END
DATE
FILMED
8--80
DTIC

1.0

1.1

1.25 1.4 1.6

1.8

2.0

2.2

2.5

2.8

3.2

3.6

4.0

MICROCOPY RESOLUTION TEST CHART

LEVEL

TACTICAL OPERATIONS ANALYSIS SYSTEM (TOAS) BASELINE CONFIGURATION

TRW Defense and Space Systems Group

Mr. George Sitton
Mr. Mike Murphey

DTIC
SELECTE
JUL 1 0 1980
C

ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, New York 13441

ADA086750

CARL A. LARSON, Colonel, USAF
Chief, Intelligence & Reconnaissance Division

FOR THE COMMANDER:

JOHN P. HUSS
Acting Chief, Plans Office

If your address has changed or if you wish to be removed from the AFRO mailing list, or if the addressee is no longer employed by your organization, please notify HQ USAF (AFCIN), Pentagon, AFB or 16441. This will assist us in maintaining a current mailing list.

Do not return this copy. Retain or destroy.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RADC-TR-80-21	2. GOVT ACCESSION NO. AD-A086 750	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) TACTICAL OPERATIONS ANALYSIS SYSTEM (TOAS) BASELINE CONFIGURATION		5. TYPE OF REPORT & PERIOD COVERED Interim Report, Sep 78 - Sep 79
		6. PERFORMING ORG. REPORT NUMBER 0221-80-01
7. AUTHOR(s) George Slaton Mike Murphey		8. CONTRACT OR GRANT NUMBER(s) F30602-78-C-0196
9. PERFORMING ORGANIZATION NAME AND ADDRESS TRW Defense and Space Systems Group 7600 Colshire Drive McLean VA 22102		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 63789F 23150221
11. CONTROLLING OFFICE NAME AND ADDRESS Rome Air Development Center (IRDE) Griffiss AFB NY 13441		12. REPORT DATE February 1980
		13. NUMBER OF PAGES 52
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Same		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same

18. SUPPLEMENTARY NOTES

RADC Project Engineer: Dennis Nawoj (IRDE)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Computer System Hardware
Computer System Software
Automated Data Processing Facility

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the baseline system being installed at the Tactical Operations Analysis Support Facility at Langley AFB VA under RADC Project 2315. This effort is part of Project 2315, which is directed at developing improved and new automated techniques for the enhancement of Tactical Operational Intelligence support. The baseline system provides the means to implement the project objectives by providing the facility for the test, evaluation and development of Tactical→(Cont'd)

DD FORM 1473 EDITION OF 1 NOV 68 IS OBSOLETE
1 JAN 73

(Cont'd)

Operational Intelligence processes for automated improvement
techniques. This report also provides a focal point for identifying
the operational facility requirements and procedures for utilization
and maintainability of the resources.

SECTION 1. INTRODUCTION

The objective of Project 2315 is to develop improved and new automated techniques for the enhancement of Tactical Operational Intelligence support. The objective is to be implemented by the evaluation and generation of intelligence processing requirements and evaluation of existing relevant applications, along with design and evaluation of alternatives that take advantage of current technology. The Project shall provide functional specifications for the design of a Tactical Operation Analysis System upgrade through the mid-1980's.

In providing a vehicle for performing the project objective, a Tactical Operation Analysis System (TOAS) baseline has been provided as a test bed for Project 2315 contractors and the Air Force.

SECTION 2.0 DOCUMENTATION OBJECTIVE

The TOAS baseline provides the facility for the test, evaluation and development of Tactical Operational Intelligence processes for automated improvement techniques. The initial baseline system will evolve as new development and test requirements are defined.

It is the intent of this baseline system documentation to provide an up-to-date reference for the TOAS user's. This reference shall maintain configuration control documentation on all resources procured or resources contracted for support via the TOAS contract. The baseline document will be maintained as a loose leaf document with change pages issued for an updated document during the period of performance. This document will also provide a focal point for identifying the operational facility requirements and procedures for utilization and maintainability of the resources.

SECTION 3. BASELINE SYSTEM CONFIGURATION

The Baseline System consists of the current hardware and software available to the TOAS facility user. The Baseline System will be updated to reflect enhancements and additions as they become available to the user.

3.1 Hardware System Configuration

The hardware configuration shown in Figure 3.1 is the overall system block diagram with each subsystem shown. Table 3.1 is a complete tabulated list of all hardware modules by module/part number and equipment manufacturer.

3.2 System Software

The operating system is Digital Equipment Corporation's (DEC) Interactive Application System (IAS). IAS is a general purpose operating system that provides a multi-function processing environment which enables real-time applications to execute concurrently with timeshared multi-user interactive and batch processing applications. IAS operating system is the multi-programming executive with real-time and timeshare scheduling, files-11 file system, interactive application program development capability, system management facilities and dynamic memory allocation.

Three different operating modes can be generated with IAS. Real-Time, Multi-User and Timesharing. The real-time operating mode has the lowest overhead, smallest system with the executive overlaid and a direct priority driven scheduler. The real-time operating mode provides a compatible update to the RSX-11D, version 6.2 operating system. The suggested use is for low program development, process control and Analog/Digital operation. The user interface is the Monitor Console Routine (MCR).

The Multi-user operating mode adds a real-time resident executive with the IAS scheduler and IAS partitions. The suggested use is program development and real-time activity (Non-hostile environment). The user interface is the Program Development System (PDS) and PDX which allows MCR type commands to be used as well as PDS commands to be used.
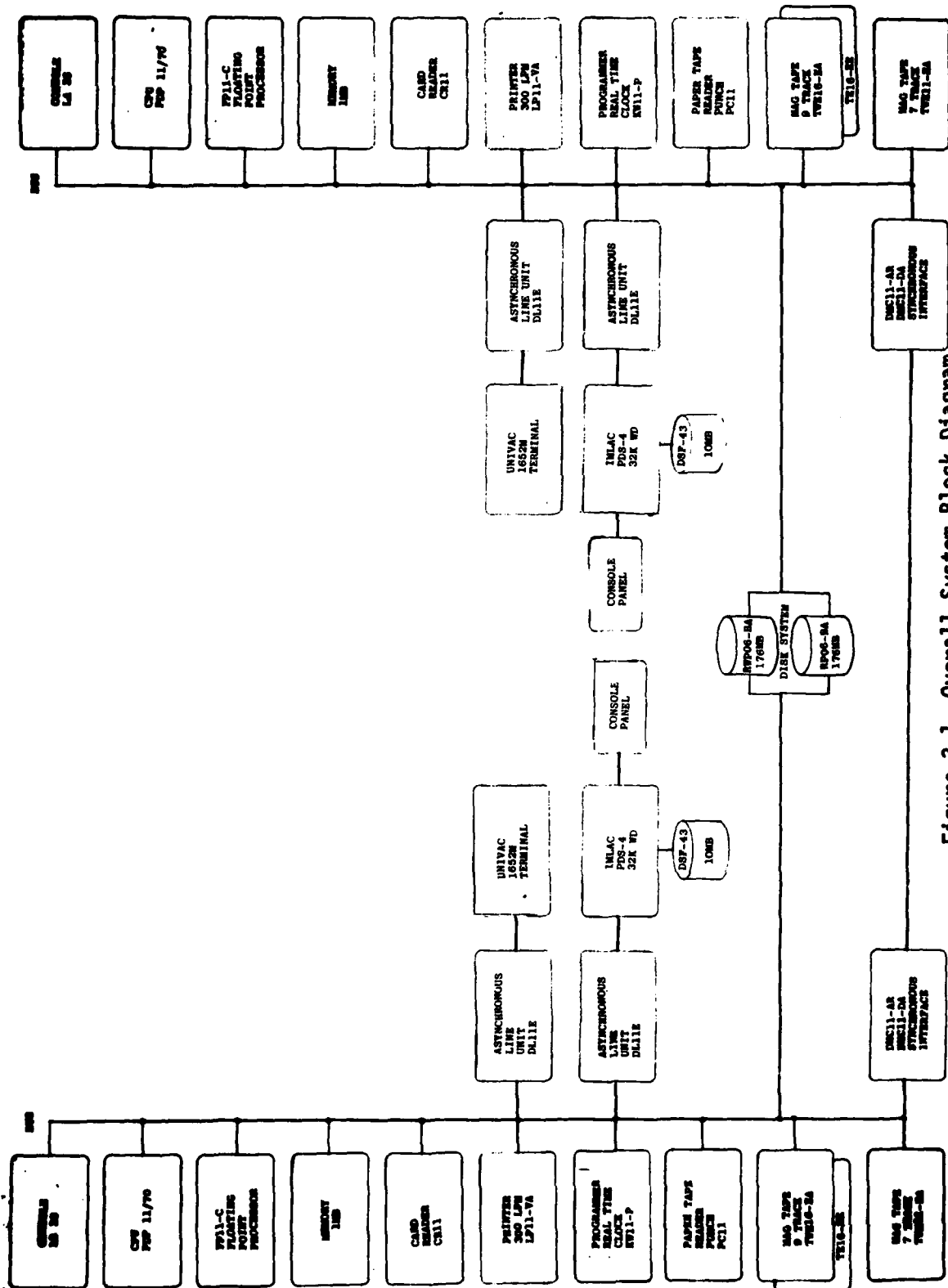
3

Figure 3.1 Overall System Block Diagram

TABLE 3.1

TOAS EQUIPMENT LIST

ITEM	MODEL	DESCRIPTION	QTY	MFG
1	11/70-VA	CPU, 128K BYTES parity core memory, serial line unit and line frequency clock, extended instruction set, 16 general purpose registers, variable stack over-flow, 4-level vectored priority interrupts, hardware memory management, ROM bootstrap loader, direct memory access, 2K byte bipolar-cache memory buffer.	2	DEC
2	FP11C	High performance floating point processor (32 bit and 64-bit floating point numbers and integer to floating point conversions)	2	DEC
3	KW11-P	Programmable real-time clock, selectable interrupts of 100KHZ, 10KHZ, line frequency or internal signal	2	DEC
4	RWP06-BA	Dual access 176 MB disk drive and 2 ea RH70 controllers.	1	DEC
5	RP06-BA	Dual access 176 MB disk drive	1	DEC
6	RP06-P	Back-up disk packs	2	DEC
7	TWE16-EA	9-track, 45ips, 800 or 1600 bpi, TE16 program selectable magnetic tape transport and controller	2	DEC
8	TE16-EE	9-track, 45 ips, 800 or 1600 bpi, program selectable magnetic tape transport	2	DEC
9	TME11-EA	7-track, 45 ips, 800 bpi, TE10W magnetic tape transport and controller	2	DEC
10	H960-DH	Cabinet with single expansion mounting chassis, BA11-F box with 9 system units of mounting space	2	DEC

5

TABLE 3.1 (Cont'd)

ITEM	MODEL	DESCRIPTION	QTY	MFG
11	DD11-DF	Expansion backplane mounting unit for BA11-F (2 system units, 7 Hex, 2 Quad Modules)	2	DEC
12	LP11-VA	300 lines per minute, 132 column, 64 character line printer	2	DEC
13	CR11	300 CPM, card reader	2	DEC
14	PC11	High-speed paper-tape reader and punch (reads 8 hole tape at 300 char per sec and punches at 50 char per sec)	2	DEC
15	DMC11-AR	Network link DDCMP micro-processor module	2	DEC
16	DMC11-DA	Network link line unit module, EIA/CCITT synchronous modems, speeds up to 19,200 bps, full or half-duplex, data set control	2	DEC
17	DL11-E	Modem controlling EIA/CCITT serial line interface asynchronous	4	DEC
18	IN-1670	448 wds MOS memory, with ECC	2	INTEL
19	U1652M	UNIVAC 1652 dual monitor display terminal, 32K bytes memory, dual VFK, light pen, interactive graphics	2	UNIVAC
20	PDS-4/L	Graphic display system, software, 21 inch CRT, 32K wds memory, control panel, direct memory access, 67 key programmable, alphanumeric keyboard (six programmable function keys), 2048 x 2048 resolution, 16 levels of hardware blink intensity, virtual display paging, ROM bootstrap, serial interface, 10MB double density disk drive and controller.	2	IMLAC

The Timesharing operating mode provides real-time processing and timesharing control of interactive and batch processing. All three types of processing can take place concurrently with service determined by priority and activity. Real-time tasks are scheduled by priority while interactive, batch and noncritical real-time tasks are allocated resources by a heuristic scheduler using a time-slicing algorithm and dynamically computed priorities. Check point capability is provided where resources are needed for high priority processing.

The Timesharing operating mode adds the Timesharing Control Primitives (TCP) for the interactive and batch processing, providing full timesharing applications. TCP provides protection and privilege-control features required for a timesharing environment. TCP enables users to protect their mountable magnetic media against other users and provides the mechanism for timesharing tasks to invoke and communicate with other timesharing tasks.

The user interfaces are Program Development System (PDS) and System Control Interface (SCI). Both interfaces use English language commands referred to as Digital Command Language (DCL). DCL is Digital Equipment Corporation's first step in providing a standard command language for all their mini-computer operating systems. The DCL is the only user interface provided through PDS; however, to ease the transfer of experienced MCR users to DCL, PDS supports a MCR mode. This provides a simulated MCR interface, which allows most MCR commands to be issued.

3.3 Application Packages

This paragraph describes software packages furnished with the systems that are of interest to Project 2315 and the associated contractors.

3.3.1 Data Base Management Systems

The Data Base Management System is Digital Equipment Corporation's DBMS-11. DBMS-11 provides data base facilities for programs written in COBOL, FORTRAN, BASIC and MACRO-11.

7

DBMS-11 provides a separate language capability for data description and manipulation, which enables the integration of data and data relations into a common data base for all application programs. The Data Definition Language (DDL) provides for definition of complete data bases or portions thereof for use of one or more application programs. The SCHEMA DDL (overall definition) defines the physical extent of data base including control, and mapping of data onto storage files. Also, it defines all records, record components and logical set relationships among records.

Data Manipulation Language (DML) statements are included within the application programs and provides for manipulation of data and records defined within the SCHEMA for the application program.

Included in DBMS-11 are data base utilities for:

Security Dump
Journal Roll Forward
Journal Roll Back
Security Restore
Initialize Utility
Page Find/Fix
On-Line Recovery
Journal Tape Fix
Data Base Query
Verify

3.3.2 DECnet-11

DECnet provides the capability to internet two computer systems and to provide network internetting if necessary for the requirements.

DECnet-11 enables point-to-point communications in computer networks. DECnet supports task-to-task communications, network file transfer and network resource-sharing capabilities. Communications between network nodes is supported by a number of both synchronous and asynchronous hardware devices. The user applications software is supported for MACRO-11 and FORTRAN.

8

Task-to-task communication can exchange messages with other user tasks with any data format.

A user can transfer sequential ASCII files between nodes. The files can be transferred between any device supported by the File Control System. Other files may be transferred where the formats are compatable with the File Control System. DECnet does not support file spooling.

The network resources can be accessed by subroutine calls in FORTRAN and by MACRO-11 coded modules. The functions supported are:

    READ
    WRITE
    OPEN
    CLOSE
    DELETE

Down-line system loading is supported for RSX-11S nodes and task loading into adjacent nodes. This feature is for supporting remote systems without mass storage devices.

DECnet provides network control for displaying statistics, controlling network components and testing network components. The operator can display statistics relating to nodes, communications lines, traffic and errors. The operator can load and unload DECnet components, start and stop interfaces and download. Messages can be sent and looped back for testing.

DECnet supports the Digital Data Communications Message Protocol (DDCMP) for full or half duplex transmission. DDCMP provides error detection/ correction.

3.3.3 UNIVAC Micro-Code

The 1652M terminal has been designed to work in conjunction with a host computer. The terminal has Read Only Memory (ROM) which contains the micro-code for performing self test and bootstrap for downloading the operational micro-code from the host.

The micro-code along with the 1652M terminal, provides basic features for switch controls, alphanumeric entries, editing functions and operating modes.

The switch controls indicate alphanumeric entries and editing functions as follows:

External Video
Internal Video
Graphics
Alarm
Insert
Upper and Lower Case Characters
Screen Selection
Paging
Initiation
Interrupt Indication
Clear
High Light Character
Transmit
Copy
Move Characters
Eraser (Character Word and Line Delete)
Cursor Control
Alphanumeric Control Entry

The operating modes are page, left, right and dual. The page mode allows eight pages of memory to be displayed, four pages for each screen. The pages are viewed by repeated keying of the function "NEXT PAGE".

In the dual mode, two different pages can be viewed by repeated key selection. The right and left page modes allow dual page viewing with paging on the selected monitor.

3.3.4 Languages

The high level languages available are COBOL and FORTRAN. The supplied COBOL language is a subset of full ANS COBOL and meets the ANS-74 low-level specifications with the exception of the RERUN option in I/O-CONTROL not being implemented. The following additions have been added:

Full level 2:

> Nucleus Module
> Table Handling Module
> Sequential I/O Module
> Relative I/O Module
> Indexed I/O Module
> Segmentation Module

Full Level 1:

> Library Module with partial level 2 REPLACING facility
> Interprogram Communication Module
> Cross Reference Compilation Listing
> Display with No advancing.

The COBOL Software includes:

> COBOL Compiler and run time system
> COBRG Report program generator utility
> RFRMT Source Program reformat utility
> CBLMRG COBOL ODL Merge utility

The FORTRAN language is an extended implementation based on ANSI FORTRAN, X3.9-1966. The following extensions have been added to the ANSI Standard.

> General expressions in all meaningful contexts
> Mixed mode arithmetic
> BYTE data type
> ENCODE, DECODE statements
> PRINT, TYPE, ACCEPT I/O statement
> Direct access unformatted I/O, DEFINE FILE statement

Comments at end of each source line PROGRAM Statements

OPEN and CLOSE file access control statements

List-directed I/O

INTEGER*4 (32 bit data type)

ENTRY statement

INCLUDE statement

PARAMETER statement

Generalized do loops

Lower as well as upper, bounds specification in array declaration

Generic function selection based on argument data type for FORTRAN defines functions

Direct access formatted I/O.

3.3.5 GRAPHELP

GRAPHELP is an interactive graphics FORTRAN software package that was designed to run on minicomputer systems. Interactive graphics is supported for TEKTRONIX 401X graphics storage tube terminals and the IMLAC PDS-4 refresh graphics system.

The software provides both absolute and relative vectors for four varying line texturers, user definable scaling, windowing, clipping, terminal transparency and 128 nested sub-picture display files for graphics. Routines are provided for interactive graphic crosshair input and screen erase control.

GRAPHELP is a software package supplied by Harry Diamond Laboratories with no warranties. The GRAPHELP System is installed on the TOAS; however, TRW does not assume responsibility for this system.

SECTION 4. BASELINE SYSTEM DESCRIPTION

The baseline system description will give a high level overview and will provide the necessary document reference numbers for a detailed description.

An updated set of documents for system hardware and software description for the resources available via the TOAS contract is maintained for project user reference. This documentation is part of the configuration management for the baseline system.

4.1 Hardware System

The major features of the hardware is documented herein for ready reference as well as detailed interface requirements.

4.1.1 Central Processing Unit (CPU) and Options

The PDP-11/70 includes several advances in the PDP-11 family. These are cache memory, 32-bit internal data paths with parity, memory management unit, double precision floating point processor and high performance peripheral controllers. The PDP-11/70 is compatible with the full PDP-11 CPU family.

The cache memory is bipolar and acts as a buffer between main memory and the CPU registers with a cache memory to register transfer speed of 240 nanoseconds. The cache memory enables an average speed between memory and CPU registers approaching a CPU cycle time of 300 nanoseconds.

Internal data paths are designed for high performance with a 32 bit parallel data bus for high performance interfaces and 16 bit parallel data bus for medium to low performance peripherals. The mass bus transfers 32 bits plus 4 parity bits (one per byte) in parallel between memory and cache memory or 4 bytes of data between memory and the high performance peripherals. The high performance peripherals being the high performance disk and tape systems. The PDP-11/70 in effect has look-ahead capability because of the 32 bit parallel interface. For example, when a transfer from memory to cache memory is performed; cache has two 16 bit words in memory, assuming the

13

second word contains the next instruction to be executed,then the execution occurs at approximately 240 nanoseconds.

Memory management is performed with hardware relocation and protection. The hardware connects 16-bit virtual addresses to 22-bit addresses enabling address capability up to four million bytes.

The Floating Point Processor (FPP) is available as an option and plugs directly into the CPU. Floating point calculations are carried out in single precision (32 bits) or double precision (64 bits). The data format provides seven decimal digit accuracy for single precision and seventeen decimal digit accuracy for double precision.

The PDP-11/70 provides for high performance controllers for secondary storage subsystems. The computer system interfaces via the RH70 controllers for the large Moving-Head Disk Subsystem (RWP06), Fixed-Head Disk Subsystem (RWS04) and the Magnetic Tape Subsystem (TWU16).

The RP06 Moving-Head Disk Subsystem operates at a maximum transfer rate of 806,000 bytes per second, (five microseconds for a four-byte transfer).

The TOAS does not have a Fixed-Head Disk Subsystem.

The TWU16 high-performance magnetic tape subsystem operates at a read/ write speed of 45 inches per second with a maximum transfer rate of.72,000 characters per second.

As an option, the computer system has a KW11-P programmable real-time clock. The clock operates in a single or repeat interrupt mode. The selectable clock rates are 100KHZ, 10KHZ, line frequency and external clock. The clock accuracy is 0.01% overall, plus synchronization error.

The memory for the TOAS computers consist of 128K bytes of Digital Equipment Corporation's Core Memory and 896K bytes of MOS semiconductor memory. The MOS memory has error detection and one bit forward error correction capability. The MOS memory has error logging which enables scheduled, corrective maintenance for all single bit failures without interruption of the user.

14

The TOAS computers are not equipped with the conventional M9301 bootstrap module. The bootstrap module is the M9312, which is DEC's new module for standardization of the bootstraps for the PDP-11 family. The bootstrap procedures are documented in Appendix A.

References:

PDP 11/70 Processor Handbook	EB-05962-20
FP11-C Floating-Point Processor User's Manual	EK-FP11C-OP-001
M9312 Diagnostic ROM	ZEROX COPY OF INFO FACILITY FILES
PDP-11/70 System User's Manual	EK-11070-OP-001
IN-1670 Technical Manual (INTEL MOS MEMORY)	19-1118-000
861 Power Controller User's Manual	EK-861AB-OP001
KW11-P Programmable Real-Time Clock User's Manual	EK-KW1PF-OP-001
KW11-L Line Time Clock Manual	EK-KW11L-TM-002
PDP-11 Peripheral Handbook	EB-07667-20

4.1.2 RWP06 Disk Subsystem

The TOAS Baseline System has two high performance moving head disk units. The disk subsystem interfaces with memory and CPU via the parallel mass bus (32 data bit interface) for a transfer rate of 806K bytes per second, directly between the disk subsystem and memory. The disk subsystem has an average seek time of 28 milliseconds.

The storage capacity is 176 million bytes usable area per disk with an expansion capability of 1.6 billion bytes per controller.

The disk subsystem is dual ported for multiple access; however, DEC does not have any software to support this hardware option.

References:

PDP-11 Peripheral Handbook	EB-07667-20
RWP06 Moving Head Disk Subsystem User's Manual	EK-RWP56-OP-001
RP06 Device Control Logic User's Manual	EK-RP056-OP-001

4.1.3 TWE16 Magnetic Tape Subsystem

The TWE16 Magnetic Tape Subsystem interfaces directly with memory and the CPU via the 32 data bit parallel mass bus. Each computer system has two 45 ips, 800, 1600 bpi tape units. The tape units are 9 track industry-compatible, program selectable, NRZI (800 bpi) or phase encoded (1600 bpi), 45 ips for record and playback capability. The maximum transfer rate is 72,000 characters per second.

References:

PDP-11 Peripheral Handbook	EB-07667-20
TE16 DEC Magtape Transport User's Manual	EK-TEWN-OP-001

4.1.4 TME11-EA Magnetic Tape Subsystem

The TME11 Magnetic Tape Subsystem interfaces with the computer system via the unibus (16 bit parallel bus). Each computer system has one tape subsystem. The tape unit is a 7 track, NRZ (800 bpi), 45 ips, TE10 high-performance magnetic tape drive.

References:

PDP-11 Peripheral Handbook	EB-07667-20
TMB11/TS03 DEC Magnetic System User's Manual	EK-TMB11-OP-001

4.1.5 H960-DH Cabinet and Expansion Chassis

The H960-DH consists of a stand-alone cabinet, power supplies and space for back-plane wiring for 9 system units. The system unit expansion has a DD11-DF expansion back-plane for 2 system units. Additional system units are added to the system by installing more back-plane expansion units up to 9 system units.

References:

PDP-11 Peripheral Handbook (Old Version)	
861 Power Controller Unit's Manual	EK-861AB-OP-001

4.1.6 LP11-VA Line Printer

The LP11-VA is an impact, 132 column, 64 character, 300 LPM line printer. The printer is Model Number 2230 and is manufactured by Data Products Corporation. The printer has off-line test capability and interfaces via DEC's standard printer-controller to the unibus.

References:

Technical Manual Model 2230 Line/Printer	DPC 241735F
LP11/LS11/LA11 Line Printer Manual	EK-LP11-TM-006

4.1.7 CR11 Card Reader

The CR11 reads the Standard 80-column EIA card at 200 cards per minute (nominal). The reader interfaces via controller to the unibus.

Reference:

CR11/CM11 Card Reader User's Manual   EK-CR11-OP-001

4.1.8 PC11 Paper-Tape Reader/Punch

The PC11 operates the PC05 High-Speed Paper-Tape Reader/Punch. The PC05 uses a photoelectric paper-tape reader and an electromechanical paper-tape punch.

The operating system software will not allow both the punch and reader driver modules to be loaded at the same time. The reader device handler is loaded when the IAS system is initiated; removing the reader handler and loading the punch handler is necessary before the punch can be used.

Reference:

PC11 High-Speed Reader/Punch and Control   EK-PC11-OP-001
   User's Manual

4.1.9 DMC11 Network Micro-processor

The DMC11 is provided for inter-computer communications. The DMC11 supports several line interface modules with speeds up to 1 Mega-bit per second. The DMC11-DA line card with rates up to 19.2k bps is installed in the baseline system. The DMC11 will enable connection of local as well as remote computer systems with DDMCP protocol. DEC has available a programmable Micro-processor (KMS11) for implementing other protocols.

References:

DMC11 IPL Micro-processor   EK-DMCMP-OP-001
   User's Manual

DMC11 IPL Synchronous Line   EK-DMCLU-OP-001
   Unit User's Manual

18

4.1.10   DL11 Asynchronous Line Interface

The DL11 is provided for interfacing the IMLAC PDS-4/L and the UNIVAC 1652 Intelligence Terminals. These interfaces are switch selectable up to 9600 baud rate and have modem control capability for remote terminals if required.

Since most intelligence systems associated with the PDP-11 system uses a Bunker Ramo BR-1569 multiplexer, a multiplexer will be added for the 1652 terminal and other interfaces or an alternate solution will be necessary.

Reference:

> DL11 Asynchronous Line Interface   EK-DL11-OP-001
> User's Manual

4.1.11   IN-1670 MOS Memory

The MOS memory is add-on memory manufactured by the INTEL Corporation. The memory provided with the TOAS baseline system is 896k bytes per computer system. The memory is modular expandable to 1024k bytes in 128k byte increments. A total of 4 megabytes could be added to a PDP 11/70 with each megabyte requiring a mounting space of 10.5 inches in a standard DEC rack.

The IN-1670 memory system features high performance, Error Coding and Correction (ECC). The memory cycle time is 790-nanoseconds for read and write allowing maximum through-put. Additional speed can be obtained by interleaving memory giving a 20-30% effective increase in bus bandwidth. The TOAS memory is not interleaved. The memory system includes ECC, error monitoring, and error logging. The ECC logic detects single bit failure. A double bit error is detected but not corrected and the CPU is forced to an error state.

Error logging is provided which enables a scheduled maintenance scan of the memory for single bit errors and a corrective action can be taken.

References:

> IN-1670 Technical Manual   19-1118-000
> INTEL System Data Catalog

4.1.12 1652 Dual Monitor Display System

The Sperry Univac Dual Monitor Display System for TOAS is a 1652M
version (S/N 418, 419). The 1652 has full-up memory for graphic displays.
The terminal also enables down-line loading the complete computer program
as opposed to earlier terminals where the loading was performed in multiple
blocks. The terminal is provided with 15-inch dual monitor, light pen,
dual VFK (60 function keys) and interactive graphics.

References:

Sperry Univac 1652 Dual Monitor Terminal Operators Manual	PX 12323

Technical Manual for Digital Computer
    Input-Output Console 02-389(V)/G
    Univac 1652M (Modularized)
	PX 12494-1-1

4.1.13 PDS-4/L Graphic Display System

This Graphic Display System has a 16 bit general-purpose minicomputer
integrated with a display processor for refreshing a 21-inch monitor,
complementary graphics and alphanumeric software. The system includes a
67 key (optional 92 key) keyboard with 6 functional keys all programmable.
The display system has a 2048 x 2048 resolution, a high contrast CRT, and
random position vector capability, also 16 levels of hardware
intensity, virtual display paging and eight levels of display jump and
subroutine commands.

The TOAS Graphic Display System has 32k of core memory, serial 9600
baud interface, console, 21-inch monitor, and a 10 megabyte disk system.
The disk system is a PERTEC Computer Corporation Model 3442 with a DIABLO
compatible interface.

References:

ROMLOAD	ID 472611-3110
RDISK FROM DISK (Testing for Bad Disk)	ID 542211-3503
Diagnostic Package (TTAPE 1)	ID 572231-1601

References (cont'd):

Diagnostic Package (TTAPE2)	ID 572211-1602
(TTAPE3)	ID 572211-1603
(TTAPE4)	ID 472231-1604
(TTAPE5)	ID 572231-1605
(TTAPE11)	ID 472231-1611
Programming Guide to IMLAC	ID 544121-3502
Disk Controller #2	
User Description	
Models D3300 and D3400	
Disk Driver with	104615
Diablo Compatible Interface	
(Operating and Service Manual)	

4.2 System Software

The system software consists of all software procured with the baseline hardware and GRAPHELP received from Harry Diamond Laboratory for the IMLAC terminals. The software modules are:

Interactive Applications System (IAS) (DEC)

Data Base Management System (DBMS-11) (DEC)

DECnet-11 (DEC)

COBOL-11 (DEC)

FORTRAN IV PLUS (DEC)

UNIVAC MICRO-CODE

IMLAC MODULES

GRAPHELP

The above DEC software modules will be updated as new versions become available. This document will indicate the latest documentation of all updated software.

It is not the intent of this document to document any application modules or modified system level modules associated with the applications; that documentation will be available from the appropriate contractor.

4.2.1 Interactive Application System (IAS)

The general purpose operating system, IAS V3.0, runs on the PDP-11/34 through PDP-11/70 processors. The system supports three modes of operation Real-time, Multiuser and Timesharing. The system features supported by the different modes of operation are:

	Real-time	Multiuser	Timesharing
Priority Scheduler	X	X	X
Heuristic Scheduler		X	X
General Purpose Timesharing			X
Volume Protection			X
Program and Data Protection			X
User Written CMD Language Interpreter			X
Concurrent Real-time, Multiuser Program Development		X	X
Program Development System (PDS) With System Control Interface (SCI)		X	X
Monitor Console Routine (MCR)	X	X	X
Print Spooling	X	X	X
Reentrant Code	X	X	X
Sharable Data Areas	X	X	X
Utilities	X	X	X
Multitasking	X	X	X

The IAS Version 3 provides significant enhancements in terms of flexibility and functionality over the predecessors RSX-11D and IAS Version 2. The significant major features are:

    a. Enhancements to the IAS/RSX-11D Executive. The ability to include the IAS heuristic timesharing scheduler into the Executive is included.

    b. Addition of subtasking support at the Kernel Executive level via the SPAWN system directive.

    c. Support for the full complement of memory management directives (including dynamic creation, attach, and deletion of regions and inter-task transmission of region access).

d. A more powerful user interface which supports both the Digital Command Language (DCL) and Monitor Console Routine (MCR) languages.

e. A new, easier system generation procedure which utilizes a question and answer dialogue for selection of major options. For TOAS, the system generation magnetic tape will not work unless the controller is removed for the TME11 (7 track magnetic tape system).

f. New Device Support.

In addition to the major enhancements, many minor features have been added and known bugs fixed.

4.2.1.1 Executive Enhancements

The IAS/RSX-11D Executive has integrated the IAS heuristic timesharing scheduler. The scheduler option will run tasks based on their past history of performance and degree of interaction. The RSX-11D timeslicer (no longer available) is replaced by the scheduler.

The system null-task has been rewritten to run in the Kernel mode. This eliminates context switching in and out of the null task.

The Executive supports the ability for a task to wait for nodes from the system pool should an allocation failure occur. The feature is selectable at task build time.

The system manager has the ability to dynamically create and delete checkpoint and swap files.

4.2.1.2 Task Spawning

Task can request the execution of other tasks and receive information regarding their termination status via the SPAWN directive. Tasks which are spawned may use the "exit with status" facility to return a termination status. Also, the task can specify that an Asychronous System Trap be queued or an event flag set to inform it that the subtask has existed.

There is no limit to the number of subtasks that a parent task may spawn. Spawned tasks may also spawn tasks. It should be noted that the task spawning facility is separate from that made possible on a full timesharing system with the Timesharing Control Primitives (TCP).

23

4.2.1.3 Memory Management Directives

Using the optional directives, users may dynamically create sharable regions of any size from their tasks. The regions may be checkpointed or swapped with a task. Regions may be deleted when no longer needed by a task or may remain resident until explicitly deleted.

Regions, as well as sharable global areas may be mapped dynamically (either entirely or a portion) into a task's virtual address space at run time. Access to a given region may be "sent" from one task to another enhancing inter-task communications. Each region has an associated protection set up by its creator which is the same format as the file protection for disk.

The directive support facility allows tasks of greater than 32k words to be entirely memory resident and dynamically mapped, thus reducing the number of disk accesses for overlaid tasks and enhancing performance.

The directive supports FORTRAN-IV Version 2 virtual arrays up to 32767 elements.

4.2.1.4 More Powerful Program Development System (PDS)

PDS supports both Digital Command Language (DCL) and Monitor Console Routine (MCR) command syntax with almost every MCR command having a DCL analog. Full timesharing systems allow specially privileged users to nave full control over real-time tasks which run at priorities up to 220.

The System Control Interface (SCI) also provides the full set of PDS functions to the operator at the console.

MCR is a supported interface for Real-time and Multiuser systems. MCR has been changed to take advantage of the task spawning features along with additional commands that have been added to enable users to access the new system features. The MCR indirect command file processor (AT) which allows the creation and use of interactive command files, is also fully supported.

24

4.2.1.5 System Generation

System generation procedures for IAS Version 3 are easier than previous Versions of IAS/RSX-11D. A question and answer dialogue prompts the user for inclusion of major options. The terminal handler build procedures and device configuration procedures have also been simplified. An indirect command file is provided for the build sequence.

4.2.1.6 New Device Support

The VT100 Video Display Terminal, the LA120 High-Speed Hard Copy Terminal and new disk systems have been added to the devices supported.

An improvement for the RP06 Disk handler has been incorporated. The new handler provides for overlapped and sorted/optimized seek capabilities.

References:

IAS Documentation Directory	AA-2500D-TC
IAS System Management Guide	AA-2520D-TC
IAS System Directives Reference Manual	AA-H002A-TC
IAS/RSX-11 I/O Operations Reference Manual	AA-2515C-TC
IAS/RSX-11D Diagnostics Reference Manual	DEC-11-OXLDA-C-D
IAS Guide to Writing Command Language Interpreters	AA-D120B-TC
IAS Guide to Writing a Device Handler Task	AA-2501C-TC
IAS Device Handlers Reference Manual	AA-H004A-TC
IAS Executive Facilities Reference Manual	AA-H005A-TC
Introduction to RMS-11	AA-0001A-TC
IAS/RSX-11M RMS-11 MACRO Programmers Reference Manual	AA-0002A-TC
RSX-11M RMS-11 Utility Users Guide	AA-4954A-TC
IAS MCR User's Guide	AA-H006A-TC
IAS PDS User's Guide	AA-H003A-TC
IAS/RSX-11 MACRO-11 Reference Manual	DEC-11-OIMRA-B-D
IAS FORTRAN Special Subroutines Reference Manual	AA-H001A-TC

References (cont'd):

IAS/RSX-11 System Library Routines Reference Manual	AA-5580A-TC
IAS/RSX-11 Utilities Procedures Manual	AA-5567B-TC
Update to	AA-5567B-T1
DEC Editor Reference Manual	AA-5789A-TC
IAS Task Builders Reference Manual	AA-2533C-TC
PDP-11 SORT Reference Manual	AA-3341C-TC
IAS/RSX-11 ODT Reference Manual	DEC-11-OIODA-B-d

4.2.2 Data Base Management System (DBMS)

The DBMS is an implementation of the COBASYL data base language specification. The DBMS provides data control and manipulation functions for application programs. The application programs can be written in COBOL, FORTRAN or other languages using the CALL statement.

DBMS supports network and hierarchical type data structures and permits structure definition suitable to the applications.

DBMS provides a separate language facility, Data Description Language (DDL),for description of the complete data base or portion of the data base. For a detailed discussion of the DBMS concept, refer to the Data Base Administrator's Guide.

References:

DBMS-11/IAS Data Base Administrator's Guide	DEC-11-ODABA-B-D
DBMS-11 COBOL Data Manipulation Language Reference Manual	DEC-11-OBMRA-B-D
DBMS-11 FORTRAN Data Manipulation Language Reference Manual	AD-5563A-TC

4.2.3 DECnet-11

DECnet is a software package that extends the IAS operating system to form computer networks. The DECnet facilities provide for device sharing, file sharing, program sharing and intertask communication. Peripheral

26

devices of a remote system may be connected to host computer systems and used via DECnet. The files from the remote system may be shared or new files opened for storage.

An executable program may be transferred to a remote system for execution (down-line loading or specific tasks).

Intertask communication is allowed between two tasks, either locally or remotely.

For a detailed description of the DECnet functions, refer to the DECnet User's Guide.

References:

RSX/IAS DECnet User's Guide	AA-5182A-TC
RSX/IAS DECnet System Manager's Guide	AA-5183A-TC
RSX/IAS DECnet Network Generation Manual	AA-D355A-TC

4.2.4 COBOL Compiler

The COBOL Compiler translates ANS-74 COBOL source programs into relocatable object modules. The compiler runs under the supervision of the IAS operating system and conforms to all connections and restrictions of IAS. To run a COBOL program, a five step process is required: 1. Prepare source program. 2. Compile source program. 3. Merge or prepare an overlay description file (optional). 4. Task-build object modules into executable task. 5. Execute task. For a detailed description of the use of COBOL, refer to the COBOL User's Guide.

References:

PDP-11 COBOL User's Guide	AA-1757C-TC
PDP-11 COBOL Language Reference Manual	AA-1749D-TC
PDP-11 SORT Reference Manual	AA-3341C-TC

4.2.5 FORTRAN

FORTRAN IV Plus is the compiler available for TOAS; however, FORTRAN IV with virtual data arrays can be installed if required. For a detailed description of the compiler use, the compile diagnostic messages and the

run time diagnostic messages refer to the FORTRAN IV-PLUS User's Guide (Appendix C). For a more detailed description of specialized applications, an Object Time System Reference Manual is provided.

References:

FORTRAN IV-PLUS User's Guide	DEC-11-LFPUA-B-D
FORTRAN IV-PLUS Object Time System Reference Manual	DEC-11-LFPOA-A-D
PDP-11 FORTRAN Language Reference Manual	DEC-11-LFLRA-C-D

4.2.6 UNIVAC Micro-Code

The Micro-code was supplied by UNIVAC in 1108 tape format. The micro-code has been converted to Files 11 format and stored on the TOAS disk (UIC[210,11]). The micro-code for the terminal maintenance has been modified to enable assembly on the PDP-11. The code has been assembled with no errors and a run time module is located at UIC [210,11].

It is recognized that the micro-code for the 1652 terminal for the existing intelligence systems was not supplied by Univac. For the 1652 terminal to function with existing intelligence systems, it is assumed that the appropriate micro-code will be furnished.

References:

Sperry Univac 1652 Dual Monitor Terminal Host Computer Programming Manual	PX 12324
Sperry Univac 1652 Dual Monitor Terminal Maintenance Micro-code Program Listings	PX 12676
Sperry Univac 1652 Dual Monitor Terminal Micro Processor Programming Manual	PX 12588
Sperry Univac 1652 Dual Monitor Terminal Application Micro-code Program Listings	PX 12673

4.2.7 IMLAC Modules

The IMLAC System provides utility programs, disk operating system, assembler, compiler, interface systems, emulator and diagnostics. These software packages were delivered as part of the PDS-4 system.

4.2.7.1 Disk Octal Debugger (DIDL)

The DIDL is a symbolic debugger with the following functions:

> Trace
> Run
> Match
> Set/clear/display break point
> Get/Dump program from disk
> Set program name
> Quit monitor
> Flip disk-core flag
> Set Functions

Reference:

> Disk Octal Debugger   ID 442431-1330

4.2.7.2 Dupe 2.H

Dupe is a combination of programs to facilitate the reproduction of tapes and cassettes.

Reference:

> Dupe 2.H Functional Specification   ID 512431-1710

4.2.7.3 Graphics Editor (ED80)

The ED80 is an edit program with time sharing, graphics and form control capability. The editor allows 80 characters per line, 40 lines to 80 lines on the screen. The Editor runs in two modes of operation. Editor mode allows for alphanumeric and graphic text editing and Form mode allows for protected areas of text on the screen.

Reference:

> Graphics Editor   ID 572431-1210

4.2.7.4 PIDL Debugger

PIDL is a debugger that allows the user to examine and change locations, trace his program one instruction at a time or set break points.

Reference:

        PIDL Debugger   ID 512471-1320

4.2.7.5 ROMLOD

The ROMLOD program will load or test any of the PDS-4 ROMs. This program is run when down-loading from the PDP-11/70. Details are given in paragraph 4.2.8.

Reference:

        ROMLOD   ID 472611-3110

4.2.7.6 TDISK from Disk

The TDISK program allows for initial testing of a disk pack for bad sectors.

Reference:

        TDISK From Disk   ID 542211-3503

4.2.7.7 System Editor (DFED)

The DFED program is a disk-scrolling editor that can scroll both down and up. The editor supports individually specified Macros along with context-editing commands. The editor can be used as a document-processing system.

Reference:

        Programmable Editor (DFED)   ID 542431-0211
         (DO5-4 User's Guide Appendix A)

4.2.7.8 Disk Assembler (ASM)
Relocatable File Library Editor (LIBRED)
Linking Editor (BIND)

Typically, an ASCII version of a program is written using the disk fast-scrolling editor (DFED); then, the newly created 'source' program is run through the Assembler (ASM) to produce either an executable 'object' program or a block of relocatable code subsequently to be bound into an object program by the Linking Editor (BIND). A 'library' of relocatable coded segments or modules can be created through use of the Relocatable Library Editor (LIBRED). If, during link editing, unresolved 'externals' are discovered, the binder searches this library and inserts the referenced modules in the proper locations.

The referenced document contains descriptions of the three programs (ASM, LIBRED, BIND) used in assembling an object program. The appendix lists assembler-recognized mnemonics, first alphabetically sorted and grouped according to function (Main Processor, Memory Referencing, Skip, and Display Processor), then numerically sorted according to octal opcode.

Reference:

DOS-4 User's Guide   ID 542471-0212
Disk Assembler (ASM)
Relocatable File Library Editor (LIBRED)
Linking Editor (BIND)

4.2.7.9 Disk Operating System (DOS-4)

The DOS provides a monitor for control of the system programs and utility programs. The system allows for file maintenance and usage on the disk system as well as generation and execution of system and application programs.

References:

Disk Operating System User's Manual   ID 542431-0210
PDS-4 System Reference Manual   ID 474721-0110

31

4.2.7.10 Compiler

The IMLAC system supports a FORTRAN IV compiler. The compiler conforms to the ANSI X3.9-1966 specification except for the following features:

1. END Lines with spaces between the E, N and D
2. COMPLEX numbers
3. STOPn
4. PAUSE
5. Adjustable array dimensions
6. EXTERNAL statement or function names as dummy arguments
7. DATA statements with arrays or repeated constraints
8. G format
9. BLOCK DATA Subprogram
10. Unlimited use of blank characters

Refer to the reference for a description of how these features are affected.

Reference:

FORTRAN IV Language Manual User's Guide   ID 542431-0240

4.2.7.11 Terminal Interface System (TIS)

The TIS was developed to use in conjunction with the United States Military Academy Graphics Capability System (GCS). A terminal interface is provided for user log on and communication with a host computer system with GCS.

The GCS has been obtained and examined for use with TOAS. The GCS is designed to run on a large host computer (CDC 6000, Univac 1108, Honeywell 635, DEC 10 and IBM 370). The GCS will not run on the PDP-11 without modifications.

Reference:

Terminal Interface System (TIS) User's Guide   ID 572431-1530

4.2.7.12 Emulator

The STR14 utility program emulates a Tektronix 4014 Terminal. The enhanced graphic module features are supported for point-plot mode, special point-plot mode and incremental plot mode. The emulator along with the GRAPHELP Library discussed in paragraph 4.2.8,enables software generated for display on a Tektronix terminal to be compiled and displayed on the PDS-4 system.

Reference:

STR14 Utility Program TEKTRONIX 4014 Emulator   ID 472431-1444

4.2.8 GRAPHELP

GRAPHELP is an interactive graphics FORTRAN IV software package that runs on a PDP-11 computer system. The GRAPHELP package supports all Tektronix 401X Graphic Storage Tube Terminals and the IMLAC PDS-4 Refresh Graphics Display System. The software package provides both absolute and relative vectors of four varying line textures, user definable scaling, windowing, clipping, terminals transparency, and 128 nested subpicture display files for refresh graphics. Routines are provided for interactive graphics crosshair input and screen erase control. The applications are oriented towards data plotting for both linear and logarithmic data, along with alphabetic and numeric symbol output.

The documentation for GRAPHELP is obtained by printing all files with TXT extension located in UIC[210,1]. The GRAPHELP libraries referred to in the documentation (PLTFTN, TKGFTN, IMGFTN, ALLFTN) are built and located in UIC[1,1].

Reference:

GRAPHELP Documentation UIC[210,1] PDP-11 Computer System

SECTION 5. FACILITY REQUIREMENTS

The facility requirements identified herein are those requirements identified for providing a usable facility including the required expendables.

5.1 Operational

The operational requirements are those requirements, observed from past experience, necessary to maintain a continuity of successful operation. It is expected that the operational requirements list will grow as experience is gained and as suggestions are received from the users. The following requirements are identified:

    a. Backup storage disks to magnetic tapes.

        The frequency of backup is dependant upon activity/changes to the disk files. It will be necessary for the facility manager to determine how often to backup. Due to the scheduled dedicated computer time necessary for backup, it is suggested that a complete backup be performed only once each week with retention of the backup tapes for a six month period during the active usage periods.

    b. All non-supported system software (modified or non-DEC software) to be maintained and used on a dedicated disk pack.

    c. Updates to the operating system software will be performed only after a backup has been performed.

    d. No hardware is to be unplugged/removed without first turning the power off. The exception is terminal interfaces (RS 232 connector) which may be changed with the power up.

    e. The backup tapes should be stored in another room (not the TOAS facility) for retention and protection in case of fire or acts of nature.

    f. Perform scheduled maintenance as specified in paragraph 5.2.

    g. Install latest software versions as they become available (which may mean a change in application software).

5.2 Maintenance

TBA

The preventive maintenance plan/schedule shall be added before TOAS becomes operational.

5.3 Expendables

The list of expendables herein are necessary for the operation of the TOAS facility. It is expected that the quantities of expendables will change during project performance and will be changed accordingly in this document to aid in budget planning. The indicated source of expendables is a suggested list and is not intended as a recommended source.

ITEM	REMARKS	QTY	EST. USAGE
Disk Pack (RP06)	For each of the candidate Intel Systems to be evaluated	5	--
Disk Pack (RP06)	Scratch disk for testing, Diagnostic program disk	2	--

SOURCE:

Memorex Corp Attn: Victor Minich 1970 Chain Bridge Rd McLean, Va. 22101 703-821-3300	Model No.: MARK 11	ERROR FREE (QTY 8 ea)	$682 ea	--
		STANDARD (QTY 8 ea)	$602 ea	--
		ERROR FREE (QTY 1 ea)	$764 ea	--
		STANDARD (QTY 1 ea)	$675 ea	--

35

ITEM	REMARKS	QTY	EST. USAGE
Disk Pack (IMLAC)	Spares	2 ea	--

SOURCE:

CDC	Model # 9846-3-24		
MEMOREX	Model # 2F-24		
3M	Model # 902-24 (used by IMLAC)		

Printer Ribbons	Data Products printer model 2230	12 ea	2/Mo

SOURCE:

COMPU-RITE Ribbon Attn: R. M. Smith 6010 Yolanda Ave. Tarzana, Ca. 91356 800-423-5131		15 inch x 15 yd $15.95 5MIL reversible ribbon for Data Products printer model 2230	
		Recycled Ribbon $8.95	

Standard Impact Printer Paper		24 boxes	10/Mo
Standard Computer	6 mo retention	48 reels	
Magnetic Tape 1/2 inch 2400 ft reel	users	48 reels	
Printer Ribbons	DECWRITER LA36	12 ea	4/Yr

SOURCE:

DEVOTE CO. 3780 Fabian Way P.O. Box 10011 Palo Alto, Ca. 94303 415-494-8844	#5234	$3.54 ea (1 doz)	
DIGITAL EQUIPMENT CORP C-36-10558-01 Accessories and Supplies Cotton Rd., Nashua, N.H. 03060 800-258-1710		$50/12 ea	

SECTION 6. FACILITY DEVELOPMENT AND OPERATING POLICIES

The development and operating policies are identified and agreed upon
by the users and RADC as the need arises. These policies are needed to
enable consistent support for the overall project.

6.1 System Planning

TOAS management will review development and test plans as available for
impact on the facility resources. The requirement for additional resources
will be reviewed with RADC and the appropriate contractor as to system
impact, cost trade-off and recommended equipment.

6.2 Documentation

All documentation for the facility resources will be available in the
computer terminal room. The documentation will be updated as changes are
made to the resources. If the contractor requires additional documentation;
then the document references in paragraph 4.0 will identify the number for
ordering.

6.3 Facility Management and Operational Policies

6.3.1 Computer Operations

The following items are guidelines for the TOAS facility computer
operations:

a. Hours of Operation. Computer resources (hardware and time) will
be scheduled by the TRW TOAS Facility Manager. Normal operations
will be from 0730-1630 Monday-Friday. Operations outside this
will require coordination with the Facility Manager. The
Operational Log in Appendix B shall be maintained for management
reporting.

b. Baseline System. A copy of the baseline operating system (as
defined by this document) will be available for each 2315 contractor
requiring access to the computer. Individual contractors will be
responsible for labeling and storing their (Classified) magnetic
media to save any unique software efforts. Limited magnetic
storage facilities will be provided.

37

c. <u>Security</u>. The TOAS facility is located in a building certified for open storage of SECRET information. A minimum of SECRET clearance is required for unescorted access to this facility.

d. <u>Environment</u>. Access to the computer room will be restricted to those personnel currently using the hardware. In order to help avoid costly maintenance problems, absolutely no smoking, drinking, or eating is permitted in the computer room.

e. <u>Scheduling</u>. Computer resources will be scheduled on a weekly basis by the TOAS Facility Manager based on inputs received the previous week. As requirements exceed resources and time, RADC will adjudicate controversy by prioritizing requirements. Refer to Appendix B for the planned usage form.

6.3.2 <u>Maintenance</u>

The TOAS Facility Manager is responsible for insuring appropriate and timely computer maintenance as required. When a user suspects a maintenance problem, notify the TOAS Facility Manager by filling out the referenced form. Refer to Appendix B for the Hardware/Software maintenance log form.

6.4 Configuration Management

6.4.1 <u>Hardware</u>

Hardware configuration management will be the responsibility of the TOAS Facility Manager. Changes to the baseline system (and possible impact on software) will be sent to each 2315 contractor for comment (prior to implementation when possible).

6.4.2 <u>Software</u>

The software procured under the TOAS contract will be maintained and updated by TRW. Any modifications to this software and documentation will be the responsibility of the particular contractor.

SECTION 7. FACILITY PLAN

7.1 Purpose

The Tactical Operations Analysis Support (TOAS) Facility is the focal
point for Project 2315, Tactical Intelligence. Located within the
'operational' environment at Langley Air Force Base, Virginia, the TOAS
facility will facilitate developer - user interaction and promote functional
requirement investigation and satisfaction. The TOAS will allow a dynamic
hardware and software environment to exist for the purpose of expeditious
development, testing and demonstration of new technology computer hardware/
software to support the tactical intelligence community.

7.2 Location

The TOAS facility is located in room 96 of building 23, Langley Air
Force Base, Virginia. See Figures 7.1, 7.2, and 7.3. Langley AFB is
the headquarters for the Tactical Air Command (TAC); the 460 Reconnaissance
Technical Squadron (RTS) is colocated with the TOAS facility. Intelligence
personnel from TAC headquarters, the 460 RTS, and RADC/IRD will provide
the primary functional user comment and direction for Project 2315 Task 02.
Intelligence personnel from the Pacific and European theaters will also
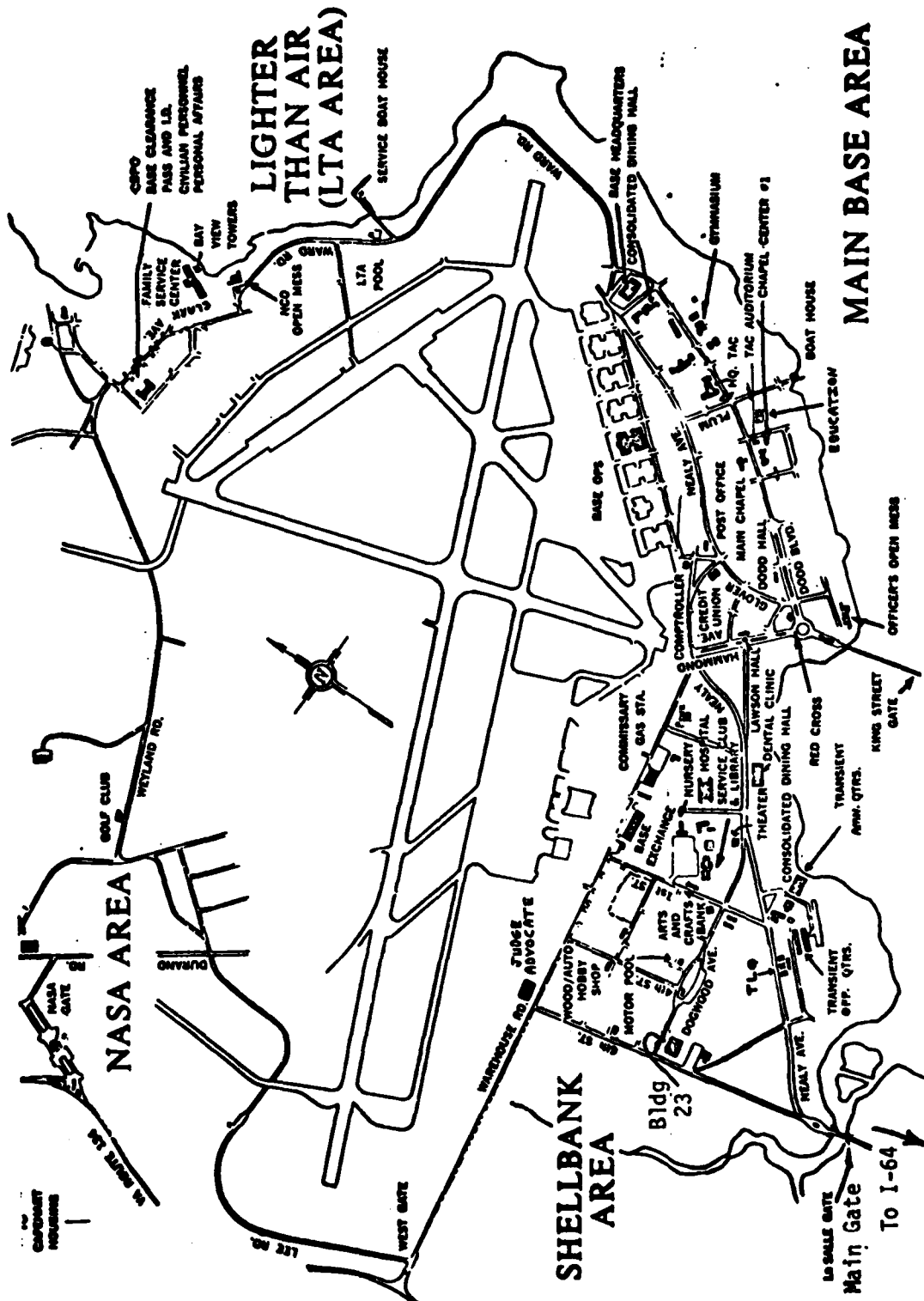participate on an as available/needed basis.

39

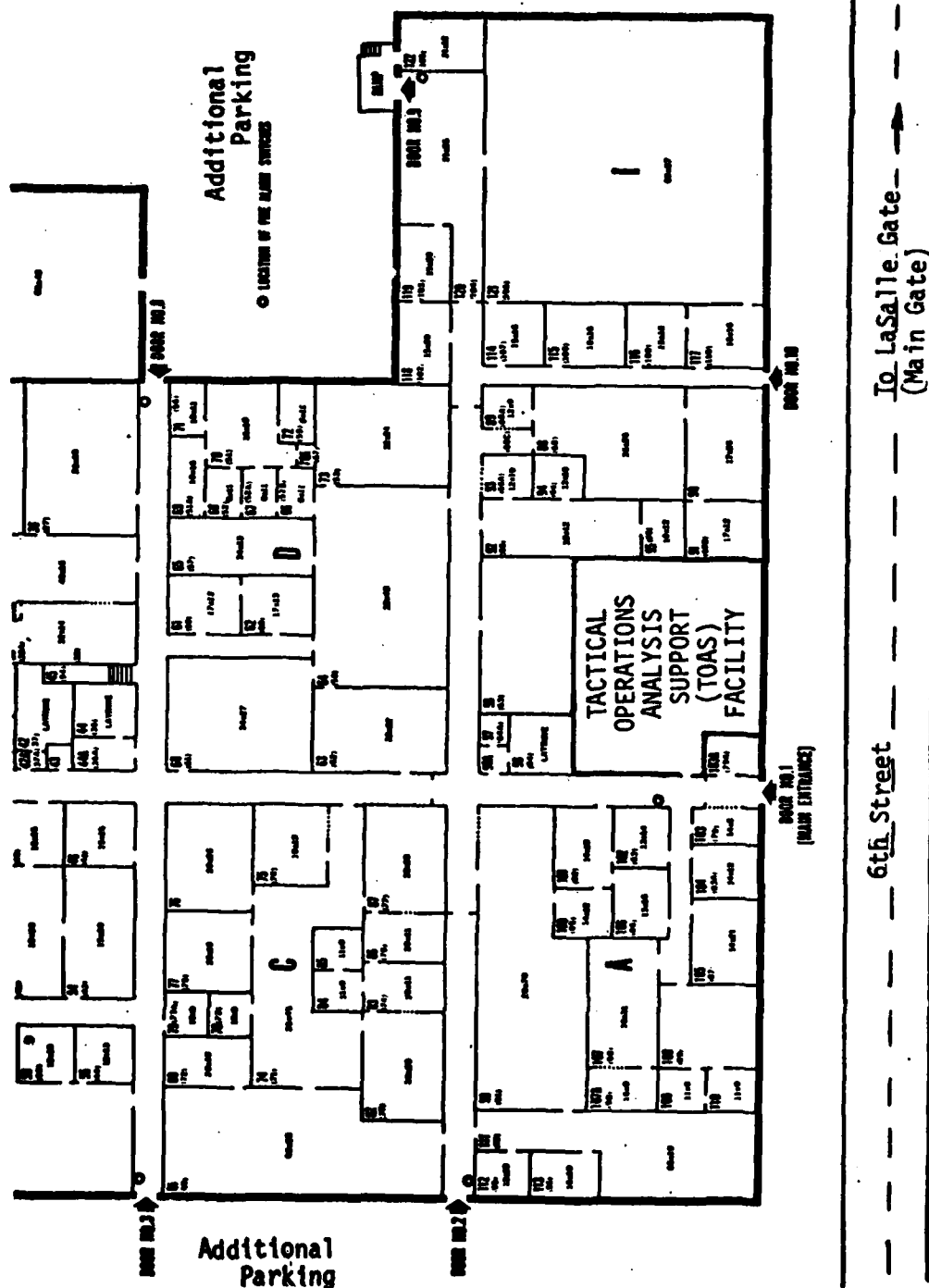Figure 7.1 Map of Langley Air Force Base

Figure 7.2 TOAS Facility Location in Building 23

41
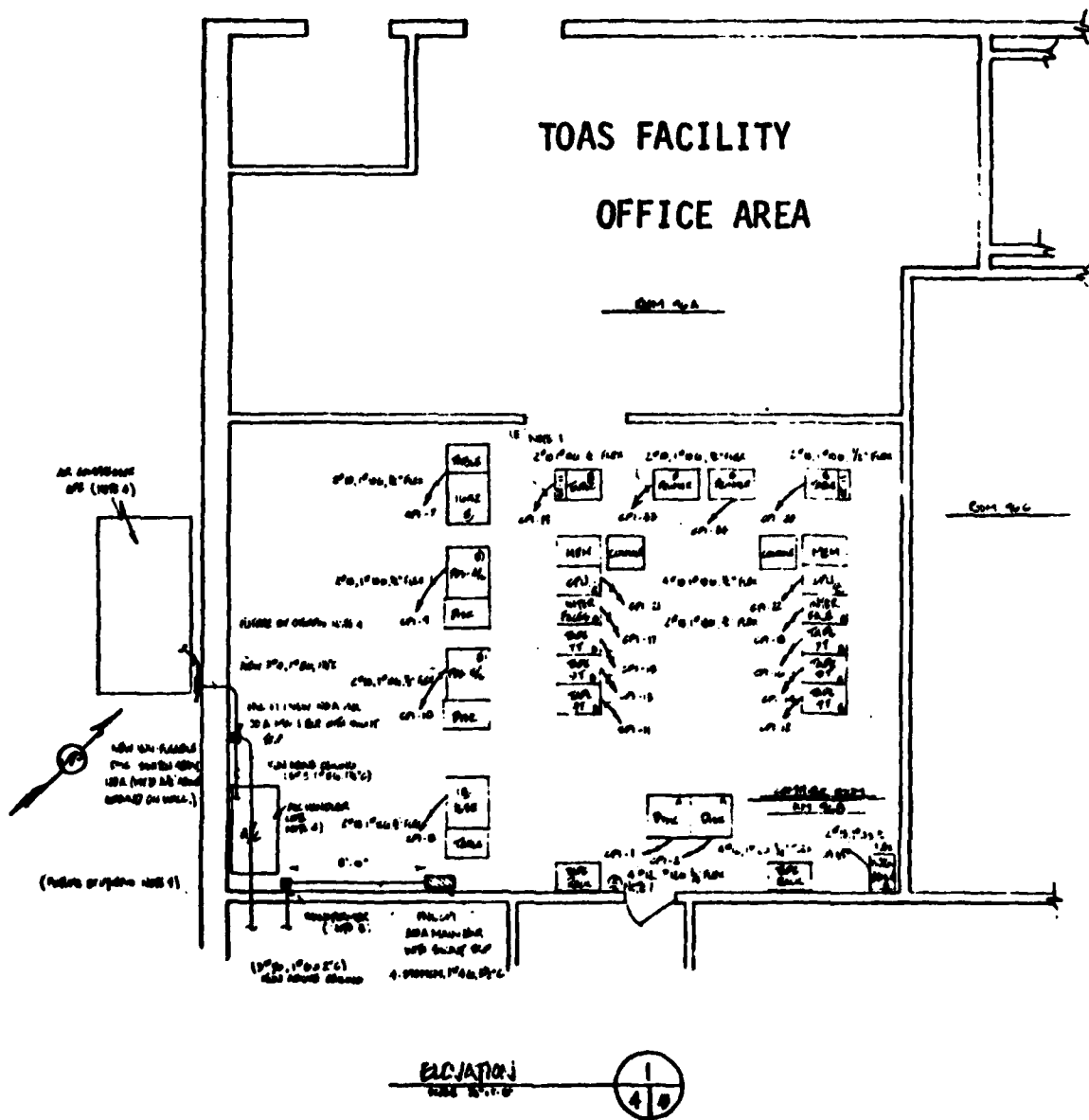
Figure 7.3   TOAS Facility Equipment Layout

APPENDIX A

LOADING AND STARTUP PROCEDURES

A1.0 Bootstrap Procedure

LOAD Address 17765744

LOAD SWR with device address

Device	TE10	412
	TU16	212
	PCØ5	612
	RPO6	56

Then   Select Start

When multiple devices are present, the boot device is selected by setting the number in Switch Register (SWR) starting with position number 9.

A1.1 Bootstrap Procedure for INTEL Diagnostic Tape

To bootstrap, load the INTEL memory diagnostic magnetic tape and perform the following:

    LOAD Address 17765744
    LOAD SWR   212
    Select Start
    LOAD ADDRESS ZERO
    LOAD 60 in SWR
    Select Start

A1.2 IMLAC Loading Procedure

The loading procedure for the IMLAC PDS-4 with the Harry Diamond Handler is as follows:

1. Boot the IMLAC system as usual at address 40 (all addresses on IMLAC are octal) with the loader switch down. The DOS will boot in and execute putting message on screen of IMLAC.

A 1

2. LOG onto the DEC computer in the system area, on another terminal, Set default to [210,1].

3. On the IMLAC, run program ROMLOD. Just type ROMLOD and hit return.

4. ROMLOD will run and give you choices on the screen. At this time, throw the loader switch up. This allows the DOS ROM to be bypassed. Choose ROMLOD choices "A" and "1".

5. Stop the IMLAC after typing "A" and "1". Set address to 60 and hit stop and start.

6. IMLAC is now ready to receive. Go to the logged on terminal run IMLOAD. It will prompt for file name. Supply "Source" and "4" to IMLOAD and hit return.

7. When source finishes loading, it will autostart and "GTS.TBV6" will appear on IMLAC. The above procedure assumes the PDS-4 terminal is connected to TTY port 4 on the PDP-11/70 computer system.

After the handler is loaded, the PDS-4 terminal can be used to log onto the PDP-11 computer system and used interactively.

APPENDIX B

HARDWARE/SOFTWARE MAINTENANCE LOG

SYSTEM/SUBSYSTEM:	DATE:	
REPORTING ENGINEER:	TIME:	
NATURE OF PROBLEM:	H/W ☐	S/W ☐

HARD FAILURE UNUSABLE ☐	FAILURE USABLE ☐	REPEATABLE FAILURE ☐	SYSTEM CRASH ☐

PROBLEM REPORTED TO MAINTENANCE	TIME:	DATE:

REPAIR TIME: DATE.	REPAIR ENGINEER	ORGANI- ZATION

SUMMARY OF CORRECTIVE ACTION:

OPERATIONAL LOG

SYSTEM/SUBSYSTEM	DATE	TIME		USER		COMMENT
		ON	OFF	NAME	ORG	

PLANNED TOAS USAGE

REQUESTER	DATE	TIME	USAGE DATE	RESOURCES	COMMENT

B 3

MISSION
of
Rome Air Development Center

RADC plans and executes research, development, test and selected acquisition programs in support of Command, Control Communications and Intelligence (C^3I) activities. Technical and engineering support within areas of technical competence is provided to ESD Program Offices (POs) and other ESD elements. The principal technical mission areas are communications, electromagnetic guidance and control, surveillance of ground and aerospace objects, intelligence data collection and handling, information system technology, ionospheric propagation, solid state sciences, microwave physics and electronic reliability, maintainability and compatibility.

END

DATE
FILMED

8—80

DTIC