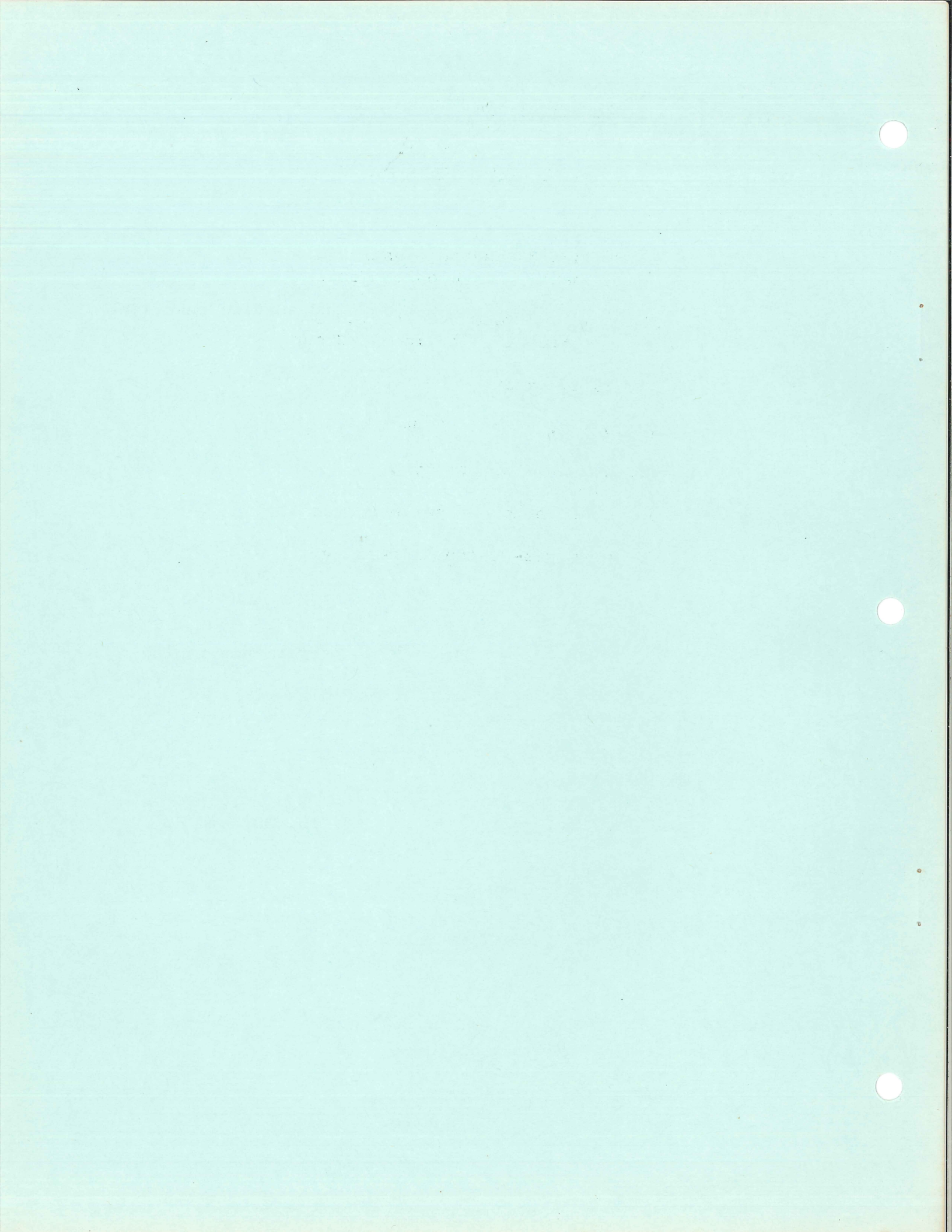


INSTALLATION NOTES

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Stanford Research Institute
Augmentation Research Center
333 Ravenswood Avenue
Menlo Park, California 94025

I. Application

The ARC site encompasses both research and service functions for users of the ARPA network and SRI.

Network users will be concerned initially with only the service function, which is the Network Information Center, or NIC.

II. Equipment

A diagram is included.

A. The ARC host is a PDP-10 with 128K of 1 microsecond 36 bit core. BBN TENEX is the operating system.

B. Supporting equipment includes:

1. 1024K words of Univac 432 high performance paging drum
2. 96 million characters of Bryant disk file
3. Two magtape drives
 - a. 7 track
 - b. 200/556/800 bpi
4. Two DECTape drives
5. 24 line Teletype scanner
 - a. Full USASCII support for 10, 15, 30, and 60 character/second devices
6. Paper tape reader and punch
7. 12 NLS workstations
 - a. Upper/lower case
 - b. Keysets
 - c. Mice
8. Line printer
 - a. Upper/lower case
 - b. 132 columns
 - c. 300 lines/minute
9. Remote devices interface
 - a. IMLAC support

III. Terminals

The system currently handles three types of typewriter-like consoles, all functionally identical and, therefore, listed together.

- A. Teletype Models 33, 35, and 37
- B. Character encoding is 7 bit USASCII. On input, the eighth bit is ignored; on output it is always set to zero. Unless the system is otherwise informed via Executive Language commands, it assumes the absence of tabs, formfeed, and lower case text capabilities.
- C. The system is capable of interacting with both half-duplex and full-duplex consoles. For network interaction, transmission will be treated as half-duplex unless the system is advised otherwise via an Executive Language command. (For local users, full-duplex operation is the default made.)
- D. In either half-duplex or full-duplex operation, the system always returns a CR (carriage return-hexidecimal 0D) after receiving a LF (line feed-hexidecimal 0A); in full-duplex mode, the LF is also returned. Also, in some cases ESC (hexidecimal 1B) is echoed as \$ (hexidecimal 24) rather than ESC.
- E. The "attention-getting" character is ETX (frequently called control-C, hexidecimal 03).

IV. Physical Resources

- A. Number of users
 - 1. Sixteen user limit initially
 - 2. Dynamic allocation of all resources
 - 3. Network user performance will be biased by various factors: system loading, time of day, file requirements, etc.
- B. Resource accounting - undefined
- C. Buffer size - undefined
- D. File storage for network users
 - Long term file storage will be available for network users

V. Interests and Capabilities

A. Augmentation

1. Man/machine interaction techniques
2. Research and development of tools for management

B. System organization and architecture

1. System instrumentation and measuring techniques
2. Modular programming

C. Programming systems

1. Meta compilers
2. Higher level system programming languages
3. Interactive system programming

D. Networking

1. Continuous improvement of NIC access
Investigation of new techniques and procedures
2. Investigation of problems related to network
collaboration/dialog

The research performed at ARC is concentrated on the problem of "augmenting the human intellect."

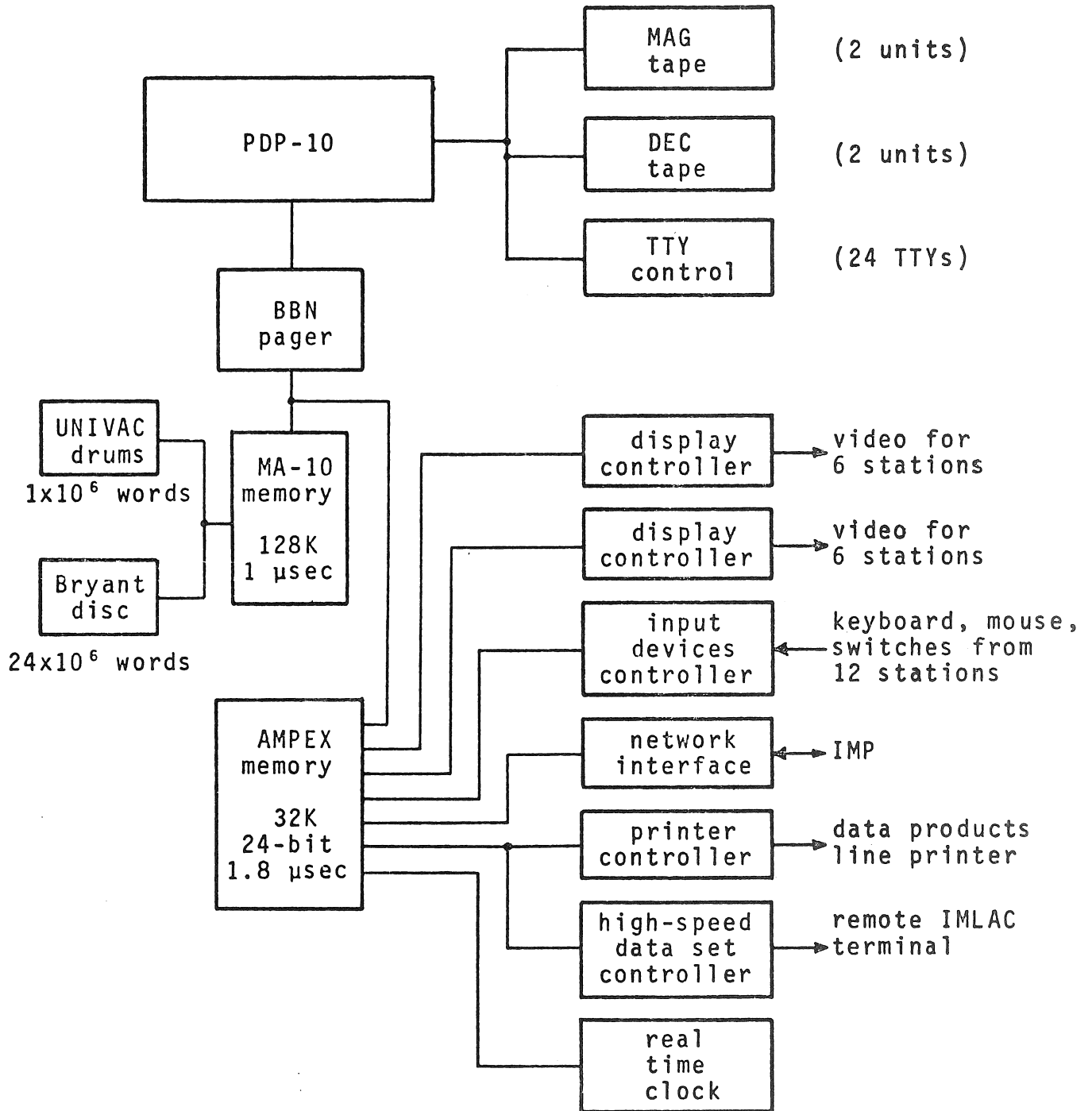
"Augmentation" means extension, improvement, and amplification of the intellectual capabilities of humans working as individuals and in groups.

The current approach is centered about the development and use of a highly interactive computer system which is utilized by individuals and groups to manipulate, in a very general sense, the information of interest to them in the solution of problems.

Of primary concern is the continuous development of NLS, the ARC On-Line System, which is presently a sub-system within the general purpose timesharing system.

Initial NIC on-line service will be through the use of TNLS, a timesharing terminal oriented variation of NLS which has special network capabilities.

ARC COMPUTER FACILITY



Stanford Research Institute
Artificial Intelligence Group
333 Ravenswood Avenue
Menlo Park, California 94025

I. Installation Type

Primarily a research installation engaged in artificial intelligence research.

II. Equipment

The equipment configuration is shown on the accompanying diagram and also listed here.

- A. The central computer is a PDP-10 with a core memory of 192K of 36 bit words and a virtual address space of 256K words in pages of 512 words each.
- B. A PDP-15 peripheral computer is being used as a sophisticated I/O channel for the PDP-10.
- C. The peripheral equipment (as shown in the equipment configuration diagram) includes the following:
 - 1. Swapping drum of 1.5 million words capacity
 - 2. Disk file consisting of 4 disk packs holding 5 million words each
 - 3. Teletype interfaces to 17 lines
 - 4. DECTape system including 4 drives
 - 5. Line printer producing 300 lines per minute of 132 characters per line
 - 6. Paper tape read and punch
 - 7. Adage graphics display
 - 8. Robot (including TV camera)
 - 9. An additional TV camera
 - 10. Analog I/O equipment
 - 11. ARPA network IMP interface

(The seventh and subsequent items on this list are connected to the PDP-10 through the PDP-15.)

III. Terminals

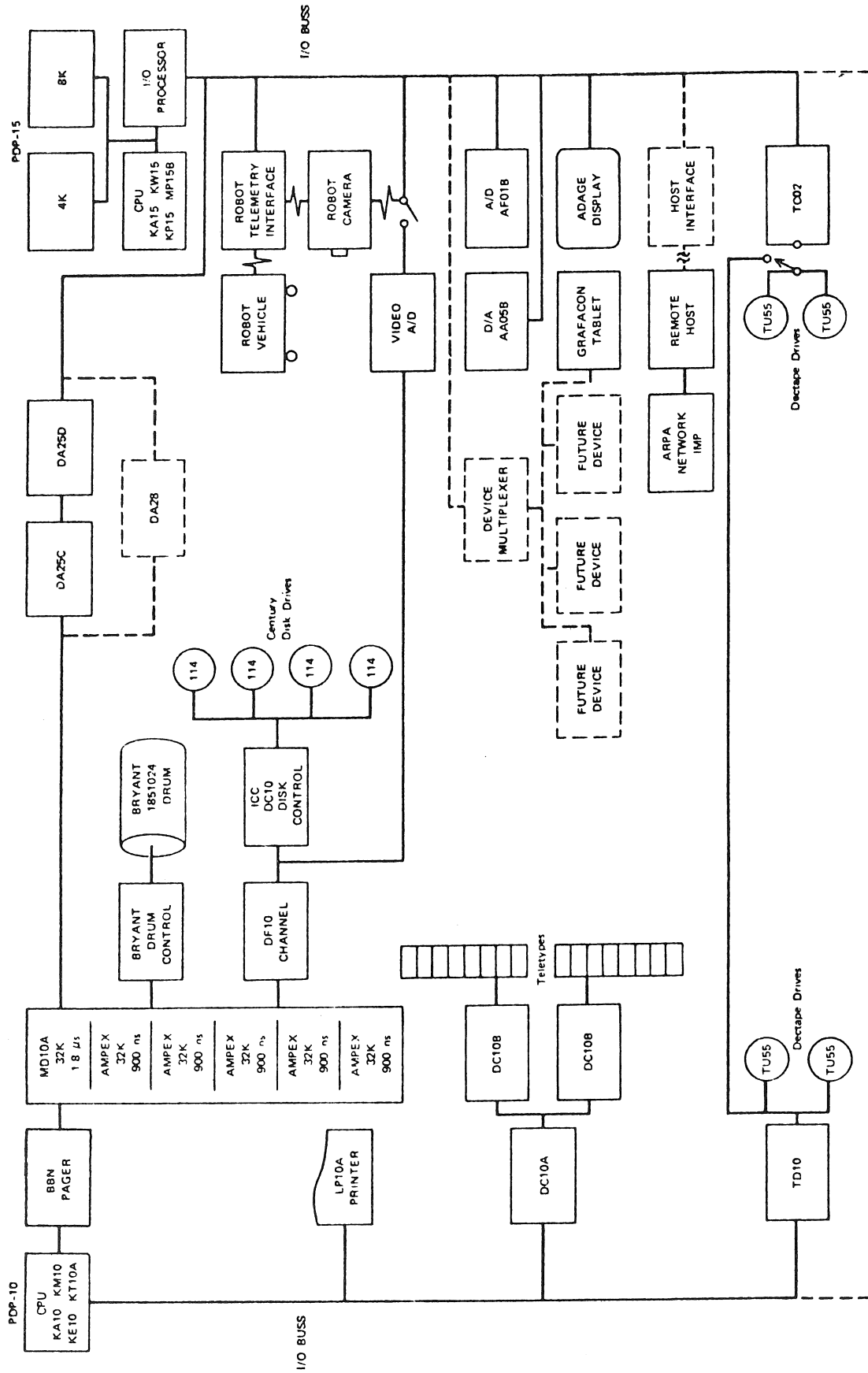
The system is capable of handling Teletype-compatible terminals at up to three different transmission rates. The

two transmission rates currently used are 10 and 60 characters per second. The PDP-10 monitor is BBN's TENEX system.

V. Interests and Capabilities

The SRI Artificial Intelligence Group has four major inter-related focal points in the public domain.

- A. A large amount of effort is devoted to robotics, robot problem solving, and robot learning. Generalized solutions to problems are sought in order to minimize the effort devoted to generating new solutions. Then generalized solutions are tailored to particular tasks to minimize effort spent in generating results superfluous to a particular goal.
- B. Another focal point is visual perception. Visually oriented service routines are used by the robot. Subsidiary visual information, such as range or color information, may be used, and they are beginning to investigate the usefulness of successive pictures taken from a robot in motion. The application of visual pattern recognition to meteorology is being studied.
- C. Work is being devoted to natural language processing, including semantic processing and the semantic retrieval of information from a natural-language data base, such as a first-year college textbook.
- D. Theorem proving, program proving, and automatic program synthesis provide another of the group's poles. They are interested in proving theorems in the first-order calculus as well as in higher order logics.
- E. A major project may soon be begun in the development of a speech understanding system.



TA-710512-10

SRI ARTIFICIAL INTELLIGENCE GROUP COMPUTER SYSTEM

Bolt, Beranek and Newman
50 Moulton Street
Cambridge, Massachusetts 02138

I. Application

The installation includes both Research and Service features. Programs run under the TENEX operating system which provides a 256K word virtual address space to each process. Other features of TENEX include a hierarchical process structure for each user, extensive file system capabilities, and a well human-engineered executive command language.

II. Equipment

- A. The primary computer at this site is a PDP-10 with a memory size of 80K 36-bit words. Also included is a hardware "pager" which allows user access to a virtual memory of 256K for each process.
- B. Peripheral equipment (see also the hardware diagram) includes:
 - 1. Paging drum of 1.56 million words with an average access time of about 16.7 milliseconds
 - 2. Bryant disk file - 50 million words
 - 3. A 64 line Teletype scanner
 - 4. Two magnetic tape drives (7 track tape, 200/556/800 bpi)
 - 5. Two DECTape drives
 - 6. Paper tape reader and punch
 - 7. Line printer (132 columns, 1200 lines/minute)
 - 8. An Evans and Sutherland LDS-1 display system

III. Terminals

The system currently handles three types of typewriter-like consoles, all functionally identical and, therefore, listed together.

- A. Teletype Models 33, 35, and 37
- B. Character encoding is 7 bit USASCII. On input, the eighth bit is ignored; on output it is always set to zero. Unless the system is otherwise informed via Executive Language commands, it assumes the absence of tabs, formfeed, and lower case text capabilities.

IV. Physical Resources

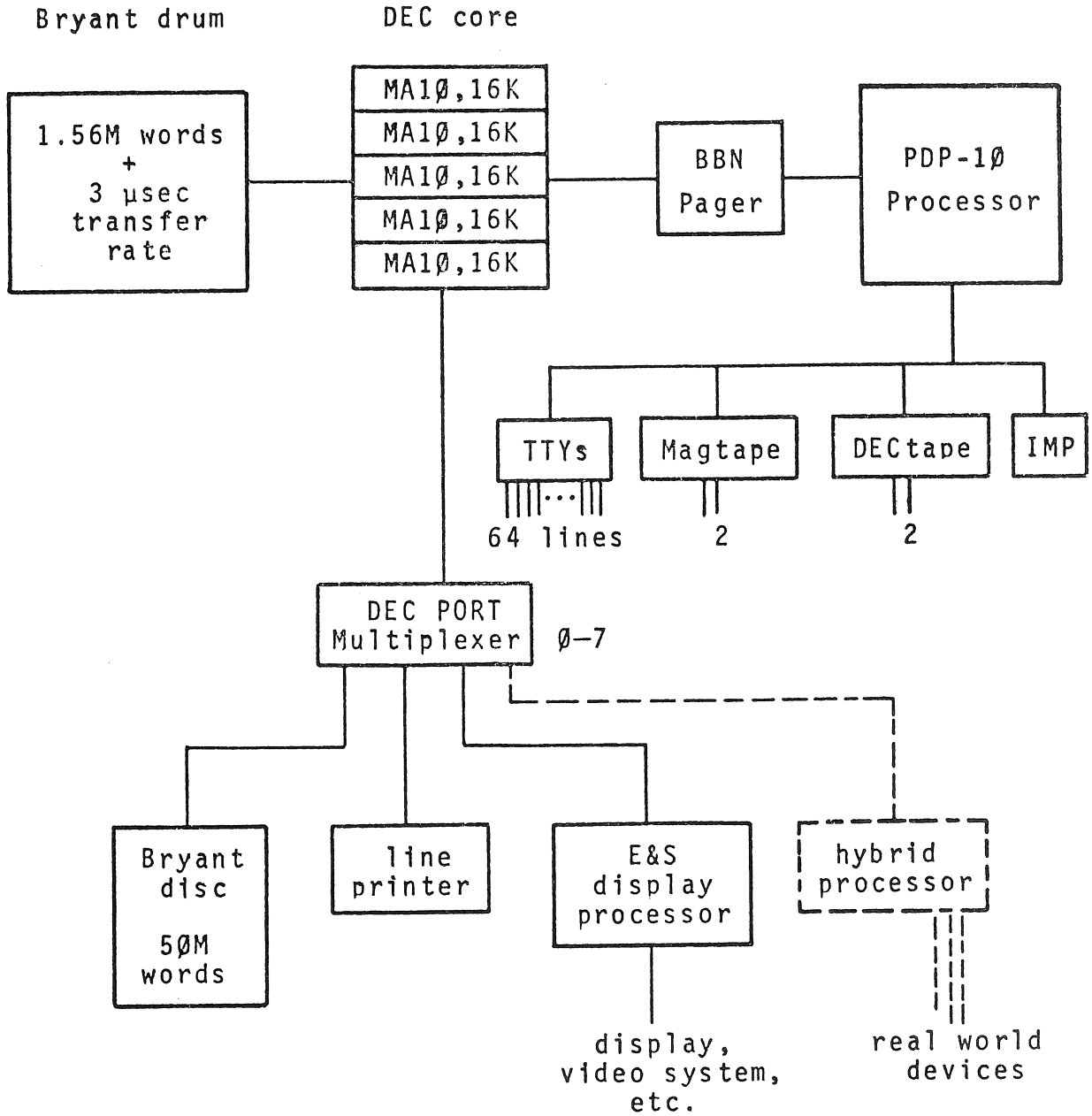
- A. Network users and local users will compete for use of the resources of the system; therefore, network use will be dynamically limited. However, an absolute upper bound of 16 users from the network will always apply. Usual peak local usage is centered around 10:30 AM and 3:00 PM local time (EST or EDT) on weekdays. The center is always open.
- B. The system's network buffering permits every user to transmit maximum length messages (8095 bits).
- C. Long term on-line storage is available to network users on magnetic disk. (The disk storage is backed up by daily tape dumps, but off-line magnetic tape storage is not available to users.) A total of about 5 million 36-bit words of storage will be available. Text is normally packed five 7-bit characters per storage word.

V. Company Background

BBN is a research, development, and consulting company with a significant emphasis on the development and use of computer systems. Principal projects and services of the Research Computer Center include:

- A. The TENEX operating system itself. As mentioned in Item I, TENEX provides each user process with a 256K word virtual address space, a well human-engineered executive command language, and many other features.
- B. BBN LISP is an implementation of LISP (a list processing language useful for symbol manipulation) which features extensive interactive debugging aids and a very large address space.
- C. Another large scale effort is devoted to natural language processing. Program development includes an English language parser and a semantic analyzer.
- D. BBN has connected an Evans & Sutherland LDS-1 display system to the PDP-10 and plans to use this to offer a "clipping" service to the network. A user may specify a large picture, a small window, and specify location of the window over a portion of the picture. The hardware will return to the user that portion of the picture which can be seen through the window.

RESEARCH COMPUTER CENTER



M.I.T. - Project MAC
Dynamic Modeling/Computer Graphics System
545 Technology Square
Cambridge, Massachusetts 02139

I. Application

The installation provides facilities for research in dynamic modeling and computer graphics. Programs on the PDP-10 run under the highly responsive ITS operating system, a non-swapping timesharing system which allows each user to possess a user process tree.

Augmenting the PDP-10 processor capabilities is an Evans & Sutherland (E&S) LDS-1 processor. The PDP-10 system with the E&S Display offers very flexible and responsive graphical interaction.

II. Equipment

- A. The primary computer at this site is a PDP-10 with the present memory size of 128K 36-bit words. Sharing this memory is the E&S LDS-1 processor and the RP02 disk system.
- B. Peripheral equipment (see also hardware diagram) includes:
 - 1. Three DEC RP02 disk drives - 5 million words each
 - 2. Eight DECTape (microtape) drives.
 - 3. One line printer (Bright 1215, 230 lines/minute) with upper and lower case
 - 4. One E&S LDS-1 display system with two CRT scopes and one tablet
 - 5. Five Adage-Computer Displays ARDS direct view storage tube terminals with joy sticks
 - 6. Four IMLAC PDS-1 programmable display systems
 - 7. One Model 37 Teletype (system console)
 - 8. Paper tape reader and punch

III. Terminals

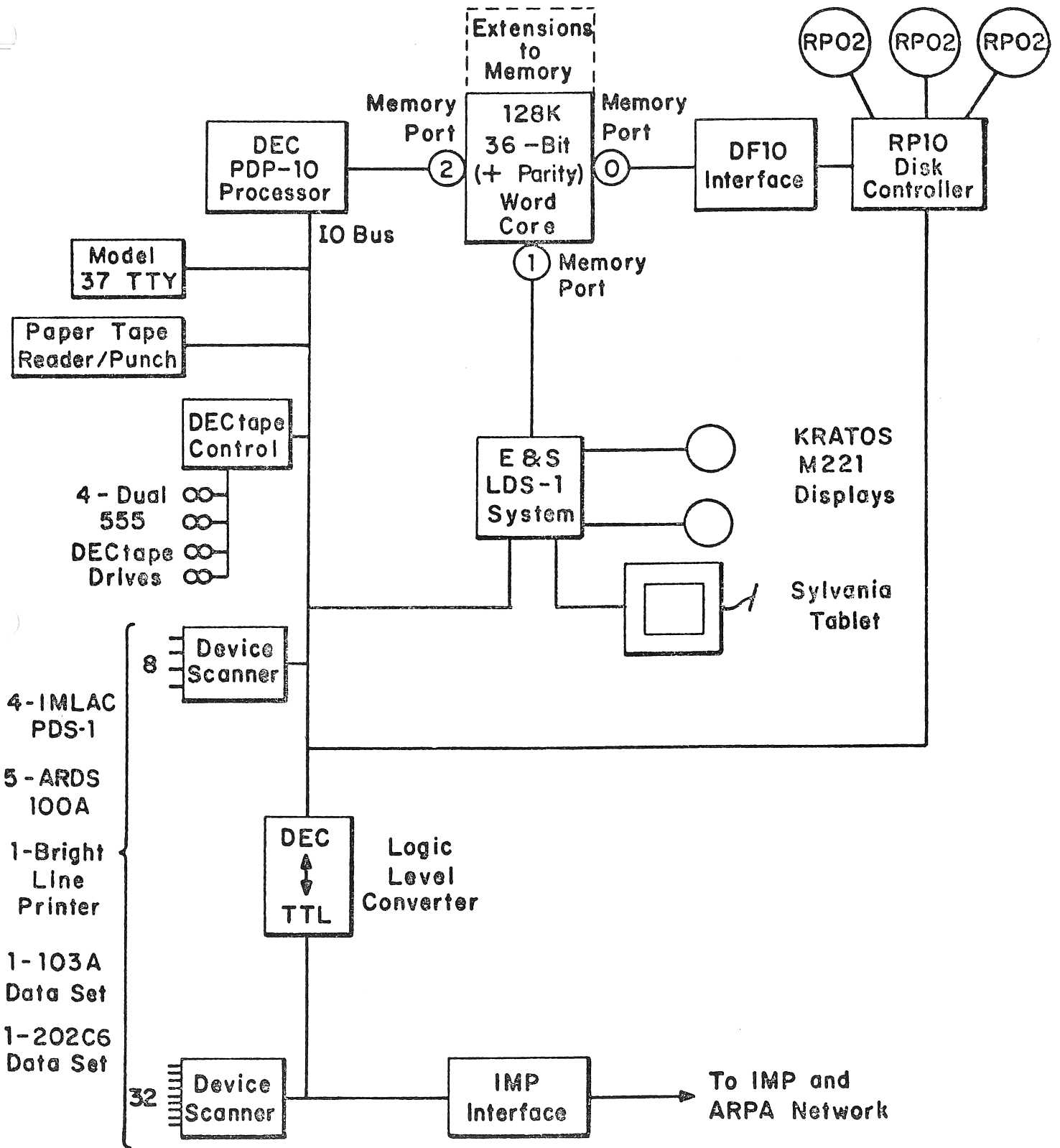
The system currently handles three types of typewriter consoles and two types of graphics display consoles in an identical manner.

Teletype Models 33, 35, and 37
IMLAC PDS-1 programmable display
Adage-Computer Displays ARDS terminals

IV. Interests and Capabilities

The DMCG group, Project MAC, M.I.T., is a research and development organization with emphasis on the development of a computing facility for dynamic modeling and computer graphics. Activities include system development for computer graphics, computer-aided modeling, and computer networks.

- A. Computer Graphics: The E&S LDS-1 display system connected to the PDP-10 offers graphic transformation functions such as "clipping," translation, rotation, scaling, and curve surface generation. The use of the E&S will be facilitated by the current effort on standardization of display subroutine conventions. A subroutine facility is available to convert digital E&S display output to a format suitable for ARDS and IMLAC displays. To aid programming IMLAC displays, we have modified MIDAS, our PDP-10 assembler, to assemble IMLAC programs.
- B. Computer-Aided Modeling: Group members are working on interactive dynamic and graphic oriented modeling tools for problem solving. Specific projects under development are: 1) programs for a visual statistics system which facilitate selection and presentation of subjects of multi-dimensional data, 2) programs for two-dimensional parsing, and 3) simulation and visual display of computer program dynamics.
- C. Computer Networks: Beyond the NCP and logger (TELNET), we are interested in using the ARPA network and making our resources available to network users. A sizable effort is also devoted to third-level protocols and service programs such as those for file transfer, graphics, and directories.



THE MIT DMCG PDP-10 SYSTEM

Harvard University
Aiken Computation Laboratory
33 Oxford Street
Cambridge, Massachusetts 02138

I. Application

The installation is a computer science research facility. The PDP-10 uses the DEC 4S72 monitor and is the principal computer. The PDP-1 is part of the same installation.

II. Equipment

The computer configuration includes:

- A. KA10 main frame with paper tape reader and punch
48K MB10 core memory (36-bit words)
- B. 500K RD10 fixed head disk
300K RM10B swapping drum
8 DECTape drives
1 ARDS terminal with two storage tubes and Sylvania tablet
8 lines in service (DC10 scanner)

III. Terminals

- A. The system currently handles any console functionally equivalent to the Model 33, 35, and 37 Teletypes.
- B. The system's communication with terminals is in 8-bit ASCII code.

IV. Interests and Capabilities

Work in progress is principally in the following areas:

- A. Polymorphic Programming Language (PPL) is an extensible language system run interpretively.
- B. ECL (for eclectic) is an extensible language system which will allow multiple users at one or more network sites to develop and operate programs cooperatively.
- C. Organic Molecule Synthesis uses graphic terminals to aid a chemist to search for feasible reactions leading to a desired molecule.

- D. Data definition, transmission, and conversion. Apart from work in this area being done by the ECL project, current work is directed toward development and use of a third-level protocol for file storage and retrieval at foreign sites.

- E. Network Graphics - Principal interest lies in investigating use of the network to gain access to resources such as clippers and massive computing power at other sites and determination of what tasks (such as inking) are best done locally to achieve balanced use of resources and acceptable response times.

Case Western Reserve University
Andrew R. Jennings Computing Center
Crawford Hall
10900 Euclid Avenue
Cleveland, Ohio 44106

I. Application

The installation is for research purposes and is dedicated to work for ARPA.

II. Equipment

- A. The computer is a DEC PDP-10 with a core store of 128K 36-bit words. It runs under the 10/50 monitor.
- B. Peripheral equipment includes:
 - 1. One paper tape punch
 - 2. One paper tape reader
 - 3. Eight DECTape units
 - 4. Two magnetic tape units (7 channel)
 - 5. One Burroughs fixed head disk (512,000 words)
 - 6. Eight DEC RP02 disk pack drives (approx. 40M words)
 - 7. One Evans & Sutherland LDS-1
 - 8. One DEC line printer
 - 9. One DEC PDP-8/I console scanner

III. Terminals

The system also has the following typewriter-like consoles:

Two Teletypes - Model ASR33
Eight DEC graphics terminals
Two IMLAC PDS-1 display terminals

IV. Interests and Capabilities

The Jennings Computer Center is operated by the Faculty of Computing and Information Science. The faculty provides undergraduate and graduate courses in computer science and also conducts research in the following areas:

- A. Computer-Aided Design and Certification of Computer Systems -- Project LOGOS

The aim is a coherent structure for computer systems

design delineated by a complete, readily accessible design data base. A summary of features of the complete target system includes: 1) criteria for automatic acquisition of data for, and computer assistance of, evaluation of hardware-software trade-offs; 2) detailed software design, implementation, and debugging; 3) data base for hardware implementation; 4) data source for management scheduling; 5) automated systems documentation; 6) automated generation of hardware and software diagnostics; 7) modification system evaluations; 8) system certification and the creation of environments in which user's algorithms will be followed -- and nothing else happens; 9) software systems transferable by careful adjustments at the hardware-software interface among certain different types of machines, and 10) exportability of the system.

A major revision of the DEC file system on the PDP-10 has been undertaken and a data management system for structuring and manipulating elements of the data base has been devised.

B. Artificial Intelligence

Research in artificial intelligence concentrates in three main areas: 1) mechanical problem solving and game playing; 2) data representation, and 3) pattern recognition.

C. Claim Structure Analysis of English

D. The "Abstract Family" Approach to Automata, Formal Languages, and Operations

E. Computer-Assisted Hardware-Software Design for Real-Time Operation

F. Operating Systems Analysis and Design

G. Extensible Systems Programming Language

H. Independent Context, Overlapped, Resolvable Grammars

I. Analytical Model for ALGOL-Type Languages

J. Intercalation Theorem for Pushdown Store and Stack Automata

K. Designing a Name-Space Environment for a Program Oriented Computer System

Carnegie-Mellon University
Computer Science Department
Pittsburgh, Pennsylvania 15213

I. Application

The installation is a research facility for the faculty and graduate students of the Computer Science Department. Programs are run under the DEC Operating System TOPS-10.

II. Equipment

- A. The computer is a DEC PDP-10 with a memory size of 240K 36-bit words.
- B. Peripheral equipment includes:
 - 1. Two swapping drums (660K words)
 - 2. Four disk drives (20M words total)
 - 3. Five DECTape drives
 - 4. Two magtape drives (7 track, 200/556/800 bpi)
 - 5. Paper tape reader
 - 6. Paper tape punch
 - 7. Card reader (1000 cards/minute)
 - 8. Line printer (132 columns, 1000 lpm)
 - 9. 24-line Teletype scanner
 - 10. ARDS terminal

III. Terminals

The CMU system supports two classes of consoles, Teletypes and Datels.

A. Teletype-like consoles

- 1. The system will handle any console functionally equivalent to the Model 33, 35, and 37 Teletypes. CMU currently has a large number of 33's and an INFOTON Display.
- 2. Character encoding is 7-bit USASCII. On input, the eighth bit is ignored; on output it is set to zero.

B. "2741-like" devices (IBM 2741, 1050; Datel; etc.)

- 1. The system will handle any console functionally

equivalent to an IBM 2741. CMU currently has a number of Datels.

2. All characters are mapped into (7-bit) USASCII by the I/O system. The characters are then processed as for Teletypes.
3. Operating mode is half-duplex.

IV. Physical Resources

- A. ARPA network users and local users will compete for use of system resources. The maximum total number of users is currently 24, and there will probably also be a limit on the number of users from the network at any one time.

The computing facility is in operation 24 hours per day, seven days per week. Peak usage is on weekdays during the hours from 1030 until 1700 local (Eastern) time. Experimental AI work is done on the PDP-10 during the hours 0100 to 0600, and system maintenance (hardware and software) is generally done from 0600 to 1000. Thus, the hours between 0100 and 1000 should be avoided by network users.



