient repair strategies for damaged mission-critical facilities in a postattack environment. The system operates by asking the user questions about a damaged facility. Using the answers, the expert system selects the most appropriate expedient repair strategies for each facility damage mode. Once a facility assessment is complete, the repair strategies are transmitted to the POST-DAM System on the host computer, for further processing.

In operation, PDES is a highly interactive, multi-level, menu-driven expert system. The system enables the user, in a postattack situation, to quickly assess structural damage to any mission-critical facility. Once a mission-critical facility is selected, PDES can further distinguish between mission-critical and non-mission-critical structural elements. These two PDES capabilities are possible because the system's inference engine uses both a static and a dynamic knowledge base.

When the user enters a mission-critical element number, obtained from Reference 21, the system asks for a description of the element damage mode. Based on the damage mode response, PDES selects an expedient repair strategy from an array of strategies stored in the system's rules base. The system then lists the material, equipment, and manpower resources required for each repair strategy, based on geometric properties obtained from the damaged element's knowledge base, and user-entered damage mode dimensions. The repair strategies and resource requirements are then stored in PDES data files, for transfer to the host computer. PDES was developed using the C-based expert system language CLIPS (C Language Integrated Production System), developed jointly by NASA and the USAF. The expedient repair strategies and repair strategy resource equations used by PDES were developed under a parallel subtask, "Expedient Repair of Structural Facilities". The prototype version of PDES was delivered to AFESC in source code form, along with the CLIPS interpreter, to allow the program to be compiled at the time of execution. Creation of a DOS runtime version of PDES was not practical, since CLIPS runtime versions do not accommodate environmental commands or embedded functions. Additional information about the CLIPS language is given in Reference 22, and detailed information about installing and operating PDES is given in Reference 4.

b. Crosstalk Mk.4

Crosstalk MK.4 is the communication software used with the remote computer. This is a complete communication package that provides: emulation of 21 different terminal types, 11 error-free file transfer protocols, unattended call-in access, and password protection in answer mode. Detailed information

about installing and using the Crosstalk Mk.4 program with the POST-DAM System remote computer is given in Reference 10.

C. COMMUNICATION SYSTEM

1. Hardware

For the prototype POST-DAM System, the remote computer interfaces with the host computer using two Zoom MX 2400R modems. The Zoom modems provide asynchronous data communication at 2400 bps through RS-232 serial interfaces, and support all Hayes commands for asynchronous operation. Further information about the Zoom MX 2400R modem is given in Reference 23.

2. Software

For the prototype POST-DAM System, both the remote computer and the host computer use the Crosstalk Mk.4 communication program and the ZMODEM file transfer protocol. The ZMODEM protocol has become very popular among PC communication programs, because it recovers from fatal errors, supports redundant file skipping, and supports the use of wildcards, which allows a group of files to be transferred in a single operation. Information about installing and using Crosstalk Mk.4 on the host computer and the remote computer is given in References 8 and 10.

D. SYSTEM PRINTER

The printer used with the prototype POST-DAM System is a Hewlett-Packard (HP) Laser Jet Series II Printer. The HP Laser Jet printer is connected to the Wang PC 380 computer through the parallel interface, and is used to print both text and graphics. Further information about the HP Laser Jet Series II Printer is given in References 24 and 25.

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SECTION III

THE RECOMMENDED POST-DAM SYSTEM

A. HOST COMPUTER

1. Recommended Hardware

a. Miltope Bobcat Transportable Computer Unit

For full-scale development, a Miltope Bobcat Transportable Computer Unit (TCU) (hardened Hewlett-Packard (HP) 9000 Series 300 computer) with a DOS co-processor module is recommended for the host computer. The Bobcat TCU is a rugged, transportable computer unit that can easily be moved if the DCC were destroyed. With the DOS co-processor module, the TCU can run all DOS programs required for the POST-DAM System. The Bobcat TCU also has an IEEE 802.3 Local Area Network (LAN) interface, which can communicate directly with the IEEE 802.3 Ethernet LAN system used with the Survivable Base Recovery After Attack (BRAAT) Communication System (SBCS) being developed by Sumaria Systems, Inc. for ESD. General information about Miltope Army Tactical Command and Control System (ATCCS) equipment is provided in Appendix A; specific information about the Miltope Bobcat TCU is provided in Appendix B; and information about the SBCS interface is given in References 26, 27, 28, and 39.

b. Miltope Color Monitor Device A

For full-scale development, a 12-inch, 512 X 400 pixel, four-color plane, Miltope Color Monitor Device (CMD) is recommended for use with the Miltope Bobcat (TCU). This rugged CMD is required to support the color graphics required by the POST-DAM System host computer software. General information about Miltope ATCCS equipment is provided in Appendix A, and specific information about the Miltope CMDA is provided in Appendix C.

2. Recommended Software

a. Operating System

For full-scale development, the UNIX System V Interface Definition 2 (SVID2) ATCCS Common Operating System (ACOS), along with an MS-DOS co-processor is recommended for use with the Miltope Bobcat TCU. The ACOS allows the Bobcat TCU to run the ATCCS common software, and provides both multi-user and multi-tasking capabilities. The MS-DOS co-processor allows the Bobcat TCU to run all DOS programs designed for the POST-DAM System host computer. Information about Miltope ATCCS common software is provided in Appendix A, and specific information about the Miltope Bobcat TCU operating system is provided in Appendix B.

b. Combined RDBMS and Project Management System

While evaluating the prototype POST-DAM system, it was found that both the RDBMS and HPM require more user intervention than desired. Because

of this problem, a separate SETA subtask (Reference 30) was written to create a single computer program to determine whether repairs are possible, based on material and equipment availability, keep track of materials used, schedule repairs based on building priority and resource availability, and produce a final output statement for each damaged, mission-critical facility. The final output statement will indicate whether the facility is beyond expedient repair. If the facility is not beyond expedient repair, the output will indicate whether repairs are possible. For repairs that are possible, the output will list the materials, equipment, and manpower required, the start and finish time for each repair, the repair strategy, and comments about the damage.

c. Communication

Communication between the host computer (Miltope Bobcat TCU) and the SBCS should use the IEEE 802.3 Ethernet LAN interface, and the Transport Control Protocol/Interment Protocol (TCP/IP) network transport system software developed by the Department of Defense (DOD). This communication protocol interface is used with SBCS, and is standard ATCCS common software used with the Bobcat TCU. Information about the Miltope ATCCS common software is provided in Appendix A; information about the Miltope Bobcat TCU IEEE 802.3 interface is provided in Appendix B; information about SBCS equipment is provided in Appendix E; and information about the SBCS interface is given in References 26, 27, 28, and 29.

B. REMOTE COMPUTER

1. Recommended Hardware

For full-scale development, a Miltope Hand-Held Terminal Unit (HTU) should be used as the remote computer. This militarized HTU is a state-of-the-art transportable computer unit, designed for operation under severe environmental conditions. The HTU is IBM-PC/AT compatible, operates under standard MS-DOS, provides up to 2 Mb of internal RAM (the next generation will provide 4 Mb) and offers extensive communication capabilities. With these characteristics, the Miltope HTU can store all required PDES and communication files in RAM, have enough remaining RAM to execute the PDES and communication programs, and send the files generated by the expert system to the host computer through the Scope Shield Radio used with the SBCS. General information about Miltope ATCCS equipment is provided in Appendix A, and specific information about the Miltope HTU is provided in Appendix D.

2. Recommended Software

An extensive, in-house evaluation of the PDES prototype was performed. The results indicate that, although the prototype system yields both useful and correct information, several improvements should be incorporated during full-scale development. Recommendations for full-scale development are presented in the following three sections.

a. ECLIPSE 86

Fundamentally, the POST-DAM Expert System has certain inherent limitations arising from several features of the CLIPS language. The main problem is CLIPS's inability to access extended memory. This problem, coupled with the large amount of RAM required to store the PDES rule and knowledge bases, forces the prototype system to rely heavily on the restrictive use of RAM. Another problem is CLIPS's inability to support embedded functions within a DOS runtime module. This forces the PDES system to be controlled by a cumbersome array of batch jobs and supporting PDES system files.

During full-scale development of PDES, the expert system shell CLIPS should be replaced by ECLIPSE 86 TOOLKIT. ECLIPSE 86 TOOLKIT is far more powerful than CLIPS, yet requires less RAM. Also, ECLIPSE 86 TOOLKIT allows the use of embedded functions within a DOS runtime module. These enhancements are reported (by ECLIPSE developers) to allow expert systems to be 150% larger and execute four times faster than those operating under CLIPS. ECLIPSE is also 100% compatible with expert systems written for CLIPS.

Use of ECLIPSE during full-scale development of PDES will allow menu screen and help function enhancements, as well as addition of future repair strategies. Also, creating a DOS runtime module will eliminate the need to compile PDES each time it is executed. This will eliminate the requirement for various PDES batch jobs and for the CLIPS interpreter. General information about ECLIPSE 86 software is provided in Appendix H.

b. PDES Enhancements

During full-scale development, several additions and enhancements should be made to the prototype software. Detailed discussions of these recommendations are provided in the following sections. The recommended features could not be included in the prototype version of PDES because of limitations in file size imposed by CLIPS.

(1) Damage Mode and Repair Strategy Additions

During PDES full-scale development, it will be necessary to modify the prototype expedient repair strategy expert system database. Modifications to some of the repair strategies will be required because some of the repair techniques were developed concurrently with the prototype expert system. Also, techniques are bound to be developed in the future. Later incorporation of several expedient repair strategies will be necessary simply because of current CLIPS file size limitations. The following expedient repairs, developed under Subtask 2.01.1 of SETA Contract F08635-88-C-0067, are not included in the prototype version for the above reasons:

DAMAGE MODE	EXPEDIENT REPAIR STRATEGY
DESTROYED WALL	EARTH BERM
	PRECAST SLAB

DAMAGE MODE	EXPEDIENT REPAIR STRATEGY
DAMAGED OVERPRESSURE DOOR	SHOTCRETE THIRD DOOR INSERTION DOOR REPLACEMENT
STUCK BLAST DOOR	PRYING FORCE
DESTROYED WINDOW	ACRYLIC PANELS POLYETHYLENE SHEETING
BUCKLED AIRCRAFT SHELTER FLOOR	SHOTCRETE RAPID-SETTING CEMENT AM2

(2) Facility/Element Assessment Status Enhancement

The PDES prototype version does not notify the user, or the POST-DAM host computer, when a facility or element selected for assessment has already been assessed. This situation may arise inadvertently if the user accidentally reenters a number, or purposely if a reassessment is required. The capability of warning the PDES user when a previously assessed facility number has been entered is needed to prevent accidental erasure of data. If the user decides to continue, the capability of notifying the POST-DAM host computer of the reassessment is needed to eliminate confusion associated with duplication of assessment reports.

(3) "RETURN TO PREVIOUS MENU" Option Enhancement

Most menu screens within PDES possess a "RETURN TO PREVIOUS MENU" option. This option allows the PDES user to page back one menu screen at a time, to modify previously entered responses. However, ascending from the Facility Specific Level to the PDES Environmental Level (Reference 4) with this option, deletes damage assessment data for the current facility. Therefore, the PDES prototype should be modified during full-scale development to warn the user of imminent loss of data, and provide an opportunity to either save any previously entered data or abort the command.

(4) "HELP UTILITY" Option Enhancement

The PDES prototype has a "HELP UTILITY" which can be accessed from only two of the system's menu screens. These help features give the user either a list of valid mission-critical facilities, or a list of valid elements within a specified mission-critical facility. The present element number HELP option should be enhanced to give detailed information similar to that given by the current facility HELP option. Also, the PDES HELP UTILITY should be expanded to include a HELP option on menu screen. These options would give a detailed explanation of each valid PDES menu option.

(5) Modification to the File PD_NSTAL.BAT

The PDES prototype has a DOS batch file name PD_NSTAL.BAT. This batch file creates the necessary sub-directories on the remote computer's hard disk, and copies all PDES files from the PDES System Diskette into the appropriate remote hard disk sub-directory. During full-scale development of PDES, this batch file should be developed as an ECLIPSE run-time module. Also, the final version of PD_NSTAL should be developed to perform the function of the PDES "OPTIONAL CONFIGURATION UTILITY" (Reference 4). This modification will eliminate the need for the user to configure the PDES system each time it is used. This modification will also reduce the size of PDES.

(6) Modification to the Files PD_SYS.BAT and PD_NOSYS.BAT

The PDES prototype has two DOS batch files named PD_SYS.BAT and PD_NOSYS.BAT. PD_NOSYS.BAT configures the remote computer for the PDES environment, and PD_NOSYS.BAT returns the remote computer to its original configuration. During the full-scale development of PDES, these batch files should be developed as ECLIPSE runtime modules.

(7) Addition of a File to Expedite Modification to the Mission-Critical Data Base

The POST-DAM Expert System knowledge base is primarily comprised of data files developed for mission-critical facilities. These data files must be generated in ASCII format, with specific data in specific locations. An ECLIPSE runtime module should be developed to facilitate modification of, addition to, or deletion from these mission-critical facility data files.

c. Crosstalk Mk.4

Communication between the remote computer (Miltope HTU) and the SBCS should use the prototype Crosstalk Mk.4 communication system with the ZMODEM protocol. The ZMODEM protocol is compatible with the XON/OFF protocol used by the SBCS system, and will interface with the SBCS Paccomm UMPAD terminal node controllers. Information about Crosstalk Mk.4 is given in Reference 10; information about the Miltope HTU is provided in Appendix D; information about SBCS equipment is provided in Appendix E; and information about the SBCS interface is given in References 26, 27, 28, and 29.

C. COMMUNICATION SYSTEM

1. Recommended Hardware

During full-scale development, the POST-DAM System should be kept compatible with SBCS. Because of this requirement, the data transmission path between the POST-DAM System remote computer and the POST-DAM System host computer must be furnished by SBCS.

The SBCS configuration presented at Critical Design Review (CDR) 2 by Sumaria Systems, Inc., has been modified to include the POST-DAM System, as

shown in Figure 4. Here, the POST-DAM System remote computers interface with the POST-DAM System host computer through SBCS communication equipment located in the DCC. The SBCS communication rack layout, and a schematic of the SBCS communication equipment presented at CDR 2 have been modified to include a separate POST-DAM System Scope Shield radio (PRC 5), plus a separate terminal node controller (TNC 4), shown in Figures 5 and 6 respectively. As shown in Figure 6, TNC 4 interfaces with SBCS at the RS 232 digital patch panel, and is routed into Port 4 of the terminal server. From the terminal server, SBCS routes the PDES data into the fiber-optic transceiver, from which it goes to the IEEE 802.3 Ethernet LAN, and then into the POST-DAM System host computer (Miltope Bobcat TCU).

A schematic of the SBCS hand-held terminals interfacing with the Scope Shield radios, presented at SBCS CDR 2, has been modified to include the POST-DAM System remote computers, as shown in Figure 7. Here, each Miltope HTU interfaces with a field TNC using the ZMODEM protocol, which is compatible with the XON/OFF protocol used by the TNC. The TNC changes the protocol to AX.25, and interfaces with the Scope Shield radio. From the Scope Shield radio, the data is relayed to the DCC TNC, where the protocol is changed back to XON/OFF. The DCC TNC interfaces with the terminal server, and the protocol is changed to TCP/IP, where the data is transmitted to the POST-DAM host computer through the IEEE 802.3 Ethernet LAN, as previously described.

The POST-DAM System uses the same Scope Shield radio and TNC used by SBCS. This requires one AN/PRC-128 radio and base station, one Kantronics KPC 2400 TNC, one HRO CS28M antenna, two Paccomm UMPAD TNCs, and two field radios with antennae compatible with the AN/PRC-128 radio and base station. Further information about SBCS equipment is provided in Appendix E, and information about the SBCS interface is given in References 26, 27, 28, and 29.

2. Recommended Software

a. Host Computer

Communication between the POST-DAM System host computer (Miltope Bobcat TCU) and SBCS should use the IEEE 802.3 Ethernet LAN interface, and the Transport Control Protocol/Internet Protocol (TCP/IP) network transport system software. These are described in Section II A.2.c. of this report.

b. Remote Computer

Communication between the POST-DAM System remote computer (Miltope HTU) and SBCS should use the Crosstalk Mk.4 program with the ZMODEM protocol. These are described in Section II B.2.c. of this report.

c. SBCS

Additional software should not be required for the SBCS configuration defined at CDR 2, if the recommended hardware and software are used. Note, however, that the SBCS configuration is subject to change at anytime.

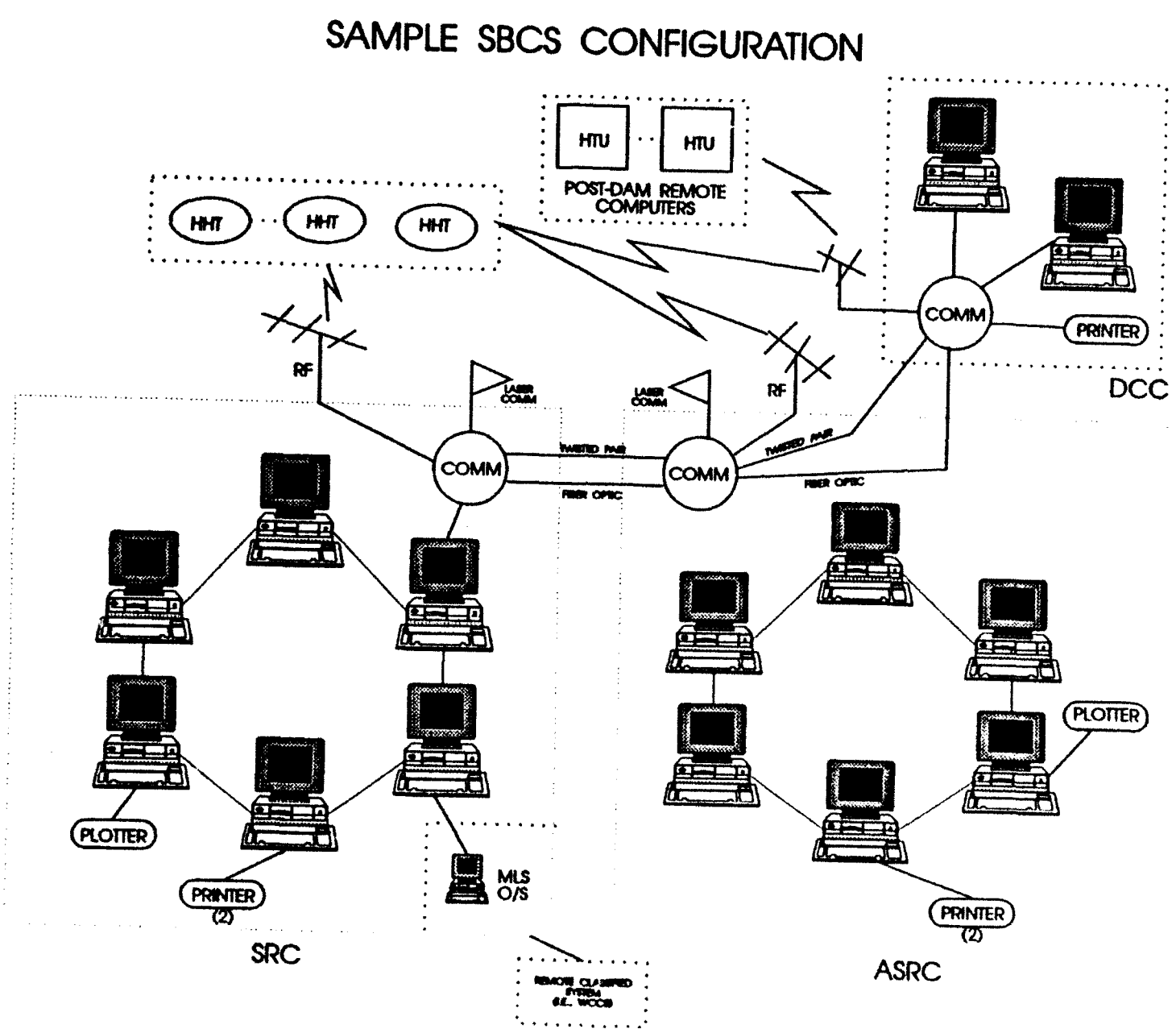
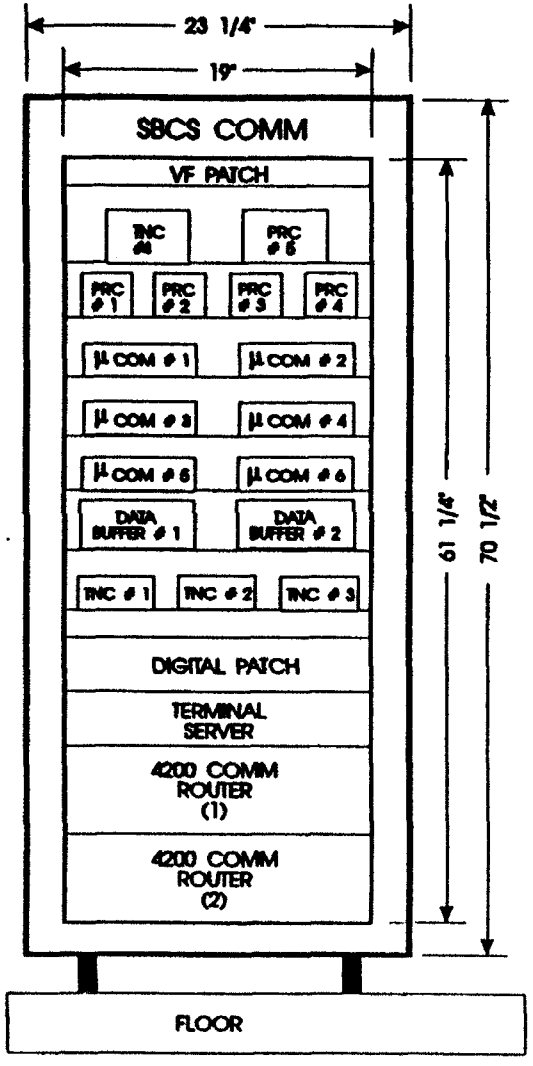


Figure 4. Sample SBCS Configuration.

COMMUCATION RACK LAYOUT



LEGEND:
PRC - RADIOS (PRC - 128)
µCOM-MODEM (WIRELINE)
TNC - TERMINAL NODE CONTROLLER

Figure 5. SBCS Communication Rack Layout.

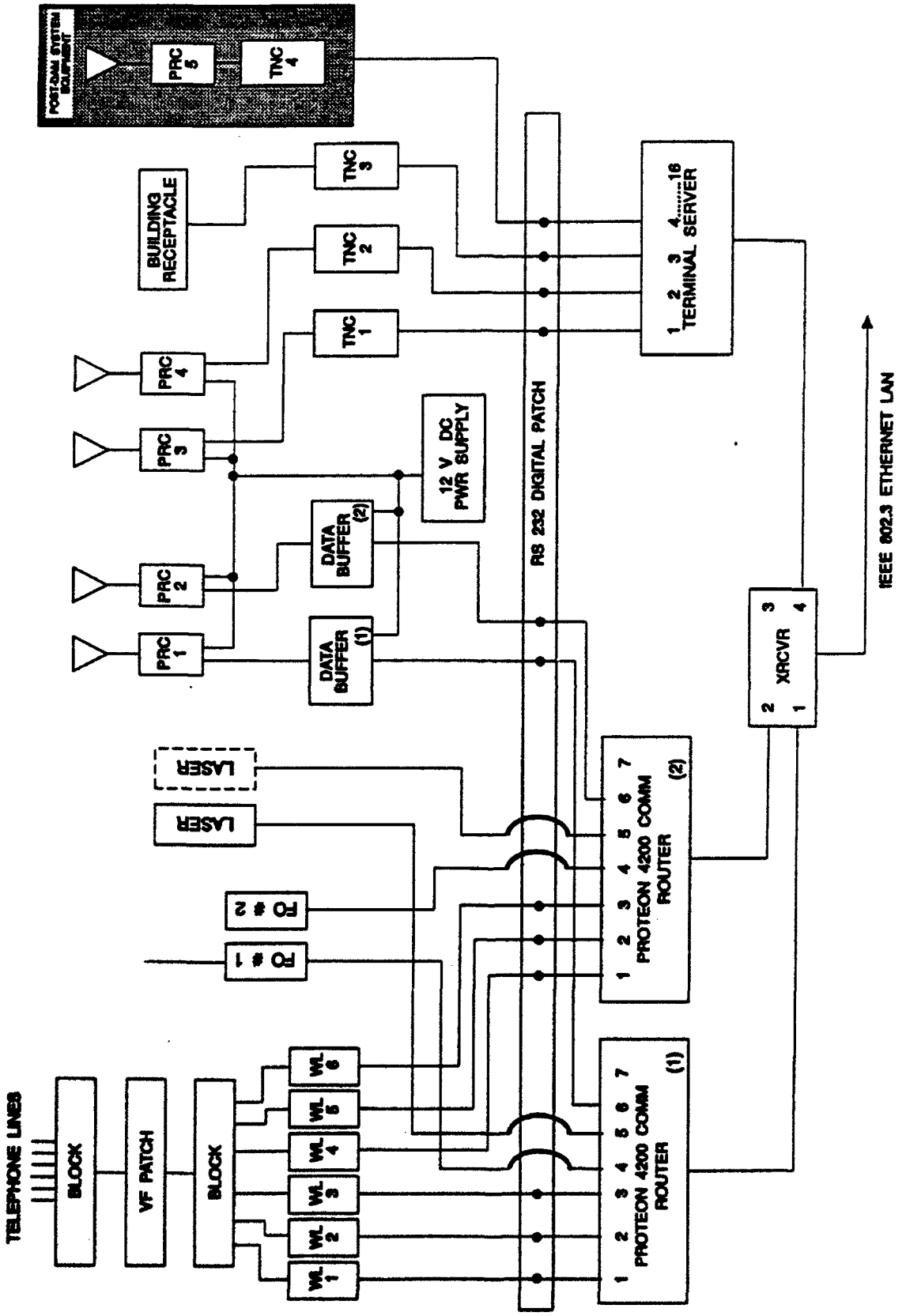


Figure 6. Schematic of SBCS Communication System.

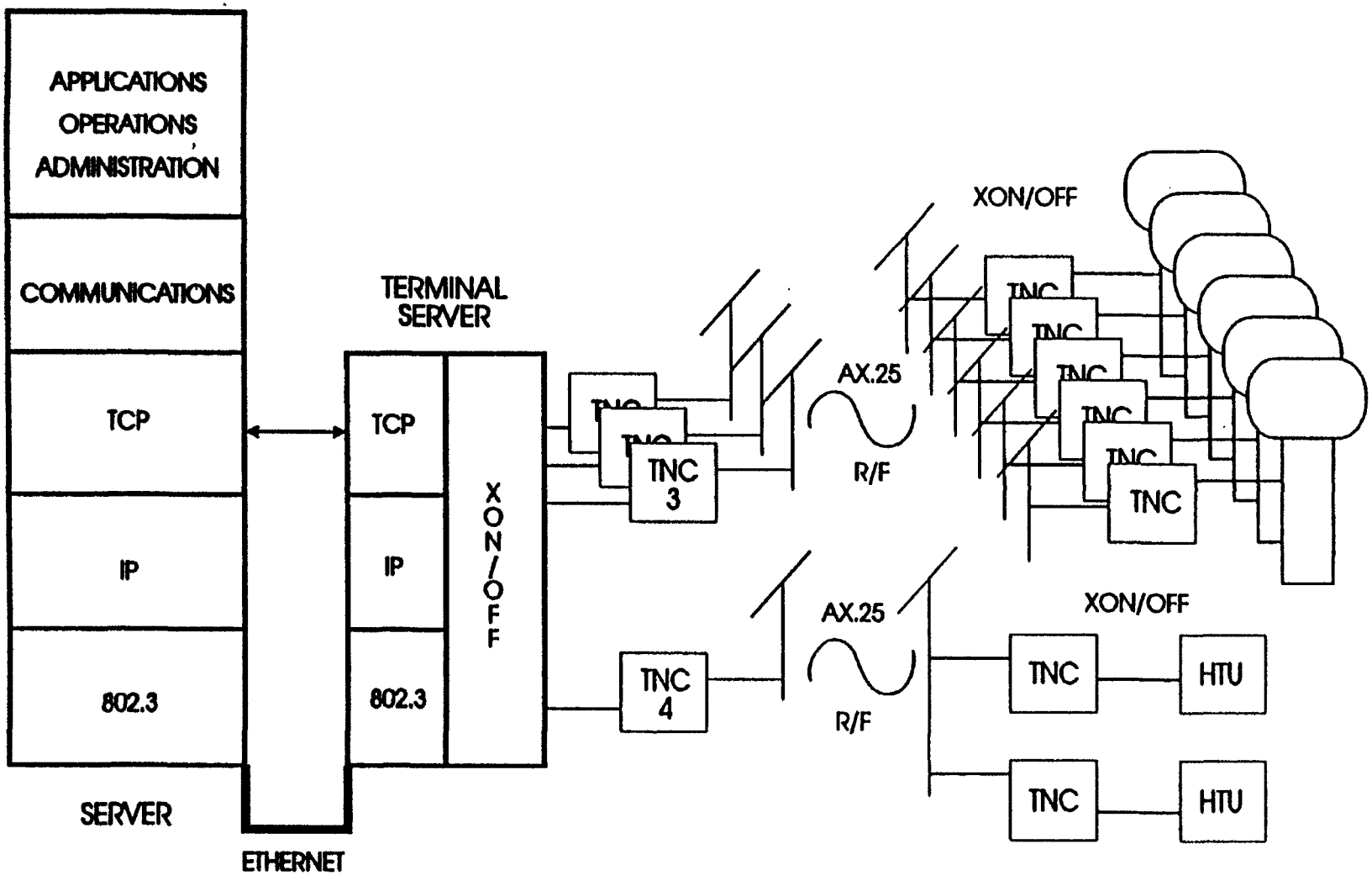


Figure 7. Schematic of SBCS Hand-Held Terminal Interface.

D. SYSTEM PRINTER

For full-scale development, a Miltope Model SPP-212 printer unit should be used with the Miltope Bobcat TCU. This portable printer unit provides 80-column printout under adverse environments, and is ATCCS equipment, so it will easily interface with the Bobcat TCU. General information about Miltope ATCCS equipment is provided in Appendix A, and specific information about the Miltope printer unit is provided in Appendix F.

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APPENDIX A

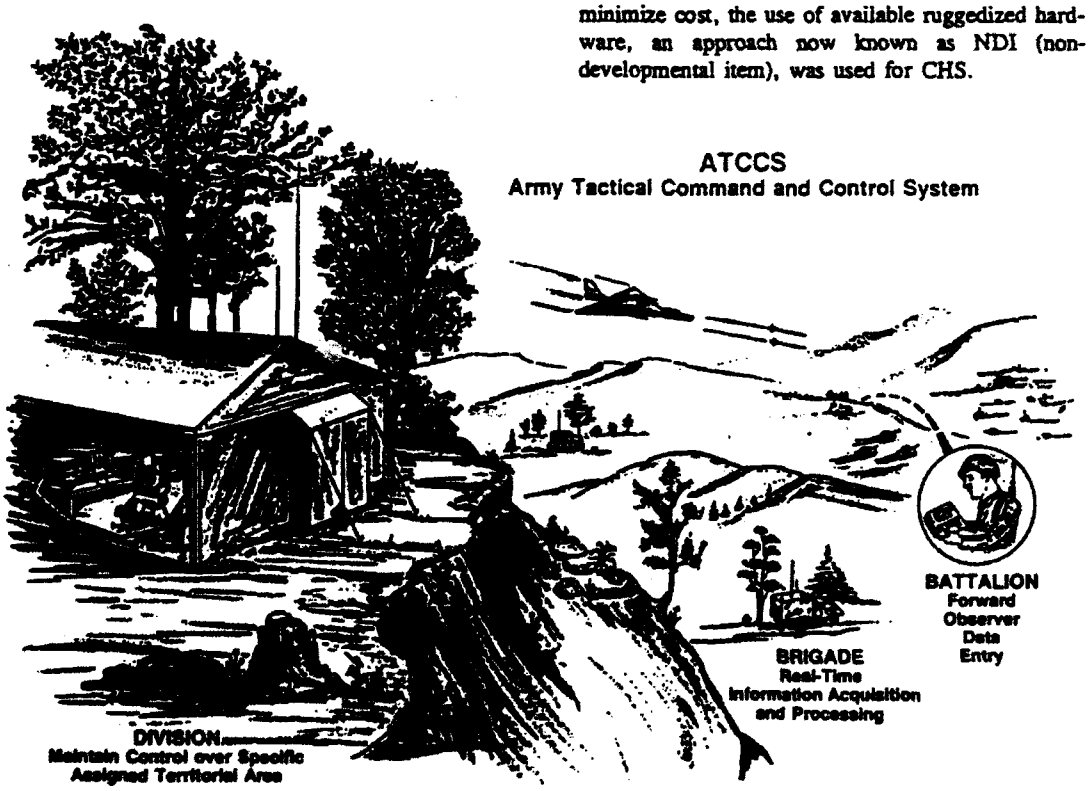
MILTOPE ATCCS EQUIPMENT

Introduction

In 1985 the U.S. Army commenced with a new initiative to automate its C2 systems by acquiring a family of computers with common software, communications protocols and local area networks to implement the Airland Battle doctrine and the Airland future concept (which describe the Army's approach to generating and applying combat power at operational and tactical levels). This ambitious program, first called the Army Command and Control System (ACCS) was renamed the Army Tactical Command and Control System (ATCCS) in 1988 to emphasize its tactical characteristics. ACCS remains as a higher level network, which ATCCS both supports and depends on for further information. When fully implemented, ATCCS will provide a force multiplier through automation that will allow U.S. forces to engage an enemy who has greater fire power and more personnel.

The Army will use the products described in this brochure in command posts and facilities throughout the battlefield to expedite information flow to the decision makers controlling battle resources. These systems will be integrated into a family of automated resources to support commanders and assist their staffs in the C2 process. The Army Command and Control Master Plan defines ATCCS to include the tactical personnel, facilities, equipment, communications, training, and C2 doctrine for military forces at corps level and below. This Army initiative is unique in breadth and scope in that it encompasses or touches upon all battlefield functions and will be used by every Army leader, at every echelon.

To achieve commonality and interoperability, all ATCCS hardware is procured through a program called ATCCS/CHS (ATCCS/Common Hardware and Software). To maximize battlefield durability and minimize cost, the use of available ruggedized hardware, an approach now known as NDI (non-developmental item), was used for CHS.



To support multiple tactical field applications, a common, reconfigurable modular building block approach for rugged hardware, suported by a System V Interface Definition 2 (SVID2) UNIX* based ATCCS Common Operating System (ACOS) was developed. The mission of this ATCCS Common Hardware/Software is to support the five functions of the U.S. Army's tactical Battlefield Functional Areas (BFA). These functions are:

- Maneuver Control
- Fire Support
- Combat Support Services
- Intelligence/Electronic Warfare
- Air Defense

Common Hardware

The U.S. Army Command and Control System's Common Hardware as described in this brochure is rugged equipment which complies with the performance specifications shown adjacent to the individual items and meets the common environmental conditions shown below. The Handheld Terminal Unit (HTU) is a full mil-spec device and its specified environmental conditions are defined separately.

This equipment is defined in the ATCCS Common Hardware product specifications as Version 1 (V1) and Version 2 (V2) equipment. Version 1 (V1) equipment is equivalent commercial off-the-shelf equipment for all peripherals. For simplicity, the V1 configuration Portable Computer Unit (PCU), Transportable Computer Unit (TCU) and Standalone Display Unit (SDU) computers are packaged identically to the V2 configurations but exclude High Altitude Electro-Magnetic Pulse Protection (HAEMP) and Tempest suppression.

Transit cases are available for all configurations. Rack adapters as well as vehicle trays or desktop system configurations can be provided for standard or custom installations.

The design of the ATCCS Common Hardware is baselined for technology insertion. The incorporation of current, state-of-the-art modules and the ATCCS Teams' commitment to future upward compatibility of hardware and software will permit new technological advances to be evaluated and fielded in a very short time frame. This circumvents the usual long development cycle and lead time required for fielding new technology.

Common Environmental Specifications for the ATCCS Equipment

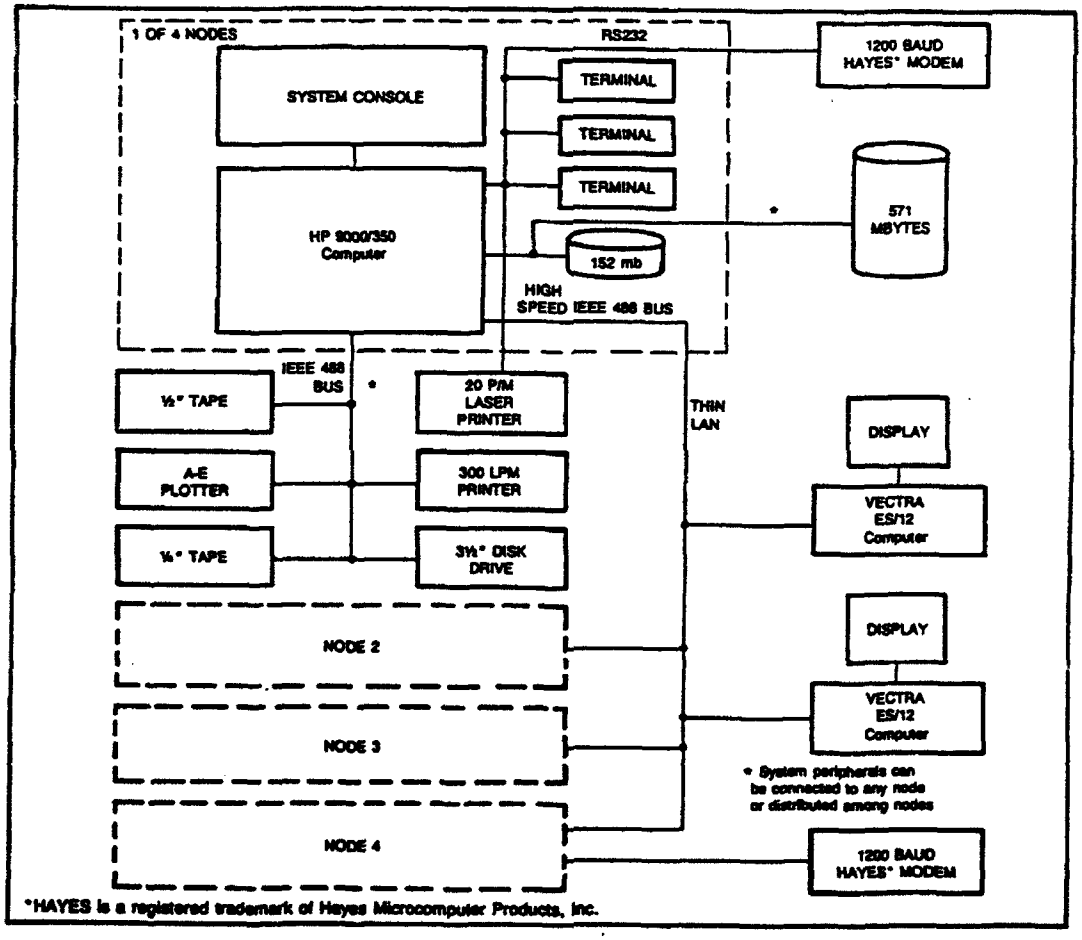
Temperature (Operating)	0°F to 120°F
Temperature (Storage)	−25°F to 150°F
Temperature Shock	0°F to 70°F and 120°F to 70°F each in ten minutes
Humidity	10% to 95% RH; Non Condensing
Altitude	To 10,000 Feet
Vibration	Operates in a tactical wheeled vehicle environment of MIL-STD-810D, Method 514.3 while hard mounted and for a tracked vehicle environment while shock mounted (disks non-operating).
Shock	Operates following 30-degree rotational drop from each bottom edge.
Rain	Resistant to inadvertent spillage or water droplets or rain blown into shelters.
Sand & Dust	No damage when subjected to exposure for 5 minutes at velocities to 3.5 mpn.
TEMPEST	Designed to meet NACSIM 5100A.
Orientation	10° incline
High Altitude EMP	Meets requirements (Classified)
EMI	FCC Part 15 Subpart J Class B
Power	110/220 VAC 50-60 Hz Single Phase Nominal 28 VDC with power converter/UPS

*UNIX is a registered trademark of AT&T.

Programing Support Environment — PSE

The Miltope Team provides a flexible PSE to allow support, validation and verification of application software modules.

The multi-user PSE is highly integrated in that it provides the capability to maintain and modify already fielded software as well as offering a full-function Ada programming environment integrated around the ACOS. The Ada compilation system is DOD validated for the PSE, TCU and PCU as both hosts and targets. Ada source code for the HTU will be developed on the PSE using the Ada compiler targeted for MS-DOS HTU operation.



The PSE consists of hardware which replicates all of the target hardware configurations in the CHS environment and a software system which not only replicates the software of the CHS but also provides for the development and maintenance of fielded application software. The PSE allows software applications to be developed in Ada, "C" and assembly language and provides libraries to link these applications to database, graphics and communications software. The PSE includes the following functional highlights:

- Supports up to 16 concurrent programmers in the standard configuration.
- Provides 2 million lines of Ada source code on-line.
- Promotes extensions of capacity and performance.
- Accommodates hardware and software technology insertion.
- Provides source code control services.
- Provides media interchangeability (5.25" to/from 3.5" floppy disks).
- MS-DOS software development in both Ada and assembler.

ATCCS Common Software

The ATCCS 'Common Software' is a software system that consists of a common operating system (ACOS), UNIX System V with real time extensions, and off-the-shelf software components. It provides software building blocks that are common to both the Program Support Environment (PSE) and the mission sensitive Common Hardware and Software (CHS) target environment.

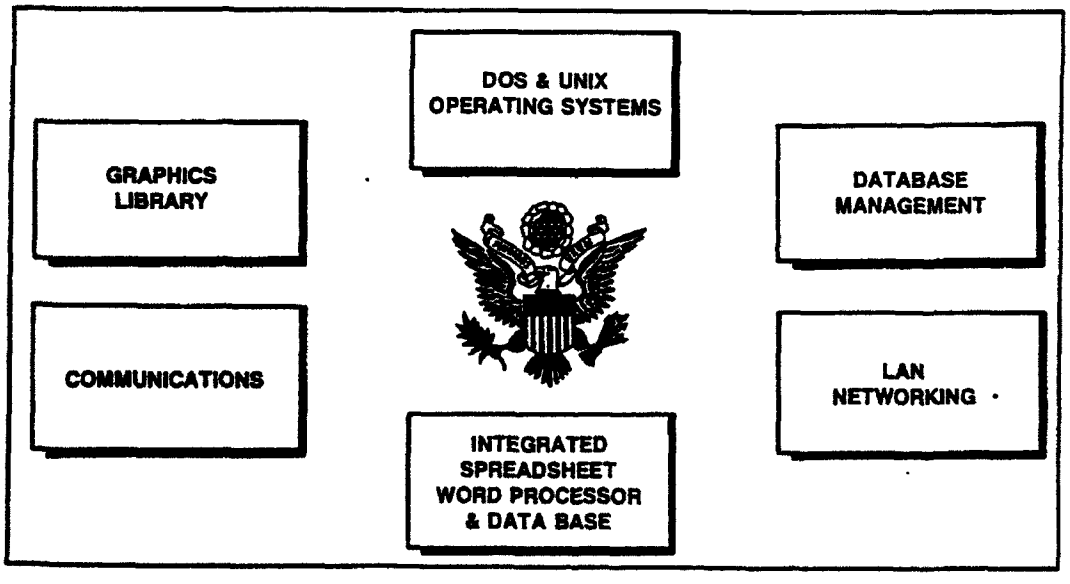
The CHS operating system (ACOS) provides a productive environment for the solution of large, complex problems. The ACOS provides the following features:

- Multi-user and multi-tasking capability
- Virtual memory
- UNIX V.2 commands
- Real time extensions

In addition the provided software components integrate the following functions into a cohesive system:

- Ada applications
- Graphics Kernel System
- SQL Database
- Electronic Mail
- Nerwork File Transfer
- Wordprocessing
- Spreadsheet
- Personal Database Management
- MS-DOS compatibility via a DOS co-processor module

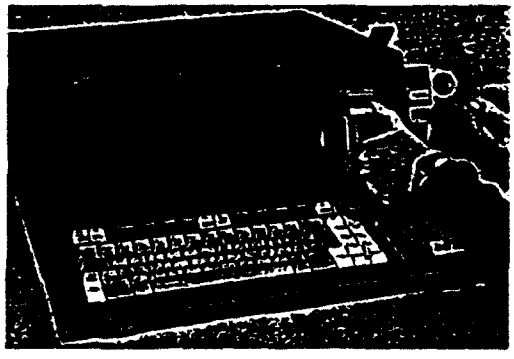
*MS-DOS is a registered trademark of Microsoft Inc.



APPENDIX B

MILTOPE BOBCAT TRANSPORTABLE COMPUTER UNIT

Portable Computer Unit (PCU)
Transportable Computer Unit (TCU)



Features

Standard

- 2, 4 or 8 mip performance
- 32-bit 68020 or optional 68030 processor
- 32-bit data bus; 6 MBytes/sec transfer rate
- 16, 25 or 33 MHz clock speed
- Floating Point Coprocessor
- AT&T SVID2 compatible operating system
- Designed to meet TEMPEST

Optional

- Removable 40 or 100 MByte cartridge hard drive
- Internal 3½" floppy disk
- Internal flat panel EL display (512 × 400 pixels) or external color monitor
- Rackmount kit: tracked or wheeled vehicle system rack and/or mounting tray kit
- Expanded RAM-16 MBytes

Description

The PCU/TCU computer configurations are versions of the Milhope "BOBCAT" computer which is based on the Hewlett-Packard 9000 Series 300 computer family.

These computers provide multitasking software resources for computational and graphics capability, sophisticated word processing and data base management. The AT&T System V Interface Definition, Issue 2 compatible operating system, is used in the standard Bobcat. The computers provide full 32-bit architecture which is implemented in both address and data. All units contain a minimum of 4 MBytes of RAM, RS-232, IEEE 488 parallel interface and IEEE 802.3 LAN ports.

The PCU/TCUs operate from standard 115 or 230 VAC power. A vehicular power adapter is available. With dimensions of 8.7 inches high by 20 inches deep by 19 inches wide, the computers can be supplied with slides to satisfy those applications requiring rack-mount operation.

Microprocessor

The standard PCU and TCU use a Motorola 68020 microprocessor operating at a clock rate of 16.7 MHz (PCU) or 25 MHz (TCU). This control microprocessor is supplemented with a Motorola 68881 Floating Point Math Coprocessor to provide high-speed, high-precision computation capability. The TCU is also available in a Motorola 68030 configuration operating at a clock rate of 33 MHz. This configuration utilizes the Motorola 68882 Floating Point Math Coprocessor. The units are totally compatible with an identically configured HP 9000 series 300 computer.

Internal/External Displays

All configurations are available with an integral flat panel electroluminescent (EL) display or with an RGB color video board to drive an external color monitor. The integral electroluminescent (EL) display provides a resolution of 512 × 400 pixels and is equivalent in display area to a 9-inch monitor. Text and graphics are displayed with high contrast and clarity and without distortion or flicker. The LSI-driven flat panel display provides for a harsh environment system of exceptional reliability. The easy-to-read, non-glare screen displays a 256-character set in 25-line by 80-column format as well as monochrome graphics. External color monitors offering resolutions of up to 1280 × 1024 pixels are described in the CMD section.

Removable Keyboard

The keyboard is a full-size, full-travel, waterproof "QWERTY" keyboard that contains 107 alphanumeric keys, including a numeric keypad and eight function keys. It is hinged to the main chassis and conveniently folds (suitcase style) toward the display for ease of storage or transport. It can be detached and relocated to 24 inches from the computer unit.

Built-in Memory

The computers contain 4 MBytes of RAM which is expandable to 20 MBytes (PCU) or 16 MBytes (TCU). A 710 KByte 3.5-inch flexible disk drive and a 40 MByte or 100 MByte removeable hard disk is available with all computer configurations.

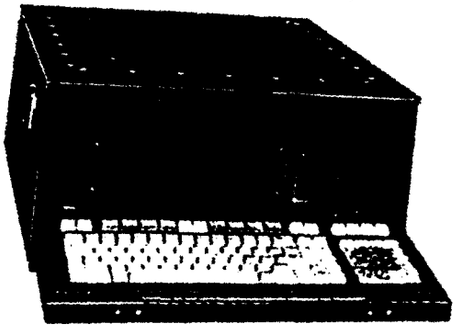
TCU
Bobcat-Transportable Computer Unit

MILTOPE CORPORATION

PRODUCT DATA 8-002

FEATURES

- 2 - 12 MIPS Performance
- 16 - 50 MHz clock speed
- RS232, Printer, Monitor and IEEE 488 Ports
- 4 - 200 MB Removable Cartridge Hard Disk
- AT&T SVID-Compatible Operating System
- Designed to Meet TEMPEST Requirements
- In-Use by Operational US Army Organizations
- 32-bit 68020 or 68030
- Floating Point Coprocessor
- 4 - 32MB Internal RAM
- 3.5-inch Floppy Drive
- Rack-Mountable in Tracked and Wheeled Vehicles
- Built-In Electroluminescent Display or External Display



Description

The Miltope Bobcat, a rugged transportable computer unit (TCU) is being delivered to the US Army for field use in several programs. The rugged TCU is based on Hewlett-Packard 9000 series 300 computers. This provides the capability to interface with a large number of compatible peripheral devices and accessories. Multi-tasking software resources for computations, graphics, word-processing and data base management are provided.

The TCU operates from standard 110 or 220 VAC power, an optional 28 VDC vehicular power adapter is available. It is designed to meet TEMPEST requirements.

Microprocessor

Clock Speed:	Motorola 68020 16.7 or 25 MHz	Motorola 68030 33 or 50 MHz
Coprocessor:	Motorola 68881	Motorola 68882
Performance	2 or 4 MIPS	8 or 12 MIPS
Data Bus:	32 Bit	32 Bit
DOS Coprocessor	AT&T SVID 2 compatible OS Optional	AT&T SVID 2 compatible OS Optional

Note: The 12MIP, 50MHz 68030 processor is upgradeable to a 20-MIP, 25MHz 68040 Processor by simply removing the 68030 module, (including the system clock) and replacing it with the 68040 module

Display

- 512 x 400-pixel electroluminescent internal or output for external RGB monitor

KBU

- Full size, full travel QWERTY
- 107 Alphanumeric Keys
- 8 Function Keys
- Numeric Keypad
- Removable - Optional Extended Length Cable
- Drip-Proof

Built-In Memory

- Minimum: 4mb
- Maximum: 32mb
- 720KB 3.5-inch Floppy - Optional
- 40/100/200mb Removable Hard Disk - Optional

Standard Interfaces

- IEEE 488
- IEEE 802.3 Ethernet LAN
- RS232
- SCSI

Expansion Unit

- Attaches to Top of TCU
- Contains 4 Expansion Slots for Full Size Cards. Also Available in VME Configuration.

SPECIFICATIONS

General Performance Characteristics

Software	HP-UX version of UNIX* System V Interface Definition 2 Operating System
Optional	HP Basic interpreter HP PASCAL compiler, FORTRAN Compiler, DOD validated Ada compiler
Keyboard	107-key drip-proof with numeric and function keypads
Display	Flat panel amber (5850 A), electroluminescent display, 512 x 400 pixel resolution or RGB color video board to drive an external color monitor.
Interfaces	
Standard	IEEE 488 parallel, IEEE 802.3 LAN, RS232 async serial
Optional:	SCSI High speed disk interface, Second IEEE 802.3 LAN, 4-channel RS232 async, serial 300/1200 Baud modem

Physical

Dimensions	19.0"W x 8.72"H x 20.0"D (25.5"D with keyboard open)
Weight	45 lbs.

Installation

Standard	Table top
Optional	19" rack mount expansion chassis
Power Consumption	120 watts (at minimum configuration)

Environmental

MTBF	20,000 hours
MTTR	20 minutes
Operational Microprocessor	Motorola 68020 (32-bit) with 68881 coprocessor or Motorola 68030 (32-bit) with 68882 coprocessor
Clock Rate:	16, 25, 33, or 50 MHz
Built-In Memory	
Standard	4 MBytes (2MiP Unit), 8MBytes all others
Optional	Up to 32 MBytes

Environmental

Temperature:	
Operating	0°F to 120°F
Storage	-25°F to 150°F
Shock	0° to 70° and 120° to 70°F each in ten minutes
Humidity:	10% to 95% RH; Non Condensing
Altitude:	To 10,000 Feet
Vibration:	Operates in a tactical wheeled vehicle environment of MIL-STD-810D, Method 514.3 while hard mounted and for a tracked vehicle environment while shock mounted (disks non-operating).
Shock:	Operates following 30-degree rotational drop from each bottom edge.
Rain:	Resistant to inadvertent spillage or water droplets or rain blown into shelters.
Sand & Dust:	No damage when subjected to exposure for 5 minutes at velocities to 3.5 mph.
TEMPEST:	Designed to meet NACSIM 5100A.
Orientation:	10° incline
High Altitude EMP:	Meets requirements (Classified)
EMI:	FCC Part 15 Subpart J Class B
Power:	110/220 VAC 50-60 Hz Single Phase Nominal
	28 VDC with power converter/UPS

*UNIX is a registered trademark of AT&T

MILTOPE Corporation

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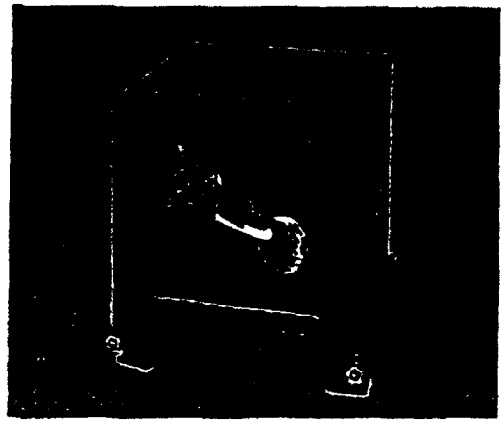
APPENDIX C

MILTOPE COLOR MONITOR DEVICE

Color Monitor Device (CMD)



Description

Four color monitor devices, offering a wide range of screen size and resolutions from 12" 512 × 400 pixels, 4 color planes through 19" 1280 × 1024 pixels, 8 color planes, are available.

The CMD can be used with the PCU, TCU and SDU. The CMD is driven by a video driver card installed in the host computer. The drive signal is analog RGB, composite sync on green.

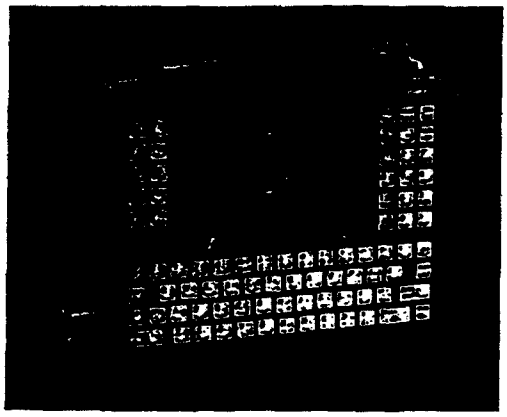
General Performance Characteristics

CMDA	
Screen size	12"
Resolution	512 × 400
Color planes	4
Size	13.0"W × 13.9"H × 18.0"D
Weight	46 lbs
Power consumption ..	90 watts max.
CMDB	
Screen size	16"
Resolution	1024 × 768
Color planes	6
Size	16.6"W × 16.2"H × 21.6"D
Weight	60 lbs
Power consumption ..	220 watts max.
CMDC	
Screen size	16"
Resolution	1280 × 1024
Color planes	8
Size	16.6"W × 16.2"H × 21.6"D
Weight	60 lbs
Power consumption ..	220 watts max.
CMDD	
Screen size	19"
Resolution	1280 × 1024
Color planes	8
Size	19.5"W × 20.79"H × 24"D
Weight	92 lbs
Power consumption ..	220 watts max.

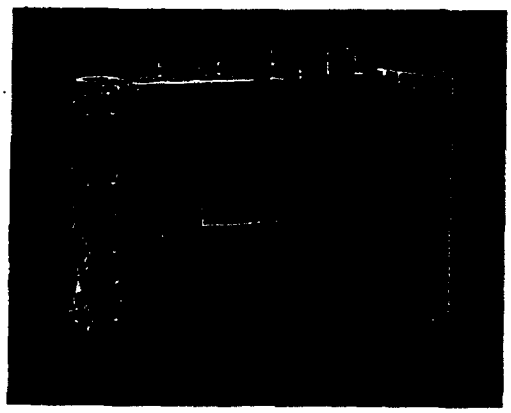
APPENDIX D

MILTOPE HAND-HELD TERMINAL UNIT

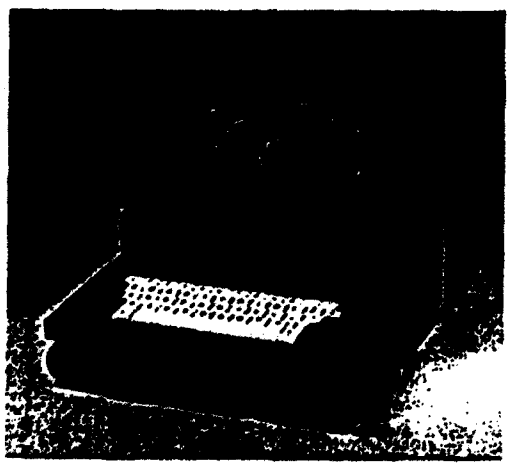
Handheld Terminal Unit (HTU) Family



HTU



FIST-HTU



E-HTU

Description

Miltope's Militarized IBM PC/AT compatible battery powered tactical handheld terminal units, (HTUs), are a family of portable microcomputers incorporating advanced state-of-the-art analog/digital communication capabilities that are compatible with the U.S. Army protocols.

The units are offered in three basic configurations allowing MS-DOS compatibility through the use of a 6 or 12 MHz 80C286 processor and up to 2 MBytes of internal RAM, and optional coprocessor. Displays in all HTUs are "CGA" compatible.

The standard HTU offers a waterproof tactile AT-style keyboard or an optional simplified fire-support key layout with a single channel analog/digital communication capability in a 5.5 pound package.

The FIST-HTU is identical to the HTU but includes options for up to four channels of communication as well as G/VLLD interface.

The HTU and FIST-HTU feature a back lit, sunlight readable 320 × 200 pixel display (4.5" × 2.75" LED). The E-HTU configuration offers an 8" × 5", 640 × 400 pixel flip-up LCD incorporating four shades of gray and operating in a double scan vertical mode. A full travel rain-proof IBM style keyboard is standard with the E-HTU. The E-HTU has provisions for adding an auxiliary rear memory pack that can contain up to two of the following options: a 3½" flexible disk, 20 MByte removable cartridge hard drive, three or four megabyte Flash (non-volatile semiconductor) memory cartridge. The memory pack also contains a spare slot for incorporating optional PC compatible cards. The E-HTU can also be provided without the memory pack but having the provisions for downloading from an external floppy or 100 MByte PCU/TCU hard drive.

HTU
Handheld Terminal Unit

MILTOPE CORPORATION

PRODUCT DATA 8-007

FEATURES

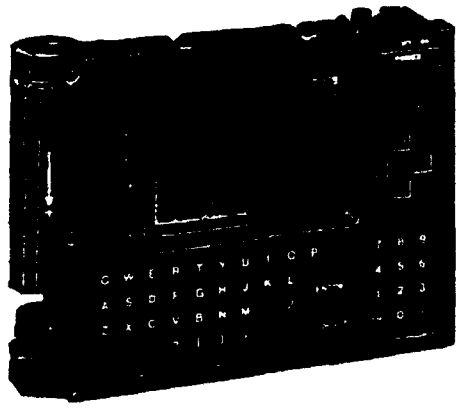
- User friendly operation
- Small dimensions
- Lightweight
- IBM-PC/AT* compatible computer
- Versatile communication capabilities
- Battery operated - standard batteries
- High contrast EL Backlit LCD display
- Standard IBM-PC* software environment
- Interfaces directly with Military Tactical Communications Networks including Net Radio, COMSEC devices, SINCGARS Radio and PJH

Applications

- Handheld computer
- Military communications terminal
- Examples:
  - Fire support computer terminal
  - C^3I systems
  - Maneuver command terminal
  - Air observers
  - Data communication
  - Forward artillery observers

Description

The HTU is a state-of-the-art military light-weight battery-operated, handheld communications terminal, designed for "man on the move" operation and providing digital communications over advanced communications systems. The terminal incorporates an IBM-PC/AT* compatible computer and a tactical communication module. Its extensive communication capabilities and operation under standard MS-DOS* make the HTU a powerful equipment with the flexibility to be tailored to customer requirements. The HTU has a modular and open architecture, allowing for internal and external expansion.



A "QWERTY" keyboard, with a separate numeric keypad and cursor controls provide user friendly operation under adverse conditions.

An EL Backlit LCD display provides both bit-mappable graphics and text capability.

SPECIFICATIONS

HARDWARE

- Display
  - High contrast graphic LCD panel, with backlit illumination (640 x 200 pixels).
- Keyboard
  - IBM-PC/AT* keyboard, 64 tactile keys.
- Memory
  - RAM-512KB (2MB option) battery backed-up.
  - RAM-DISK
  - EPROM - 512KB.
- Processor
  - 80C286, 16 bit.
  - 80287 (Optional Coprocessor)
- Brightness and illumination control
  - Operation under all light conditions.
- Clock
  - Time, day, month and year, battery backed-up.

INTERFACES

- Local Interface
  - COM1, RS-232C, asynchronous, 75 to 9600 bps.
- Communication Interfaces
  - Data rates: 75 bps to 32K bps
  - Digital interface: MIL-STD-188-114
  - Analog interface
  - Built-in modem for direct wire line (2W/4W) and HF/VHF/UHF radio
  - COMSEC interface

SOFTWARE

- Operating system
  - MS-DOS
- Flexibility
  - Standard IBM-PC* software support environment
- Languages
  - All IBM-PC* languages such as:
  - Ada*, C, PASCAL, BASIC, FORTRAN, PLM-86, PROLOG, LIST.
- Communication
  - Embedded communication support.
- Up/Download utility
  - For programs and data.
- BIT
  - Comprehensive built-in-test.

ENVIRONMENTAL

- Temperature range
  - MIL-STD-810D,
  - Operating: -25° to +50°C
  - Storage: -25° to +65°C.
- Shock
  - MIL-STD-810D, Method 516.3, Category 1, Figures 514.3-1,2,3.
- Sand and Dust
  - MIL-STD-810D, Method 510.2, Procedure 1
- Rain
  - MIL-STD-810D, Method 506.2, Procedure 1
- Solar radiation
  - MIL-STD-810D, Method 505.2, modified Procedure 1
- Humidity
  - 5% to 95% RH, MIL-STD-810D
- Salt fog
  - MIL-STD-810D, Method 509.2, Procedure 1
- Altitude - MIL-STD-810D
  - Operating - 0 to 15,000 ft
  - Non-operating - 0 to 40,000 ft
- EMI/RFI
  - MIL-STD-461/462.

ELECTRICAL

- Internal battery
  - Standard lithium BA-5800/U or standard alkaline AA size or standard NiCd AA size
- Vehicular power supply
  - 28 VDC
- Power consumption
  - 2.8W

PHYSICAL

- Aluminum case
  - Dimensions - 10.8" X 7.8" X 2.6" (W X H X D)
  - Weight - 6.4 lb, less batteries, 9.0 lb with batteries, interconnecting cables and carrying case.

RELIABILITY/MAINTAINABILITY

- MTBF
  - Greater than 10,000 hours MIL-HDBK-217E.
- MTTR
  - 20 min.

*IBM PC/AT is a trademark of IBM Corp.
Ada is a trademark of the U.S. Government.
MS-DOS is a trademark of Microsoft Inc.
Data subject to change without notice.

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The display and the keyboard are illuminated by a backlight for night vision.

3.2.1.2 Power Utilization

The switching type power supply converts the input voltages from the input source to output voltages required by the unit. The main features of the power supply are:

Input voltage range 4.5-15 Volts
Current limit
Low voltage indication

3.2.1.2.1 Power Interface

The MTU shall operate from internal batteries or from external +15 to +32VDC power adaptors.

3.2.1.2.1.1 Battery Power Source BA-5800/U.

The BA-5800/U is a non-rechargeable lithium sulfur dioxide battery approved for use by the U.S. Army (per MIL-B-49430 (ER)).

These BA 5800 batteries shall provide a minimum of 72 hours of continuous 2 MB RAM MTU operation IAW the below profile without exceeding the 8.5 pounds limitation for the MTU, carrying case, communication cables and batteries.

Operation Mode	% of Time
Standby	33
Receive	5
Transmit	5
Process	57

3.2.1.2.1.2 BA Battery Adapter.

The BA-11 battery adapter fits into the MTU BA-5800/U battery compartment. The adapter accepts eight size AA standard batteries, alkaline or NICAD, connected in series.

3.2.1.2.1.3 Vehicular Prime Power.

Vehicular power is a nominal 28 VDC with applicable characteristics per MIL-STD-1275 requirements 5.1.2.3, 5.1.2.4 and 5.2.3. The MTU operates from this voltage via the DCA DC adapter that is fitted in the battery compartment. The DC adapter converts 28 VDC vehicular power to internal power supply requirements.

3.3.1 WEIGHT

HTUs are available via the configuration table in aluminum or plastic cases. The HTUs and accessory maximum weights are listed in the following table:

PART	ALUMINUM WEIGHT	PLASTIC WEIGHT
HTU, no batteries, .5 MB RAM	6.89 lbs.	5.89 lbs.
Shoulder Carrying Case	.61 lbs	.55 lbs.
Communication cable, radio (3 ft.)	.46 lbs.	.48 lbs.
2 MB RAM	.17 lbs.	.17 lbs.

See the last paragraph of section 3.2.1.2.1.1 Battery Power Source BA-5800/U, for the weight specification.

Battery Adapter, BA	.4 lbs.	.4 lbs.
DC Adapter, DCA-11, with DC Cable	.9 lbs.	.9 lbs.

3.3.2 Dimensions

The nominal size of the HTU is as follows:

Width: 10.75"

Depth: 2.5"

Height: 7.75"

3.4 RELIABILITY

The HTU with its options, has the following mean-time-between-failures (MTBF). The MTBF is predicted on the basis of a component failure rate, per MIL-HDBK-217E assuming the following conditions:

a. Ambient (free air) temperature: 104 degrees F

b. Environmental service condition: class MP (manpack).

c. Serial reliability model:

1. HTU - 10,672 Hr. min. (.5 Mbyte memory, no coprocessor)

2. HTU with 2MB RAM - 5400 Hr. min.

3. HTU with 2MB RAM and coprocessor-4700 Hr. Min.

APPENDIX E

SBCS COMMUNICATIONS EQUIPMENT

SURVIVA~~BILITY~~ RECOVERY CENTER (SRC)/ ALTERNATE SURVIVA~~BILITY~~ RECOVERY CENTER (ASRC) (CON'T)

ITEM	QTY SRC	QTY ASRC	BRAND/MODEL
• CABLES AND CONNECTORS	1 SET	1 SET	MISC.
• FIBER OPTICS XRCVR	2	2	CHIPCOM 9301T
• LASER AND ASSOCIATED EQUIPMENT	1	1	LASER COMMUNICATIONS INC L-0-18
• SCALABLE MODEMS (300-9600)	6	6	MICROCOM QX3296C V.32
• RADIO AND BASE STATION	4	4	GFE AN/PRC-128
• COMM ROUTER	2	2	PROTEON P4200-31
• TERMINAL SERVER	1	1	XYLOGIC
• TERMINAL NODE CONTROLLER	3	3	KANTRONICS KPC 2400
• DIGITAL DATA BUFFER	2	2	HARRIS RF 3490A
• HHT	12		ITRON T4000

SURVIVABILITY RECOVERY CENTER (SRC)/
ALTERNATE SURVIVABILITY RECOVERY CENTER (ASRC) (CON'T)

ITEM	QTY SRC	QTY ASRC	BRAND/MODEL
• HHT - TNC	12		PACCOMM UMPAD
• NETWORK MANAGEMENT SYS	1		PROTEON P2351
• LAN TRANCEIVER (4 PORT)	2	2	BLACK BOX LN-LEO53A
• DIGITAL PATCH PANEL	1	1	ADC PMS-16-MF
• VF PATCH PANEL	1	1	ADC JLC 2/24
• EQUIPMENT RACKS	3	1	ZERO MFG
• BUILD RECEPTACLE	1	1	SUMARIA
• ANTENNAS	4	4	HRO CS28M
• SOFTWARE			
UNIX WITH TOOLS			INTERACTIVE V2.02 RUNTIME
MAP CREATION			AUTOCAD RELEASE 10-386
DATABASE			ORACLE V6.0.27 RUNTIME
RISC OPERATING SYSTEM			SUN OS
KANTRONICS TNC			VERSION V2.85
OVERVIEW MANAGER			PROTEON V1.0
P4200 ROUTER			PROTEON RELEASE 8.1
TERMINAL SERVER			XYLOGIC RELEASE 4.1

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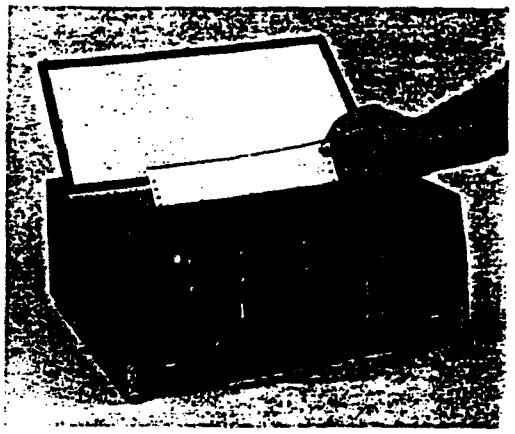
APPENDIX F

MILTOPE PRINTER UNIT

Printer Unit



Description

The Miltope Model SPP-212 is a rugged printer designed to satisfy 80-column printer applications in adverse environments where size, weight, and power consumption are prime considerations. This portable device employs solid state, serial dot matrix, impact printing technology.

The SPP-212 employs standard bond type paper per MIL-P-40023. In addition, the SPP-212 may employ cut sheets (8.5"W × 11.0"L) or optionally, roll paper per UU-P-547. Using fanfold, sprocket fed forms, the SPP-212 prints an original plus up to four carbon copies. The ribbon is a "self-inking" cartridge which is easily loaded by the operator in less than 20 seconds. The unique self-inking technology produces clear, crisp print quality, suitable for photocopy, with a life of three million characters.

The SPP-212 affords the user a multitude of features including numerous character sets and font styles as well as addressable dot plotting. The SPP-212 is available with several signal interfaces including Centronics parallel, RS232 and IEEE 488 bus. In the 80-column draft printing mode, characters are formed in a 7 × 9 matrix. In the 80-column-near letter quality (NLQ) mode, characters are formed in a 17 × 13 matrix. The optional graphics printing provides a resolution of up to 240 dots per inch (DPI)

The SPP-212 printing speed is a function of the character font selected. In the 80-column alpha numeric draft mode, print speed is 300 characters per second. In the 80-column alpha numeric NLQ mode, print speed is 62.5 cps. In any of the several enhanced alpha numeric character modes, print speed is a function of the number of dots per character.

General Performance Characteristics

Standard

- 80 columns per line at 10 characters per inch
- 132 columns per line at 17 characters per inch
- 300 CPS, 80-column draft mode
- 62.5 CPS, 80-column NLQ mode
- 132 ASCII characters and symbols
- Built-In Test
- Programmable menu selection
- Parallel or serial signal interface
- Original plus four-copy printout
- Character pitch 5-20/inch
- Graphics

Optional

- IEEE 488 interface (includes bar code module)
- 19" Rack Mounting

Physical	
Dimensions	17.0"W × 7.7"H × 15.5"D
Weight	31 lbs in table top configuration
Power Consumption ...	65 watts (printing)
Environmental	
MTBF	4000 hours (ground fixed)
MTTR	15 minutes

APPENDIX G

TELXON PTC-750/755 HAND-HELD TERMINAL UNIT


Telxon PTC-750/755
solutions bring super power
to the big screen!
TELXON PTC-755
TELXON PTC-750

For handheld computers, Telxon 750/755 means a whole new era of productivity.

From warehousing to route accounting, from retail automation to field information, the Telxon PTC-750/755 family of handheld computers can make your people and your business more productive. That's because these Portable Tele-Transaction Computers, or PTCs, go where the action is. In the sales representatives' hands, on the distribution center floor, in the store aisle. Instantly, they can send information to and receive information from your host computer. They accurately and efficiently gather, process and disseminate information critical to your business. And with their big screens and expanded power, training your people to use them is extremely easy.

The 750/755 series of PTCs from Telxon: closing the gap between your computer and the real world.

IT'S TIME TO REVISED A SMESSER HANDHELD COMPUTER. THE ELITE OUR NEW EGA SCREEN MODELS. The Telxon PTC-750/755 units have big, high resolution screens. This means fewer abbreviations, fewer acronyms, fewer hard-to-read codes. It's easy to read, so it's a lot easier to use.

Faster work. Computers in general are known for how fast they process information, but handheld computers are not. That was until now. The Telxon PTC-750/755 units utilize a third generation microprocessor. They have as much power as many personal computers (PCs) because they use the same 80C88 microprocessor. This means they can process information like a PC, not like older model handheld computers.

Store and retrieve more information than ever before. No other PTC has ever offered this much random access memory (RAM). Now your people can carry around more files, more prices, and more orders than ever before, so they always have the information they need at their fingertips, literally. And your host computer can be sent all the field information it needs.

PTC-755 models: multi-function telecommunications for on-the-go operations control.

Like the PTC-750 models, the Telxon PTC-755 models for batch communication have big screens, super power, and large storage capacities, plus all the other features and functions you can imagine in a hand-held computer.

FUNCTIONS

System extension

- ☐ *Expanded memory lets people gather and carry a complete set of data or operating instructions, without the necessity of constantly uploading data in order to free up memory to hold additional data.*
- ☐ *Full function, easy-to-use keyboard allows non-shift entry of alpha and numeric data.*
- ☐ *Magnetic coupling provides 99% successful connection on first call.*
- ☐ *Supports a full range of peripheral devices.*
- ☐ *Generates invoices, order copy and order verification on the spot.*

Full spectrum of telecommunication capabilities, including one-way or two-way link via acoustic or direct RJ-11 modem connection.

APPLICATIONS

Route accounting

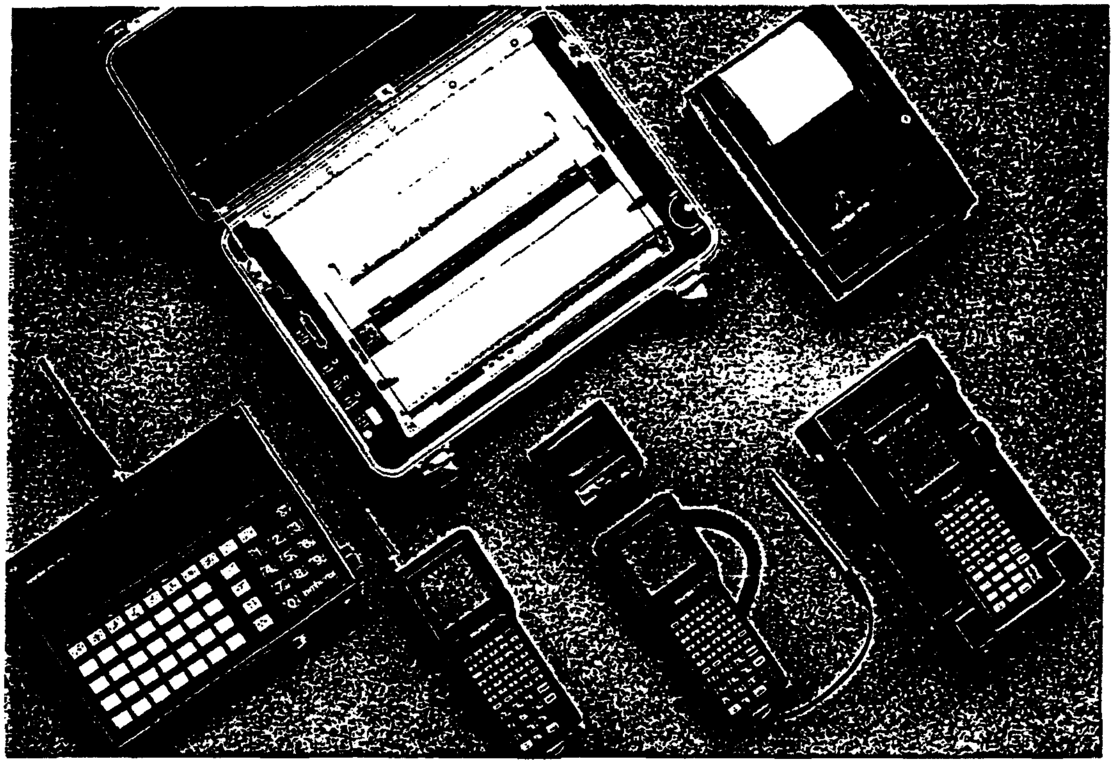
- ☐ *Puts needed information in your hand to make sure the right products are in the right place at the right time.*
- ☐ *Combines the large storage capacity with the fast processing speed needed to perform rapid searches of multiple and extensive files.*

Field information systems

- ☐ *Allows fast, easy access of the complete account history for each and every sales or service call.*
- ☐ *Sends and receives electronic mail.*

Retail store automation

- ☐ *Supplements your RF system real-time applications with batch applications to achieve complete control of all your operations.*



MODELS	ENVIRONMENTALS/ Operating Temperature	ENVIRONMENTALS/ Storage Temperature	Waterproof Case	95% Noncondensing Humidity	O.S. & Application	RAM	ROM	Keyboard	No-Shift Alphanumeric Entry	Standard & Custom Overlays Available	DISPLAY LCD (software selectable)	DISPLAY Vacuum Fluorescent	E.L. Backlight	Power
PTC-750	32° to 120°F	−20° to 160°F	no	yes	O.S. in EPROM App. written in TCAL or in MS-DOS in EPROM or RAM	1M	128K	50 keys	yes	yes	16 x 16 or 16 x 21	no	yes	Plug-in rechargeable battery pack
PTC-750IM	−22° to 122°F	−22° to 160°F	yes	no	O.S. in EPROM App. written in TCAL or in MS-DOS in EPROM or RAM	256K	128K	54 keys	yes	yes	no	2 x 40 or 8 x 40	no	Voltage range 12 to 72 volts
PTC-755	32° to 120°F	−22° to 160°F	no	yes	O.S. in EPROM App. written in TCAL or in MS-DOS in EPROM or RAM	1M	128K	50 keys	yes	yes	16 x 16 or 16 x 21	no	yes	6 AA batteries
PTC-755 2-way acoustic	32° to 120°F	−22° to 160°F	no	yes	O.S. in EPROM App. written in TCAL or in MS-DOS in EPROM or RAM	1M	128K	50 keys	yes	yes	16 x 16 or 16 x 21	no	yes	5 AA batteries
PTC-755 optical communications	32° to 120°F	−22° to 160°F	no	yes	O.S. in EPROM App. written in TCAL or in MS-DOS in EPROM or RAM	1M	128K	50 keys	yes	yes	16 x 16 or 16 x 21	no	yes	6 AA batteries

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APPENDIX H

ECLIPSE RULE LANGUAGE

Eclipse

affordable intelligence for real problems

- has been derived from CLIPS:

  the data-driven inference engine
  NASA derived from Inference Corporation's ART℠

- by the former Chief Scientist of Inference
- is many times faster than CLIPS
- supports much larger applications than CLIPS
- supports fast binary loading of knowledge-bases
- offers Truth Maintenance and other features not found in CLIPS
- provides a Client / Server architecture which
  - can place any portion of a knowledge-base in *extended memory*
  - is so open that its development environment is actually a client!
  - allows you to develop, copy, and port clients *without restriction*
  - allows clients to operate across networks *without restriction*
- includes all client source code for its development environment
- includes all server source code (except THE Rete or Not℠ Algorithm)
- is implemented entirely in C for easy customization and integration
- is priced from under $300 with trial period and updates
- includes ROYALTY-FREE distribution rights

Call (412) 741-6420

The Haley Enterprise 413 Orchard Street Sewickley, Pennsylvania 15143 (412) 741-6420, 741-6457 fax

THE Eclipse

Eclipse is a single C source code which is compiled and linked in two ways to produce either Eclipse 86 or Eclipse 386. Eclipse 86 is compiled and linked into a single executable image using Microsoft C. Eclipse 386 is actually two executable images. One executes in protected mode using the full 32-bit data path of the 80386 and full access to as much as the 16 megabytes available under protected mode. This image is created by compiling much of the Eclipse source using Metaware's HighC 386 compiler and linking with PharLap's 386 ASM/Link. The DOS client image is created using only Microsoft C.

Eclipse 86 $275

Eclipse 86 ranks among the world's fastest inference engines - more than twice as fast as CLIPS. With Eclipse 86 you can build DOS applications with hundreds of rules - the binary loading kernel can be as small as 100 kilobytes! There are hundreds of CLIPS applications that will run much better using Eclipse 86. Eclipse 86 includes all the object code needed to link with and embed knowledge in your applications. Furthermore, The Haley Enterprise allows unlimited, royalty-free distribution of Eclipse 86 applications.

Eclipse 86 Toolkit $425

The Eclipse 86 Toolkit is Eclipse 86 with the source code for the Eclipse development environment, parser, utilities and all run-time components other than those which manipulate T.H.E. Rete or Not Algorithm data structures. With this toolkit you can perform even the most difficult systems integration tasks without obstacle. Your license allows you to port Eclipse's development environment and application interfaces to the platform of your choice and put your Eclipse inference engine and knowledge on your network for collaborative development and workgroup applications deployment.

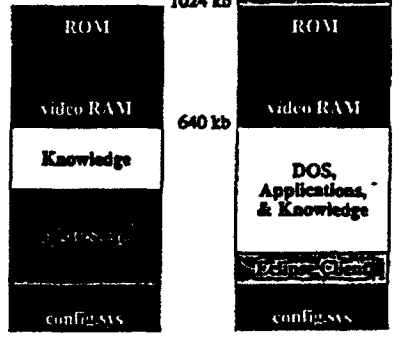
Eclipse 386 Toolkit $625

Eclipse 386 is approximately twice as fast as Eclipse 86. Unlike CLIPS and other AI languages, it is hard to imagine applications that will be too large for Eclipse 386. Even a two megabyte 386 will run applications up to 8 times larger than CLIPS can - more than 4 times as fast! With a 4 megabyte 386 you can develop systems as large as have yet been developed - thousands of rules - that run with record-breaking speed!

Eclipse 386 Server Toolkit $875

In order to deploy many executable images incorporating Eclipse 386 you will need to select a DOS extender and obtain the object code for the Eclipse 386 Server which we have generated using MetaWare's HighC 386 compiler. The Eclipse 386 Server Toolkit is precisely the Eclipse 386 Toolkit plus this object code. Although it is not necessary to obtain the Eclipse 386 Server object code, you may be interested in this license if you want to integrate Eclipse 386 with your own 32-bit compiled, DOS-extended functionality.

- **Developed by Paul V. Haley, formerly**
  - Vice President for R&D, Intelligent Technology Group
  - Visiting Lecturer in AI at Stanford University
  - Chief Scientist, Inference Corporation
  - Project Scientist, Carnegie-Mellon
  - Consultant to Digital Equipment
- **Commercially Supported with Incremental Updates**
- **Call about Ports, Customization and Consulting**



CLIPS

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