# Kinow who's got PDP-10s on campus?

Caltech, Bowdoin, Stanford, o SMU, Carnegie Mellon, MIII. Westerm Omtario, Harvard, Oxford, Michigan, Western Australia, Catholic, Essex, Oregon, Yale, Bonn, Mumich, Cornell...

## The best of both worlds...plus

Traditionally, university computer centers have offered only batch processing services. In fact, when computers were much more expensive than they are now, it made good economic sense because batch kept the computer systems efficient.

But times change.

Now users worry about keeping themselves efficient. And that's where the PDP-10 comes in.

It's a big, flexible, expandable computer that can give your faculty, student body and administrative staff the best of both worlds...

Enough multiprogrammed batch capability to

handle the heaviest loads. Enough interactive timesharing capacity to support a whole campus of users effectively. Plus enough real-time potential to satisfy several scientific or engineering laboratories.

All simultaneously. At less than half the cost of comparable systems.

Skim through the next several pages. They summarize what our PDP-10 can offer you and your users. Then look over the seven configurations that follow. They typify the more than forty PDP-10 installations in colleges and universities around the world.

Be ready for tomorrow today...

Meet increasing instructional, research and administrative workloads on campus with a PDP-10 in your computer center.

As batch processing requirements grow, you can expand your PDP-10 system from 49,052 to 262,144 directly addressable 36-bit words (over 1,000,000 bytes). Keep the same operating system. Make no major software changes. Experience virtually no interruption of service.

As timesharing needs evolve, you can introduce or increase timesharing terminals. Your PDP-10 will accommodate up to 127 for concurrent use. It will also handle FORTRAN, BASIC, COBOL, ALGOL and ASSEMBLER in the timesharing mode. And you can easily add auxiliary storage for more than 82 million words.

As remote batch processing demands arise, you can meet them by connecting remote readers and printers to your PDP-10. Later, upgrade your remote batch system by adding time-

sharing terminals, DECtape and a punch. You can add remote batch units to match the growth of your workload.

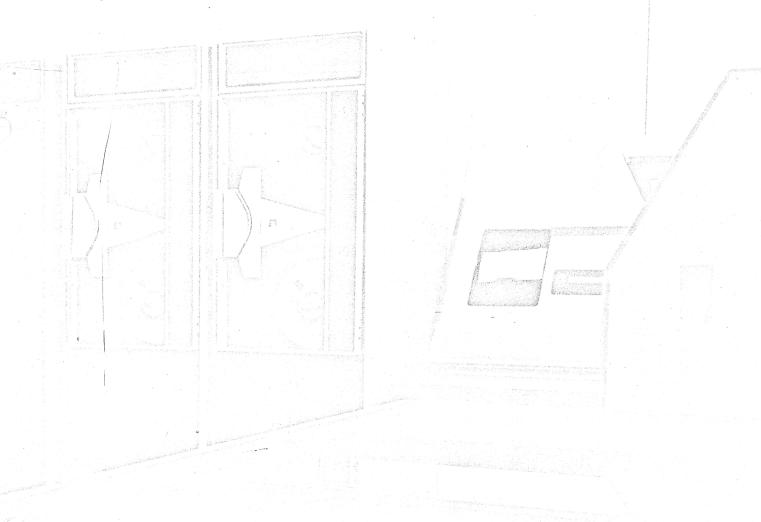
As real-time requirements develop, you can tie laboratory instrumentation into your PDP-10. A unique priority interrupt system maximizes real-time service. Instruments interface with ease.

## It's reliable, too

Of nearly 150 PDP-10 installations to date, more than a dozen are in timesharing utilities. This is one application where downtime is absolutely intolerable, and that's an acid test of PDP-10 reliability.

But just in case, we maintain a highly competent field service organization at strategic locations here and abroad. Mostly for piece of mind.

We'll be glad to put you in touch with PDP-10 users in your locale for a firsthand impression.



## The industry's best price/performer

When your computer center workload begins squeezing your pocketbook, you should know about the PDP-10. It's really four computing systems in one. With it, your center could handle up to 127 timesharing users simultaneously, local batch, remote batch, and real-time tasks. All equally well and all at once.

But the PDP-10 operating system is more than just versatile. It's also very compact, so it's extremely efficient.

And the PDP-10 compilers are extremely efficient, too. They produce a reentrant code which allows a single copy of one of them to serve many users concurrently. This conserves core space, cuts down on swapping, and lets the PDP-10 accommodate more users.

Program execution is highly efficient and rapid on the PDP-10. This is because the system software makes use of a repertoire of 366 hard-wired instructions. That's more by far than any comparable system offers.

File throughput is also fast and efficient with the

PDP-10. That's because the PDP-10 operating system optimizes file placement and retrieval.

Then there's cost.

You should know that the majority of our campus PDP-10 installations fall within a purchase price range of \$400,000 to \$1 million. Full payout lease costs run from \$9,000 to \$22,500 per month. (When the lease payments are over, you own the system.)

But most important. Buy or lease, a PDP-10 costs less than half what a comparable competitive system would. And even then, some couldn't hold a candle to ours.

## Minimal site preparation costs

Site preparation costs for a PDP-10 are exceedingly modest. The average system uses less than 1500 feet of floor. And less than 15 tons of air conditioning will support the whole operation. All in all, you might get away with a site preparation cost of under \$20,000. One of our customers did just recently, starting from scratch.

## arimal Staffing Requirements

Typically, our university center installations need only one operator per shift. This is because the operating system—we call it TOPS-10—services all four operating modes simultaneously. The single operator even remains free enough to handle special user requirements

as they come up.

A typical installation needs only two or three system programmers, too. The more than 2 million console hours we've logged in the field have worked out operating system bugs. What few updates we issue from time to time can be implemented with ease through SOUP, a special source merging program.

All in all, the PDP-10's efficiency will keep your staff efficient. Its operating system and language compilers are simple to learn and easy to use. Operating manuals are clear and concise. And the system itself was engineered for people from top to bottom.

## Accounting Package

We supply a series of accounting programs to control and record machine utilization. One program checks user authorization and the allocation of time period and location. Another records processor time for each user, connect time, user identity, main memory used, disk space used, and so forth. Still another gathers usage data for billing purposes and enables the addition of users or changes in passwords.

## **User Protection Scheme**

To ensure user protection, the PDP-10 maintains the following nested eight-level security scheme: No privileges • Execute only • Read • Append • Update • Change name • Supersede • Change protection

In addition, if certain jobs need to be given a different priority than originally assigned, the system operator simply adjusts the job queue accordingly.

## Wide software selection

We offer PDP-10 users a broad choice of software. Below, we've listed items that might be of special interest to campus computer center users. All languages may be utilized from the timesharing terminals as well as in the local and remote batch mode. Additional user-developed programs are available through membership in DECUS, the Digital Equipment Computer Users Society.

FORTRAN IV. Produces highly efficient object code resulting in programs 30 to 50 percent shorter than most other FORTRAN compiler programs. Reentrant. Device independent. Modular.

BASIC. Extended version. Easy-to-learn conversational problem-solving language. Reentrant. Produces machine language directly. Runs at high speed in minimal core. Has internal debugging, editing capabilities. Dartmouth public library programs written in BASIC are available from DECUS.

COBOL. Compiler based on August 1968 ANSI level 2 specifications. Reentrant. Contains separate report generation program. Both index sequential and random access data modes.

ALGOL. Compiler is a complete subset of ALGOL 60 with added features such as string handling, byte manipulation, double precision floating point, assignment within expressions, modulus operator, octal constants. Will be available in the summer of 1971.

MACRO-10. Two-pass assembler. Direct access to 366 instruction set. Device independent. Offers complete macro facilities, conditional assembly features, indefinite repeat operations, unlimited nesting of macros.

TECO. Concise text editing language. Editing is performed on a character, line or variable character string.

LOADER. Assigns consecutive core space and loads independently assembled or compiled

programs prior to execution.

DIAGNOSTICS. Comprehensive set for checking system operation. Most run without system downtime in timesharing mode.

AID. An easy language for engineering and scientific problems. It is based on the JOSS language.

PIP. Transfers files between standard input/output devices, eliminating the need for a satellite computer.

EDITOR. Line editor that produces or modifies MACRO, FORTRAN or other source files from teletype.

DDT-10. On-line debugging program for any MACRO-10, FORTRAN IV or COBOL program.

LISP. General-purpose language utilizing a list-structure storage scheme for both program and data. This package is a current version of LISP 1.6.

SNOBOL-10. Symbol manipulation language compatible with Version 2.0 of SNOBOL 4 as released by Bell Telephone Laboratories.

SCHOLAR/TEACH. Highly efficient computer assisted instruction (CAI) system.

GASP II. Discrete simulation language which consists of a set of FORTRAN subprograms.

BLISS. Designed for writing software systems such as compilers and operating systems.
Currently under development at customer location.

WATFOR. An in-core FORTRAN compiler designed to support heavy FORTRAN batch job streams.

APL. A programming language based on a consistent unification and extension of existing mathematical notations. Currently under development at customer location.

PL/1. A procedure-oriented language for both scientific and administrative users. Currently under development at customer location.

## Supporting services

Our interest in your PDP-10 installation doesn't stop with start-up. For your computing center personnel, we offer training courses in PDP-10 programming (two weeks), PDP-10 monitors (two weeks), and PDP-10 maintenance (five weeks). All of the courses are normally given at our headquarters training center in Maynard, Massachusetts, near Boston. But if desired, they can be conducted at your installation. For university officials, we run five-day seminars twice yearly to familiarize them with the rapidly growing role of computers on campus.

We also provide complete documentation for your PDP-10 system. It includes comprehensive software handbooks, hardware manuals, looseleaf software notebooks that we update periodically, and application-oriented software bulletins that catalog newly available applications software for the PDP-10.

Also available to you is membership in DECUS, our Digital Equipment Computer Users Society, a voluntary, non-profit users group supported by DEC. The largest of its kind, the 6000 plus DECUS membership is drawn from the United States and 32 other countries. For the membership, it publishes an information-packed bimonthly newsletter and sponsors symposia in the United States, Canada, Europe and Australia. Of special interest to you, over forty colleges and universities contribute programs to the DECUS library for mutual use.

In support of your own people, DEC service contracts can be arranged to cover most of your requirements. And in instances where special software, interfacing, logic or modifications to DEC products are needed, our broadly based Special Systems Group can be utilized.

## Campus installations

DEC is no stranger on campus. As the world's leading manufacturer of small computers, we pioneered their use in university laboratories and classrooms. Over 1000 such installations to date.

Now we're providing multi-mode computing with our large-scale PDP-10....Timesharing, local batch processing, remote batch processing, and real-time processing. All concurrently on one system.

We are because campus computation needs are changing.

Computer centers no longer can rely solely on

batch processing to keep pace with user requirements. Today's faculty and students want to interact with the computer via timesharing terminals.

With a PDP-10 in your computer center, you can provide this interaction. And you can handle real-time and batch processing at the same time.

But don't accept our word for the versatility of the PDP-10. Below is a list of campus installations around the world. If you can, visit one to see for yourself. Meanwhile, here are seven actual PDP-10 configurations to examine, along with application summaries and approximate purchase or leasing costs.

Bowdoin College California Institute of Technology Carnegie Mellon University Case Western Reserve University Catholic University of America Colorado School of Mines Cornell University **Emory University** Essex University, U.K. Faculte de Medicine de Paris, France Harvard University Hatfield Polytechnic, U.K. James Cook University, Australia Louisiana State University at New Orleans Massachusetts Institute of Technology Ohio State University Oxford University, U.K. Pennsylvania State University Princeton University Southern Methodist University Stanford Research Institute Stanford University

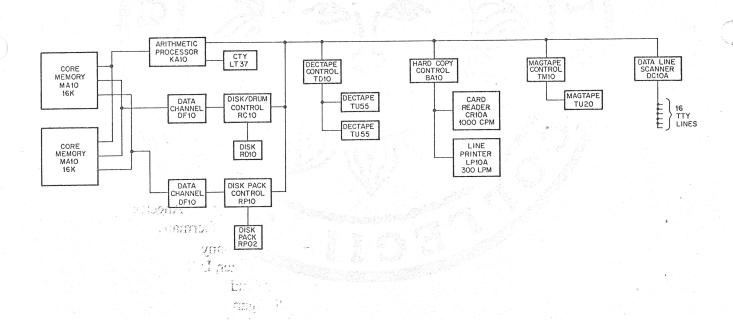
Stevens Institute of Technology Syracuse University Technical College of Aachen, Germany Technical University of Berlin, Germany University of Bochum, Germany University of Bonn, Germany University of California at Irvine University of California at Los Angeles University of Heidelberg, Germany University of Kiel, Germany University of Manchester, U.K. University of Maryland University of Michigan University of Munich, Germany University of Oregon University of Pittsburgh University of Queensland, Australia University of Utah University of Washington University of Western Ontario, Canada Western Michigan University Yale University

## Bowdoin College, Brunswick, Maine

Bowdoin College has a combined academic and administrative computing center. The PDP-10 replaced all existing equipment for academic instruction, for general research in psychology, chemistry, biology and physics, and for administrative jobs such as payroll, inventory, and student records. Bowdoin also shares its PDP-10

with a number of public and private secondary schools and colleges in Maine via timesharing terminals.

Undergraduate student enrollment: 1,000 Purchase price: approximately \$500,000 Lease price (5-year full payout): approximately \$11,000/month

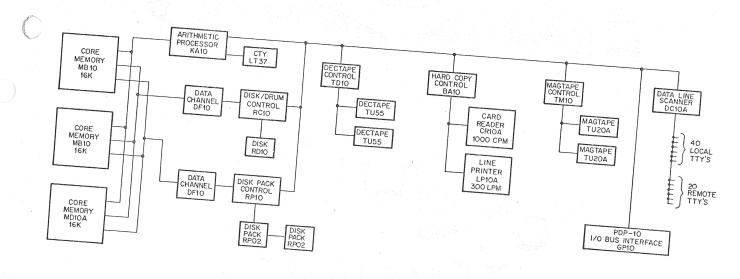


# California Institute of Technology, Pasadena, California

The chemistry and biology departments use the system, through a GP-10 special equipment interface, for real-time data acquisition from two gas chromotographs and two ammino acid analyzers. Students and faculty use the PDP-10 for interactive timesharing work on 40 teletype terminals located throughout the campus. In addition, six colleges within the vicinity use the

system for student instruction on 20 remote terminals.

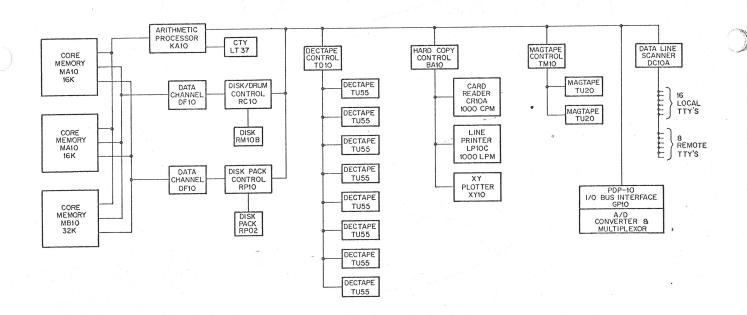
Undergraduate student enrollment: 680 Graduate student enrollment: 700 Purchase price: approximately \$650,000 Lease price (5-year full payout): approximately \$14,000/month



## Catholic University of America, Washington, D.C.

The PDP-10 installed in the computer center satisfies the instructional computing needs of all the academic departments. These departments make extensive use of the timesharing and batch processing capabilities of the PDP-10. The heaviest users are the departments of chemistry, civil and mechanical engineering, psychology,

physics, aerospace and atmospheric sciences. Undergraduate student enrollment: 2,200 Graduate student enrollment: 4,000 Purchase price: approximately \$600,000 Lease price (5-year full payout): approximately \$13,000/month

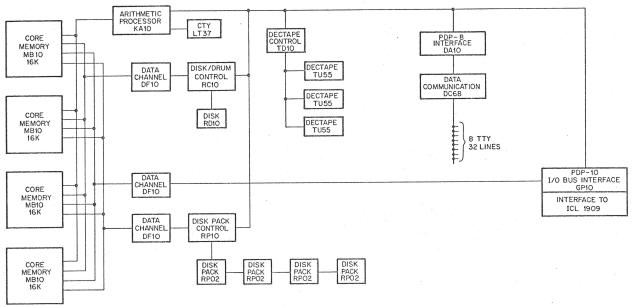


## Essex University, Colchester, Essex, United Kingdom

The PDP-10 performs timesharing and batch processing for Essex University. Particularly interesting, the computing center is building a high-speed link (about 300,000 characters per second) between the PDP-10 and an ICL 1909 computer. When the fast channel-to-channel link between the PDP-10 and ICL 1909 is completed, the 1909 will act as an input/output processor for the PDP-10, using four magnetic tape drives, two paper tape readers and punches, a fast line printer, card reader, and card punch. The

PDP-10/1909 system will support the university's research, instructional, and administrative computing requirements. Research and teaching computing requirements will also be supported by a DEC PDP-15 computer system.

Undergraduate student enrollment: 170 Graduate student enrollment: 40 Purchase price: approximately \$600,000 Lease price (5-year full payout): approximately \$13,000/month

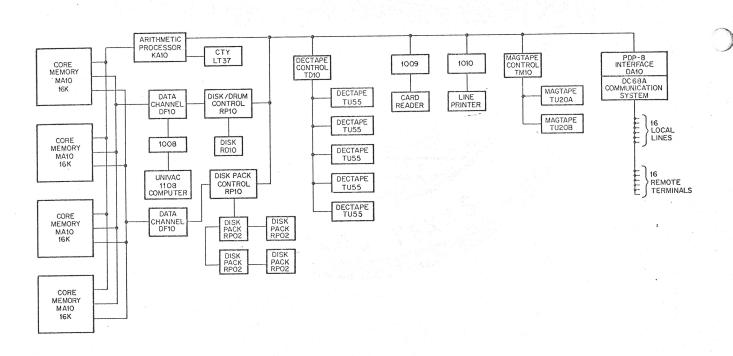


### Southern Methodist University, Dallas, Texas

The PDP-10 in the computing center is currently used to teach students BASIC, FORTRAN and assembly language programming, and the general principles of data processing. Higher level research involves compiler design and heavy use of LISP and SNOBOL. The Business School, the statistics department, and the Institute of Technology all utilize the PDP-10 via timesharing terminals. Timesharing also allows members of the TAGER network to have access to the PDP-10. (TAGER

is an experiment in teaching graduate level science, mathematics and engineering courses by television.)

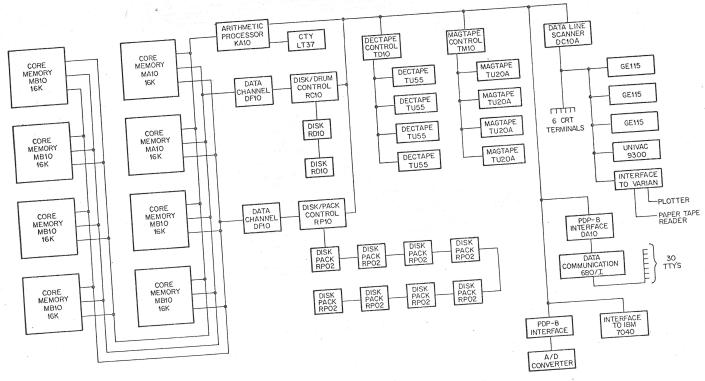
Undergraduate student enrollment: 10,000 Graduate student enrollment: 2,000 Purchase price: approximately \$750,000 Lease price (5-year full payout): approximately \$16,500/month



## University of Western Ontario, London, Ontario, Canada

The PDP-10, interfaced to several other computers of different sizes and speeds, enables the computing center to provide on-line computing services via timesharing terminals or remote batch stations to users in the departments of applied mathematics, chemistry, computer science, geography, astronomy, geophysics, economics,

geology, physics, psychology and botany.
Undergraduate student enrollment: 10,000
Graduate student enrollment: 1,600
Purchase price: approximately \$1,200,000
Lease price (5-year full payout):
approximately \$26,400/month



## University of Utah, Salt Lake City, Utah

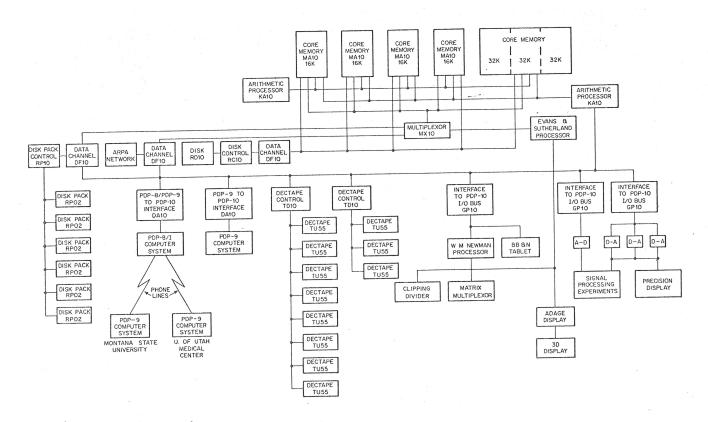
The PDP-10's unique ability to allow real-time activity to run concurrently with timesharing plays a key role in the computing program at the University of Utah in Salt Lake City. In a dual processor configuration, one of the processors is used to support a university-wide graduate student timesharing system. The other is designed for graphics research. Digital signal processing experiments, as well as other on-line experiments, are carried out through special interfaces.

Part of the graphics research involves three PDP-9s connected on-line to the PDP-10 system. One PDP-9 is interfaced through a KA10 and has four specially designed Univac 1559 scopes. Each of the other two PDP-9s also contains a Univac scope. One is located on campus in the

physiology department at the Medical Center and the other at Montana State University in Bozeman, Montana. These displays are used in interactive graphics research.

Another part of the graphics research is centered on the Evans and Sutherland Corporation's high performance, three dimensional line drawing display processor, and a halftone display processor which generates perspective drawings that are properly shaded to provide a realistic effect.

Undergraduate student enrollment: 17,000
Graduate student enrollment: 4,000
Purchase price: approximately \$1,500,000
Lease price: (5-year full payout):
approximately \$33,000/month



## Keep us in mind

Chances are, another computer for your center is still off in the future. We understand. But we also want to be included when the time comes. In fact, now may be the perfect opportunity to take a long hard look at the PDP-10. We won't mind. Start with a call to your local DEC office. If you're

ready, suggest a visit from one of our sales engineers. If you'd rather browse through more literature, just ask what's new, take your choice, and have it sent. Our pleasure.

Maybe you'll be reading about you in the next edition of this brochure. We hope so.

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