

# FOCAL Time-Sharing System Introduced

A new special purpose or **single language small computer time-sharing system** using the conversational language, **FOCAL®**, has been introduced.

The system is designed specifically for educational and engineering applications, but because it lowers the time-sharing terminal cost to \$5,400 with Teletype, the lowest price yet offered, and a price lower than the yearly rental rate of large time-sharing computer terminals, it is expected to have a variety of other applications. The maximum number of terminals in the system is seven. With the addition of more core memory and other hardware options, the number of terminals can be increased to 16 or more, and the system made general-purpose, giving it the capability of using a variety of computer languages.

The key to the system, which can be installed in any DEC PDP-8, PDP-8/I, or PDP-8/L computer equipped with disk storage, is FOCAL. Disk capacity can vary from 32,768 words to more than a million words, depending on user requirements. In all cases, FOCAL permits the storage of programs in a common library on the disk.

The system is designed so that if a user designs a program requiring more than his allotted space in core memory, that program can be broken into segments and the needed segments can be stored in the disk storage unit. When it is time to call up this program, FOCAL first removes the segment that is in the core memory and takes the remaining segments from the disk storage unit, automatically chaining the program together in its proper sequence. There is common storage of up to five variables between segments.

The FOCAL language was originally designed for use by one operator of any of DEC'S PDP-8 family of small computers. Since then, two- and four-user versions have been made available for use with the PDP-8 line, as have single-, two-, and four-user versions for use on DEC's medium-scale, 18-bit computers. FOCAL, standing for FORMula CALCulator, is similar to the language JOSS

and is one of the most powerful languages ever devised for the small computer. At the same time, it is as simple a computer language as any yet devised, and persons with little or no computer knowledge have mastered it in less than two hours.



**FOCAL is the key to time-sharing on DEC PDP-8, PDP-8/I or PDP-8/L computers equipped with disk storage.**

FOCAL'S 12 functions include trigonometric, logarithmic, device controls and sign part, integer part, absolute value, square root, and random number. Individual character editing eliminates the need to correct an entire line due to one typographical error. A trace feature allows an operator to determine not only what the error is but also where in the program it is located.

*(Continued on page three)*

## DEC First Aid!

Are you an OEM or a distributor? Would you be interested in photos of DEC's equipment? Samples of advertising and promotional materials? If so, Digital's Advertising Department invites you to check the customer service box below.

For information on the Promotional Support Program, check customer service box #1.

## Control Products Group Formed

The creation of a **Control Products Group** to focus attention on the growing requirement for advanced industrial control systems has been announced by Stanley C. Olsen, DEC vice-president and group manager.

In making the announcement, Olsen stated that "Penetration of sophisticated electronic technology into the industrial control market has advanced to the point where a number of specific approaches are beginning to be well defined."

"Having followed this penetration for the ten years that the Company has been supplying this market, we are confident that our new approach will allow us to dedicate our resources most effectively, not only to enhance our present position, but also to develop new products and innovative techniques to meet the specific demands."

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## PDP-10 Monitor Improvement

A significant improvement to the **PDP-10 time-sharing monitor** to permit multi-user access to a single program in core was recently developed. The improved monitor is available immediately and can be used with all PDP-10 programming languages including FORTRAN, BASIC, MACRO, AID, TECO, and the recently announced COBOL.

Lawrence J. Portner, manager of programming at DEC, explained that with the new monitor, "only one copy of a program need now reside in core instead of requiring many individual copies for each user. For instance, 10 FORTRAN IV programs concurrently being compiled require only one copy of the 8K compiler and ten 2K user data buffer areas. This is a total of 28K as compared to a 100K requirement usually needed." (10 x 8K plus 10 x 2K)

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## PDP-10 Monitor (cont.)

The monitor takes advantage of the fact that a majority of the code in most programs does not change when it is being executed and, therefore, can be consecutively shared and reentered by many users with no adverse effect.

The dual protect and relocation registers in the PDP-10, which provide hardware protection of programs concurrently sharing core memory, make it possible for each user to access two separate areas in memory. The software is designed such that one of these areas will contain a copy of the reentrant program, which is shared by all users simultaneously employing that system program, while the second area contains the unique code (or data) which is relevant only to the individual user.

In addition to the substantial increase in the amount of usable core memory created by this monitor, this "reentrant" capability also minimizes the swapping load in the system according to Portner.



Multi-user access into a single program in core is now available to PDP-10 users with the improvement to the time-sharing monitor.

"Since the reentrant code by definition is never modified, it is always in its original state. Therefore, the reentrant portion need not be saved on the swapping device when a user's program is swapping out onto auxiliary disk storage. Using the same example as above, only the 2K user data buffer is stored on the swapping disk and the 8K reentrant FORTRAN compiler need not be swapped."

Commenting on the reentrant monitor, Portner noted that the "resultant improvement in core and logistics resource utilization leads, in turn, to more effective use of the central processor and to the possible expansion in the number of system users. Naturally, the full advantages of the reentrant capability are most evident when dealing with larger programs and those which experience a high incidence of multi-user activity."

For information on the PDP-10 Monitor, check customer service box # 2.

## Two NMR Software Packages With LAB-8

Two new software packages, offering complete nuclear magnetic resonance spectrometry acquisition and analysis capability to users of LAB-8 computer-based signal averaging systems, are being offered by DEC.

The programs are available at no cost through the Digital Equipment Computer Users Society (DECUS), the company's users group. This is the first time a spin simulation system has been made available to users of a small, general purpose computer in the \$20,000 price range.

Nuclear magnetic resonance is commonly batch processed on larger computers. Although larger computers can calculate as many as ten spins, the majority of analytical work can be done in the two-to-six-spin range.

The spin simulator program was written by D. F. Juers, R. J. Boettcher, V. J. Hull, and H. E. Zimmerman, all of the Chemistry Department of the University of Wisconsin. It allows physicists to

analyze the molecular structure of chemical compounds up to six spins in a LAB-8 equipped with 8,192 words of memory. The program will process six spins in a maximum time of fifteen minutes, five spins in a maximum of three minutes, and fewer spins in seconds. (The number of spins indicates the complexity of a molecule's NMR spectrum.)

The data acquisition program for nuclear magnetic resonance spectra is MADCAP II, designed by G. W. Dulaney, of Virginia Polytechnic Institute. The program accepts analog output from such analytical instruments as a mass spectrometer, electron spin resonance spectrometers, nuclear magnetic resonance spectrometers and curve followers, and converts it to digital form. Output is in the form of printed and punched information, and either a line or point plot. Instructions, binary tapes and listings are available through the DECUS Library.

The LAB-8 is any PDP-8/I or lower priced PDP-8/L equipped with the AX08 laboratory peripheral.

For information about the LAB-8 signal averaging system, check customer service box # 3.

For information on NMR software packages for the LAB-8, check customer service box # 4.

## Physics Computer Performs "Impossible Analysis"

Using a relatively small computer to do a job normally requiring a large data processing system has been considered an impossible task by most data processing people, but the Nuclear Center laboratory at Lowell Technological Institute in Lowell, Mass. is doing just that! Faced with the unavailability of a larger computer on campus Dr. Suresh C. Mathur, Donald R. Donati, and Richard Hully developed a way of using their small data acquisition computer, a PDP-9, to perform complex nuclear analyses.

The Nuclear Center personnel had to devise a way of adapting large analytical nuclear structure programs to their 16K core memory PDP-9. By using the DEC-tape mass storage capacity of the computer (a magnetic tape recording system) they developed a program technique that allows the PDP-9 to use only a portion of the total program at a time, while the bulk remains a mass storage. Effectively they are now able to do calculations on the small PDP-9 computer that were

originally developed for large machines such as the IBM 7094, IBM 360, CDC-1604, and CDC-6600 computers with core memories in the range of 32-128K. The program run times on the PDP-9 computer compares favorably with those on the larger computers.

"The use of the PDP-9 for this application is totally unique," says Dr. Mathur. "In fact, what we're doing was first thought to be impossible, but there is a lot you can do with a small computer if you put your mind to it."

Three nuclear structure programs originally written for large computers are now being used with the PDP-9. The results of one of their investigations in inelastic nucleon scattering, in which analyses were performed with the PDP-9 computer, have been reported at the recent American Physical Society Meetings held in Miami Beach, New York, and Washington. A paper has also been published in the international journal, *Nuclear Physics*.

## Over 100 Orders For PDP-15

More than 100 orders have been received for DEC's newest computer, the medium-scale **PDP-15**, since its introduction less than two months ago.

The 18-bit machine, which is offered in four configurations, was announced in late April and made its debut at last month's Spring Joint Computer Conference. Initial reaction to the computer has caused management to study methods of increasing its production rate.

Early purchasers of the PDP-15 indicate they plan to use it in such areas as education, research, medicine, physics and hybrid computation. Customers include colleges and universities, government agencies and manufacturers of other equipment who plan to make the computer part of their product (OEM's).

The four configurations of the PDP-15 include a basic system at \$16,500, an advanced monitor system at \$36,000, one designed for background/foreground applications at \$58,000 and a large, disk-based background/foreground system selling for \$92,000. Early purchasers favor the PDP-15/30, the background/foreground system, which was developed to meet the demands of research, engineering and industrial environments where one or more real-time tasks typically require continuous responsiveness from the computer but do not use its entire capacity. The system includes 16,384 words of core memory, magnetic tape storage and a wide range of software.



Early PDP-15 purchasers indicate they plan to use the system in education, research, medicine, physics, and hybrid computation.

For information on PDP-15 systems, check customer service box # 5.

## Control Products Group (continued from page one)

The Control Products Group is comprised initially of four product lines covering three major control needs: solid state machine control for repetitive processes — PDP-14; systems for numerically controlled machinery — N/C Products; and control modules for a variety of industrial applications — Module Products. The fourth product line, Control Systems, will draw on all product areas within DEC to develop specialized systems for industrial control.

The newly appointed Product Line Manager/Control Products is Allan T. Devault. He has been with DEC for three years, originally as Marketing Manager for the Module Product Line, and most recently as Product Line Manager/Modules. He will have responsibility for overall activities within the control products group.

John Holzer, former Project Manager, has been named PDP-14 Product Manager; Russell Doane, former Module Development Manager, is now N/C Product Manager; Frederick Gould, former Module Sales Specialist, has been named Module Product Manager; and Martin S. Gordon, former Supervisor of Module Applications is now Control Systems Manager. Each of these Product Managers will be responsible for overall activities related to their respective product including development, marketing, and support.

## First U.K. Typesetting Systems Installed

The first computerized typesetting systems in the United Kingdom using **PDP-8/L** computers, the **TYPESET-8/L**, have been installed at the Belfast, Northern Ireland, **TELEGRAPH** and the Coventry **EVENING TELEGRAPH** and Croyden **ADVERTISER** in England.

The installation at the Belfast newspaper, part of the Thompson Organization, Ltd., chain of newspapers, is a dual system, while the Coventry and Croyden newspapers share a single installation.

The PDP-8/L, lowest-cost model of DEC's PDP-8 line of small computers, enables the typesetting systems to process

unjustified tapes at a continuous rate of 110 characters per second, and 12,000 newspaper lines per hour. The systems can be expanded by adding magnetic tape or disk storage to increase the capacity of the library of typesetting programs DEC provides. Because it is a general purpose computer, the PDP-8/L can perform such functions as updating circulation figures, maintaining production statistics, and monitoring newsprint inventories when it is not setting type.

The typesetting systems were installed by DEC's European subsidiary, Digital Equipment Company, Ltd., of Reading, Berkshire, England. The low-cost typesetting system based on the PDP-8/L, priced at \$16,900, was introduced in the United States last month. To date, DEC has installed more than 180 **TYPESET-8** systems.

For information on the **TYPESET-8/L**, check customer service box # 6.

## Focal Time-Sharing System (continued from page one)

Other program specifications include five arithmetic operations — exponentiate, multiply, divide, add, and subtract — and an exponential range of 10 to the plus or minus 600th power. All variables may be subscripted. Two arithmetic subroutines are available so users can choose the correct six- or ten-digit precision.

**FOCAL** has proven particularly valuable in education, both on the secondary and college levels, in civil engineering, aeronautical engineering, statistical work, medicine, and research. One aerospace accessory manufacturer, one of the earliest users of the language, has combined **FOCAL** with a PDP-8/S and substituted the system for the slide rule in jet engine component testing. In other instances, it has enabled users to substitute a small computer for the less versatile calculator.

Multi-user versions of the language have proved equally appealing, according to Norman Doelling, marketing manager for the product, allowing two, three, and four users to work on different problems, as if each had his own computer. Now, a similar advantage can be enjoyed by up to seven users, each of whom has access to disk storage for his program.

**FOCAL®** is a trademark of Digital Equipment Corporation

For information on the **FOCAL** Time-Sharing system, check customer service box # 7.



# DEC Builds In-House Special Systems Capability

Digital Equipment Corporation's **Computer Special Systems Group**, organized five years ago to meet individual customer engineering needs, produced more than \$10.6 million in sales during 1968. The group has built more than 300 systems since it was organized, including 163 systems shipped in 1968.



Remote PDP-8/S controlled pumping station along Interprovincial's pipeline is linked to station controls by monitoring and control equipment designed by Computer Special Systems.

According to Brad Vachon, the group's manager, the bulk of its business involves interfacing to customer instrumentation for data accumulation and control in such areas as: numerical, process, and experimental control; communications; physics; biomedicine; interfacing to mass storage devices; hybrid systems and display systems and interactive terminals. To satisfy needs in any of these areas, Computer Special Systems builds special peripherals, interfaces the customer's instrumentation to DIGITAL computers and even interfaces DEC systems to competitive computers.

As a company, DEC has found that many computer customers are unaware that the computer itself is often only a small part of the cost of a computer-based system.

"The development of a special systems capability means we are able to point out the true costs of a system to a customer," Vachon says. "After the customer has told us what he needs, the engineering responsibility for interfacing to his specialized instrumentation is ours."

The range of interfacing and systems problems the group has dealt with is staggering, but Computer Special Systems has met them head on with a skilled staff of applications engineers, sales support personnel, project engineers, programmers, and manufacturing specialists.

The Computer Special Systems Group cuts across all DEC computer lines, including the small PDP-8/I and 8/L, the medium scale PDP-15, and the large PDP-10. In addition, Vachon's group has worked with time-sharing systems, interfacing small computers to larger ones, and with DEC's older computers, helping customers keep hardware that is no longer in production up-to-date.

Working with **D.C.F. Systems Ltd.** of Toronto, Computer Special Systems developed a network of 22 small PDP-8/S computers to control the flow of crude oil through 1100 miles of pipeline for **Interprovincial Pipe Line Company** of Canada.

The 22 remote computers now automatically monitor and/or control the pumping stations and perform all data acquisition, interpretation, and transmission functions at a faster speed and with greater accuracy than previously possible.

A number of safety checks are also computer-generated. In the Edmonton center, 2 PDP-8/S computers control communications, and an IBM-360/40 stores and processes the data.

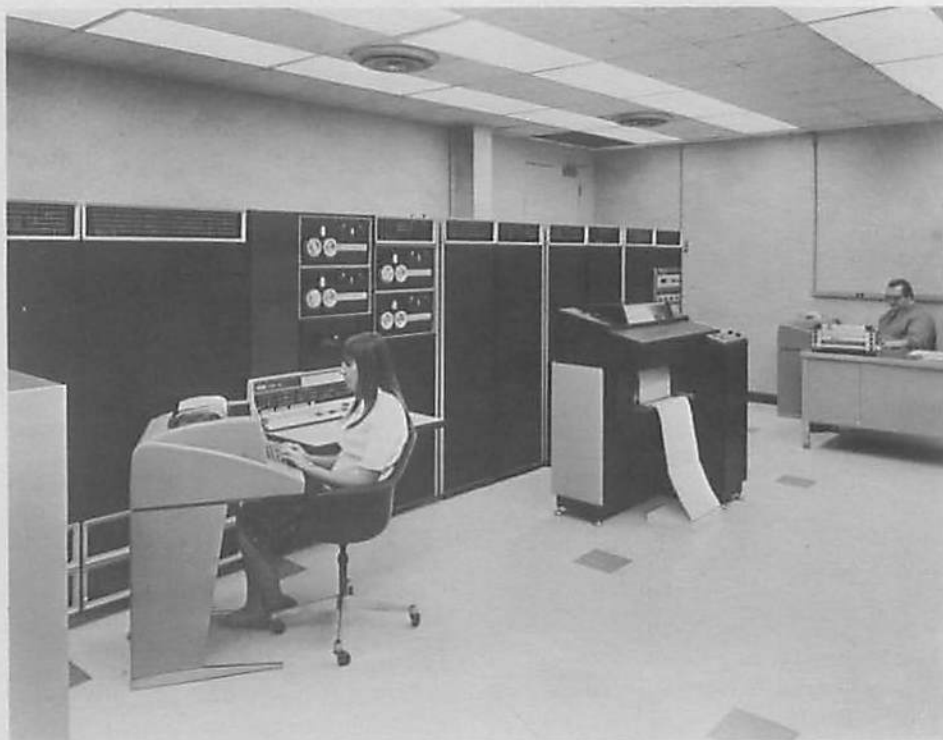
**Call-A Computer**, an offspring of Pillsbury Company and Occidental Insurance, is using a number of CSS produced DEC 680 data concentrating systems to provide its customers on-line access to larger time-sharing computers in a number of major cities including New York, Chicago, and Los Angeles.

The group also developed a subsystem for **University Computing Company** of Dallas, a major computer utility. The object of this subsystem is to reserve its large central processor for the work it is best suited to, leaving lesser tasks to smaller computers.

This subsystem, **FASBAC**, is presently being used by UCC's British subsidiary, **Computer Services** (Birmingham, England). **FASBAC** is hierarchal in structure beginning with a PDP-8 with an 8K memory used as a multiplexor to simultaneously handle up to 32 teletypewriters, graphic or display units.

The communications controller has access only to the next unit in the hierarchy a PDP-9 with a 32K memory. This processor is the nerve center of the **FASBAC** subsystems and contains the necessary

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Time-sharing PDP-10 computer system at Chase Brass and Copper Company's Montpelier, Ohio Blue Dot™ brass rod plant was interfaced by DEC's Computer Special Systems Group to monitor and control manufacturing functions.

time-sharing capabilities to query requests, schedule processing, dispatch processing, direct I/O devices, monitor the strategy for its own and the 1108 programming system and send data and requests to the 1108 and/or mass memories. The FASBAC subsystem provides the time-sharing user with an economical and fast method for handling any data processing applications which demands the use of high-level languages and direct access to large volumes of his own stored data.

**Chase Brass And Copper Company's** Montpelier, Ohio facility recently installed a large DEC PDP-10 computer system to monitor manufacturing functions at its Blue Dot™ brass rod plant. For this system, Computer Special Systems built a 36-bit line driver unit. The driver controls motors, solenoids, relays — in short, devices requiring control signals.

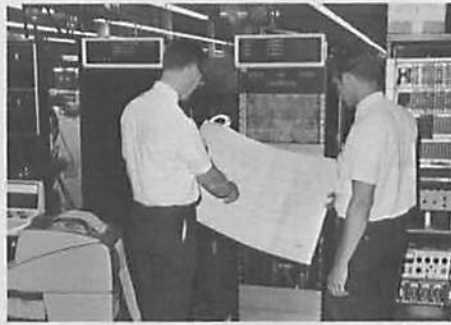
To allow man interaction with the computer as well as machine interaction between weighing scales and conveyors with the computer, CSS built and interfaced a contact interrogation unit to the PDP-10. This enables the operator to enter data into the PDP-10 on a time-sharing basis with many different machine outputs.

The PDP-10 at the Chase site has a 32K, 36-bit word memory, a 500K word disk, a 20-channel analog data acquisition subsystem, and special interfacing to various production machines. All of the interfacing was done by CSS, Chase Brass, and Electron of Ohio.

When the Chase in-house time-sharing system is finally complete, plant management will have open loop control of manufacturing processes; an integrated plant logistics operation including order entry, inventory planning, production scheduling, material allocation, economic truckload planning, and billing; a system to prepare management reports as well as production/customer work analyses; a payroll capability; control over spare parts inventory; even the ability to simulate mill operation.

Computer Special Systems has also provided large numbers of PDP-8 and PDP-9 based multianalyzer systems to physics laboratories around the world. The group has interfaced DEC computers to telemetry systems for space research, to production equipment, and to special graphic displays.

The list of the group's accomplishments does not end there, as any of the DEC product line managers will attest. "Ser-



Brad Vachon (left), Computer Special Systems manager, and Bob Hurley (right), engineering group leader, review details of special PDP-10/data acquisition system interface. To date, Computer Special Systems has interfaced more than 300 systems for DEC customers.

vice is the name of the game" signs are scattered throughout Digital's sales and field service offices and its Maynard plant. As long as the slogan remains true, the Computer Special Systems Group will remain invaluable to the company's growth and Digital's customers.

Information on Computer Special Systems capabilities may be obtained from your local DEC Sales Office.

## PDP-8/S Controls Neutron Spectrometer

The Danish Atomic Energy Commission (DAEC) is testing a new computer-controlled system to analyze the structure of matter at its Risø facility. The DAEC is using a PDP-8/S computer for direct on-line control of a neutron spectrometer.

Before developing its new system, the DAEC controlled the spectrometer with tapes prepared on an off-line computer. The on-line control provided by the PDP-8/S will permit greater flexibility in gathering data.

Neutron spectrometry is a method by which neutrons, traveling at a slow or "thermal" velocity, are directed in a beam at a sample to be analyzed. The beam interacts with the structural arrangement of the atoms in the sample and is scattered in a pattern. Like fingerprints, these patterns are unique for different substances. Detectors, rotating slowly through angles around the target, pick up elements of the pattern. From the intercepted pattern, information concerning the nature of the structure of the sample is uncovered.

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## British European Airways Selects PDP-10

British European Airways has selected a PDP-10 computer for use in a management information system currently under development. The system is designed for management planning and operations research models upon which major decisions could be made.

BEA's operational research unit currently uses the carrier's Beacon reservations system for its work, which includes the simulation of movement of aircraft, studies for the rostering of aircrews, the evaluation of timetables, traffic forecasting, and timetable construction. Increased demands on the reservations system made the purchase of the PDP-10 necessary.

Plans call for the research work to be done in NELIAC, a high level computer language derived from the ALGOL language and developed by the U.S. Navy Electronics Laboratory. BEA is probably the only British user of this language.

The PDP-10 will be used in a real-time, interactive mode for program development. A number of terminals will be connected to the system for information retrieval. It will be equipped with 32,768 words of core memory, an 800 card-per-minute card reader, a 1,000 line-per-min-

ute line printer, magnetic tape and disk storage, and control units for up to 16 incoming lines.

DEC's large computer is beginning to gain wide acceptance in the British aircraft industry. Rolls Royce, Ltd. recently selected the PDP-10 for use in jet engine testing, and one will monitor the structural testing of the Concorde supersonic commercial transport, testing that will lead to the craft's certificate of airworthiness. Preparations for this project are underway at the Royal Aircraft Establishment of Farnborough, England. The project has been called "probably the most elaborate structural test ever carried out." It is a series of dynamic tests with continuous computer control of the application of loads to the fuselage of the plane and continuous computer monitoring of stress effects.

The test program will go on throughout the service life of the Concorde. Four hours flying time will be condensed into one hour of simulation time. The testing system also uses two PDP-8/I computers, one to control the operation of the loading jacks and the other to monitor operations.



## DECUS Call For Papers

Papers are now being considered for presentation at the DECUS Fall 1969 Symposium to be held at the Flamingo Hotel, Las Vegas, Nevada.

### Session topics are:

Analytical Instrumentation

Astronomy

Education

Interactive Systems and Computer Graphics

Physics-Nuclear and General

Computers in Clinical Medicine

Computers in the Life Sciences (Research)

Authors should submit a 75-100 word abstract of their paper to the DECUS office before September 1 accompanied by a one or two-page mini-paper, a condensed version of the final paper.

These mini-papers, which will be used as a basis for review for acceptance, should indicate whether the work discussed is in the planning, experimental, or construction stage, and results (if any.)

Authors will be notified of acceptance during the second week in September.

## European Headquarters Moved to Geneva

Digital Equipment Corporation recently transferred its European headquarters from Reading, England, to Geneva, Switzerland. The Geneva headquarters will be known as Digital Equipment Corporation International, and the Reading Plant will be used exclusively for manufacturing.

This brings to seven the number of DEC subsidiaries in twelve European countries, as well as sales and service offices in the United States, Canada, Japan, and Australia. Other than Reading, manufacturing facilities are located in Maynard; Carleton Place, Ontario, Canada; and San German, Puerto Rico. In addition, DEC is expanding its manufacturing capacity in Maynard and adding plants in Westfield and Leominster, Mass.

## Astrodata Selects PDP-8/L

Astrodata, Inc. of Anaheim, Calif., long a manufacturer of data acquisition systems, has selected DEC's small PDP-8/L digital computer as the central control element of its latest analog and digital system.

The ADAC system, which can be used for both data acquisition and control, is priced at \$30,000 and is expected to have applications in such areas as seismic studies, spacecraft checkout, biomedical research, wind tunnel testing, nuclear reactor monitoring and control, telecommunications control, petrochemical process analysis and control, geophysical monitoring and the monitoring of fabrication and assembly processes in industrial facilities.

Astrodata is ten years old. In the past, it has specialized in the production of custom-built data acquisition systems with emphasis on low-level analog outputs from a variety of sources. First deliveries of its new ADAC systems are scheduled for September. Almost immediate availability of the PDP-8/L permits the firm to offer 60-day deliveries on the standard system. The weight of the PDP-8/L — 83 pounds — and its size — about that of an office typewriter — help make the system ideal for remote applications under cramped conditions.

ADAC acquires low- and high-level analog signals, provides for on-line monitoring and control, and produces a digital computer compatible output. Besides providing control, the PDP-8/L can be used for such things as data editing, limit checking, and conversion of data to engineering units. The system can acquire a range of input signals from five millivolts to ten volts over a broad speed range and can be easily expanded in the field. The standard system consists of an analog input section with a low-level multiplexer and an analog-to-digital converter, an intercoupler for connecting the analog and digital sections of the system, the PDP-8/L, and a teletypewriter.

The low-level multiplexer has 10 channels expandable to 100 channels in 10-channel increments and to 500 channels with the addition of more multiplexer assemblies. A high-level multiplexer, which can be expanded to 128 single ended or 64 differential channels by the insertion of 16-channel multiplexer cards is also available.

Software accompanying the system includes assemblers, a FORTRAN compiler, a symbolic tape editor, utility and maintenance programs, device diagnostics, checkout routines, modular data acquisition packages, and DEC's conversational language, FOCAL®.



Latest data acquisition system from Astrodata, Inc. of Anaheim, California is an analog and digital system using DEC's PDP-8/L computer as the central control element.

## Field Service Contract Options Announced

Field Service has announced a **major expansion of service contract options**. In response to the special requirements surrounding typesetting, communications, time-sharing, petrochemical, and bio-medical applications, Field Service has increased both its capacity and the number and types of coverage to be made available to the user.

Users can define their requirements and choose among the more than 180 service options to tailor the service contract to their particular need.

The service contract option requires only that the user agree to coverage for the prime shift of 8 hours per day, Monday through Friday; and if service on Saturday and/or Sunday is desired, at least a prime shift 8-hour block in the weekend day or days be selected.

With this new service schedule, users may vary their coverage to fit individual requirements. For example, service may be tailored to an 8-hour shift Monday through Friday and 8 hours on Saturday, or 12 hours Monday through Friday and 16 hours on Sunday, or simply 24 hours a day Monday through Friday. In all, the flexibility of the new service coverage affords users a wide latitude in choosing a plan to meet their service needs.

As with the present service contract, the user will still receive:

Preventive maintenance geared to the system configuration and usage pattern

Prompt remedial service

Spare parts availability in depth with express dispatching from Maynard if necessary

The periodic rejuvenation of the system by rebuilding all items that can be feasibly rebuilt

All necessary parts, labor, material, and test equipment to insure proper systems operation

Ease of budgeting

Complete service for a fixed monthly fee; elimination of the risk of large, unscheduled expenditures

All requests and questions concerning this extended service should be routed through the applicable Field Service district office.

## Five Years At Carleton Place Reflects Canadian Growth

As Digital pauses to applaud its Canadian subsidiary after five productive years based at its present manufacturing facility at Carleton Place, the accomplishments to date have been noteworthy. Since being incorporated in 1963, **Digital Equipment of Canada, Ltd.** has installed computers at a faster rate than any other supplier in Canada. In fact, DEC now enjoys the position of being second in the Canadian computer industry, in terms of the number of machines installed. This success in Canada has, to a large degree, reflected the work done in Carleton Place.

Looking at five successful years of growth in Carleton Place, Canadian Regional Manager Denny Doyle notes, "We have kept pace with our growth only by successfully attracting the very best people in Canada to our staff — and also by attracting some high level people up to Canada from the United States as well."

At present, more than 130 persons are employed in the 94 year old building on the banks of the Mississippi River in Carleton Place. Digital has recently acquired a second building just across the river, expanding the capacity of the manufacturing facility by 14,000 square feet, and the company holds an option for another 11,000 square feet of space in the same building.

Manufacturing facilities at the plant are quite efficient, resembling Maynard in many ways. **COMPUTER LABS**, conceived and produced at Carleton Place, are uniquely a Canadian product used as training aids for teaching the fundamentals of computer hardware. The world's supply of **COMPUTER LABS** is produced in Canada.

Computer sub-assemblies and components are also manufactured here, including assorted cables, power supplies, and logic panels for various DEC computers. To produce logic panels, seven wire wrap stations have been installed, all under the control of a PDP-8 computer.

The stations are semi-automatic, with the computer removing all possibility of error while the operator does the complex job of wiring. Each logic panel requires about 36 hours of work.

Growth, however, is the key word in the Canadian operation. Denny Doyle notes with pride that, "Our field organization



Wire wrap operators at Carleton Place produce logic panels for several DEC computer lines, all under the control of a PDP-8 computer.

now includes personnel stationed in every major Canadian city from Halifax to Vancouver and support for these personnel is provided from five strategically located field offices, each of which is equipped with field service and software support facilities. Right here in Carleton Place we have a warehouse, a software library, and various technical support groups. All of these make us a top rate organization capable of supporting our computers out in the field."

## DECUS Announces Fall Meeting Topics

The **Digital Equipment Computer Users Society (DECUS)** has added "Analytical Instrumentation" and "Astronomy and Space" to their technical session program for the 1969 Fall Meeting. Held in conjunction with the Fall Joint Computer Conference, the DECUS meeting will take place in Las Vegas, Nevada, on November 17 and 18, at the Flamingo Hotel.

In addition to the two new topic areas, technical sessions will cover Education, Physics (both nuclear and general), Interactive Computer Systems, Computer Graphics, and an extensive series of papers in Biomedicine, covering both computers in clinical medicine and computers in life science research.

Originally attended only by DECUS members, the semi-annual meetings are now open to all interested parties. Approximately 1,000 are expected to attend the forthcoming meeting.

For information on DECUS membership, check customer service box # 8.



## Ship Models Made by Computer

Today in Canada they are even using computers to build test models of ships that may someday ply the waterways of the world. These boats, unlike the small plastic models familiar to children, are wooden test models up to 25 feet long used for studying such things as hull design, propulsion, maneuvering, and motion simulation.

Researcher Dr. D. Gospodnetic at the Ship Section of the Division of Mechanical Engineering at the **National Research Council** in Ottawa, Canada is using a **PDP-8/I** computer as a control element in a unique and complex processing system. The computer controls a milling machine that cuts ship models out of large blocks of wood.



Dr. D. Gospodnetic checks keel of boat model which has been milled from a large block of wood using a PDP-8/I computer.

The small PDP-8/I computer (equipped with a disk, an extended arithmetic element, a real-time clock, 8,192 words of core memory, an X-Y plotter, and a tape recorder) takes data stored on magnetic tape and feeds it into the numerical control system that oversees the milling operation by which the models are made. "The job of cutting away the blocks of wood is thus totally automated," comments Dr. Gospodnetic.

The system's Machine Control unit reads, decodes, and prepares milling instructions from the control tape made by the computer and transfers this information to logic circuitry which periodically sends out signals (pulses) to the servo-mechanism.

The servo-controlled milling machine has two cutters that move along the Y and Z axes while the model itself, mounted on a carriage, moves along the X axis. The rate at which pulses are generated, and the duration of the signal-generating process determine the combined motion in all three planes of the milling machine and the model being cut.

Once the model is properly shaped, it is sanded smooth and coated with shellac — ready for test runs in the tank to acquire the necessary design data for later analysis. Soon, an older PDP-8/S, the prototype computer used in the development of the milling process, will be placed on the test carriage at the tank to aid in data accumulation.

## Martin Marietta Develops System For Spacecraft Guidance and Control

A launch vehicle and spacecraft guidance, control, and navigation (GC&N) simulation system with an accuracy of five seconds of arc has been developed by **Martin Marietta Corporation** at its space center in Denver.

Using a **PDP-9** computer as the master unit, the system provides real-time simulation of guidance, control, and navigation from launch to orbit, and orbital control. In addition, the system is used to provide real-time simulations and control of an inertial three-axis table.

Acting as the master unit, the PDP-9 provides real-time interrupts every five milliseconds, and the real-time data derived from the simulation is printed on-line every two to four seconds. For real-time simulations, the PDP-9 computes the GC&N equations and exercises control of the inertial three-axis table unit. In this application, the real-time interrupts occur in the 10-50 millisecond range. On-line data printouts are ob-

tained at selected intervals of from one to ten seconds. In addition, studies of spacecraft guidance, navigation, and control problems are performed on the PDP-9 using the PDP-9 FORTRAN IV computer language.



PDP-9 computer is master control unit of a highly accurate computerized launch vehicle/spacecraft guidance, navigation, and control simulation system.

## Recent DEC Articles in Print

### "Automation in Data Acquisition"

by Rudolph E. Penczer,  
PDP-9/PDP-15  
Physics Marketing Manager  
in the April, 1969 Issue  
of *American Laboratory*

With the advent of automation, data processing has become more creative. The question is whether to use automatic instrumentation coupled to a hardwired data processor or to a general-purpose computer (or any combination of the two). The trend is to combine the speed of the former with the data manipulation and flexibility of the latter. The future will see faster data rates and more programs and programming aids, as well as programs that can be used simultaneously by several people.

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### "Packaging Discrete Modules"

by Russell C. Doane,  
Manager, Module Development  
in the March 13, 1969 issue  
of *Machine Design*

Electronic control logic permits the design of faster and more sophisticated machine controls than were previously available with moving armature (contact) and moving-fluid logic. Compact size, high reliability, and lack of moving parts of modules present an opportunity for more complex and sophisticated controls. The article includes discussion of logic capabilities, signal converters, choosing a logic system, module packaging, and noise immunity. Reprints are available from the Public Relations Department on request.

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### "What Kind of Computer For Your Plant?"

by Ronald Noonan,  
Data Acquisition and  
Control Systems Manager  
in the June 2 Process Control issue  
of *Chemical Engineering*

The article examines computer applications in the Chemical Process industries. Included is a discussion of on-line, off-line hard-wired, dedicated, multifunction, special purpose, and general purpose applications, as well as the definitions of the terms themselves.