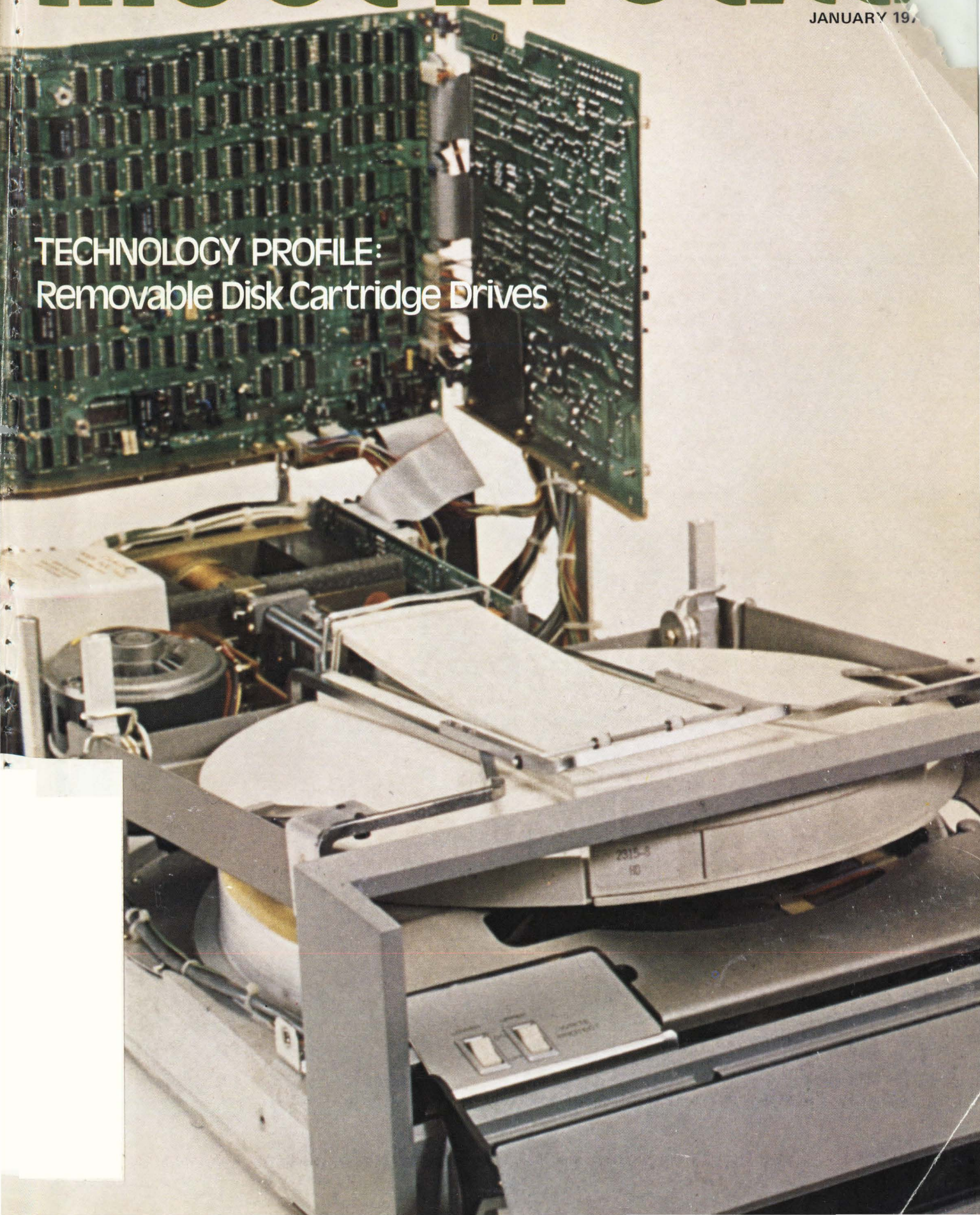
Dup

modern data

JANUARY 197



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The OP1/8—Priced from $1795 in OEM quantities*

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OP1/S

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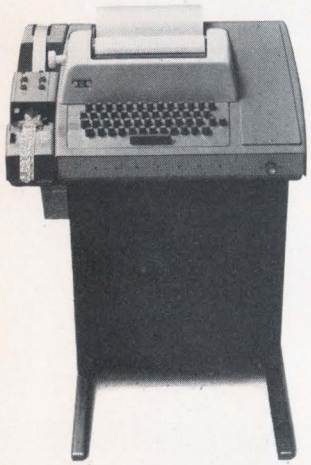

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BPA

JANUARY 1976 • VOLUME 9 • NUMBER 1

modern data

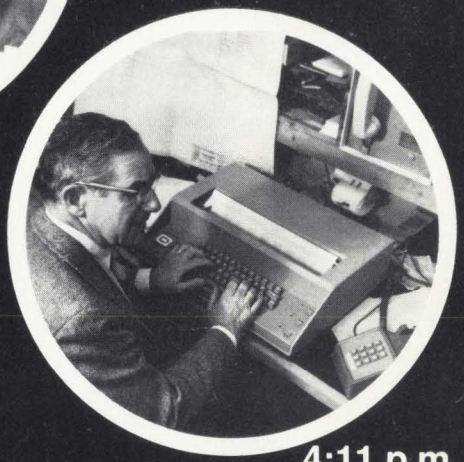
COVER CREDIT:

A Photo of the Computer Labs/Pertec dual platter Disk Memory System. This system features complete PDP-11 compatibility (including media) and fast access time and data transfer rate. See survey article on page 36.

CDI Wide Carriage Portables

9:05 a.m.
Financial V.P.

1:26 p.m.
Marketing Department



4:11 p.m.
Production Control Department

really move around

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The CDI 1132 is ideal for timesharing applications requiring large volumes of data per line — such as financial planning, sales forecasting, budgeting, personnel records, etc. The *first* wide carriage portable timesharing terminal, the CDI 1132 features 132 print positions and operates at 10, 15, and 30 characters per second, selectable from operator's keyboard. Operating in ASCII code, the CDI 1132 is also available in APL configuration.

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CIRCLE NO. 4 ON INQUIRY CARD

letters

To the Editor:

I'd like to compliment MODERN DATA's coverage of IBM's new 5100 portable computer in the October 1975 issue. In particular, the article entitled "A Perspective On The IBM 5100 – Some crackerbarrel philosophizing on the historical and competitive significance of this unique package," appeared particularly even-handed and broad in scope, and was even distributed to ATSU members with our December Newsletter.

Hillel Segal, President
The Association of Time-Sharing Users

In the year since ATSU was formed, the Association has grown to over 1,000 time-sharing users and now provides a monthly newsletter to members which reports on developments in the time-sharing and minicomputer industries. More information about ATSU activities may be obtained by writing to Mr. Segal, c/o the Association of Time-Sharing Users, 210 Fifth Ave., New York, NY 10010. –Ed.

To the Editor:

In reviewing the ADAPSO white paper published in your November Issue, I am reminded of the concerns that the buggy whip manufacturers had at the turn of the century. There is little doubt that the entire computer industry is one of dynamic dynamics. Many developments that are occuring that impact the use of the computer will place a strain on all those who are currently using computers to assess how developments can best serve their special situation. ADAPSO would be well advised to predict how their industry can adapt to future situations rather than build up a protective wall around current conditions. Data processing service organizations will need to go through a metamorphosis to survive. Those that do not, will undoubtedly fall by the wayside.

I have been in the data processing business for over twenty years and I still feel that the potential is unlimited for the use of computers and communications in our society. The industry is still in its infancy and the potential for growth and opportunities for data processors has never been greater. Perhaps ADAPSO's acronym should be changed to ADAPT-SO.

Herbert E. Martenson, Chief
Data Processing and Systems
South Carolina Dept. of Social Services
Columbia, SC

To the Editor:

I would like to correct an article which appeared in your October issue. The article, "Requiem for the Punched Card," contained a tabular listing of card equipment manufacturers and their locations. Control Data card products are produced in Valley Forge, Pennsylvania, not in Hawthorne, California.

M.L. Holec
Product Sales Manager
Control Data Corporation

TRADE SECRETS – KEPT AND UNKEPT

TOO CLOSE FOR COMFORT

Data General won a permanent injunction in the Delaware Chancery Court barring Digital Computer Controls from further use of DG Nova 1200 or DCC D-116 logic drawings for the purpose of manufacturing computers substantially identical to the Nova 1200. The court ruled that DCC had violated DG trade secrets and improperly used DG's logic design in the manufacture of the D-116. DCC subsequently filed an appeal, and the injunction was suspended pending a decision on the appeal and upon DCC's posting a $500,000 bond to cover possible further injury to DG during the appeal period. Data General announced that a jury trial will be held to determine the amount of damages it would receive. A spokesman for Digital Computer Controls said that DCC would continue to manufacture and ship its full product line, including the D-116 computer involved in the suit, pending a decision of appeal.

CALIFORNIA DAISIES

For the past couple of years the so-called "daisywheel" printer has found its way into an increasing number of terminal systems. The first really successful daisywheel printer was from Diablo, which was subsequently purchased by Xerox. The second came from Qume, Diablo's neighbor in Hayward, CA. For awhile, the two companies existed in relative harmony. The competition was fierce, but that just helped make both firms produce better devices, as is evidenced by the HyType II from Diablo and the Sprint series from Qume, both introduced at the 1975 NCC. The two companies were even talking to each other about how to coexist in the market. But then the dam of goodwill burst. Xerox sued Qume for violation of trade secrets relating to the HyType and for patent infringements. Qume responded by filing an antitrust suit alleging that Xerox "has sought improperly to control the large OEM character printer market and the non-IBM portion of the multimillion dollar word processing market." In point of fact, Xerox doesn't hold the largest share of the non-IBM portion of the word processing market; Redactron does. Furthermore, Centronics and a slew of other companies may dispute that Xerox is even close to having the largest portion of the OEM character printer market. At any rate, it seems that Qume and Xerox (a la Diablo) are sinking into the sue me, sue you quagmire.

NONRECRUITMENT

After winning some (major) concessions, Fairchild Camera and Instrument has dropped its suit against National Semiconductor and former Fairchild employee Martin J. Alter. National had to agree not to use any Fairchild trade secrets and confidential information Alter may have obtained while at Fairchild, and Alter may retain his position as manager of National's high-density bipolar memory effort. But to make sure there are no slips, an impartial technical expert will be appointed to examine National's bipolar effort to ensure it doesn't too closely resemble Fairchild's. And so it doesn't happen again – at least in the near future – National agreed at Fairchild's insistence not to recruit any Fairchild employee from the bipolar group before August 1, 1976. Whatever happened to EEO?

IBM KEEPS A PROMISE

Remember back in September of '73 when IBM had to suspend termination charges on its lease plans pending the outcome of the Telex lawsuit? IBM warned its customers to hang on to the money because the day would come when the company would want it all back. The day came. When Telex dropped the case before the Supreme Court in October, the U.S. Court of Appeals ordered judgment for IBM. So IBM now wants all termination charges back – retroactively.

CALLS FOR PAPERS

Graphic-oriented hardware, software, and application papers are requested for *SIGGRAPH '76,* the *Third Annual Conference on Computer Graphics, Interactive Techniques and Image Processing.* Sponsored by ACM/SIGGRAPH, it will be held at the University of Pennsylvania, Philadelphia, July 14-16, 1976. Papers should be submitted immediately to *Udo Pooch, Dept. of Industrial Engineering, Texas A&M Univ., College Station, TX 77840* . . . Computer technology papers are needed with emphasis on communications, data management, performance evaluation, privacy and security, programming techniques and software engineering for the *15th Annual Technical Symposium* sponsored jointly by ACM and the Institute for Computer Science and Technology. The symposium will be held June 17, 1976, at the National Bureau of Standards in Gaithersburg, MD. Drafts with 150-word abstracts should be submitted to *Dr. David C. Wood, The Mitre Corp., Westgate Research Park, McLean, VA 22101.*

EFTS WITHOUT COMPUTERS

After one year of waiting, President Ford has finally appointed the National Commission on Electronic Funds Transfer – 26 members from the government, financial, law, business and academic communities, but not one from the data processing community. And ADAPSO (Association of Data Processing Service Organizations) is not too happy about it. In fact, it has urged that Congress extend the interim and final report dates of the commission so that data processing individuals can be appointed. (The interim report of the commission was due in October, but that's hard to do without a commission.) President Ford's yawning attitude on EFTS is obviously not going to change until he gets his monthly statement with a salary credit and supermarket debit.

XEROX NOT REALLY QUITTING THE GAME

It's only changed card decks by getting out of computer mainframes into computer peripherals (where the money is anyway). For some unknown reason, Xerox was able to talk Honeywell into not only the maintenance rights to the Xerox computer line, but also the manufacturing rights. (How does Sigma 60 sound?) For its first card in the new deck, Xerox agreed in early November to purchase printer and plotter manufacturer Versatec, apparently intending to merge the firm with its printer and disk subsidiary, Diablo. A couple of weeks later, Xerox flashed another card. This time it was Daconics (Sunnyvale, CA) of word processing fame. Whether Daconics will be merged with Xerox Office Systems Division in Dallas or operated independently still isn't known. Daconics also makes H-P compatible controllers for independent disk, printer and tape systems. The question now is, are there other cards in the deck?

SHIPMENTS DECLINE AS WORLD WAITS FOR IBM

"The volume of computer industry shipments is controlled more by the introduction of new generations of large and giant machines than by economic conditions," said Arthur D. Little's computer specialist, Frederic Withington. This is because it takes many more small and medium computers to influence dollar volumes. As a result, the growth spurt won't start until the industry giant (i.e., IBM) introduces its new generation . (Will 3-1/2 be enough? See accompanying article.)

So while computer consumers either wait for IBM or postpone deliveries due to the recession, general-purpose computer shipments will drop – by about 20 percent in 1975 from 1974 levels, both here and abroad. However, the domestic cumulative installed base will grow 9 percent annually from 1975's $40.8 billion to 1980's $60 billion. Additionally, U.S. installations abroad will grow 10 percent annually, from 1975's $25.4 billion to 1980's $40 billion. Withington estimates that the U.S. share of foreign *shipments* will grow to 85 percent in 1975 compared to 71 percent in 1974. That means shipments are declining, but the U.S. share is growing. By the close of 1975, Withington estimates the U.S. will have 72 percent of the foreign installed base. Growing at an even faster rate than mainframes are terminals, satellite processors and communications equipment (but we've heard that before).

GENERATION 3-1/2

IBM may have decided to come out with an evolutionary generation 3-1/2 in 1976 instead of a revolutionary 4 in the late 70s, according to Drexel Burnham's Harry Edelson – no stranger to these pages. One of the reasons for this is that IBM's revenue and earnings growth rates take the shape of the Greek letter Lambda (Λ) over the course of a product cycle. The low point of the 370 Lambda formation should be reached by fourth quarter, 1975. An upgraded mainframe along with expensive purchase-oriented advanced peripherals and minicomputers could provide IBM with enough earning's growth to carry it until the more revolutionary computer system is ready later in the decade.

Signs of a possible 1976 announcement are 1) recent price changes – like the 15 percent price drops on the S/370-115 and -125 – apparently to encourage purchase, and 2) new production of only four models (115-2, 125-2, 158-3, and 168-3). The half generation, which could be called the 370/8, may have already started with IBM's 1975 peripherals and IBM World Trade Corp.'s 370-115-2 and 125-2 announced in October. New features were increased memory size, faster instruction execution rates, greater variety of peripherals, and a higher multiplex channel speed. The next step could be the 370-118, 128, 138 and 148, and possibly a 178 – an extremely powerful host computer to be used in distributed processing networks.

FALL CHEER

October and November were the months the mainframe manufacturers decided to catch up with inflation and the "cost of doing business." IBM started it by raising rental and purchase prices about 4 percent and maintenance charges about 9 percent. Honeywell followed with almost identical price hikes (except for its Levels 61 and 62). Sperry Rand followed, but not in step, choosing to raise only maintenance charges 9 percent and leave most rental and purchase prices as they were. Burroughs finally followed on the heels of the others. It raised most lease and purchase prices 2.5 to 4 percent and maintenance charges 9 percent. Nice to have consensus.

BITS & BYTES

There's a new gardener on the "Island of Greenhouses." It's a Burroughs B 2700 used to monitor plant growth, fertilization, appearance, temperature, and sunlight on the island of Guernsey, Channel Islands. About 1/15th of Guernsey's total land area is greenhouses and the island's specialty is *orchids.* The computer monitoring system ensures that only the healthy plants are fertilized and enables them to be grown "on target" for certain holidays . . . White wine with fish or is it poultry? When in doubt, turn to the Electronic Wine Captain found in several southern California supermarkets. After the customer types the budget, planned menu, and occasion into the terminal, the CRT screen displays the appropriate wine. The system was developed by marketing consultant Sheila Hoffman in conjunction with Sanders Data Systems . . . A telephone for the deaf – the Teletype – is being used in the Los Angeles area. The hearing impaired use Teletypes to call up their friends or a central information service for data on community agencies, medical care and other services . . . The computer at the California Dept. of Motor Vehicles naturally rejected an applicant with a birthdate of 2/3/72. But after closer examination, 103-year Maude G. Tull was granted a license to drive her electric car in her neighborhood . . . Now there's a pen to frazzle the best of forgers. Developed by Dr. Hewitt Crane of Stanford Research Institute, the pen is connected to a computer that recognizes an individual's patterns of pressure and motion as he writes his name. If someone else signs the name, the computer blows the whistle (rings a bell?).

international news

BOHDAN SZUPROWICZ / International News Editor

ITALY'S AUTOMATED AIRPORT

Italy's largest aerospace company, Aeritalia, and Hewlett-Packard have joined forces to provide Italy's first Aircraft Loading and Balancing Automation (ALBA) system. Turin, third among Italian Airports in volume of freight shipped, is the lucky city. ALBA is designed to speed up all activities relating to flight departures at medium-sized airports with up to 100 departures per day. The HP 2100 with Aeritalia's software automates aircraft weight and balance calculations, management of outgoing freight and mail, passenger check-in and passenger boarding.

NEW U.S.-YUGOSLAVIAN CO.

Advanced Computer Techniques Corp. (New York) and Ekonomski Biro of Yugoslavia recently announced an agreement in principle to form a joint company to provide data processing consulting services to Yugoslavia and other countries. The American computer consulting firm and the Yugoslavian management consulting firm expect the transaction to take place by January.

JAPAN LIFTS COMPUTER IMPORT RESTRICTIONS

Beginning January 1976, U.S. companies will no longer have to contend with Japanese import controls and quotas for computers. The U.S. share of the Japanese computer market, which is second only to that of the U.S., was 38 percent in 1974. To celebrate, the U.S. Dept. of Commerce is sponsoring a computer exhibition in Tokyo on March 15-19. For more information on Computer '76, contact *Mr. John Wolf, (202) 967-2461.*

COMPUTER PRODUCTION: SHANGHAI EXPRESS

The taciturn People's Republic of China revealed that – yes, two large-system computers were being manufactured at the No. 13 Radio Plant in Shanghai. Thought to be the largest computers manufactured in China, the general-purpose high-speed integrated circuit computers can perform 1 million calculations per second. The No. 13 Radio Plant also produces desk calculators and a large number of medium systems, which perform 110,000 calculations per second. Production records are being set as well at the Shanghai plant. The plant said the value of its production was almost twice that of 1973, with medium system and calculator production increasing fivefold.

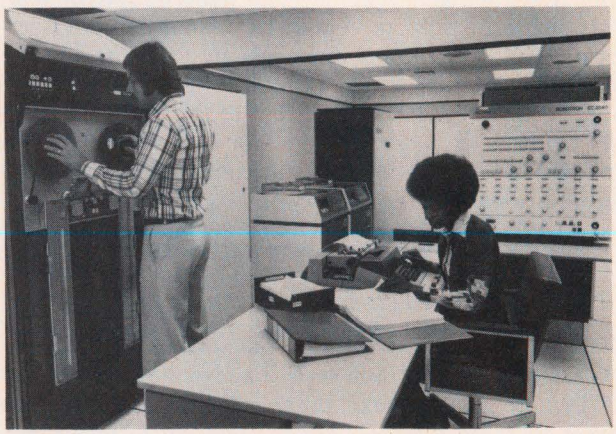
A BART COUNTERPART IN BRAZIL

Sao Paulo, Brazil, is learning from experience – San Francisco's, that is. Sao Paulo's Metro is the second fully computerized subway system. The Metro is controlled by three Prodac P-250 process control computers developed by Westinghouse, according to *Data News,* a South American biweekly. Westinghouse incorporated in Metro what it learned in its development of BART (Bay Area Rapid Transit). The operator interface has been simplified and more error checking features have been added. Four operator consoles, each with two CRT screens, allow online command entry and provide the status of four functional systems: passenger traffic, auxiliary systems, electrification and train control. Dual switching gives the system a backup capability as well as providing online simulation.

RYAD – HIGH TECHOLOGY WITHOUT MASS PRODUCTION

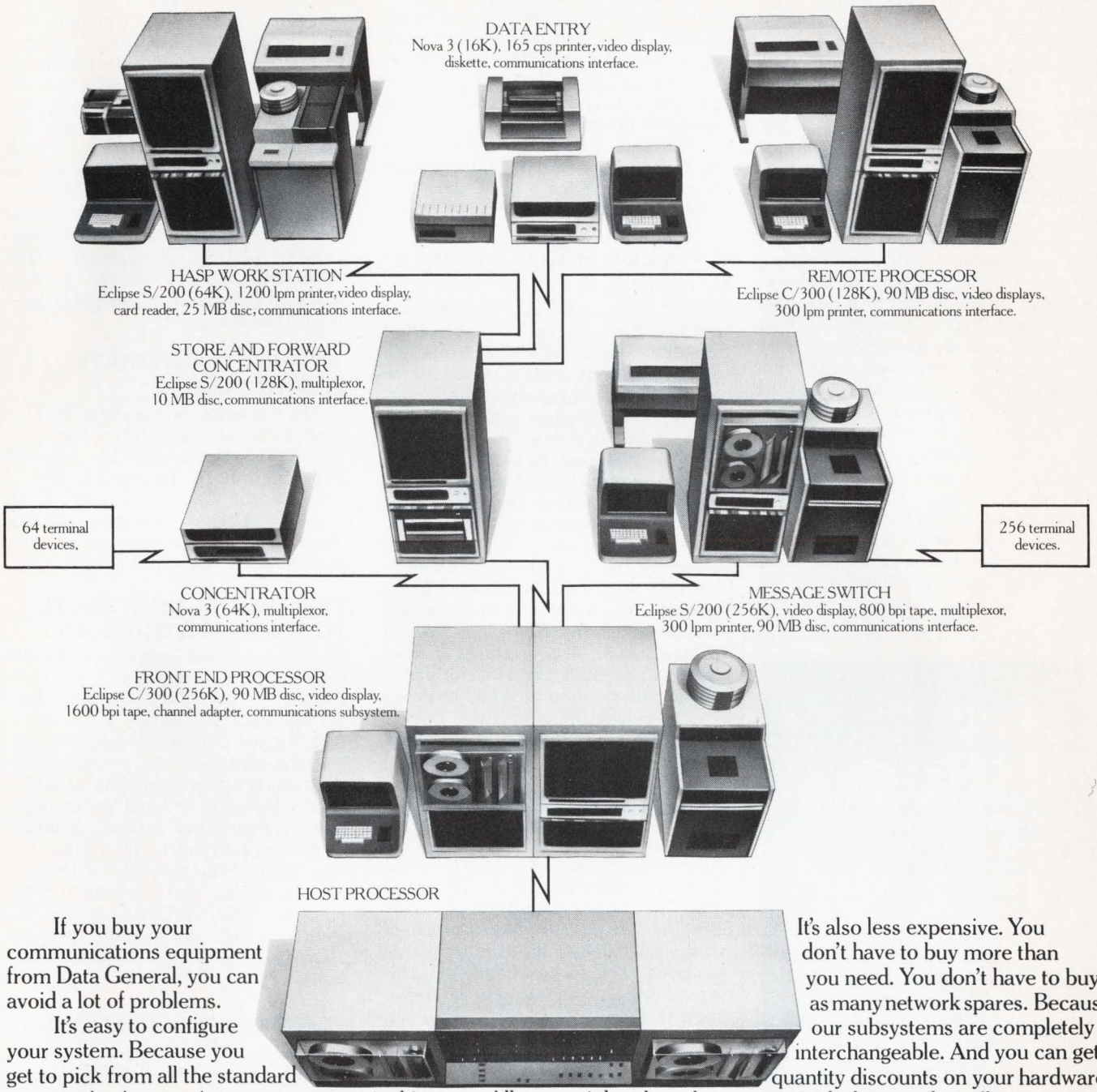
The Eastern Bloc countries are still behind the U.S. in computer technology, but not the often cited ten years. This was the central finding of Control Data tests on the first RYAD computer system in the U.S. – the ES 1040. Demonstrated recently at CDC's Washington facility, the ES 1040 is manufactured by East Germany's Robotron organization. The central processor uses integrated circuits and microprogram control, and has an instruction look-ahead feature. CDC estimates that ES 1040, released by East Germany in 1972, could have been manufactured in the U.S. in 1968. Although similar in architecture to the IBM 370, the ES 1040 cpu was said to be capable of faster execution. However, CDC tests show the relatively slow core memory speed (1350 nsec cycle time) is not well matched to the CPU. Robotron Director Fritz Wokurka said MOS memory will be available in the near future.

Also part of the RYAD computer system were disk, tape, graphics display, printer and card equipment subsystems from various Socialist countries. CDC's finding that Eastern peripheral technology was far behind that of the U.S. was verified by either slower operating speeds or cabinet systems almost three times the size of comparable U.S. peripherals. CDC sees a viable market for the RYAD computer family in other Eastern countries and Third World countries. However, Robotron Director Wokurka would not say how ES 1040 prices compared with those of the 370, commenting only that they were "competitive." According to Wokurka, in 1974 Robotron produced more than fifty 1040s. That's hardly mass production and competitive pricing would seem to be difficult on such a small scale – not to mention the problem of hard (Western) vs. soft (Eastern) currency.



First Ryad Computer In U.S. ES 1040 computer system and East European peripheral devices are shown above in CDC's Capital Facility in Washington, DC. At left are two Robotron-built single-density 75-ips tape drives. At rear center are two Bulgarian-built 7.25-Mbyte disk drives with German Democratic Republic controller. Operator's console of computer system manufactured in East Germany is at right.

We not only make all this communications equipment. We make it all work together.



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CIRCLE NO. 6 ON INQUIRY CARD

dc datascan

NAN MEREDITH / Washington Editor

EXPORT LICENSES: CDC VS. GOVT.

Control Data recently demonstrated the first Eastern Bloc RYAD computer in the U.S. (see *International News)* at its Washington, DC, facility. CDC is trying to convince the Federal Government to relax restrictions on computer trade with the East so it can market its peripherals and exchange technology. Although European countries are presently selling computer systems to the Eastern Bloc countries, U.S. companies have been discouraged from such trade by Uncle Sam. According to CDC spokesman, the Department of Defense believes that by providing the East with advanced computer technology, the East will reallocate its research resources to armament technology. CDC began exporting computer systems to Eastern Bloc countries in 1965. Since 1972 that trade has come almost to a halt as the Federal Government began denying export licenses for computers and the East began to develop their own technology. CDC maintains that the East will obtain computer technology from Europe anyway, and U.S. companies are therefore at an unnecessary disadvantage.

IBM HAS PROBLEMS WITH EASTERN EXPORTS TOO

The DOD rejected an IBM proposal to install a $10 million S370/158 reservations computer for the Soviet Intourist agency. More than 30 IBM 3330 disk drives were to have been included in the system originally. IBM agreed to cut them back to 16, and Intourist agreed to provide safeguards to prevent unwarrented use of the disks. But to no avail. Both with and without former Secretary of Defense Schlesinger, the application was denied after two years of deliberation.

EFTS AND PRIVACY RIGHTS

A recent report by Prof. James Rule of the State University of New York outlines the social impact – beneficial and detrimental – of a system in which a person has one computer account for all financial transactions. The report, entitled "Value Choices in Electronic Fund Transfer Policy," was presented to Vice President Rockefeller's Committee on the Right of Privacy. Rule's concerns were that the government could use the system to track anyone who owed it money, whether it be for a parking ticket or income tax, and to cut that person off from future EFTS transactions. Another problem would be access to the EFTS files. Would companies and all government agencies have access? Rule suggests that elaborate security measures would be necessary to ensure the individual's right to access the files and his right to contest their contents.

NATIONAL PLANNING DRY RUN PROPOSED

Testifying on the Humphrey-Javits Bill on economic planning before the Joint Economic Committee of the Senate and the House, John Diebold of the Diebold Group (New York) proposed a "dry run" on national planning before a massive bureaucracy is set up. This would consist of a trial plan developed by a temporary (two-year) task force. The task force would be responsible for: 1) macro economic planning evaluation, i.e., making the decision makers aware of the implications of their decisions 2) cost justification of government expenditures, and 3) essential needs planning to avoid shortages while taking into account elasticity of supply and demand. The trial run would avoid copying non-applicable planning models such as Sweden's, which has a smaller economy with more government control. And it would also be possible to see how pervasive the controls would have to be, i.e., would the government or demand control supply?

THREE PERCENT OF GNP FOR R&D?

The U.S. should adopt a national policy of devoting 3 percent of the gross national product to R&D spending. This was the suggestion of IEEE (Institute of Electrical and Electronics Engineers) in a white paper sent recently to President Ford. Under the proposal, the Federal Government would have the responsibility of filling the gap between private sector support of R&D and the 3 percent figure. To start implementation of this policy, IEEE recommended that a Presidential Science and Technology Advisor be appointed. The President has acted on this by submitting legislation to Congress to reestablish the office.

ACCESS TO AUTOMATE ARMY RECORDS

At the recommendation of the RAM II Task Force of the Adjutant General's Office, the U.S. Army has awarded Access Corp. of Cincinnati, OH, a contract for the automation of all active duty army personnel records. The number of documents to be automated will exceed 52,000,000.

FAA AWARDS CONTRACTS TO COMPUTER SCIENCES

Two engineering support contracts valued at $1.6 million have been awarded to Computer Sciences Corp. by the Federal Aviation Administration. Under the communications engineering contract, the company will assist the FAA in improving its UHF/VHF air-ground terminal communications systems and related facilities. Tasks assigned under the second contract will provide the FAA with technical assistance and support for the planning, documentation and implementation of automation projects affecting U.S. air traffic control centers.

NEW NBS PUBLICATIONS

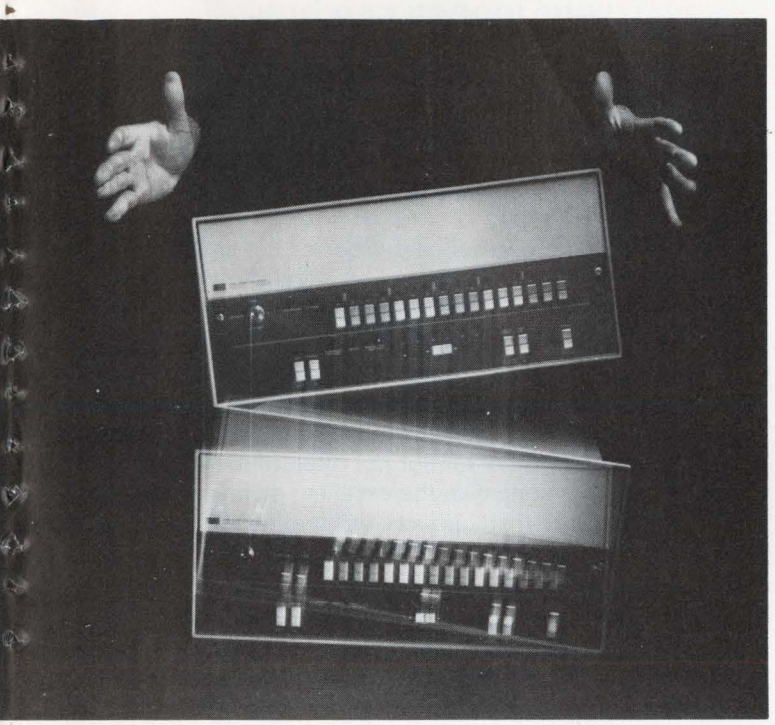
Calibration of Unrecorded Low and Medium Density Type Magnetic Surfaces, Nicholas P. Goumas, $0.45, SD Catalog No.: C13.46:884.

Computer Performance Evaluation: Report of the 1973 NBS/ACM Workshop. $2.45, SD Catalog No.: C13.10:406.

A Basis for Standardization of User-Terminal Protocols for Computer Network Access, A.J. Neumann, $0.80, SD Catalog No.: C13.46:877.

Order the above publications prepaid from the *Superintendent of Documents, U.S. Govt. Printing Office, Washington, DC 20402.*

THIS OEM ASKED US TO BE TOUGH.

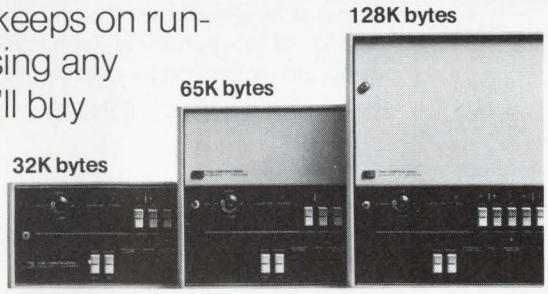


We don't recommend dropping computers. Hewlett-Packard's or anyone else's. But Magnavox made us an offer we couldn't refuse. "If we drop your 21MX four inches while it's running, and it keeps on running without losing any information, we'll buy a bunch."

We thought about it, made certain improvements, and were able to drop it four inches and have it keep running. Magnavox was pleased. And, in fact, did buy a bunch.

Then, spurred by our success, we let it drop a full ten inches. Sure enough, it kept right on running.

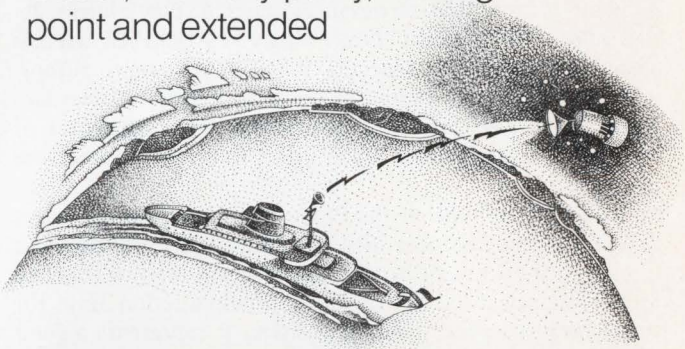
Now we aren't about to guarantee that you can get away with that kind of abuse.



The Hewlett-Packard 21MX Minicomputer Family.

However, you should know that we've incorporated all those improvements into our standard production-line models.

Which means, if you're looking for a tough mini, you ought to check out Hewlett-Packard's 21MX series. All models are user microprogrammable. All are brownout proof and have standard features like a ROM bootstrap loader, memory parity, floating point and extended arithmetic included in the price. All share Hewlett-Packard's tradition of compatibility: Software that ran on our first minicomputers, runs today on the 21MX series.



Magnavox Government and Industrial Electronics Company puts a 21MX in its ship-and air-borne satellite navigation systems. Positions can be found to within feet. Reliability is essential.

Add in Hewlett-Packard's world-wide service and support, and we think you'll agree with us.

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book reviews

LANG-PAK – AN INTERACTIVE LANGUAGE DESIGN SYSTEM *by Lee E. Heindel and Jerry T. Roberto. American Elsevier Publishing Company, Inc., New York, 117 pages + appendices and index, cloth $13.50, paper $8.75.*

This book gives the reader specific and clear instructions that enable him to build an "interactive computer language" tailored to his (or an intended user's) needs. In a section called a "perspective" and three chapters, the authors present the rationale, theoretical grounding, and instructions for using a meta-program that permits the reader to develop his own language syntax and semantics. 62 pages of appendices describe the actual programs (coded in both Fortran and PL/1) and the internal data structures. This complete and detailed information permits the reader to use LANG-PAK to develop a broad range of special languages.

The authors note that LANG-PAK has been used to implement information retrieval, graphics display, forms design and other systems. Interestingly, LANG-PAK itself is an application of the program. LANG-PAK uses an author-defined language to permit the user to define his own language. This "self-defining," plus the authors' delimiting of the machine-dependent code, permits bootstraping the program.

As the first book in the Programming Languages Series of the Elsevier Computer Science Library, the text provides a highly useful blueprint and construction manual that can reduce significantly the design and construction time for those users needing such capabilities. It represents a good step towards software engineering. –John L. Berg.

(Mr. Berg has developed compilers for Cobol, Fortran, and several dialects of Algol. His background includes over 16 years experience with computer vendors, consulting firms, and at the National Bureau of Standards.)

COST-EFFECTIVE TELECOMMUNICATIONS *by Richard A. Kuehn. ANACOM, 135 West 50th St., New York, NY 10020. 150 pages + index, $16.95.*

A general introduction to communications along with a definition of terms are included in this book, which places its greatest emphasis on Ma Bell and how to use her voice and communications equipment more effectively. Kuehn, who is president of RAK Associates, a telecommunications consulting firm, is right at home talking about Ma, her history, ways to control message units and toll costs, Wats usage, and how to evaluate her data communication equipment.

As the title indicates, this book concerns itself with *tele* (voice) – as opposed to *data* (digital) – communications. If you're worried about your company's telephone bills, you're in the right place – tariff and routing trunk tables are part of Kuehn's working appendix. But if you need to know about digital communications, look somewhere else. The scant amount Kuehn does provide is dated due to the recent rapid growth of the interconnect agencies. Points to consider when purchasing a data communications system are outlined, but no cost comparisions are made between AT&T and its interconnect competitors. –B.A.R.

8. RECURSIVE PROGRAMMING TECHNIQUES (14450)
William H. Burge
Written on the advanced undergraduate-graduate level, this book examines various elements of programming (program structure, data structure, parsing, sorting) from the point of view of expressions rather than mechanisms. *277 pp, $15.95*

Written and edited version of an important seminar —

9. PRACTICAL STRATEGIES FOR DEVELOPING LARGE SOFTWARE SYSTEMS with contributions by Jules Schwartz, Barry Boehm, Winston Royce, Ray Wolverton, John Brown, Leon Stucki, Harvey Bratman, and Ellis Horowitz. edited by Ellis Horowitz (2977)
The papers in this book represent a written and edited version of a one-week seminar held at the University of Southern California entitled "Modern Techniques for the Design and Construction of Reliable Software" with some additional material to round out the coverage. *240 pp, $11.95*

How the computer is changing our lives —

10. FREEDOM'S EDGE: THE COMPUTER THREAT TO SOCIETY (8543)
Milton R. Wessel
For every obvious benefit the computer gives us, the author points out the often overlooked and inadequately understood danger lurking just beneath the surface. *160 pp, 10 illus, $5.95*

A collection of thought-provoking essays —

11. THE MYTHICAL MAN-MONTH: ESSAYS ON SOFTWARE ENGINEERING (0650)
Frederick P. Brooks, Jr.
An eminent computer expert, Brooks has written a series of essays that draw from his own experience as project manager for the IBM System/360 and for OS/360, its operating system. *185 pp, $6.50*

An outsider's perspective on the mad world of computing —

12. TRAVELS IN COMPUTERLAND OR, INCOMPATIBILITIES AND INTERFACES (6737)
Ben Ross Schneider
Modern Data calls this "the heartwarming and humorous story of a man and his database." Schneider is an English professor who finds himself engaged in a mammoth computer project converting *The London Stage,* an 8000-page calendar of performances from 1660 to 1800 to a computer-accessible information base. How he accomplishes it is truly entertaining. *256 pp, 12 illus, $5.95*

Significant advances in the field of algorithms —

13. THE DESIGN AND ANALYSIS OF COMPUTER ALGORITHMS (0029)
Alfred V. Aho, John Hopcroft, and Jeffrey D. Ullman
This book brings together the fundamental results of research so that the unifying principles and underlying concepts of algorithm design will become easier to teach. *470 pp, 198 illus, $17.95*

A second edition that incorporates IBM/370 concepts —

14. ASSEMBLER LANGUAGE PROGRAMMING: THE IBM SYSTEM/360 AND 370, SECOND EDITION (7322)
George W. Struble
In this second edition, new problems and examples have been added which illustrate the instructions and consolidate and extend the reader's knowledge. *477 pp, $14.95*

Stressing the interdependence of hardware and software —

15. SYSTEMS PROGRAMMING: Concepts of Operating and Data Base Systems (2950)
David K. Hsaio
A frame of reference for concepts and notions in systems programming, this book presents these concepts and notions abstractly, selecting a view or a model that will provide a better framework for perceiving the complexity of the system. *328 pp, $16.95*

A look at computers and systems analysis —

16. MATHEMATICAL FOUNDATIONS OF SYSTEMS ANALYSIS (3957)
Robert H. Kupperman and Harvey A. Smith
Designed to help readers develop mathematical abilities sufficient to enable them to deal competently with systems analysis problems. *214 pp, $13.95*

Something different for computer people —

17. COMPLETE CONDITIONING: The No-Nonsense Guide to Fitness and Good Health (3786)
Howard Knuttgen and David Shepro
Everything you need to know about hormones, health clubs, cellulite, food additives, and 60 other topics related to exercise and nutrition. Special features include a complete discussion of the heart and the necessary ingredients for cardiovascular fitness. *160 pp, $6.95*

18. THE JOB HUNTER'S MANUAL (7214)
Donald H. Sweet
Everything people need to know about getting another job. Tips on self-evaluation. References and resumes. Leads and letters. Interviews and interviewers. *89 pp, $3.95*

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JOINT VENTURE FOR INSTANT MICROFILM SYSTEM

Bell & Howell, General Electric, and Gordon Lysle, Inc. of Northport, NY, have entered into an agreement to form a company – the Microx Corp. – to develop and manufacture an instant image microfilm system which would be marketed by Bell & Howell worldwide. The new system utilizes a dry photo plastic film technology developed by G.E., and a camera/processor, duplicator, and various peripheral equipment designed by Gordon Lysle. The system would enable the user to film documents and view the fully processed image instantly.

FAIRCHILD ESTABLISHES MICROSYSTEMS DIVISION

Fairchild Camera & Instrument Corp. announced the formation of a new Microsystems Divsion, with central responsibility for company activities in the field of microprocessors, microcomputers and related products. The company also said it will enter the memory systems market and has established a separate Memory Systems Unit for that purpose. David L. Hahn, former general manager of the Communications Equipment Unit, has been named general manager of the Microsystems Division. Heading the Memory Systems Unit will be Chester A. (Al) Burns, director of advanced systems development for the Memory and Logic Group.

NEW CDC GROUP FOR DISTRIBUTED PROCESSING

Control Data has formed a new dp and terminal systems group for the distributed data processing and small computer markets. The new group will "focus CDC resources that develop small systems of similar characteristics either as stand-alone products or subsystems used in distributed data processing environments." Examples of CDC products already competing in these application areas include the Cyberdata data entry system, the 979 bank entry subsystem, various optical character recognition terminals, various display and multi-station remote batch terminals, and the System 17 computer system.

BOX SCORE OF EARNINGS

COMPANY	PERIOD	REVENUES	NET EARNINGS (Loss)	EARNINGS (Loss) PER SHARE
Ampex	6 mos. 11/1/75	129,690,000	5,159,000	.47
	10/26/74	121,363,000	14,697,000	1.35
Beehive Medical Electronics	9 mos. 6/30/75	6,804,386	318,026	.34
	6/30/74	4,291,956	36,497	.04
Cambridge Memories	12 mos. 8/31/75	18,858,000	(4,128,000)	(2.43)
	8/31/74	23,140,000	1,040,000	.70
Compucorp	9 mos. 9/30/75	10,083,000	(2,553,000)	(1.16)
	9/30/74	19,210,000	(3,997,000)	(2.22)
Computervision	9 mos. 9/30/75	15,747,000	(4,156,000)	(1.79)
	9/30/74	19,352,000	1,520,000	.66
Comshare	3 mos. 9/30/75	3,449,664	301,800	.22
	9/30/74	2,902,514	501,000	.37
Comten	9 mos. 9/30/75	12,230,203	14,676	.01
	9/30/74	8,228,094	110,221	.05
Data 100	9 mos. 9/30/75	67,996,000	4,840,000	1.35
	9/30/74	48,097,000	3,240,000	1.06
Dataram	12 mos. 4/30/75	5,997,835	648,993	1.27
	4/30/74	5,322,728	709,326	1.39
Decision Data	9 mos. 8/30/75	30,426,000	(170,000)	(.05)
	8/31/74	27,924,000	824,000	.22
Digital Equipment	3 mos. 9/27/75	140,458,000	11,390,000	.95
	9/28/74	111,753,000	7,488,000	.63
Electronic Arrays	6 mos. 9/30/75	7,534,000	236,000	.13
	9/30/74	9,454,000	870,000	.51
Fabri-Tek	6 mos. 10/3/75	14,637,000	(679,000)	(.18)
	9/27/74	18,990,000	438,000	.12
Fairchild Camera and Instrument	9 mos. 9/28/75	216,163,000	9,259,000	1.73
	9/29/74	314,425,000	22,903,000	4.36
General Computer/Systems	12 mos. 6/30/75	12,452,947	612,251	.35
	6/30/74	15,136,928	1,059,261	.64
Hazeltine	9 mos. 9/30/75	60,707,000	(908,000)	(.46)
	9/30/74	71,097,000	326,000	.17
Hewlett-Packard	12 mos. 10/31/75	982,703,000	83,957,000	3.04
	10/31/74	884,053,000	84,022,000	3.08
Identicon	6 mos. 9/30/75	605,598	(129,254)	(.12)
	9/30/74	223,642	(378,275)	(.34)
Megadata Computer & Communications	9 mos. 7/31/75	2,004,000	85,100	.12
	7/31/74	867,800	(29,400)	(.04)
Microdata	12 mos. 8/31/75	15,944,074	1,117,997	.71
	8/31/74	13,829,599	641,466	.41
Mini-Computer Systems	9 mos. 7/31/75	3,157,419	264,326	.42
	7/31/74	1,583,589	116,064	.18
Modular Computer Systems	9 mos. 9/30/75	27,245,000	1,667,000	.61
	9/30/74	17,807,000	1,598,000	.62
Optical Scanning	3 mos. 9/30/75	4,213,193	943,453	1.43
	9/30/74	4,436,635	(64,584)	(.10)
Penril	12 mos. 7/31/75	4,296,484	758,718	.60
	7/31/74	4,254,929	627,316	.50
Pertec	3 mos. 9/26/75	12,545,000	874,000	.27
	9/27/74	10,002,000	341,000	.11
Prime Computer	9 mos. 9/28/75	7,910,491	410,817	.20
	9/30/74	4,452,815	(546,375)	(.27)
Scan-Data	9 mos. 9/30/75	8,201,050	191,384	.11
	9/30/74	6,952,057	13,452	.01
Telex	6 mos. 9/30/75	52,443,000	3,647,000	.34
	9/30/74	56,850,000	386,000	.04
Western Digital	3 mos. 10/4/75	3,037,000	(346,000)	(.25)
	9/30/74	3,780,000	169,000	.12

DPF TO FINANCE AMDAHL LEASES

DPF Inc. confirmed that it has been negotiating with banks and other financial institutions pursuant to an agreement with Amdahl Corp. to provide long term lease financing for up to $160 million of Amdahl computers in 1976. Amdahl's 470 V/6 computers cost from $3.7-$6 million. Leases are expected to be for five- to seven-year terms.

MERGERS & ACQUISITIONS

Automatic Data Processing and **The Delos International Group** reached an agreement in principle whereby ADP will acquire all of the outstanding stock of Delos for $5.25 per share. Delos is a timesharing company with its principal activities conducted through six offices in the U.K. and an office in Brussels . . **Control Data** has acquired the **Medlab/Pathlab** business of Medlab Computer Services of Salt Lake City. CDC previously owned 43 percent of the MCSI stock. . . . . **Itel Corp.** has acquired **Capital Business Services, Inc.** a privately-held computer services company based in Lansing, MI. **Kaiser Aerospace & Electronics Corp.**, a subsidiary of Kaiser Industries, has agreed to purchase the **Computer Division of Genisco Technology Corp.**, Compton, CA. . . . . The **Graphic Systems Divison of Gould, Inc.**, Newton Upper Falls, MA, has been acquired by the **3M Company**. The former Gould Division, which manufactures the Beta line of computer-output-microfilm (COM) equipment, has been merged with 3M's Microfilm Products Division . . . . . **Tymshare** will acquire the domestic (U.S.) timesharing division of **Leasco Response, Inc.**, a subsidiary of Reliance. A parallel British T-S subsidiary of Reliance, **Leasco Response Ltd.**, was recently acquired by **On-Line Systems.** Tymshare also announced an agreement in principle under which it would acquire the business and operations of **AutEx**, a securities information service principally used by broker-dealers and financial institutions . . . . . **Xerox Corp.** has executed an agreement for the acquisition of **Versatec, Inc.** of Santa Clara, CA, a manufacturer of electrostatic printers and plotters. The acquisition will be based on an exchange of stock with each share of Versatec valued at $12.50. In a separate announcement, Xerox revealed that it had completed its acquisition of **Daconics Corp.** of Sunnyvale, CA, for nearly $4.5 million in Xerox common stock. Daconics makes custom systems that employ minicomputers, including a shared-logic word processing system.

KENNEDY-DATA PATHING PACT

Kennedy Co. of Altadena, CA, has won a $350,000 contract for Series 9000 tape transports from Data Pathing, Inc., Sunnyvale, CA. The transports will be used with Data Pathing's interactive terminal systems, data collection system and source data automation systems. The agreement extends for one year with options for renewal.

"In the time it took to say 13 transactions, the PDP-11/70 did them."

David Kosko, Digital Test Programmer

It started last June with a report out of Cleveland. One of the customers said he ran close to 500 transactions a second doing analog inputs. Then another report came in. A New York bank set a record of 3.2 transactions per second doing multiple data base tasks. Across the country, more and more customers were amazed at the throughput power of the 11/70.

We weren't. Some time ago, we conducted a test of our own in the lab, based on a customer service application adapted from an actual situation. If we had hit 3 or 4, most people would have been amazed. What we got was 13 transactions per second, hour after hour. Our $200,000 computer performed like a million-dollar main frame.

The question: how could it happen? There are at least 5 reasons.

Reason 1. Total systems speed. The 11/70 is designed for speed both inside and out. Not just the processor, but the software, the cache memory, the I/O channels, the disks, the peripherals. In fact, the complete package is especially designed to run a lot of data. In a hurry.

Reason 2. Up to 2 million bytes of core memory. Attached to a 2k byte, 240 nanosecond bipolar cache. (Uniquely, the cache acts like a high speed buffer between the main memory and the CPU, and just as uniquely this results in an effective memory cycle of under 400 nanoseconds.)

Reason 3. The 11/70 uses high speed dedicated I/O busses. These busses can transfer data from a disk as fast as 1 megabyte per second. And the disks themselves can be expanded to give you up to 700 million bytes of storage on-line.

Reason 4. The 11/70 can be accessed by hundreds of terminals. What's more, you're not limited to just a few standard disks and terminals. Instead, you can choose from 60 different peripherals including a variety of line printers, tape drives, disk systems, and more. Much more.

Reason 5. Your choice of three operating systems. IAS lets you do batch, real-time, and timesharing tasks—all at the same time. Or you can choose our dedicated operating systems, RSTS/E for timesharing. And RSX-11 for real-time. With languages to match. ANSI-74 COBOL, extended BASIC, MACRO assembler, FORTRAN IV.

The PDP-11/70 gives you a throughput breakthrough. At a breakthrough price. For more information, call your nearest Digital representative. Or write Digital Equipment Corporation, Maynard, Mass. 01754. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel: 42 79 50. Digital Equipment of Canada, Ltd.

digital

50,000 computers saving managers millions.

13 Transactions/Second Defined. To show how the 11/70 handles data, we set up a real-life transaction processing application. We used standard 11/70 hardware. Standard RSTS/E software. And a standard commercially available data base stored across two disk packs. Then we wrote an applications program to allow 27 users to simultaneously query and update the file. The 11/70 responded at a record 13 transactions per second. With an average 2.6 disk accesses per transaction, including the read/write/verify sequences in file updates.

Digital Equipment Corporation, Communications Services
NRII/M15, Northboro, Mass. 01532

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(LONDON STOCK EXCHANGE)

International Computers, Ltd.

Putney, London, England

OFFICERS AND DIRECTORS: *T.C. Hudson,* Chairman; *G.R. Cross,* Managing Director; *A.L.C. Humphreys,* Deputy Chairman; *D.C.L. Marwood,* Secretary. **Other Directors**: *E.P. Chappell, Sir John Clark, J.C. Duckworth, R.H. Grierson,* and *J.T. Wiltshire.*

BACKGROUND: Resulting from a merger between International Computers and Tabulators Limited (ICT) and English Electric Computers Limited, ICL began operations in August 1968 with over 28,000 employees around the world, and an annual revenue of $214 million. ICT, formed originally from Power Samas and British Tabulating Machines, also brought with it interests of EMI, Ferranti and General Electric (UK). To create ICL, a holding company – International Computers (Holdings) Limited – was established in July 1968. ICT then changed its name to International Computers Limited, and became a wholly-owned subsidiary of the holding company. The English Electric Company Limited then transferred its wholly-owned subsidiary, English Electric Computers, to IC (Holdings) in return for an 18 percent share holding, together with loan stock and cash.

FACILITIES: Major manufacturing centers in Great Britian are located at Letchworth, Stevenage, Croydon, Kidsgrove, Winsford, and West Gorton. In 1969 ICL began manufacturing equipment in India in association with the government-owned Bharat Electronics Company. ICL maintains sales and service offices and customer training establishments in more than 50 countries, where it operates through subsidiary and associate companies, agents and representatives.

PRODUCTS: In 1964 ICT introduced the 1900 Series, a general-purpose batch-oriented system of which more than 3,500 have been installed. An online data entry multiprogramming system, the 2903, was introduced in 1973. Competing with IBM's System/3, the 2903 emphasizes visual communications with data entry and file interrogation via keyboards and CRTs instead of cards or tape. Since the 2903's introduction, more than 1,200 machines have been sold, 57 percent to first-time users. In 1974 the company introduced the first of its "New Range" with the large-scale 2900 Series. The initial offerings of the 2970 and 2980 compete with IBM's System/370-158 and 168, and have such advanced features as a virtual operating system, a user program protection mechanism, stack processing, and cache memory. ICL also manufacturers data communications equipment and computer media, and provides computer services through its Dataskil company.

CURRENT POSITION: ICL considers itself the fifth largest computer manufacturer in the world. According to a recent Quantum Science Corp. (London) study, ICL holds 36 percent of the U.K. market in terms of installed sales value compared to IBM's 39 percent. ICL has 8.2 percent of the Western European market, putting it in third position with Unidata (behind IBM and Honeywell Bull). In a breakdown of product line installations for 1974, 2903s made up 9 percent; 1900s 85 percent according to Quantum. Of ICL's total 1974 sales ($467 million), the U.K. accounted for 63 percent, Europe for 17 percent and the U.S., Africa, Asia, Australia and Eastern Europe for the remainder. Customers include the European Space Research Organization, the New Zealand Post Office, and the Marine Midland Bank in the U.S.

OUTLOOK: As sales of the 2903 system increase and as ICL breaks into the large system market, Quantum expects ICL will have the second largest market share in Europe with over $1 billion in sales by 1980. The 2900 Series is expected to compete with IBM's future systems. ICL expects exports to exceed domestic sales in 1975 and that this trend will continue through 1980. Dr. C.M. Wilson, director of the company's international division, predicts sales in the America's sector will double each year for the next five years. In September 1975 ICL signed an agreement with NCR and Control Data Corp. to acquire a one-third interest in Computer Peripherals, Inc., giving the company a manufacturing base for peripheral equipment in the U.S. The company is also considering a U.S. joint venture partner as one way of expanding the marketing base in the America's sector.

FINANCIAL SUMMARY: The Plessey Co. Ltd. holds 18 percent of ICL's equity, the U.K. government holds 10 percent. There are about 14,200 shareholders holding 33,369,000 shares of common stock. The company's 1975 financial data is not yet complete. Total export sales in 1974 were $175,942,960. The company has total assets of $286,823,000.

Period	Revenues	Earnings	Earnings Per Share
FY 9/71	352,000,000	12,400,000	.41
FY 9/72	359,000,000	2,300,000	.07
FY 9/73	393,000,000	15,900,000	.48
FY 9/74	467,237,000	13,514,000	.39
6 mos. 3/74	213,148,000	6,524,000	
6 mos. 3/75	258,839,700	8,194,000	

VADIC ALLOWED TO USE OWN DAA

Vadic Corp. became the first independent manufacturer to be certified and registered to connect its modems directly through its own DAAs (Direct Access Arrangement) to switched dial telephone networks without the need for a DAA provided by the telephone company. Registration was made under a California Public Utilities Commission (CPUC) General Order. Though the registration pertains only to California, it is the first such action by any state. Basically, the California certification is made by an independent licensed engineer working to standards set forth in the CPUC order. If the manufacturer's products meet the standards, the engineer certifies this and files his report with the CPUC for registration. Vadic's DAA's and associated modems were tested and certified by Gaines M. Crook, P.E., of Chatsworth, CA.

THE FANCIFUL DISTINCTION BETWEEN VOICE AND DATA

AT&T's Vice President of Marketing, Kenneth J. Whalen, obviously disagrees with MODERN DATA (*Datacomm Scene,* Sept. and Dec., 1975) that the distinction between voice (analog) and data (digital) might serve to separate communications markets. Whalen told a meeting of the Sales Executives Club of New York that the question of the Bell System's proper function "arises particularly with those who want to make a distinction between voice and data – although the transport of data information from one point to another is functionally no different than the transport of voice information. Different hardware may be required, of course. Transmission and switching may be different, but the function is the same." Said Whalen: "I believe strongly that the electronic data processing industry's growing expression of interest in communications processing should try to shrink any false distinction between voice and data that exists in fancy and not in fact."

SATCOM MARKET STUDY

Among the conclusions of a recent study on satellite communications by MarTech Strategies, Inc. is that domestic shipments of military and commercial satellite communication user terminals will double during the next five-year period, rising from $216.0 million in 1974 to $427.0 million in 1979. It was predicted that these markets will account for $1.5 billion in end-user terminal shipments through 1979. Including user terminal equipment for navigation satellites, a ten-year potential of $5 billion was forecast by the study. Significant contributing factors were: growth of dedicated application services, development of private satcom networks, IBM's entry as a domsat carrier, new satellite technology, and ballooning growth of digital data traffic due to expanding computer-communication networks.

The 400-page study found that, after dropping off in 1975 and 1976 from the $50 million level in 1974, terminal sales to the commercial domestic and international segment will rebound in the 1977-1979 period. Terminal shipments destined for user-dedicated applications will grow dramatically from a negligible $4.0 million base in 1974 to $61.0 million in 1979, reflecting an average annual growth rate of approximately 75%. Timing of this market development will be heavily influenced by the implementation of private networks and by decisions on IBM's entry into the domsat market.

The complete study is available from *MarTech Strategies, Inc., P.O. Box 3516, Indialantic, FL 32903.*

WANG LABS: HEAD-TO-HEAD WITH IBM – AND WINNING

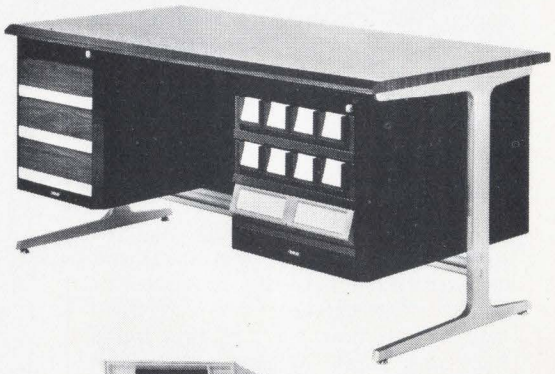
One of the features of the IBM 5100 Portable Computer that IBM has made much of is that system's ability to communicate directly with IBM mainframes using established IBM protocols. The Wang Laboratories' System 2200, one of the strongest competitors to the 5100, also communicates with IBM mainframes, but not as efficiently. For that reason Wang Labs has been emphasizing other of the 2200's strong points, such as its ability to interface with many more local peripherals (35) than either the 5100 (only 3) or, for that matter, any of its competitors. Now even that deficiency has been corrected. Wang Labs recently introduced a communications option that allows the 2200 and other Wang Labs computers to emulate an IBM 2780 remote batch terminal. The new Model 2228 Communications Controller supports IBM's Binary Synchronous Communications (BSC) discipline with the EBCDIC character set at 2000, 2400 and 4800 bps on a dial-up basis. A 2200 *with* the new option and *including* terminal emulation software is priced $1000 under the cost of a comparable 5100.

Tab makes –

one desk for CRT displays,

one for typewriters,

one for programmers,



one for microfilm readers,

and one for just plain work.

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The function of Tab Data Display Desks can be adapted to whatever work you need to get done. Component options let you make the desk a programmer's work station; another change makes it ideal as a CRT desk; still other pedestals and desk returns can transform it into a secretarial desk; or, used without components, the desk is an ideal conference or work table. You select from 2 and 3 drawer pedestals, 6 and 12 drawer card files, desk return, modesty panels, 27" and 30" heights and 31 1/2", 45" and 62" lengths to create the exact desk you need to accommodate virtually any function. Tab display desks come in black and simulated walnut or contrasting shades of grey, with pedestals in any color you need to suit your office decor.

For complete information contact your local Tab representative, or write Tab Products Company, 2690 Hanover Street, Palo Alto, California 94304.

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"Make of it what you will"

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CIRCLE 49 ON READER CARD

FOUR-PHASE SYSTEMS: THE COMPANY THAT WILL NOT WAIT

While most systems manufacturers take pride in announcing that they are utilizing the latest offered technology, some companies go even further. Four-Phase Systems, for example – which doesn't believe in waiting for someone else to do the offering. Four-Phase pioneered the intelligent terminal concept in 1970, when it introduced the first processor/terminal that combined an LSI CPU with semiconductor RAM. Two years later Four-Phase shipped systems with 2K RAM chips – another industry first. Now the company has come up with a network processor that incorporates 16K RAM chips, a feat all the more noteworthy in that the chips were developed in-house. Designed for use at intermediate network locations, the company's new NP/80 allows up to 64 local displays to access a central data base of up to 270M bytes through direct channel connection of two Four-Phase System IV/70 display processors. The NP/80 system includes multiple DMA channels, software and hardware error recovery facilities, firmware diagnostics, a memory relocation and protection system, and communications control for up to six high-speed lines.

Four-Phase Systems' new NP/80 Network Processor. The heart of the NP/80 is a powerful 16-bit computer with 500 nanosecond cycle time and up to 256K bytes of MOS/LSI memory. The hand in the foreground contains all the 16K-bit RAM chips needed for a 256K byte memory including error correction. These devices, designed and manufactured by Four-Phase, will occupy a single printed circuit board when assembled.

WU CONTRACTED FOR CENTRAL ED FACILITY

A $250,000 contract for data communications equipment has been awarded to Western Union Information Systems by Sperry Univac for what was described as the nation's first planned large-scale centralized computer education facility. Sperry Univac is developing the facility for the Minnesota Educational Computer Consortium, headquartered in Minneapolis. Two C-2100 front-end communications multiplexers and special switching equipment will be used with an 1110 System from Sperry Univac to terminate at a central facility 300 communication lines used by computer students at various remote terminals throughout the state. The central facility may eventually be expanded to enable 1,000 students to access it simultaneously.

TELENET EXPANDS NETWORK

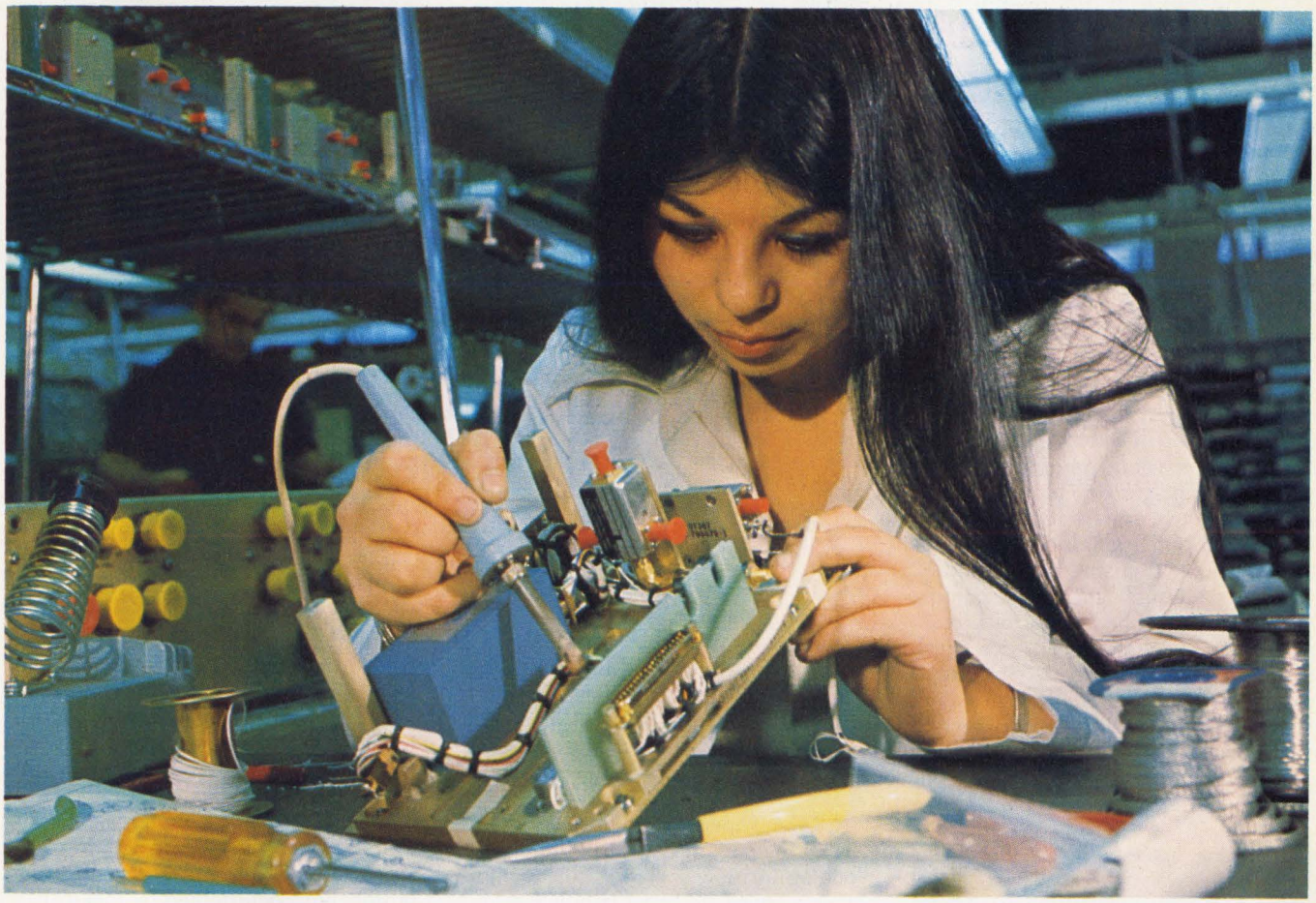
Telenet Communications Corp. announced that it has completed the installation of nine additional switching centers, increasing the number of central offices in its nationwide public data communications network to 16. The company indicated that its tariff, on file with the Federal Communications Commission, has been revised to reflect the expanded geographic coverage of the network. The new Telenet Central Offices are located in Atlanta, Cleveland, Detroit, Houston, Minneapolis, St. Louis, Pittsburgh, Philadelphia and Newark. Telenet's initial seven central offices were installed during the first half of 1975 in Boston, Chicago, Dallas, Los Angeles, New York, San Francisco and Washington, DC.

HAEFNER TO INCREASE DATRAN COMMITMENT

Wyly Corp. announced that it and its Data Transmission Co. (Datran) subsidiary have reached preliminary agreement with Walter Haefner Holding AG, of Zurich, Switzerland, which will allow additional investment in Datran by Haefner Holding. Under the agreement, Haefner will receive an option to acquire an additional $20 million of Datran 8% subordinated convertible debentures and will subscribe to $7 million of these debentures in early 1976. This $7 million subscription will increase Haefner Holding's current investment in Datran to $47 million, an investment that is secured by substantially all of Wyly Corporation's non-Datran assets.

DP Dialogue

Notes and observations from IBM that may prove of interest to data processing professionals.



Technician Elizabeth Garcia wires the front panel of a chassis assembly produced by GTE Sylvania.

Structured Programming Eases Deadline Pressure at GTE Sylvania

A deadline had been set for completion of a complex management control system. If it couldn't be met, a major government contract would be lost.

That was the situation at the Western Division of GTE Sylvania's Electronic Systems Group in Mountain View, California. The division performs system development, manufacture and integration in the fields of reconnaissance, electronic defense and electro-optics for government and industry.

"In order to meet government requirements, we had to design a total system that could relate cost elements, scheduling and actual performance to every phase of the project," explains Gene Giannotti, manager of computer services. "That's a great deal of work to accomplish in a year."

Fortunately, the company had already geared for quick, accurate program development with a structured approach to systems design and programming.

"We've found that all facets of the structured approach—top-down development, modular design and structured walk-throughs—contribute to much more efficient overall project control," says Giannotti.

"The approach has enabled us to reduce debug time from about 50% of total programming time to practically zero," adds Pat Thompson, supervisor of application development.

The internal design of the Cost Schedule Control System (C/SCS) called for 50 different programs and modules to adequately define scores of

(Continued on next page)

Advertisement

GTE Sylvania...

(Continued from preceding page)

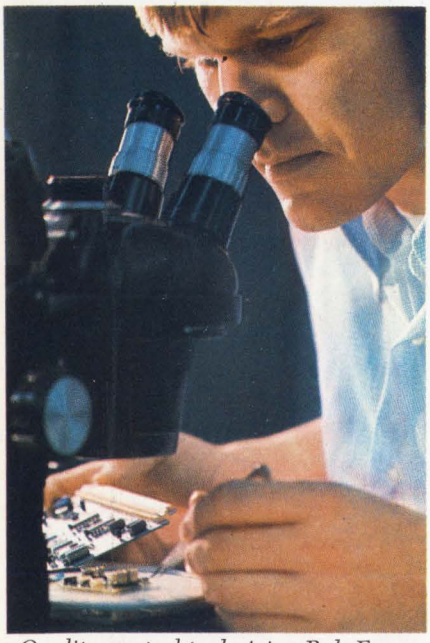
requirements from the engineering, manufacturing and financial departments. That's why one of the primary principles of structured design—that all programs be broken down into small, functionally defined modules—was especially critical. Top-down development—working from the highest level of logic to detailed segments—was also significant.

"Using the modular approach, many programmers can contribute to the same program simultaneously," says Bill Inmon, chief programmer. "As a result, we saved a great deal of time."

At GTE Sylvania, initial data entry was keypunched. Subsequent compiling and "fine tuning" were done on IBM 3277 Display Stations linked via IBM's Time Sharing Option to the division's System/370 Model 158 computer.

After each program was completed, it was submitted to a structured walk-through—basically a review session during which several programmers get together to analyze design logic, detect errors and develop test strategies.

"In addition to producing programs that are easier to maintain and modify, structured design and programming has proven invaluable to our engineers," says Donald Kiser, vice president and general manager. "Structured programming is far more logical and accurate than traditional approaches. It has helped us improve programmer productivity and the quality of our end-product at the same time."



Quality control technician Bob Evans inspects a circuit board produced by GTE Sylvania.

A customer makes a deposit directly to her savings account through an IBM 3604 teller terminal located in a Pick-n-Pay supermarket in Cleveland.

Meat, Potatoes and Cash—All in One Stop

If there is one place the average family visits at least once each week, it's the supermarket. And they don't always come with cash in hand. As a result, supermarkets may dispense large amounts of cash to their customers, often in return for personal or payroll checks. And the faster they can do that, the sooner shoppers can be on their way.

"The supermarket business is incredibly competitive. So we're always looking for new ways to provide additional services to bring people into our stores," says Richard Bogomolny, president of Pick-n-Pay Supermarkets, Inc.

In a joint venture with The Broadview Savings and Loan Company, the Cleveland-based supermarket chain now offers a new service which it calls "The Money Service." It enables Broadview's customers to make deposits or withdrawals from their savings accounts directly through IBM 3604 teller terminals—part of the IBM 3600 Finance Communication System—located in 55 Pick-n-Pay stores. Broadview plans to move to the more compact IBM 3606 Financial Services Terminal sometime in 1976.

"In addition to extending banking hours—we're open until 6 pm weekdays and all day Saturday—the terminals mean people can keep all their money in interest-bearing savings accounts until the moment they need cash," says Bogomolny. "And it can all be done in one stop, right along with their regular grocery shopping."

The terminals, equipped with keyboards and display panels, are activated by magnetically encoded plastic "debit cards" issued by the savings and loan company. An operator simply inserts the card and then keys the cardholder's four-digit security code into the terminal, followed by the amount to be withdrawn or deposited. In a matter of seconds the transaction is completed. In the case of withdrawals, the customer can request cash up to a flexible limit determined by Pick-n-Pay—provided the account balance is large enough to cover the amount requested.

The terminals are online to an IBM 3601 Controller, a part of the 3600 system. The controller in turn communicates with Broadview's System/370 Model 145 virtual storage computer to ascertain account balances and to debit or credit accounts.

"Just two years ago, we had to enter all information manually, a process that used to take several minutes for each transaction. Now, with the online capability of the 3600 system, that time has been reduced to seconds," comments Broadview's president, John Rupert.

"Because of the tremendous modular flexibility the system provides, we were able to install all 55 terminals in a matter of a few weeks. They will enable us to bring financial services to our customers at a fraction of the cost of opening new branches."

APL Helps ABC Set a Fast Pace in the Ratings Race

At the ABC Television Network in New York City, the two questions most likely to be asked are "How did you like the show?" and "What's the rating?"

Ratings of TV shows are measures of their popularity, with a single rating point representing some 700,000 households which have viewed a given program. When a rating goes up or down, the Network's future advertising revenues may be affected. People at ABC involved with network planning therefore, keep an eagle eye on costs, revenues and ratings.

"We analyze network schedules and costs up to 78 weeks in advance," says Al Rubin, the TV network's vice president of business analysis and financial planning. "APL helps us meet our needs for analyzing financial changes related to new program schedules. Its speed and flexibility allows us to examine alternative schedules in hours instead of man-days. We can repeatedly adjust our data bases' input—costs, availabilities—in precisely the format desired, while avoiding elaborate computer reprogramming in accomplishing these tasks."

ABC uses an advanced version of APL called A Programming Language Shared Variables. Through the use of APLSV, a wide range of data bases are accessible. APLSV runs on one of ABC's two Model 158s under Multiple Virtual Storage (MVS).

"Contrasted with standard data base management, APLSV is far speedier and more flexible," says Marvin S. Mord, vice president of research services for the Network. "We get data breakouts with APLSV that were not possible before.

"To us, the most helpful feature of APLSV is the simple one-statement expression that manipulates entire data sets," he adds. "By hitting just six keys, for example, we can get the average of a large set of program ratings.

"APLSV helps provide answers to vital questions—such as what would happen if we shifted a show to a new time slot against different competition? What would the effect be on overall network performance? That kind of capability means a lot to us, because we always seem to be racing the clock in this business."

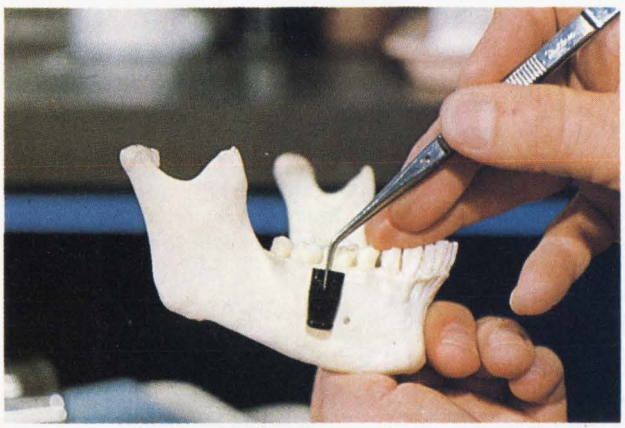
The ABC building in New York City, headquarters for one of the "big three" in television

As Mark Cohen, vice president for finance and planning for the ABC Television Division, puts it: "APLSV gives us the ability to rapidly review and analyze Nielsen rating data. It's a particularly effective way of getting the information we need in the form we want."

Scientists Perfect Dental Implantation Technique

Until recently, replacing a lost tooth almost always required bridgework—anchoring the false tooth to the healthy ones surrounding it. Now, using a new technique, dentists at the University of Southern California are implanting artificial teeth directly into the jawbone. Their successful procedure uses vitreous carbon, a material new to dentistry, whose characteristics were tested on the university's IBM computer.

"The jaw is subject to constantly changing stresses that are created as a person chews," says Dr. Ronald Voss, director of the clinical implantation program at USC. "We had to be sure that artificial teeth made of vitreous carbon would approximate the behavior of normal teeth very closely. If there is insufficient stress, the jawbone will start to deteriorate. On the other hand, if the stress is too great, either the bone or the implant itself will break down."



A vitreous carbon rod, whose use in dentistry was developed with the aid of computer analysis, is implanted in the jawbone to serve as the foundation for a dental crown.

Using an IBM System/370, Dr. Dale Grenoble, associate professor of dentistry, and biomechanics engineer Albert Knoell, developed a mathematical model of the carbon implants to determine their maximum stress patterns. "This computer analysis focused on one part of the problem by helping us verify the structural integrity of the implant design without incurring the time and expense of building actual models," says Knoell.

The implant operation, which normally takes about half an hour, involves drilling a hole into the jawbone and inserting a grooved vitreous carbon rod. After a healing process of several months, a stainless steel post is anchored to the rod and a dental crown is attached.

So far, implants have been performed successfully on more than 300 patients. "Our oldest implants have been in place just over four years," says Dr. Voss. "We believe that in certain situations, implants can be more aesthetic and functionally efficient than any other dental replacements."

The new, expanded headquarters of General Reinsurance in Greenwich, Connecticut, symbolizes the rapid growth of the company.

DL/1 Speeds Growth at General Reinsurance

An online data base management system organized with Data Language/1 has resulted in faster communications as well as improved customer service for the General Reinsurance Corporation of Greenwich, Connecticut.

As the largest reinsurance company in the U.S., General Reinsurance assumes risks originally undertaken by other insurers in categories like property, casualty, fidelity, surety, aviation, marine and automobile insurance. It also covers specific individual risks for a fixed time period—for example, the hands of a pianist before a major performance. These are known as facultative agreements.

"It used to take a month or longer for new premium and claim information to be totally processed," recalls Frank Fahy, assistant vice president of business systems planning. "That included mailing time from the branch offices, coding and entering into the central data base. By the time corporate reports were consolidated and production reports were forwarded to account executives, some of the information was already outdated. Today, total processing takes just a few days."

"In addition to improved turnaround time, DL/1 enabled us to cope with a 39% growth in transaction volume in our facultative business last year without any additional staff," adds Tony Kandiew, assistant vice president of electronic data processing.

Beginning in July, 1974, General Reinsurance made the transition from a System/360 Model 30 with a conventional base largely on tape to a System/370 Model 158 running under DOS/VS and the online DL/1 data base system. Under the current system, data can be entered in realtime from any one of 30 display terminals located in the regional and local offices, and then be communicated back to the Model 158 in Greenwich through a Customer Information Control System Virtual Storage (CICS/VS) interface.

Under DL/1, all related data files are organized hierarchically with the most significant and frequently accessed data on the highest level. Normally, every new application program requires the formation of a totally new sequential data file. With DL/1, however, data is structured into a common format that allows many batch or online programs to access the same data. Data security is preserved by a segment sensitivity feature that locks users out of data files that are not required by their applications.

"We decided on the DL/1 data base approach because it offered the flexibility and data security we wanted without using too much memory," says Kandiew. "If we ever need to expand to an even larger data base, such as the Information Management System (IMS), we feel confident the conversion would be quite easy because IMS uses the same data entry format as DL/1.

"We eliminated a great deal of redundant data using DL/1," says Kandiew. "Before, the same premium information may have been repeated in 100 different files. Today, it appears only twice: in the premium file and in the balance file.

"Our data base management system forces us to define logical data relationships before creating a new file. By improving documentation, it has significantly reduced the time we spend on file maintenance and costly reprogramming."

Fred Schmitt, assistant vice president of information services, points out, "With more accurate and current status reports available using DL/1, our branch information services staff can supply our clients with a more comprehensive service package much earlier now. We feel DL/1 has helped us to achieve a much tighter control of our business."

DP Dialogue appears regularly in these pages. As its name suggests, we hope DP Dialogue will be a two-way medium for DP professionals. We'd like to hear from you. Just write: Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

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analysis of enacted EFTS state legislation

The American Bankers Association provides an overview of the present status of electronic fund transfer legislation.

Twenty-four states have now enacted legislation dealing with electronic fund transfers. Twenty-one of these statutes were enacted in 1975. EFT laws were already on the books in Washington, Massachusetts, Oregon and Wisconsin. Oregon enacted a second statute repealing the 1973 EFT law this year.

Some of the features of the legislation include: wild card statutes in Rhode Island, New Hampshire, Virginia and North Dakota; a limited moratorium in Utah; treatment of remote facilities as branches in Maine, New York and New Jersey; statutory determination that remote facilities are not branches in 11 states and power in state regulatory authorities in the other states to determine whether or not remote facilities are branches by regulation.

ABA's State Legislative Counsel, James D. McLaughlin, has analyzed each of these EFT laws to determine what these bills permit state chartered financial institutions to do. The analysis chart on the following pages poses a series of questions important to the development of EFTS and examines each of these laws to see how they answer them. The Comptroller of the Currency's CBCT ruling is also examined.

The chart reflects which type or types of financial institutions the bill applies to, gives the state's branching law, determines whether or not an out-of-state bank is permitted to establish an in-state facility, and whether or not the facility is considered a branch when established by in-state banks.

The chart is then divided into two parts to consider the statutory treatment of unmanned and manned remote facilities. Each statute is examined to determine if any geographic limitations are placed on remote facility locations, the functions permitted at a remote facility, sharing requirements and whether or not advance supervisory approval of facility establishment is required.

Explanation of Column Headings

1. **Applies To:** A bill's provisions cover the named financial institutions.
2. **Branching Law:** This describes the state's bank branching law: S = statewide; L = limited branching; U = unit banking.
3. **Out of State Entry:** The comptroller's ruling permits interstate placement of facilities. Each statute is analyzed to determine whether or not, and if so, under what conditions units owned by out-of-state banks will be permitted in a state.
4. **Is Facility A Branch:** This indicates whether or not the law treats remote facilities as branches.
5. **Unmanned Remote Facility:** Each statute is reviewed to determine if, and to what extent, distinctions are being made between manned (e.g., POS type terminals) and unmannned (e.g., automated teller) units. Remote facilities are those not on the premises of a bank or branch.
   (a) **Geographical:** If a bill permits unmanned remote facilities, the legislation is screened to determine where the bill permits a facility to be located, i.e., anywhere in the state (statewide) or some more restricted area (limited). This may be compared with the authority given national banks and the limits of state branching law.
   (b) **Functions:** This is an examination of the functions that may be performed by a remote unmanned facility.
      (1) **Deposits:** Whether or not the facility may accept deposits.
      (2) **W/D:** Whether or not the facility may dispense cash to customers.
      (3) **Pre-authorized Loans:** Whether or not lines of credit or overdraft privileges are available through unmanned remote tellers.
      (4) **A/C Transfers:** Whether or not account transfers, e.g., from savings to checking, are permitted at facilities.
   (c) **Sharing:** Whether or not an establishing financial institution must share its unmanned remote facility with other institutions. It may be a mandatory sharing requirement (M); a permissive requirement (P); or silent (S).
      (1) **Like Institutions:** This indicates whether like institutions must or may share facilities (banks and banks, S&Ls and S&Ls).
      (2) **Unlike Institutions:** This indicates the sharing requirement between banks and thrifts or vice versa.
   (d) **Advanced Supervisory Approval:** This examines whether or not the governmental official with jurisdiction over financial institutions must act to authorize a facility or if only notice is required.
6. **Manned Remote Facilities:** This category examines the treatment by a bill of manned remote terminals. The category contemplated POS terminals although other manned terminals are included under the heading. The review of the bills examines the same questions raised by authorization of unmanned facilities, as well as one additional question – Who mans the unit.
   (a) **Who mans:** Basic to a manned unit is the requirement that it be operated by a party who is not an employee or agent of the bank. Generally, the language of the bills states that it shall be a *3rd party* or a *3rd party under contract.*

analysis of enacted EFTS state legislation

STATE	Applies To	Branching Law	Out Of State Entry	Is Facility A Branch	UNMANNED REMOTE FACILITY								MANNED REMOTE FACILITY								
					Geographical	Functions				Sharing		Advanced Supervisory Approval	Geographical	Functions				Sharing		Advanced Supervisory Approval	Who mans
						Deposits	W/D	Pre-auth. Loans	A/C Transfers	Like Institutions	Unlike Institutions			Deposits	W/D	Pre-auth. Loans	A/C Transfers	Like Institutions	Unlike Institutions		
COMPTROLLER OF THE CURRENCY (Revised Ruling, May 9, 1975)	National Banks	N/A	N/A	No	Within 50 miles of main or branch office[1]	Yes	Yes	Yes	Yes	P[1]	P[1]	Notice only	Within 50 miles of main or branch office[1]	Yes	Yes	Yes	Yes	P[1]	P[1]	Notice only	Bank customer or 3rd party
ALABAMA Act 1127, Laws of 1975	Banks S&Ls CUs	L	Yes, Recip-rocal only	Silent	Silent	The Superintendent of Banking may authorize activities properly incident to the business of banking through on-premise as well as off-premise operations. Savings and loan associations and credit unions may not offer services now prohibited to them. No distinction is made between manned and unmanned remote facilities.															
CONNECTICUT Public Act 75-373	Banks SBs S&Ls	S	No	No	Statewide[2]	Yes	Yes	Yes	Yes	M	M	Yes	Statewide	"Sales transactions can be charged directly to the buyer's deposit or loan account."				M	M	No	3rd party
FLORIDA Chapter 75-134	Banks S&Ls CUs	U[3]	No	No	Statewide	Silent	Yes	Silent	Silent	P	P	Notice only	Statewide[4]	← Silent →				Bank owners M P / S & L & CUs[5] P P		Notice only	3rd party
GEORGIA Act 169, Laws of 1975	Banks	L	No	No	Limited	← "routine banking transactions" →				P	P	Yes	Limited	"Record, directly with a bank, transactions occuring as a result of the sale of goods or services."				P	P	Yes	3rd party
ILLINOIS Public Act 79-609, Laws of 1975	N/A	U	N/A	N/A	Creates an Electronic Funds Transfer Systems Study Commission "to conduct a thorough study of electronic funds transfer systems and their possible use within the state and to consider the public policy and other considerations including the consistency of EFTS with presently existing statutes." Commission shall report its findings and suggestions to the 79th General Assembly by March 1, 1976.																
IOWA S.B. 536, Laws of 1975	Banks S&Ls CUs	L	Yes[6]	No	Statewide	"Transactions which are incidental to the conduct of the business of that particular institution."				Bank owners[7] M	Bank owners[7] P	Yes	Statewide	"Transactions which are incidental to the conduct of the business of that particular institution"				Bank owners[7] M	Bank owners[7] P	Yes	3rd party
KANSAS S.B. 515 Laws of 1975	Banks	U	No	No	Statewide	← Banking transactions →				M	S	No	Statewide	← Banking Transactions →				M	S	No	Silent
S.B. 519 Laws of 1975	S&Ls		No	No	Statewide	Yes	Yes	Yes	Silent	M	S	No	Statewide	Yes	Yes	Yes	Silent	M	S	No	Silent
LOUISIANA Act 241, Laws of 1975	Banks	S	Silent	Silent	Adds incidental power clause allowing commissioner to authorize services "consistent with services offered by banks chartered under the laws of the United States."																
MAINE Chapter 500, Laws of 1975	Trust Cos. SBs S&Ls	S	No	Yes	Statewide	Yes	Yes	Yes	Yes	M	M	Yes	Statewide	Yes	Yes	Yes	Yes	M	M	Yes	Employees of business where facility located.
MARYLAND Chapter 515, Laws of 1975	Banks SBs	S	No	No	Statewide (locations remote from main office or branch)	Yes	Yes	Yes	Yes	P[8]	P[8]	Yes	Statewide (locations remote from main office or branch)	Yes	Yes	Yes	Yes	P[8]	P[8]	Yes	3rd party under contract
MASSACHUSETTS Chapter 1147, Laws of 1973	Banks SBs S&Ls	L	No	Silent	Limited	Silent	Yes	Silent	Silent	P	P	Yes	N/A →								
NEBRASKA L.B. 269, Laws of 1975	Banks	U	No	No	Silent	Yes	Yes	Yes	Yes	M	S	Yes	Silent	Yes	Yes	Yes	Yes	M	S	Yes	3rd party
NEW HAMPSHIRE Chapter 233, Laws of 1975 (Wild Card)	Banks SBs S&Ls	L	Silent	Silent	The Board of Bank Incorporation may promulgate rules permitting any bank or cooperative bank to establish and maintain electronic devices or machines similar to those permitted by the Comptroller of the Currency for national banks, or by the Federal Home Loan Bank Board for federal savings and loan associations.																

NEW JERSEY Chapter 148, Laws of 1975	Banks SBs	S	No	Yes	Statewide	Any business conducted at principal office				P[9]	P[9]	Yes	Statewide	Any business transacted at principal office				P[9]	P[9]	Yes	3rd party under contract
Chapter 159, Laws of 1975	S&Ls		Silent	Yes	Permits establishment with the Commissioner's approval of "limited facility branch offices" which may be fully automated. Commissioner must adopt regulatory requirements "in substantial conformity" with those of the FHLBB.															
NEW YORK Chapter 764, Laws of 1975	Banks SBs S&Ls	L[10]	Silent	Yes	Permits establishment of ATMs and POS terminals pursuant to regulations of the banking board. Such devices engaged in "deposit-withdrawal activities" are branches. Numerical restrictions on new branches for savings banks and S&Ls do not apply.															
NORTH CAROLINA Chapter 553 Laws of 1975	Banks	S	No	No	Subject to the rules and regulations of the State Banking Commission, banks may establish manned or unmanned off-premise facilities.															
NORTH DAKOTA H.B. 1542, Laws of 1975	Bank of N.D.	U	N/A	No	The N.D. State Bank may establish EFT system for its customers and customers of other financial institutions authorized to utilize such services (includes State banks).					M	M	Yes	Silent →							
S.B. 2443 Laws of 1975 (Wild Card)[11]	Banks		Silent	No	Interstate	Yes	Yes	Yes	Yes	M	S	Yes	Interstate	Yes	Yes	Yes	Yes	M	S	Yes	3rd party
OREGON Chapter 797, Laws of 1973 (Repealed by H.B. 2644, Laws of 1975)	Banks	S	Silent	Silent	Silent except if more than 4 units	← General banking business →				S	S	Notice only for first 4 units, approval for 5th or more.	N/A →							
H.B. 2644 Laws of 1975	Banks SBs		Yes[12]	No	Silent	Yes	Yes	Yes	Yes	M	M	Notice only 30 days after installation or removal	Silent	Yes	Yes	Yes	Yes	M	M	Notice only 30 days after installation or removal	3rd party
RHODE ISLAND Chapter 290, Laws of 1975 (Wild Card)	Banks SBs S&Ls CUs	S	Silent	Silent	Provides that every financial institution may establish CBCTs to the same extent and only during such periods of time that competing financial institutions federally regulated and domiciled in the state are permitted to provide. Supervisory approval is required. Sharing is permissive with all financial institutions.															
SOUTH CAROLINA Ratification No. 375,[13] Laws of 1975	Banks S&Ls CUs	S	No	Silent	Statewide	← Silent →						Yes	Statewide	← Silent →						Yes	Silent
UTAH S.B. 100, Laws of 1975	Banks S&Ls, CUs	S	Silent	Silent	MORATORIUM UNTIL JULY 1, 1976. Permits Bank Commissioner to authorize experimental EFT systems. (Should a Court or the Congress authorize establishment of EFT systems in Utah prior to July 1, 1976, then Commissioner shall grant financial institutions same authority.)															
VIRGINIA Chapter 81, Laws of 1975 (Wild Card)	Banks	L	Silent	Silent	Gives State Corporation Commission authority to, by regulation, define a branch so as to give state banks parity with national banks.															
WASHINGTON Chapter 166-XXX Laws of 1974	Banks MSBs S&Ls	S	Silent	No	Statewide	Yes	Yes	Silent	Yes	Bank owners M / P MSBs & S&Ls P / P		Yes	N/A →							
WISCONSIN Chapter 193, Laws of 1974	Banks	L	Silent	Silent	Limited	Yes	Yes	No	No	S	S	Yes	Limited	Yes	Yes	No	No	S	S	Yes	Silent

1. Within 50 miles sharing is permissive. A CBCT may be established beyond that distance only if it is available to be shared by local financial institutions.
2. Home office protection provided.
3. Effective January 1, 1977, banks will have limited branching power.
4. Cannot be located on any premise having a pari-mutuel license.
5. Other owners must share with banks; may share with S&Ls and CUs.
6. Out-of-state bank may utilize a facility in Iowa only if consent is given by an Iowa bank which uses the facility.
7. Sharing by S&Ls and CUs apparently subject to regulation by appropriate supervisor.
8. The Bank Commissioner may establish rules and regulations for the operation and sharing of facilities to the same extent and effect as rules and regulations promulgated by the C of C with respect to sharing and operation of facilities by national banks.
9. Commissioner may require sharing with institutions insured by FDIC or FSLIC.
10. Statewide branching in New York effective 1/1/76.
11. Establishes parity with federally regulated financial institutions, including federal S&Ls.
12. Out-of-state bank may use facility if Oregon bank may use facility in home state of non-Oregon bank.
13. Provisions of act effective until July 1, 1977 only.

'76 NCC Landmarks in Data Processing

Mark the place and time... New York City, June 7-10... for the National Computer Conference, a landmark event for computer professionals, applications specialists, users, business managers, administrators, educators, and others concerned with data processing.

The '76 NCC will be your one opportunity during the Bicentennial Year to hear leading experts, to see and evaluate the latest in products and services, and to confer with colleagues, customers, and industry representatives... all in one place at one time.

More than 100 information-packed sessions will analyze the latest trends and issues affecting performance, productivity, and profit. The program sessions will be organized into 10 or more major areas, or "tracks," running throughout the Conference and covering such topics as complex systems, hardware technology, software and components, system architecture, computer communications, management concerns, education and training, advanced applications, and societal issues.

In addition, the program tracks will include more than 20 special one-day "mini-symposia," each consisting of four sessions. In advanced applications, for example, mini-symposia will cover medicine and health care, banking and electronic funds transfer, and business systems. Other symposia will include such key topics as government policy, control instrumentation, performance measurement, standards, networking, privacy, legal considerations, and word processing systems.

And there's much more. The world's largest lineup of data processing products and services will be displayed on three floors of the New York Coliseum.

Included will be the latest offerings from more than 275 organizations, ranging from mainframes, minicomputers, peripherals, packaged programs, and publications, to microprocessors, memories, terminals, systems, and services. Among the exhibitors will be such leading companies as Ampex, Control Data, Data General, The Harris Corporation, Hewlett-Packard, IBM, ICC/Milgo, Lear Siegler, Modular Computer Systems, NCR, Pertec, and Xerox.

Conference registrants will also have the opportunity to attend five special Plenary Sessions featuring leading spokesmen from industry, the computing profession, and major user areas. And, for an additional fee, they will be able to choose among a number of in-depth Professional Development Seminars dealing with advanced techniques for cost-effective computer usage.

In addition, a Pioneer Day Program will honor individuals from the Moore School of Electrical Engineering, University of Pennsylvania, who developed ENIAC—the world's first electronic digital computer. All this plus a Computer Art and Graphics Display, a National Student Computer Fair, the annual Conference Reception, and many other high-interest events promise to make '76 NCC a landmark event for the entire computer industry.

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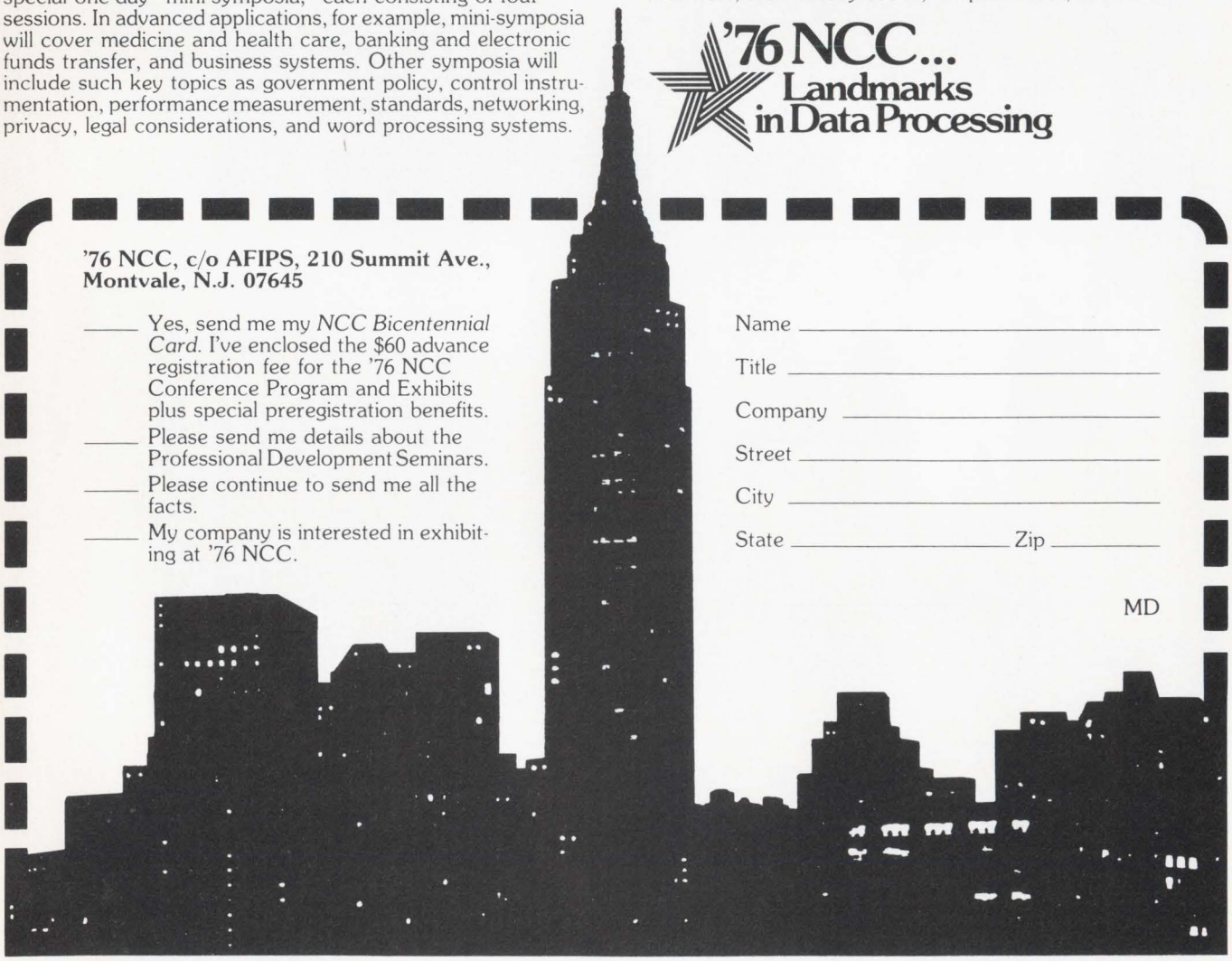
'76 NCC... Landmarks in Data Processing



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MD

CIRCLE NO. 13 ON INQUIRY CARD

T. MITSUTOMI

modem uses a custom-designed rather than standard microprocessor

Application requires high-speed arithmetic operations and only a very limited instruction set

Editor's Note:

Hycom President Takashi Mitsutomi is a strong proponent of the digital modem, which he sees as better in every way than its analog counterpart. When the idea of designing such a device first occurred to him, his first inclination was to build it around an existing microprocessor. In this regard he was typical of many other designers who have found in the "Microprocessor Revolution" ample reasons for making the switch from analog to digital. Atypically, however, Mitsutomi went a step further – he decided that he would not only design a μP-based digital modem, but his own μP as well. Frankly, we were puzzled when we first learned of Mr. Mitsutomi's efforts. "Why re-invent the wheel?," we asked. "Weren't existing micros sufficiently flexible and sufficiently fast for this application? Wouldn't the expense of a custom-designed micro cancel the benefits of a digital modem?" What follows is Mr. Mitsutomi's reply.

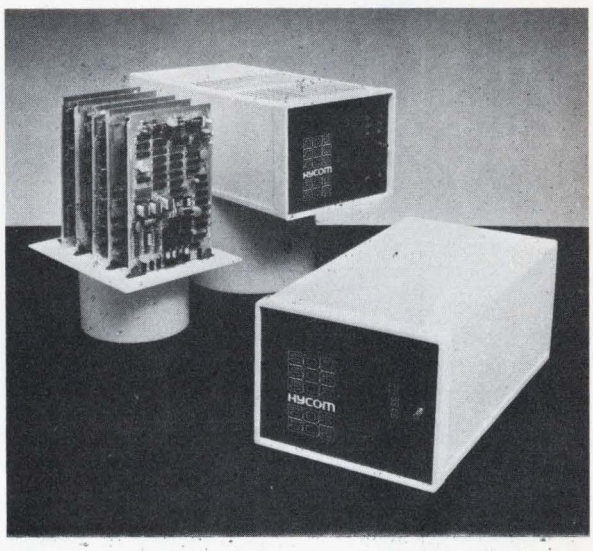
Designing 4800- and 9600-bps modems to operate digitally provides them with superior performance, greater reliability and less maintenance (resulting in less system downtime) Analog modems suffer from performance that degrades with time. Consequently, they require periodic adjustment to maintain high-level performance.

Should the design incorporate a microprocessor? For reasons that will soon become apparent, the answer is definitely YES. Which one? Off-the-shelf or custom? Certainly off-the-self units are less expensive than custom-designed units.

However, the only off-the-shelf units presently available anywhere near fast enough are bipolar microprocessors which are designed to operate as general-purpose computers. Consequently, they do not perform arithmetic operations, such as multiplication, fast enough.

Takashi Mitsutomi, president of Hycom, Inc., received his B.S. and M.S. degrees from Massachusetts Institute of Technology in 1952 and 1953, respectively. After a stint at Rockwell International, from 1953-71, he helped found Hycom in Irvine, CA.

The cost of the general-purpose architecture in standard microprocessors is high. A modem does not use most of the micro's available instructions and its wastes much of the available memory. Additionally, implementing a modem with an off-the-shelf microprocessor requires four to eight separate devices. Consequently, custom designing a microprocessor specifically for modems does pay off, especially when the development costs can be spread over a sufficient volume.



The Hycom Family of Digital Modems. Built around a custom MOS/LSI microprocessor, these modems require no periodic adjustment or calibration because the required accuracy comes from their digital operation. If a system failure is suspected, a built-in testing capability quickly isolates the fault to the line, the modem, or other equipment. In case of line failure, a single button activates the dial back-up capability. The 502B (top right), operates at 4800/2400 bps with a simultaneous 130 bps reverse channel. The 505A (shown without cabinet) achieves a bit error rate of 1×10^{-6} at 17 dB S/N at 4800 bps. The 505B adds a fast learn (< 30 ms) capability for polling applications.

Designing a custom microprocessor-based modem requires assembling a multidisciplinary team with members experienced in communications, digital signal processing, computer architecture, MOS integrated circuit design and

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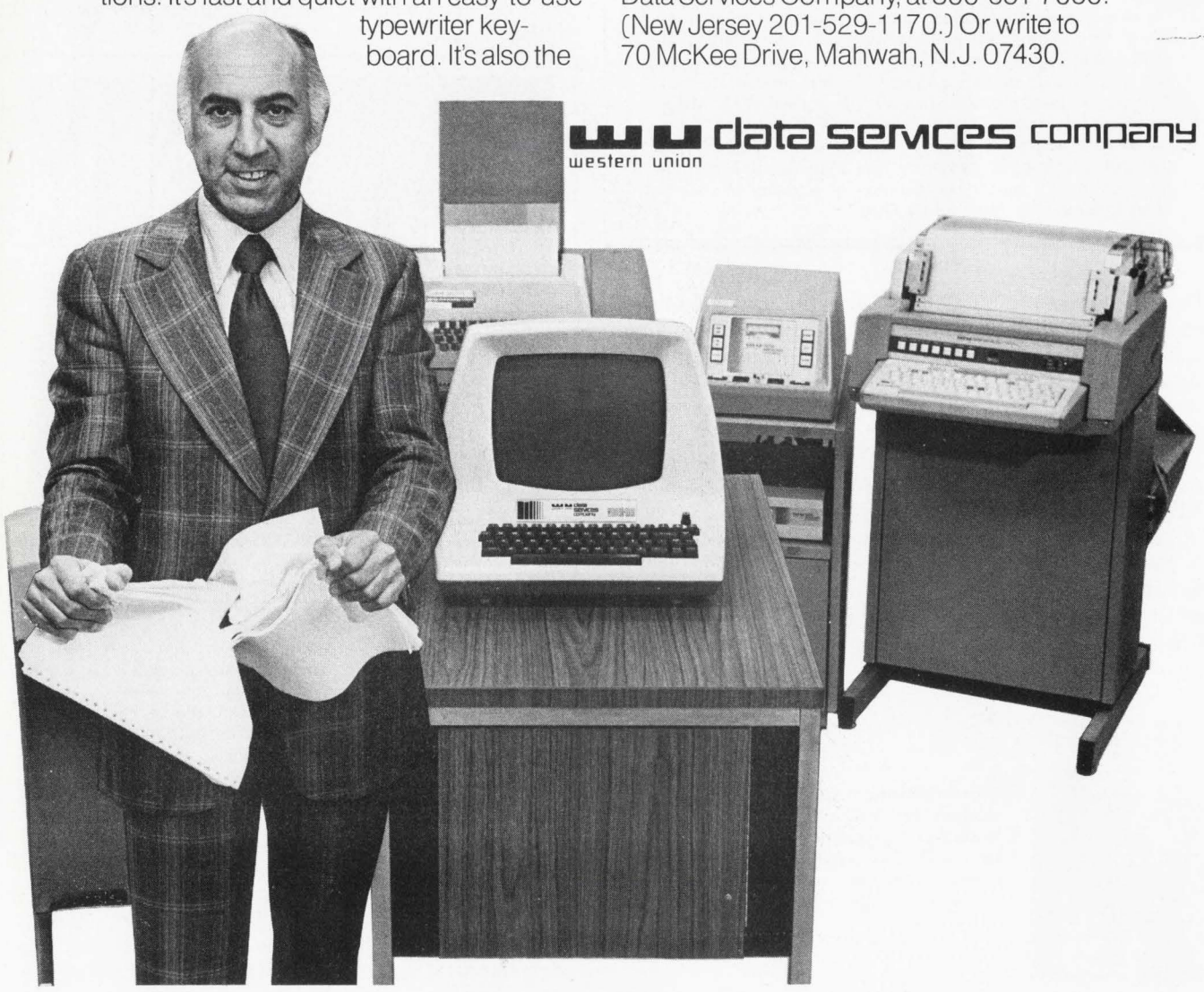

CIRCLE NO. 33 ON INQUIRY CARD

software systems. This team must develop a large amount of proprietary software to aid in the design.

The custom microprocessor approach provides these added advantages:

- It allows mechanization of sophisticated mathematical analysis and equalization techniques too costly to implement in conventional IC logic.
- Design changes to improve performance usually only require changing the ROM instruction coding rather than the logic board. These changes are relatively inexpensive and impact production very little.
- Changing the ROM coding to customize handshaking and other operational parameters costs little and provides quick turnaround for shifting customer requirements.
- ROM coding helps the manufacturer develop a family of modems that share the same PC cards. Sharing cuts design cost and factory inventory.

MICROPROCESSOR ORGANIZATION

Two custom-designed N-channel MOS/LSI devices, a data storage unit (DSU) chip and a communications micro-

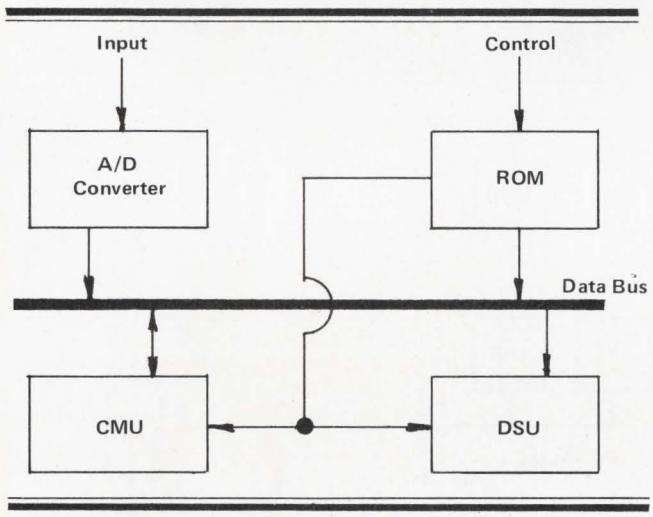

Fig. 1 — **High-Speed Communication Microcomputer.** *The heart of the modem receiver is the CMU/DSU microprocessor with the control ROM as the brains. A small amount of additional logic routes data from data bus to customer's equipment.*

processor unit (CMU) chip form the heart of the microprocessor (Fig. 1). This specialized microprocessor supplies the flexibility needed to design a whole family of modems. The family concept helps amortize the MOS chip design and development costs over a broader product line than would otherwise be possible.

To handle the mechanization of digital filters at high speed, the CMU (Fig. 2) can form a single arithmetic product by using a two-bit-at-a-time multiplication algorithm and sum it with a series of products at a rate exceeding 400,000 per second. Although the modem processes 10-bit words, the CMU chip accumulates its results to 15 bits to reduce truncation errors in the computations. All the arithmetic operations except multiplication occur at speeds greater than 800,000/sec. Fifteen instructions, some of them quite complex, provide all the arithmetic operations necessary for modem signal processing.

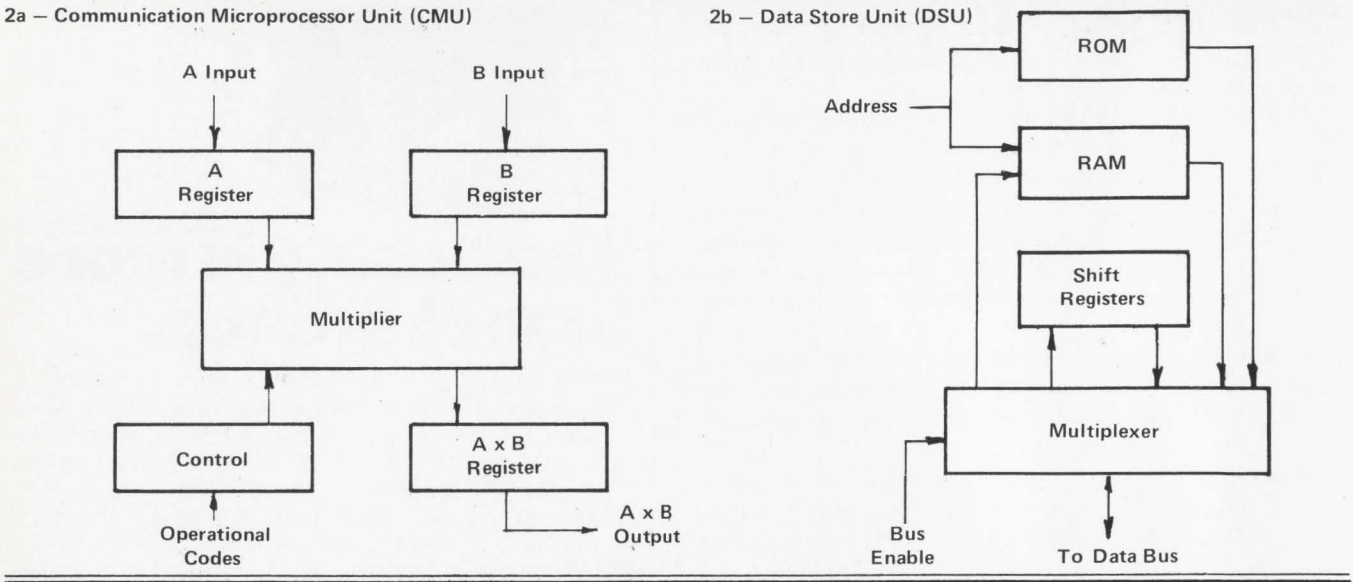

Fig. 2 – Block diagram (a) shows the CMU chip organized for fast multiplication, and (b), the DSU with its three types of data storage.

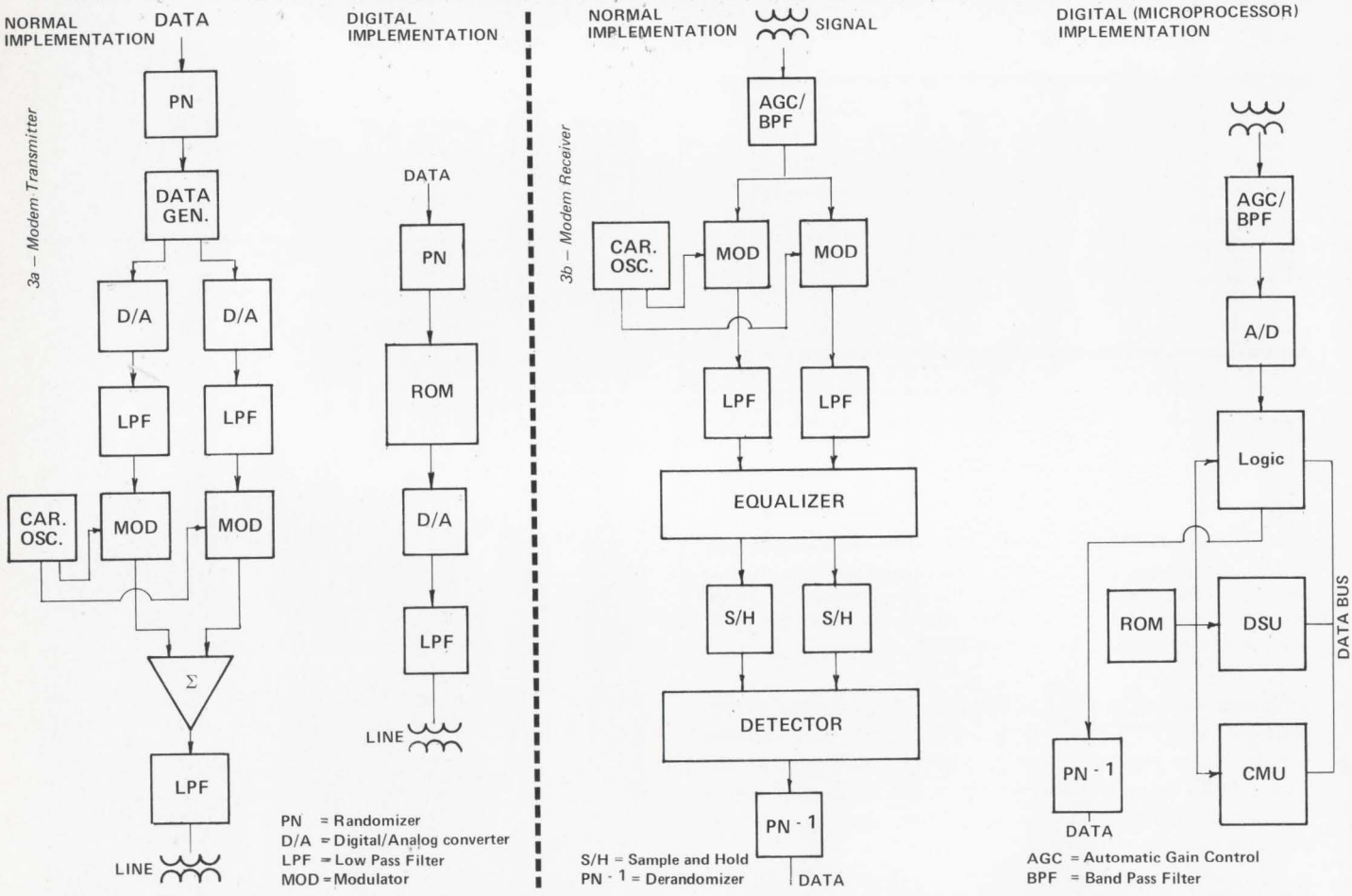

Fig. 3 – **The Methods Compared.** *3a shows block diagrams of a modem transmitter, nondigitally and digitally implemented. 3b shows block diagrams of a modem receiver, also nondigitally and digitally (with microprocessor) implemented. Programming the ROM for different modulation and filtering schemes gives the modems great flexibility.*

The DSU chip (Fig. 2) consists of RAM, ROM and shift register storage areas. The RAM provides a scratch-pad storage; the ROM holds constants for initialization, comparisons and filter coefficients. The chip also contains a mechanism for updating learned filter coefficients without tying up the data bus and CMU chip.

Figure 3 shows microprocessor-based modem architecture. Note how the custom-designed processor simplifies the construction of a transmitter and a receiver. In addition, the designer, with almost no hardware change, can adapt these systems to handle varying requirements by simply changing the ROM coding. ■

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CIRCLE NO. 17 ON INQUIRY CARD

REMOVABLE DISK CARTRIDGE DRIVES

EDITOR'S NOTE:

The small disk cartridge drive used in minis today, which is about the size of a large breadbox, has come a long way from the first removable disk drive of the 50s, when they were about the size of a Cadillac. Presented first as part of this Technology Profile is an historical perspective of removable disk storage – where it's come from and where it's going. Then a look at the present with a list of all disk cartridge manufacturers and what they have to offer. This is followed by a user's view of what to expect in the future from disk cartridge drives. This Profile is followed by a featured product: it seems the future has already begun.

REMOVABLE DISK STORAGE

Where It's Come From and Where It's Going.

DAN M. BOWERS / Technical Editor

There is no dispute that the history of the computer business has in large part, over the past dozen years, strongly followed improvements in the technology of logic circuits – tubes to transistors to integrated circuits to large scale integrated circuits to microprocessors. However, the development of the computer industry over an even longer period, and to an almost equally great extent, has followed improvements in the technology of storing digital data on a magnetic surface. Beginning with Univac and IBM in 1955-56, and followed after a few years by Bryant Computer Products, drum and disk storage appeared on the computer scene. If you compare those early, 6-megabyte units with current technology, for example Diablo's announcement last month (see *Featured Product*) of a 53 MB unit, you have to agree that advances in this technology have been equally as great as those in circuit technology.

Those early wondrous units provided 6 megabytes (50 million bits) of storage in a package roughly the size of the family car at a price of $40,000, with an access time on the order of one-half second. Now we are accustomed to using desk-drawer-size units containing nearly an order of magnitude more storage, with both price and access time reduced by a full order of magnitude.

The early disk and drum files were tremendous breakthroughs in their day; however, for the first half dozen years of their use, the storage elements were universally fixed in place. IBM's 305 RAMAC, for example, contained 50 disks, each nearly three feet across, stacked in a cabinet. Univac's Randex drum looked like a steel rolling mill, and contained two over-under magnetic drums, the assembly being about five feet long and five feet high. Removable storage was not a practical matter to discuss, unless you didn't mind using a fork-lift truck.

ENTER THE REMOVABLE MEDIUM

In the early 1960s, Potter Instrument Company introduced what it called RAM, for "removable access memory." Potter's RAM also incorporated the "magic number" of storage capacity, about 50 million bits, on sixteen 36-inch loops of two-inch-wide magnetic tape. Potter's RAM gave the computer industry the removable-storage device that it had long needed. However, the technical problems resulting from the large number of new innovations incorporated into the device (e.g., wide magnetic tape), delayed its impact on the market for several years. During that period, about 1962, IBM introduced the removable disk file and the modern era of disk storage was off and running. *The introduction of the removable disk file, as we have said many times in the past, was one of the most significant developments in the computer industry.*

IBM's 2310, 2311, and 2314 removable disk memories revolutionized the computer industry and spawned a great number of sub-industries. One of these was the plug-compatible market, wherein copies of IBM disk files were made by independent manufacturers to be directly interfaced with IBM computers, replacing IBM's own drives. Another direction was independent disk drives not compatible with IBM's, primarily in the mini/micro area of capacity. Prime among these movers were the original developers of the tape RAM memory, who began in business for themselves and are still there. Removable disks proliferated, primarly pursued on the upper end by IBM disk packs, and on the lower end by the floppy disk (which promises to be as revolutionary for very small systems as the hard disk was for large systems).

DISK VS TAPE

The impact of the removable disk upon the only previously available method of mass storage – magnetic tape – was dramatic. We predicted ten years ago that magnetic tape storage was a dying technology, and indeed its share of the computer storage market has been continually decreasing. That magnetic tape itself has not experienced a dramatic

decline in sales is due only to the dramatically increasing volume of the computer business itself. Another interesting characteristic of disk as compared with tape, is that the compatibility requirements are quite different. It has been more than 15 years since the manufacturers of magnetic tape equipment found that they could not survive unless they adopted the *de facto* standard for magnetic tape (common densities, speeds, head arrangements, etc). That is, the standard used by IBM in its tape units.

This has not been the case for disk, except, of course, in the IBM plug-compatible area. The buyers of mini/micro versions of disk storage were not particularly concerned with adhering to IBM's standards, and without a defined set of ground rules, technology and price/performance improvements occurred more spontaneously. However, disk manufacturers realized the aura of compatibility was an important selling point. So nearly all (including floppy) manufacturers now use IBM standard media. Interestingly, floppies did not have to be compatible with the IBM standard media, but those who branched out in the beginning found that their credibility was nil until they adopted some semblance of IBM's way of doing the job, even if it meant only using the same media.

WHAT OF THE FUTURE?

Microcomputer control of the disk file – the logic, the interface, the diagnostics – will be routine within the coming year in disk as in all other peripherals. We foresee a substantial number of systems within a few years which will have no need for a central processor since all of the functions needed will be performed by the microprocessor in one or both of the peripherals. For example, neither tape-to-printer or disk-to-printer systems have a need for the interposition of a central processor, nor do peripherals such as disks, printers, tapes and terminals whose function is to communicate with another device over a telephone line.

Charge-coupled devices, bubble memories, large-scale core, and holographic memories have all been touted as replacements for disk/drum memories; we have been hearing these words about holographics for nearly a decade. We expect to see the impact of the charge-coupled device upon the high-speed, small-capacity head-per-track drum memory within the coming year; however, we expect that it will be a long time before any of these devices can have an impact on the removable disk, moving-head market. This is because of the low cost/performance of the moving-head disk (due to its fewer heads, amplifiers, etc.), because disk storage must inherently be nondestructive, and because the archival aspect of a removable storage medium will be difficult to duplicate in a purely electronic device. The storage capacity, if access time is not a factor, of a removable disk system is for all practical purposes infinite. We expect eventually that holographics will provide such archival storage. Although we predicted a decade or so ago that we would see such devices by now, we do not. Therefore, we renew our prediction that the wide use of holographic storage is a half a decade away.

The early disk storage unit had a density of about 10,000 bits per square inch. In two decades we have increased that by only two orders of magnitude to roughly 1 million bits per square inch. We predict an increase by 1980 of about one more order of magnitude, and we see the ultimate improvement in density to be less than one order of magnitude beyond that. (See "Predicting Future Computer Developments", MODERN DATA, May 1973.)

The cost of disk storage has decreased over the past two decades from $6000 per megabyte to the present under $100 per megabyte in the mini (i.e., under 50 MB) range. We foresee no more than one-half to one order of magnitude further improvement in cost.

A MATURE INDUSTRY

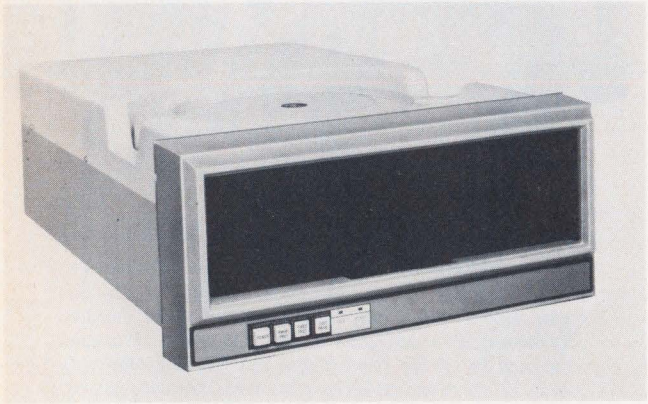
Comparing how far we have come in disk storage with how far we have to go provides an apt description of what we consider representative of a mature industry in that it illustrates there is more of a need for solid systems and applications work and a better understanding of the users' needs, than for massive technical breakthroughs. The hardware presently exists for our industry to perform economically a massive number of applications that are not presently solved. The days of Gee Whiz technological breakthroughs are over for the disk storage industry: we applaud this and applaud as well the fact that the next decade will be devoted to arriving at realistic solutions for real world problems.

REMOVABLE DISK CARTRIDGE DRIVES

Who Makes Them and What They Offer

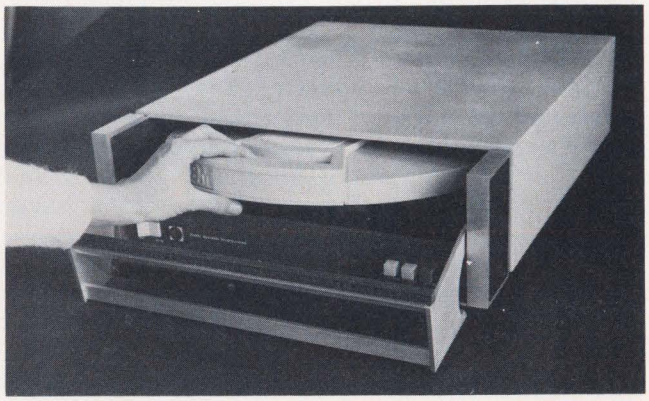
BARBARA A. REYNOLDS / Associate Editor

Outgrown the floppy, but not ready for the disk pack? The single-platter disk cartridge is the answer. It's just as removable as a disk pack with specifications on the same order of magnitude, but a lot smaller and less expensive. Drive costs are about three times that of a floppy, but performance characteristics are an order of magnitude better. Whereas the floppy has an access time averaging 300 milliseconds, the disk cartridge averages 55 milliseconds. The floppy stores 250 kilobytes per drive, the cartridge drive stores up to 10 megabytes (up to 53 MB with Diablo's announcement – see *Featured Product* this issue). Some floppies have approached the cartridge's transfer rate of 187 kilobytes per second, but most are an order of magnitude lower.



A Top Loader. Microdata's 9100 Series with one removable 5440-type top-loading cartridge.

Specifications for cartridge drives do not differ that much from manufacturer to manufacturer as can be seen by Table 1 for OEM Disk Cartridge Drive Manufacturers and Table 2 for End-User Disk Cartridge System Manufacturers. Exceptions to the norm can result by increasing bit densities, providing intelligent controllers, or increasing rotational speed. Disk cartridges come in two versions: the top loading IBM-standard 5440 cartridge type and the front loading IBM-standard 2315 cartridge type. There's a one-drive cabinent with either one fixed, one removable, or one fixed combined with one removable disk. Fixed disk drives are not covered in this Profile.



A Front Loader. Diablo's Model 31 with one 2315-type front loading cartridge.

The following tables list all known manufacturers of removable disk cartridge drives and systems along with the various parameters most often cited by the manufacturers. In tables involving so many manufacturers, errors and omissions are difficult to avoid. However, every effort was made to obtain the latest information from all manufacturers. The reader should contact manufacturers of interest for up-to-date and complete specs. The following notes on these parameters will help in using the tables.

1. **MODEL.** In cases where manufacturers had a large number of models with similar characteristics, one example of the model was given with an indication that others were available.

2. **OEM DRIVE** (Table 2 only). Manufacturers of systems for mini end-users generally buy the drive from an OEM manufacturer.

3. **DRIVE TYPE.** Removable and combination fixed-removable disk systems were included.

4. **CARTRIDGE TYPE.** The IBM standard 2315 cartridge is front loading; the 5440 is top loading.

5. **DRIVE CAPACITY.** An attempt was made to list unformatted capacity in megabytes to achieve a common spec. However, OEM manufacturers usually speak of unformatted capacity in terms of bits, and end-user manufacturers specify formatted capacity in terms of words. In the fixed-removable systems, the drive capacity is equal to that of the fixed plus removable disk. Drive capacities generally range from 2.5 to 10 MB.

6. **AVERAGE ACCESS TIME.** Included in access time is latency, which typically ranges from 12.5 to 20 milliseconds.

7. **TRANSFER RATE.** Rates were usually 200 or 312 kilobytes per second. However, Diablo's recent innovations have increased the rate to over 500 KB per second. Datapoint's high transfer rate is due to an intelligent controller.

8. **SPEED.** Disk rotational speed is usually 1500 or 2400 rpm. Transfer rates and access times improve with higher disk rotational speed. If both speeds were available, 1500 rpm was used to determine the specs.

9. **TRACK DENSITY.** Track densities are typically 100 or 200 tracks per inch.

10. **BIT DENSITY.** Although bit densities were almost always 2200 bits per inch, the new generation of disks has increased density to over 4000 bpi, with resulting increases in transfer rates and capacities.

11. **COMPATIBILITY** (Table 2 only). Independent manufacturers usually manufacture their own controller and interface it with an OEM drive and selected minis.

12. **SOFTWARE** (Table 2 only). Diagnostics and drivers are usually supplied with the disk system. In some cases, independents also offer an operating system, and in other cases the systems are software compatible with certain mini disk operating systems.

13. **DATE FIRST SHIPPED** (Table 1 only). Directions in disk cartridge drives can be seen from the announced disk products of Diablo and EM&M, which will not be shipped until 2nd quarter, 1976.

14. **OEM PRICE** (Table 1 only). The single unit drive price is specified for quantities of 100.

15. **PRICE** (Table 2 only). Controllers, supplied with end-user systems, range in price from $3000 to $5000. Disk cartridge *systems* can therefore range $5000 to $7000 higher than the price of OEM *drives*. If OEM pricing is also available, this is indicated to the right of the end-user price.

16. **BIT ERROR RATE** (not included). The soft (recoverable) errors were almost always one in 10^{10}; the hard (non-recoverable) errors were one in 10^{12}. An exception was the Datapoint disk system, which used the intelligent controller to correct errors before they got to the CP.

TABLE 1 – OEM DISK CARTRIDGE DRIVE MANUFACTURERS

DISK DRIVE MANUFACTURER	MODEL	DRIVE TYPE	CARTRIDGE TYPE	DRIVE CAPACITY (MBytes)	AVG. ACCESS TIME (MSec)	TRANSFER RATE (KBytes/sec)	SPEED (rpm)	TRACK DENSITY (tpi)	BIT DENSITY (bpi)	DATE FIRST SHIPPED	PRICE FOR ONE (Q = 100)
CONTROL DATA CORP. **8100 34th Ave. S. Minneapolis, MN 55440**	9427H	F-R	2315	3-12	47.5	312	2400	100/200	2200	6/74	4000
DATA 100 CORP. **7725 Washington Ave.,S.** **Minneapolis, MN 55435**	Iodisc 3002	F-R	2315	6	75	195	1500(2400)	100	2200		
	Iodisc 3004	F-R	2315	12	75	195	1500(2400)	200	2200		
	Iodisc 3402	F-R	5440	6	75	195	1500(2400)	100	2200		
	Iodisc 3404	F-R	5440	12	75	195	1500(2400)	200	2200		
DIABLO SYSTEMS **24500 Industrial Blvd., Hayward, CA 94545**	31	R	2315	3	90	195	1500	100	2200		2500
	33	F-R	2315	6	90	195	1500	100	2200		
	43	F-R	5440	6.25	50.5	312	2400	200	2200		
	44	F-R	5440	12.5	50.5	312	2400	200	2200		3500
	Series 400*	F-R	3330 media	13.3-53.3	52.5	655	2400	200	4750	2/76	2715-4105
ELECTRONIC MEMORY & MAGNETICS (CAELUS) **12621 Chadron Ave., Hawthorne, CA 90250**	203/1*	R	2315	3	40+I	198	1500(2400)	100	2200	1/72	
	206/2*	F-R	2315	12	40+I	198	1500(2400)	200	2200	1/74	4400
	303/2*	F-R	5440	6	60+I	198	1500(2400)	100	2200	10/71	3840
	306/2*	F-R	5440	12	35+I	198	1500(2400)	200	2200	1/74	4400
	312*	F-R	CMIV	23	57.5	537-806		370	4040	2/76	4700

**Other versions of this model are available*

TABLE 2 – END-USER DISK CARTRIDGE SYSTEM MANUFACTURERS

DISK SYSTEM MANUFACTURER	MODEL	OEM DRIVE	DRIVE TYPE	CARTRIDGE TYPE	DRIVE CAPACITY (MBytes)
ADVANCED ELECTRONIC DESIGN, INC. **754 N. Pastoria, Sunnyvale, CA 94086**	AED 2100(31)	Diablo	R	2315	2.5
	AED 2100(43)		F-R	5440	6
	AED 2100 (44)		F-R	5440	12
	AED 2200		F-R	2315	6
BALL COMPUTER PRODUCTS **5601 College Ave., Oakland, CA 92806**	4300	Western Dynex	F-R	2315/5440	6.25
	4400		F-R	2315/5440	12.5
COMPUTER AUTOMATION **18651 Von Karman, Irvine, CA 92664**	18224-15	Pertec	R (F-R also)	2315	5
COMPUTER LABS **1109 South Chapman St., Greensboro, NC 27403**	M3001	Pertec	R	2315	2.5
	M3002		F-R	2315	5
	M3011		R	5440	2.5
	M3012		F-R	5440	5
	M3021		F-R	5440	10
DATA GENERAL CORP. **Route 9, Southboro, MA 01772**	4237	Diablo	R	2315	2.5
	4234		F-R	5440	10
DATAPOINT CORP. **9725 Datapoint Dr., San Antonio, TX 78229**	9350 Series	Diablo	R	2315	2.5
DATA SYSTEMS DESIGN **1122 University Ave., Berkeley, CA 94702**	240-8	Diablo	R	2315	2.5
	240-8	Western Dynex	F-R	5440	10
	240-11	Microdata	F-R	5440	10

DISK DRIVE MANUFACTURER	MODEL	DRIVE TYPE	CARTRIDGE TYPE	DRIVE CAPACITY (MBytes)	AVG. ACCESS TIME (MSec)	TRANSFER RATE (KBytes/sec)	SPEED (rpm)	TRACK DENSITY (tpi)	BIT DENSITY (bpi)	DATE FIRST SHIPPED	PRICE FOR ONE (Q=100)
MICRODATA CORP.	9100	R	5440	2.5	47.5	312	1500	100	2200	12/74	2275
17481 Red Hill, Irvine, CA 92705	9200	F-R	5400	5	47.5	312	1500	100	2200	12/74	2535
	9101	R	5400	5	47.5	312	1500	200	2200	1/75	2600
	9201	F-R	5400	10	47.5	312	1500	200	2200	1/75	2925
PERTEC CORP.	D3311*	R	5440	2.5	55	195	1500	100	2200		
9600 Irondale Ave., Chatsworth, CA 91311	D3322*	F-R	5440	5	47.5	312	2400	100	2200		
	D3331*	R	2315	2.5	55	195	1500	100	2200		
	D3342*	F-R	2315	5	47.5	312	2400	100	2200		
	D3421*	F-R	5440	10	60	195	1500	200	2200		
	D3442*	F-R	2315	10	52.5	312	2400	200	2200		
VERMONT RESEARCH CORP.	5017	F-R	5440	50	35+I	763	3165		4000		4990
Precision Park, N. Springfield, VT 05150											
WANGO INC.	F-1211*	F-R	2315	3.12	70	195	1500	100	2200		3200
5404 Jandy Place, Los Angeles, CA 90066	F-2222*	F-R	2315	12.5	70	312	2400	200	2200		up
	T-1211*	F-R	5440	3.12	70	195	1500	100	2200		
	T-2212*	F-R	5440	6.25	70	312	2400	200	2200		
	T-2422*	F-R	5440	25	70	625	2400	200	4400		
WESTERN DYNEX CORP.	DD-6121	R	2315/5440	2.5	47.5	312	1500(2400)	100	2200		2700-
2910 N. 30th Ave., Phoenix, AZ 85017	DD-6221	F-R	2315/5440	5	47.5	312	1500(2400)	100	2200		3000
	DD-6122	R	2315/5440	5	47.5	312	1500(2400)	200	2200		
	DD-6222	F-R	2315/5440	10	47.5	312	1500(2400)	200	2200		

AVG. ACCESS TIME (MSec)	TRANSFER RATE (KBytes/sec)	SPEED (rpm)	TRACK DENSITY (tpi)	BIT DENSITY (bpi)	COMPATIBLE w/which minis	SOFTWARE AVAILABLE	PRICE DRIVE & CONTROL	OEM ALSO
90	180	1500	100	2200	DG	AE DOS	5950	●
50.5	312	1500	100	2200	DG			●
50.5	312	1500	200	2200	DG			●
90	180	1500	100	2200	DEC		8565	●
55	200	1500(2400)	100		DG	Ball DDOS		
55	200	1500(2400)	200					
47.5	195	2400	100		CA	DOS	8275	
55	195	1500	150	2200	DEC	DEC-	8380	●
55	195	1500(2400)	100	2200	(Media	Compatible	8950	●
55	195	1500	100	2200	Compatible		8380	●
55	195	1500	100	2200	Also)		8950	●
55	312	2400	200	2200			10,700	●
70	195	1500	100	2200	DG	RDOS	10,900	
38+I	312	2400	200	2200			12,500	
90	1562	1500	100	2200	Datapoint	DOS	9800	
90	200		100	2200	DEC	Handlers	7295	
47.5	312		200	2200			7595	
47.5	312		200	2200			7995	

TABLE 2 — END-USER DISK CARTRIDGE SYSTEM MANUFACTURERS / Continued

DISK SYSTEM MANUFACTURER	MODEL	OEM DRIVE	DRIVE TYPE	CARTRIDGE TYPE	DRIVE CAPACITY (MBytes)
DATUM INC. **1363 S.State College Blvd., Anaheim, CA 92806**	4091 Series	Diablo	R	2315/5440	1.25-10
		Pertec	F-R	2315/5440	1.25-10
DIGIMETRIX INC. **20698 Corsair Blvd., Hayward, CA 94645**	700	Western Dynex	F-R	5440	6-12.5
	1101		F-R	2315	6-12.5
DIGITAL COMPUTER CONTROLS **12 Industrial Road, Fairfield, NJ 07006**	116-447A	Wango	R	2315	2.4
	116-447B		F-R	2315	4.8
	116-447D		F-R	2315	10
DIGITAL EQUIPMENT CORP. **Maynard, MA 01754**	RK11 (RK05)	DEC	R	2315	2.5
GENERAL AUTOMATION **1055 S. East St., Anaheim, CA 92805**	3341	Wangco	R	Basf-600	8
	3343		R	Basf-1100	25
	3346		F-R		5
	3347		R		2.5
HEWLETT-PACKARD **1501 Page Mill Road, Palo Alto, CA 94304**	7900A	HP	F-R	2315	6
	7905A		F-R	2315 w/ 3330 media	26
INTERNATIONAL MEMORY SYSTEMS **14609 Scottsdale Rd., Scottsdale, AZ 85260**	Data Miser 112	OEM	F-R	2315	4.8
	Data Miser 113		F-R	5440	4.8
	Data Miser 116		F-R	5440	9.6
LOCKHEED **6201 E. Randolph, Los Angeles, CA 90040**		Pertec	F-R	5440	5
MEDIA III **2259 Via Burton, Anaheim, CA 92806**	2610-030	Diablo	R	2315	2.5
	2610-043		F-R	2315/5440	5
	2610-044		F-R	2315/5440	10
MICRODATA CORP.	See Table 1				
MODULAR COMPUTER **1650 W. McNab Rd., Ft. Lauderdale, FL 33309**	4126	Diablo	R	2315	2.6
	4128		F-R	2315	5.2
PLESSEY MICROSYSTEMS **1674 McGaw Ave., Santa Ana, CA 92705**	PM/DD Series	OEM	R	2315	2.25
			F-R	2315	5
PRIME COMPUTER **145 Pennsylvania Ave., Framingham, MA 01701**	4123	Pertec, CDC	R	2315	2.9
	4127		F-R	5440	5.8
SOFTWARE ENGINEERING **1945 Pauline, Ste. 16, Ann Arbor, MI 48103**		Pertec	F-R	2315	2.5
SYNCOMM SYSTEMS, INC. **11911 Weddington St., No. Hollywood, CA 91607**	F-180	Syncomm	R	5440	
	F-190		F-R	5440	10 max.
SYSTEM INDUSTRIES **535 Del Rey Ave., Sunnyvale, CA 94086**	3500-31	Diablo	R	2315	2.5
	3500-33		F-R	2315	5
	4500-43		F-R	5440	5
	4500-44		F-R	5440	10
SYSTEMS ENGINEERING LABS **6901 W. Sunrise Blvd., Ft. Lauderdale, FL 33313**	9306	Pertec	F-R	5440	6.25
	9308	Pertec	F-R	5440	12.5
UNITECH INC. **1005 E. Saint Elmo Rd., Austin, TX 78745**	721-2*	Diablo	F-R	2315	5
	731-2*	Wangco	F-R	2315	5
XEBEC SYSTEMS INC. **566 San Xavier Ave., Sunnyvale, CA 94806**	XMD-6000 Series	CDC	F-R	5440	10

**Other versions of this model are available*

AVG. ACCESS TIME (MSec)	TRANSFER RATE (KBytes/sec	SPEED (rpm)	TRACK DENSITY (tpi)	BIT DENSITY (bpi)	COMPATIBLE w/which minis	SOFTWARE AVAILABLE	PRICE DRIVE & CONTROL	OEM ALSO
32.5	312	1500(2400)	200	2200	DEC,DG,Varian	Diagnostics	5050-	●
32.5	312	1500(2400)	200	2200	Univac, Rolm		10,375	●
47.5	195	1500(2400)	100/200	1850	HP,CA,HIS	Driver	6950-	
47.5	195	1500(2400)	100/200	1850	Varian, GA, SEL	Diagnostics	8000	
90	181	1500	100	2200	DCC,DG	DOS	9400	
90	181	1500	100	2200			9950	
90	181	1500	200	2200			10,450	
70	180	1500	100	2040	DEC	DOS	11,000	
	156	2400	200	3000	GA	DOS	19,500	
	312	2400	200	3000			24,500	
45+I	156	1500	200	3000			11,000	
45+I	312	1500	200	3000			9000	
42.5	312		100	2200	HP,DEC,	DOS, RTE	12,000	●
33	937		192	4680	DG,Varian	timeshare	15,000	●
65	184	1500	100	2200	DEC, Varian,	DOS,	7815	
49.5	184	2400	100	2200	DG, Interdata	Diagnostics	7750	
57.5	312	2400	200	2200			8450	
55	195	1500	100	2200	Lockheed			
47.5	312		100	2200	DG, DCC	Diagnostics	6200	●
47.5	312		100	2200		OS	7745	●
47.5	312		200	2200			8595	●
90	195	1500	100	2200	Modcomp	DOS	11,000	
90	195	1500	100	2200			14,000	
75	195		100	2200	DEC, DG	DEC, DG	6840-7070	
75	195		100	2200		Compat.	7220-7330	
47.5	312			2200	Prime	DOS		
47.5	312		200	2200				
47.5	312		100	2200	DEC	OS, Driver	9275	
	187	3600			Most minis	Compat.	1950-	
	187						9000	
90	195	1500	100	2200	DEC, DG,	OS,		
90	195	1500	100	2200	others	Diagnostics		
50.5	312	2400	200	2200				
50.5	312	2400	200	2200				
47.5	312		100	2200	SEL	Handlers,	6000	
47.5	312		200	2200		Diagnostics	7500	
70	195	1500	100	2200	DG	OS	9800-	
70	195	1500	100	2200			13,500	
40+I	312	2400	100	2200	DG, HP, DEC, Interdata	XDOS	10,150	●

PAUL DAVIES / President, Educational Data Systems, Irvine, CA

DISK CARTRIDGE DRIVES

A user's view

EDITOR'S NOTE:
The author, as president of a company that supplies real-time business systems and minicomputer hardware/software tools, is particularly concerned with advances in disk storage. This article was submitted about one month before the Diablo Series 400 announcement (see Featured Product). With the announcement, much of Davies' view of the future has become a part of the present.

Cartridge disks appear to be on the threshold of another quantum jump upward in performance. In the coming year, we're likely to see the familiar fixed disk plus removable cartridge system go from 2200 bits per inch to 4400 bpi, probably accompanied by an increase from 200 tracks per inch to 400 tpi. (Manufacturers are having trouble doing this unless they use servo tracking.) So the current 10-megabyte disk system capacity could jump up to 20 MB, or 40 MB with 400 tpi.

But that's not all. Cartridge disk manufacturers are not limiting themselves to achieving higher capacity alone. They're responding to requests from systems houses and end-users to improve the operational, user-oriented characteristics of cartridge disk drives.

For example, those of us who supply multiterminal, real-time business systems and who write operating systems and applications software for them, are deeply concerned with providing appropriate program and data file backup to our customers. It's imperative that such systems have their operating systems, programs, and data file "snapshots" in cartridges readily available on the shelf in case something goes wrong.

Before the fixed and removable disk cartridge combination came along, we had to use magnetic tape for backup with the consequent different drive mechanism, different recording medium, and inconvenient file copying and retrieval. The fixed disk plus removable cartridge changed that situation: another type of drive mechanism and a second recording medium were eliminated, and file backup could be easily achieved through the use of the removable cartridge.

But systems have a ravenous appetite for more storage. So when the capacity of removable cartridges in needed for system storage and operation, the file backup problem returns. Of course, it's possible by a several-step copy-down and copy-up procedure to record the contents of both the fixed disk and removable cartridge on two backup cartridges. But it's far from convenient. Therefore, increases in capacity are needed not only for operating storage, but to simplify backup procedures.

WHAT'S UPCOMING

Fortunately, the cartridge disk manufacturers are about to take a major step toward eliminating this capacity-related backup problem by expanding from one fixed disk to multiple fixed disks on the same spindle with the removable cartridge. The economic impact of increased capacity on one spindle will be significant. But very welcome also will be the capability of using some of the fixed disks as buffers for backup file copying and retrieval. Users will have cheaper storage, more capacity, and greater operational convenience when these multiple fixed disks plus removable cartridge drives arrive.

Another important advance is coming up. Multiple fixed *heads* will be available on one or more of the added fixed

disks. This is very important to those of us who build real-time timesharing systems that require a lot of program a and file swapping from disk to mainframe memory.

So the disk manufacturers are preparing a "triple threat" solution for practical, real-time systems:

1. Single spindle moving head economy will be combined with increased bit and track packing density to achieve capacities of 20 to 40 MB. Higher rotational speeds from 2400 to 3600 rpm will decrease latency and will boost bit transfer rates, already increased by higher packing densities, to extremely high levels.

2. Multiple fixed disks will provide another avenue for capacity expansion while still preserving the utility of the removable cartridge. Each additional fixed disk will allow an increase in storage from a minimum of 5 MB up to 10-20 MB. This feature will allow electronic track switching up and down the cylinders and will sharply reduce time delays due to moving head seeks.

3. The addition of fixed heads on one or more fixed disks will strongly enhance program and file swapping performance.

Improvements of this kind will put cartridge disks into respectable competition with the currently available "5 high" and "10 high" disk pack systems in capacity, performance and economics. Moreover, the multiple fixed disks plus removable cartridge combination provides a backup capability not available in removable disk pack systems that have no fixed disk storage.

TEMPERING FACTORS

However, there are some factors which should probably temper our enthusiasm. We wonder about some things:

1. Will higher bit packing density require even higher quality recording media with resultant higher cost for cartridges?

2. Will the new disk drives have cartridges interchangeable with the old? Or will the new drives be able to read the old cartridges in order to transfer existing data bases to the new systems?

3. Will increased bit densities and elevated bit transfer rates cause disk I/O bandwidths to exceed those of minicomputers? How will this and more sophisticated error detection and correction schemes, which may be necessary, affect controller costs?

4. How long will it take to bring these new higher performance disk systems up to the reliability of the previous generation?

Of course, there are other questions. But, all in all, we look forward to these new systems because minicomputers are being called upon to perform radically new functions in the business environment. Minicomputers offer the potential of replacing conventional batch processing with real-time business management operation. By allowing immediate access to a firm's entire data base, the multiterminal timesharing minicomputer system can not only provide standard accounting reports, but can enable the executive to manage his inventory, manufacturing and distribution on a minute by minute basis. But to achieve this potential, minicomputers need higher capacity, higher speed disk systems to support the required operating system and data base management software. Disk manufacturers have made tremendous strides in the last few years. They can do it again. Meanwhile, let's applaud them for what they have accomplished. Remember what it was like before we had cartridge disks?

DAN M. BOWERS / Technical Editor

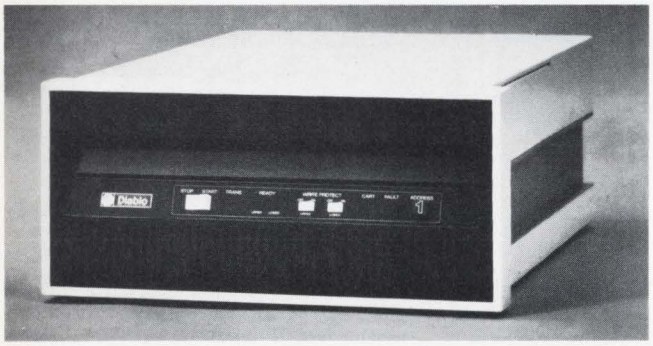
DIABLO'S SERIES 400 DISK CARTRIDGE DRIVE

A New Family on the Block

A new line of disk files for the small computer industry combines a comprehensive, wide ranging, compatible product line with technical innovations that would have brought screaming headlines not many years ago. Unfortunately, the usual tired publicist's words – "revolutionary," "breakthrough," "new era," "unique," etc., will obscure the solid advances in both technology and systems utility offered by the new Diablo Series 400.

A COMPATIBLE FAMILY

The new series consists of eight disk drives ranging in capacity from 13.3 to 53.3 megabytes and in price from under $2500 to just under $3600 in OEM quantities. Available in both top and front loading models, all are the same size – 8.75 inches high in a 19-inch rack mount. Upward modularity of the series is achieved by starting with a removable disk and adding on one, two or three fixed disks.



Diablo's new family. *A new range of capacities (13.3 to 53.3 MB) is available in the same Series 400 cabinet . . . and with the same interfaces and controllers.*

The system approach to the design of the Series 400 provides significant advantages to OEMs. First, they can respond quickly to the changing capacity requirements of their customers. It's now possible to upgrade to a higher capacity drive without having to write new software, change to a different technology or redesign cabinets, interfaces or controllers.

Secondly, the family continuity reduces operating and manufacturing costs; cuts inventory investments in drives, controllers, cabinets and spare parts; and simplifies requirements for training field service personnel.

THE SPECIFICATIONS

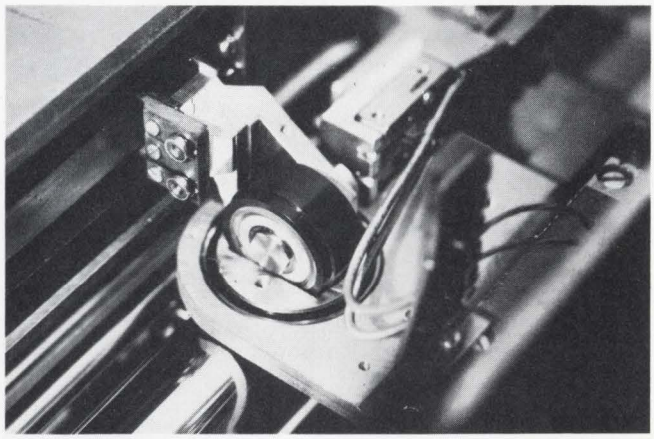
The capacity is 13.3 MB per disk, with one removable disk and up to three fixed disks. There are 430 tracks per disk surface, 15,584 bytes per track, divided into 16 or 24 sectors. Bit density is 4750 bits per inch; track density is 200 tracks per inch. At the 2400 rpm rotational speed, 5.24 megabits per second are transferred. Access times for each of the two positioners are 10 ms, track to track; 40 ms, average move; 75 ms, maximum; and 12.5 ms, average latency.

The price per megabyte in OEM quantities runs from $180 for the single-platter 13.3 MB drive to $68 for the four-drive, 53.3 MB model. This compares with Diablo's 10 and 2.5 MB drive prices of $320 and $880 per megabyte, respectively. Other manufacturer's prices are even higher: $520 in the 5 MB range, $290 in the 10 MB range, $160 at 25 MB, $100 at 50 MB, and $65 at 80 MB.

STARTING ANEW

Rather than improving previous cartridge drive technologies, Diablo started from the beginning – using a flywheel principle of operation for *two* actuators, an inertial power supply, direct track positioning and microprocessor control.

A Low-Power Actuator. The Series 400 inertial actuator eliminates the usual large magnetic fields, and operates with a fraction of the power consumption normally associated with traditional voice coil positioners. It is said to require no periodic preventive maintenance, re-alignment or replacement. The actuator operates on a flywheel principle, with a



Diablo's head positioner. *Shown is one of two head positioning mechanisms; one inertial actuator can independently move two head positioners per disk drive.*

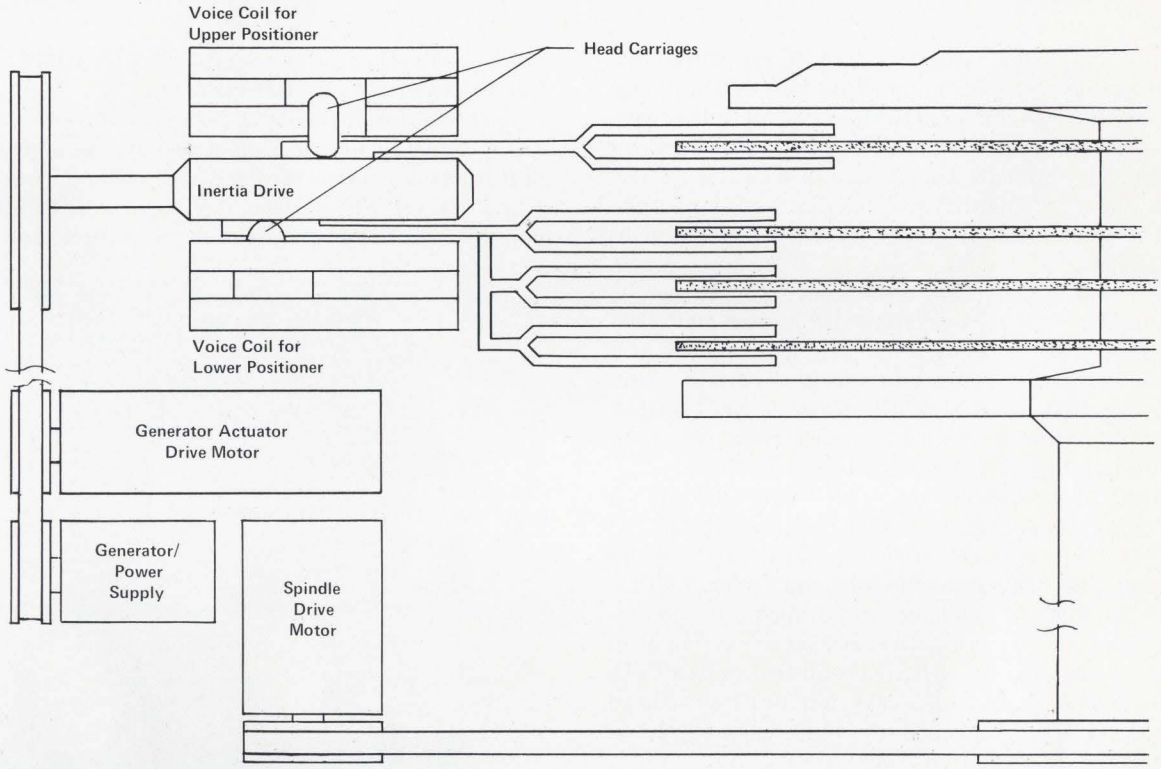
driveshaft continually rotated by an AC motor. The actuator rides on the driveshaft through a small drivewheel, and positioning is performed by changing the angle of the drivewheel on the shaft. Direct positioning power requirements are therefore limited to the power required to rotate the drivewheel shaft. Actual motion is provided by the flywheel driveshaft for a tremendous mechanical advantage. A lesson in first-year physics!

Today's positioners previously had the problems of bulk, weight, power and precision – and the resultant cost. How-

ever, the two actuators in the Series 400 are less than 8 inches in height, and the weight of the dual system is about 40 percent of the weight of a single voice coil actuator. The power used by the dual system is 2 percent of the power used by one voice coil actuator for a comparable drive. Additionally, the 400 actuator is said to be considerably more precise in positioning than a voice coil system.

The low power actuator contributes to the low total power consumption of the Series 400 – only 200 watts (versus the 400 to 1000 watts required for present drives). This results in cooler running, minimizing component heat stressing and permitting much broader environmental limits of operation (50 to 104 degrees F). It also results in a corresponding increase in overall drive reliability.

Direct Track Positioning. Another feature of the new drives is an innovative servo-following technique. Each data track has a prerecorded servo data written in each sector overhead area, so each head operates in a closed loop servo on the track it is seeking. This not only permits the use of all disk surfaces for data storage, but should significantly increase positioning accuracy. It also improves pack interchangeability by eliminating thermal compensation requirements and minimizing the effect of accumulative mechanical intolerances. The Diablo servo-following technique is said to eliminate completely the need for C.E. alignment packs because heads can be aligned using any standard data pack. Diablo anticipates that the removable packs for the Series 400 will be supplied by several major pack manufacturers.



Two Independent Positioners. *Both ride on the same driveshaft. One is used for the fixed disks; one is used for the removable disk.*

Two Independent Actuators. Diablo didn't stop with one actuator; there are two indpendent actuator drivewheels riding on the same driveshaft, providing two independent and overlapping actuators. One is used for the removable disk and the other serves all of the fixed disks (see diagram). This has the effect of putting two disk drives in a single machine and doubling the throughput. Seeks on one can be performed simultaneously with reads or writes on the other. Also, the drive on the fixed disk can be operated either with or without the removable disk in place.

An Inertial Power Supply. Already armed with the AC motor, Diablo decided to belt-couple a motor-generator set at the DC power source. At first brush, this sounds like a giant 20-year step backwards, but on further consideration it makes a lot of sense. There is no connection between the frequently noisy AC line and the DC voltages. Also, the flywheel effect of the rotating mechanical system filters out disruptions and interruptions in the line. The drive will continue to operate normally for 150 milliseconds even if line power disappears entirely.

And a Microprocessor, Too. With all of these goodies, it is inconceivable that Diablo would have forgotten to include a microprocessor. They didn't. A micro is an integral part of the logic, replacing many discrete components, performing internal diagnostics and providing interface flexibility. But with all of these innovations, it is difficult to get excited about the suddenly mundane presence of a micro.

THE SHAPE OF THE FUTURE

We are (obviously) enthusiastic about this new product line. As practicing engineers, we applaud the solid engineering achievements. As observers and frequent critics of the mini/micro computer industry, we applaud the sensible systems approach and broadly compatible line. We believe that Diablo, which in only six years has come form a couple of guys laboring in the shadow of Mount Diablo to the thriving flagship of the almost weekly-increasing Xerox presence in the mini/micro industry, has made a significant contribution to our industry.

For more information on the Diablo Series 400 disk family, Circle No. 100 on Inquiry Card ■

The evolution of an I/O communications system

The EDS-8 Data Channel Multiplexer from Educational Data Systems is a logical step up for peripheral-oriented mini systems.

Historically, one of the basic limitations to system size and flexibility has been the I/O communications system. Since the mini wasn't originally intended to serve multiple peripherals, the first minis had no multiplexers at all. The I/O for each peripheral required a unique card. This was quite adequate for early systems that had only one or two peripherals, but it became totally impractical when larger systems were envisioned.

The first improvement was the so-called "Bit Banger," a software-implemented mux that provided limited multiplexing capability. The Bit Banger transferred data, a bit at a time, all under software control, to a simple interface board. While this resulted in a heavy processor overhead load, it did permit, with the addition of a single board, up to 16 Teletypes (at 110 baud) to be tied into a computer.

The next development was the "Byte Banger," a character-at-a-time multiplexer using the programmed I/O channel. For every character to be transferred, an interrupt is generated. The CPU enters the interrupt service routine, selects the appropriate character from its memory, and outputs that character. While the Byte Banger was certainly an improvement over the Bit Banger, it still tied up the CPU. The mini's operating system usually requires from 200 to 300 microseconds to access and transmit a single character, including all the overhead processing.

As systems grew, users could choose only between installing multiple computer systems or adding a sophisticated I/O processor to the central processor. The price tag was sure to be at least $20,000. If all that was wanted was to add 10 terminals and/or peripherals, the I/O cost for the device was comparable to that of the device itself.

THE NEXT STEP

A solution to this dilemma is a data channel multiplexer for the medium-size (up to 128 devices) system. Really an I/O communications system rather than a conventional multiplexer, this hardware system operates on a DMA basis, servicing buffers in the core memory directly. It steals cycles and only generates an interrupt when one is desired, i.e., when an entire message transfer is completed. Thus, using techniques normally reserved for disks and other high-speed devices, the general-purpose mux substantially reduces the CPU overhead needed for input/output.

The system shown in Fig. 1 (the EDS-8) interfaces up to 128 devices operating in either full- or half-duplex mode. These devices may be in any combination of Teletypes, CRT terminals, printers, card readers, plotters or paper tape equipment. The EDS-8 provides rate control on a port-by-port basis and permits each port to operate in either a character-at-a-time or in automatic buffer mode for operation through the mini's DMA channel.

To control the EDS-8, the program stores the appropriate I/O command words in a dedicated area in core. For each port, there is a mux control block 8, 16, or 32 words in size (strap option). Within each block, three words control input and three control output. In each set of three, one word is a general control word and the other two are pointers to the beginning and end of the desired buffer areas in core. The sizes and locations of these buffers, then, are entirely under software control. Moreover, several ports may transmit from the same buffer at the same time, since each keeps track of its own pointers. If a port is operated in the character-at-a-time mode, the pointer words simply are not read by the mux.

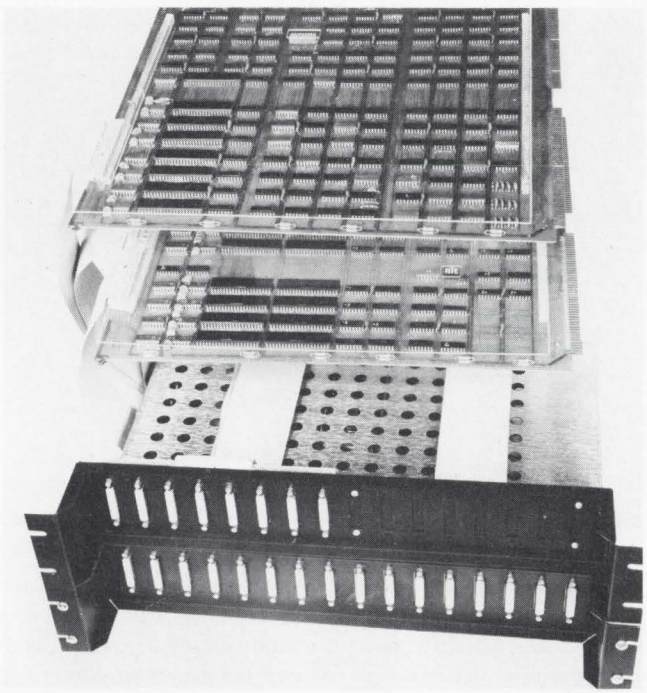


Fig. 1 – The EDS-8 DMA Channel Multiplexer. *All communications multiplexer channels are packaged on three standard circuit board types which plug directly into any of the Nova-type computer slots. One board contains all the common circuitry and eight asynchronous channels. A second board contains up to 24 additional asynchronous channels, and a third contains up to 8 synchronous channels. Thus the complete I/O system to handle 128 asynchronous lines or a combination of 104 asynchronous lines and 8 synchronous lines is packaged on six Nova-type boards.*

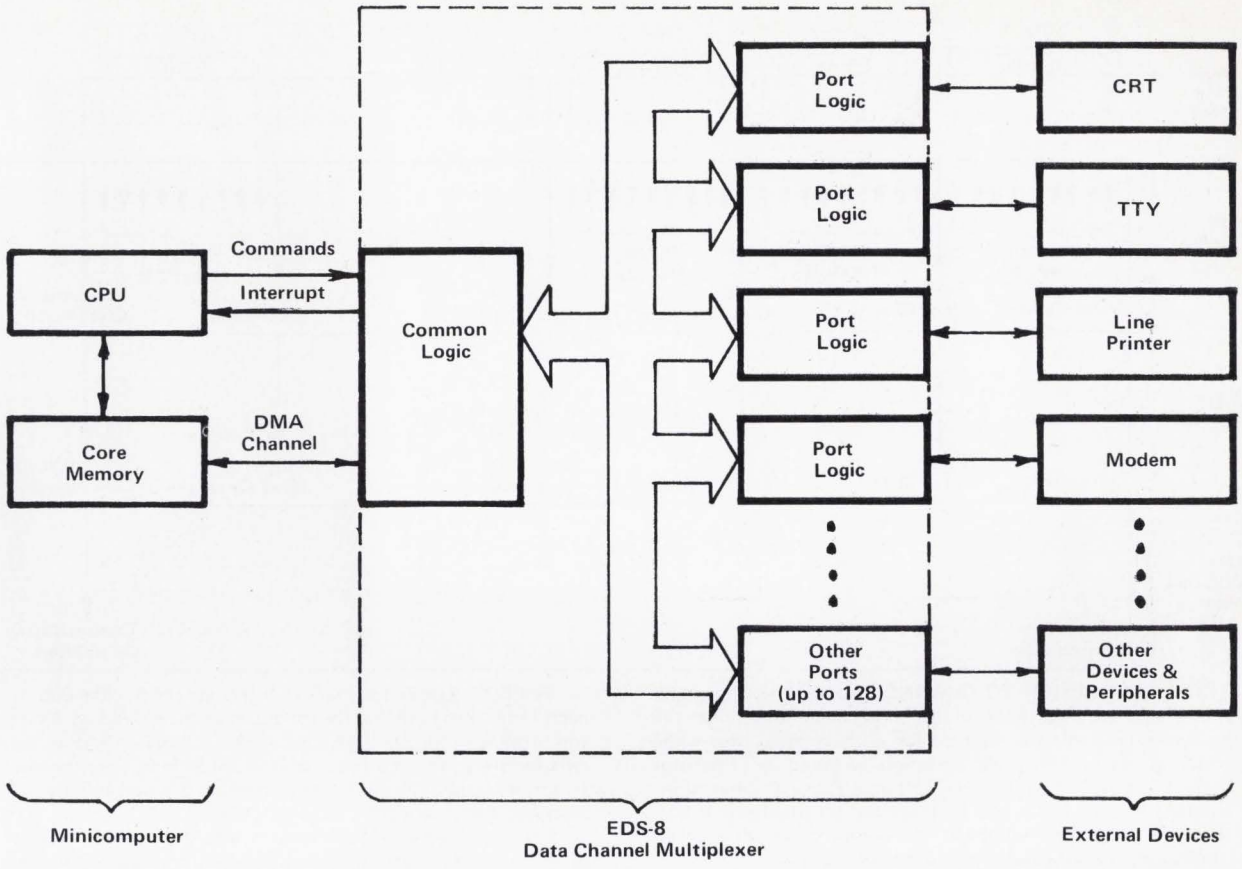
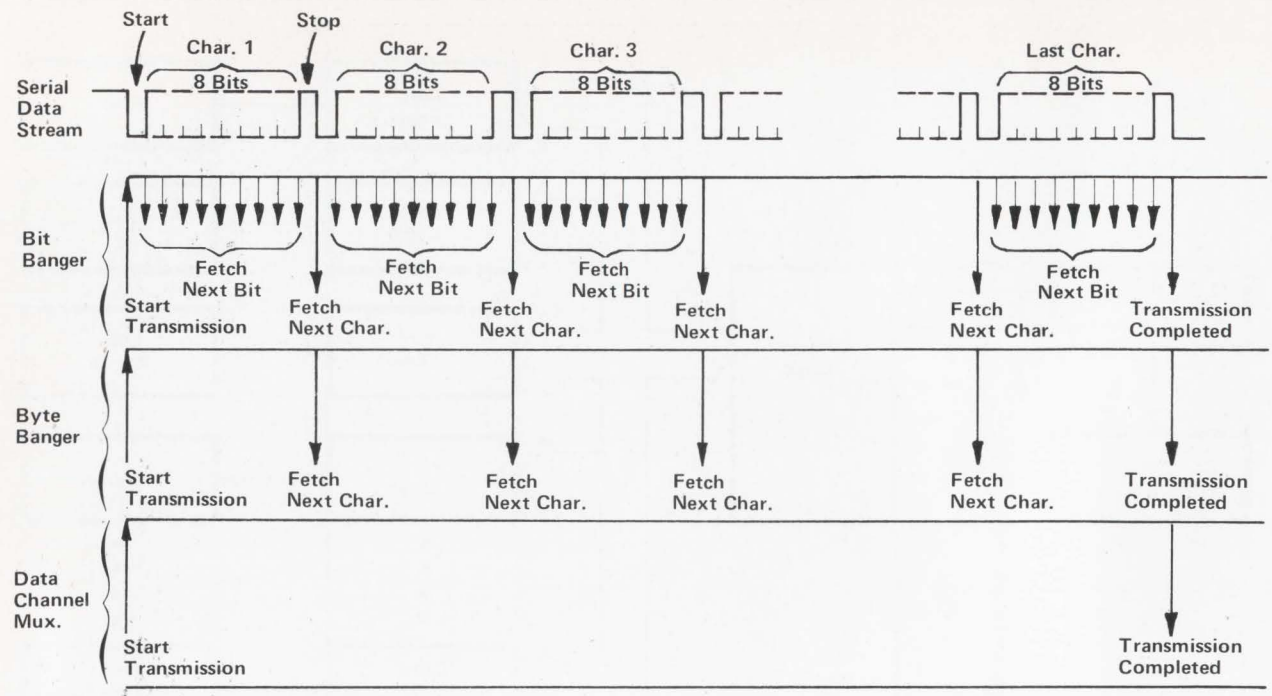


Fig. 2 – Block Diagram of EDS-8 Data Channel Multiplexer



FROM BIT BANGER TO CHANNEL MUX. The Bit Banger was primarily a software multiplexing technique, with the hardware limited to a flip-flop for each channel plus some common logic. This mechanization required an interrupt every bit time, at which time software routines determined whether the last bit output was the last bit of a byte. If not, the next bit would be fetched, the computer would again be interrupted, and the determination made again.

If the bit being output was the last bit of a byte, another routine would determine whether that byte was the last byte of a message. If not, the next byte would be accessed and the fetch-interrupt-query process repeated. In addition, the software had to insert stop and start bits, determine and insert parity bits, and perform other bookkeeping functions.

The Byte Banger transferred much of this processing from software to hardware. In the typical implementation, each channel had an MOS LSI chip known as a Universal Asynchronous Receiver/Transmitter (UART), which handled parallel-to-serial conversion, insertion of start and stop bits, and insertion of parity bits.

The Byte Banger required an interrupt only at the end of each byte, thus reducing the software overhead load by a factor of almost 10. The interrupt service software determined whether the byte just output was the last byte of the message. If not, it fetched the next byte; otherwise it determined what message, if any, would be transmitted next.

The Data Channel Multiplexer mechanizes all this routine processing within a message in hardware, only generating an interrupt at the end of the entire message. This reduces the software overhead typically by an additional factor of from 20 to 100, depending on average message length. Six logic chips on each channel, plus common logic, handle all the message processing – requesting and receiving data channel access; keeping track of whether the last byte of a message has been transmitted; recognizing and providing interrupts for certain control characters; performing parallel-to-serial conversion; and inserting start, stop, and parity bits. The requirements for the software are thereby reduced to (1) starting the transmission by setting up the appropriate control words, and (2) receiving an interrupt when the transmission is completed.

For each asynchronous port, the I/O processing commands contained in the control words define:

1. Length and location of the string buffer in core from/into which character strings are to be transferred.

2. One of eight standard transmission and reception rates (110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud)

3. Character length (5, 6, 7, or 8 bits)

4. Parity mode (even, odd, or none)

5. Number of stop bits (one or two)

6. Interrupt condition (for each character, for certain defined control characters, or only when the end of the specified buffer is reached).

OPERATION

Each asynchronous mux port has two data lines (incoming and outgoing) and two control lines (the outgoing Device Control line and the incoming Device Status line). The mux transmitter receives the data from the computer, converts it from parallel to serial form, inserts a start and stop bit, inserts a parity bit (if enabled), and transmits the data at the rate selected for the port.

The receiver portion reverses the process. Circuitry on the mux checks each port once per 100 microseconds for an input request. When such a request is found, the mux reads the control word for that port and carries out the indicated operations – including access of the automatic buffer or interrupt of the computer, depending upon the conditions.

The EDS-8's synchronous multiplex channels can each receive and transmit synchronous data at any rate selected by the modem up to 50,000 baud. The synchronous mux generates the flag sequence to provide the synchronizing character, converts the outgoing message from parallel to serial form, inserts a zero bit following five one bits to distinguish between a flag sequence and data, and generates the 16-bit Cyclic Redundancy Check (CRC) codes.

For incoming data, the process is simply reversed. The mux senses the flag sequence, checks for and extracts the zero bit, converts data from serial to parallel form, examines the CRC word, and packs the 8-bit characters in core.

For additional information, Circle No. 98 on Inquiry Card ■

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CIRCLE NO. 22 ON INQUIRY CARD

DUKE RAOUL* / Chief of MODERN DATA's Sports Desk

beer & groaning at the second annual "INTER DATA GENERAL" Data Bowl

A Penetrating Account of the Savage World of Flag Football.

It wasn't such a bad day for the refs, especially not for this one, who had encountered a fire engine red Mazda on his drive up from Washington on the morn of THE GAME. The Mazda wanted a race and it got one for about 100 miles of 85 mph driving while dodging trucks, cars and cops. [Any resemblances noted between the respective writing styles of "Duke Raoul" and Hunter Thompson of *Fear and Loathing* fame are purely intentional. – ARK]

It was a bad day, however, for Data General co-captain George Rideout. Rideout and his team had to suffer a six-hour bus ride from Southboro, MA, to Long Branch, NJ, then traverse the slopes of a party the night before THE GAME. To make matters worse, Rideout didn't even have his starting quarterback. Data General QB and prime mover Wally Raymond was flat out with a case of mono.

Joe McLaughlin was called on to lead DG in its second shot at the Data Bowl against defending champion Interdata, with the disadvantage of being several hundred miles from home, albeit on neutral territory. So it was no surprise when Interdata stopped Data General cold on the first series of downs and took advantage of a negative yardage punt to march through DG's defense for the first touchdown, a ten-yard jaunt by halfback Bill Sweet.

It was the start of a frustrating afternoon for George Rideout. Interdata continually throttled the DG offense, with its only threat coming late in the first half when DG had seven plays from inside the Interdata 15-yard line, but couldn't score. Only after giving up two TDs – the second a forty-yard bomb from Interdata quarterback Mike Dunn to Barry Ashley, otherwise known as the Sundance Kid – did Data General's defense manage to contain the Interdata offense.

The game even became a little heated, which isn't unusual for a flag football tilt. Flag football is a cross between rugby, touch football, and good old American sadism. The players wear no padding and have two thin cloth "flags" dangling from their waists. When the rip-away flag is pulled from the man with the ball, the play is dead. What makes

*Duke Raoul is rumored to be former MODERN DATA Associate Editor Stephen Caswell, now Director of Information Central for the Computer Industry Association.

MODERN DATA Editor and Referee Alan Kaplan presents the Data Bowl *trophy to victorious Interdata linemen Dick Vivian (left center) and Bob Howie. This photograph was provided by Interdata and rushed to MODERN DATA barely in time for this issue. We hope to have additional photographs of the game next month, including a shot of the balance of the judging staff: Head Linesman John Murphy, former Associate Editor of MODERN DATA and now Managing Editor – Datapro Research Corp.* Reports on Office Products; *Line Judge Stephen Caswell, former Associate Editor of MODERN DATA and now "Chief of Information Central" for the Computer Industry Association; and Umpire Paul Goldman, District Sales Manager for Sykes Datatronics, Inc.*

the game mean is that almost everything else is like tackle: Blocking on the line, in particular. There are eight men to each side and the only saving rules are no kickoffs (play starts from the 20-yard line), no fumbles (the ball is dead when it touches the ground), and no rushing the kicker during punts.

Rules to the contrary, you can't stop 200-pound bodies from smashing each other, especially since the game is about sixty percent running and forty percent passing. And that's what finally happened to George Rideout, or more precisely to George's QB Joe McLaughlin. Interdata co-captain Bob Howie hit McLaughlin a bit too hard, which prompted an equal and opposite reaction to Howie. Howie started going after any DG player he could find and almost ended up with Rideout.

Then came the penalities, especially a clipping call that nullified a twenty-yard DG gain. Rideout's adrenalin count went off-scale and he began blocking like a madman with his hands a touch too high and his temper a touch too short. He had been warned once and was nearing eviction plus a few penalties when McLaughlin sent him out of the backfield about thirty yards from the end zone.

As Rideout rumbled down the sideline, a Data General lineman made a clear grab of a rushing Interdata lineman, which prompted my flag. McLaughlin put the ball deep into the end zone as Rideout looked back and made a spectacular dive that would've warmed a Kamikaze's heart. His back was to the ball, he was parallel to the ground, but he was so furious that nothing was going to stop him from making his over-the-shoulder grab. Both feet hit inside the goal line, and then the rest of George came crashing down outside the end zone for a spectacular belly-flop TD.

Rideout was down-and-out for the count. His breath had been knocked out as my teeth would have been had I done what any good ref should have. But it wasn't to be. The flag had fallen by accident, George had his spectacular touchdown, and Data General finished second in the Data Bowl by a score of 14-6. Interdata received its trophy, compliments of MODERN DATA.

By now there has to be a question in everyone's mind. Just what the heck is the Data Bowl? It all started more than a year ago when Interdata was moving into a sales office in Cleveland. Interdata's Dick Vivian came across an office newsletter that had been left behind by the former occupant, Data General. The letter put out a call from Skip Stiles of DG for people interested in playing flag football. Vivian called Stiles and challenged Data General to a game to be played in Connecticut. DG said "Yes" and Interdata proceeded to put its muscle where DG's myth was to win the first outing 19-12. A few photos made their way to MODERN DATA, which ran a story and offered to referee the Second Annual Data Bowl and provide a trophy. One month before the game, I got a call from MD editor and head ref Alan Kaplan: Data Bowl No. 2 was set for Dec. 6.

There was more than just a football game that day. The crowd numbered more than 300, the cheerleaders and baton twirlers numbered about ten from Interdata and three from DG, Interdata's Drum, Bugle and Stumble Corps numbered about twenty (they even played the National Anthem before the game, although someone forgot to fly the flag over the field) and, most importantly, the beer kegs numbered four.

Interdata used a 7/16 mini to keep track of the two 45-minute halves. There were local press *paparazzi* at the game and there was one guy who kept calling himself Ron Reeves (a famous sports photographer), although he looked more like Lance LeGeau, the ace computer journalist from some northern New Jersey magazine. To a flourish of kazoos, Elwood Baxter, the Mayor of Interdata's home, Oceanport, threw out a JVC pro ball worthy of any NFL field. It was even worthy to the point that three little kids were seen walking out of the stadium with it during halftime, although they didn't run fast enough to get away.

After the game, Interdata threw an enormous buffet dinner and beer blast at a local pub. The cheerleaders did their thing and the Interdata faithful chanted and sang tribute to the company. In the world of savage competition in the minicomputer market, antitrust suits in the mainframe market, and bits, bytes, bauds and boondoggles on the technical side, it was an abnormal day for the industry. The temperature was in the high 50s, spirits were soaring (and pouring), George Rideout made a great catch, Interdata kept THE CUP, and the head linesman raced a Mazda for 100 miles. Next year the game goes to Massachusetts. To win it, DG'll need some more speed, some more kegs, a flag for the anthem . . . ■

SKOWTZ DU GUD

Knoxville radio station WKGN had a problem. The bank that processed election results for WKGN suddenly bowed out. Enter Explorer Post No. 533 and Steve Dendrinos, who besides being advisor to the dp-oriented Boy Scout group also happens to be a business systems specialist for Wang Laboratories. Steve assembled his "mission impossible [sic] team," and after a "ferverish [sic] week of programming activity, . . . with inumerable [sic] dry runs, . . . the disiplined [sic] troop, . . .which knows that the human element must allways [sic] be accounted for, . . ." accomplished the job using "The Wang Computer System 20, . . . thought by many to be the fore runner [sic] of home computer [sic] of tommorrow [sic]."

Congratulations, Post 533, for a job well done. But from our vantage point, making sense out of the Wang news release was a lot tougher. Oh well, to quote Steve, "Many glamourous sounding jobs lose their luster after one has worked at it for a while [sic, sic, sic]."

"QUALITY" MICRO KIT

A new M6800-based microcomputer from WaveMate Computers and Systems (Gardena, CA) is targeted to the upper end of the computer hobbyist market, but has features which also commend its use for commercial applications. The Jupiter II, sold in kit form for $1225, includes octal address display and RS-232C interface, 8K bytes of 4K RAM for program memory, and 2K bytes of ROM-ed monitor and debug software. An additional 128 bytes of RAM is dedicated to the system for scratchpad use, leaving all of program memory intact for the user.

Dennis Brown, president of WaveMate, freely admits that "hobbyists can get cheaper systems," but maintains that "none is of better quality." Jupiter II ICs are individually tested and all are socketed for easy replacement; power regulation, heat sinking and RFI filtering is provided at the card level; and all four voltages are available at each of the up-to-32 gold-contact 18-pin sockets to simplify custom interfacing.

Brown likens the contrast between Jupiter II and such systems as the MITS Altair to the way "a professional's Nikon camera compares with a Brownie," saying that "while aimed at the serious hobbyist market, our product is of such high quality it can easily be used for engineering development or highly-reliable small business systems." As an example of how both markets are covered, he points on the one hand to the "Heathkit-like quality" of the manuals and program documentation, and on the other to the software interrupt and hardware breakpoint capabilities that "make it superior to Motorola's EXORciser for program development."

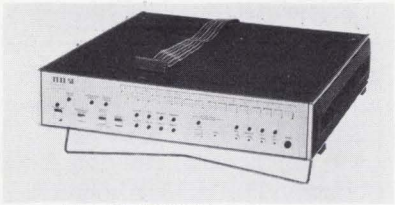
MULTI-USER MICRO

Digital Equipment has put together a multi-user timesharing version of its PDP-11V03, itself a disk-based version of the PDP-11/03 microcomputer with operating system and higher-level languages. The multi-user MU11V03 follows the original 11V03 announcement by only 2-1/2 months, and comes less than a year after DEC's introduction of the Datasystem 310, a low-cost ($15,000) disk-based PDP-8 system that represented DEC's first foray into the desk-contained, single-user commercial market. Primary market for the MU/11V03 will be to educational users, but commercial applications are expected to follow shortly. Basic price of a four-terminal MU/11V03 system is $19,970. First units will be delivered this month, as will the first units of the 11V03, priced in September at $9950. The MU/11V03 is directly supported as a DEC *system;* the 11V03 is from DEC's Components (OEM) Group and is primarily supported by selected turnkey vendors.

Time-Shared micro from DEC

BOARDS AND BOXES

Ramtek Corp. (Sunnyvale, CA) claims it couldn't get sufficently fast delivery of Intel's "ICE Machine" (In-Circuit Emulator), so it went ahead and put together its



The ICEBOX from Ramtek

own, which it calls, appropriately enough, the ICEBOX. Otherwise known as the MM80, the unit directly replaces the 8080 in a user's system and allows the designer to examine, alter and control his program *in vitro*. The MM80 base unit ("a real 8080 at the end of a cable") sells for $3950 and is available with a ROM-resident one-pass assembler.
Circle No. 75 on Inquiry Card

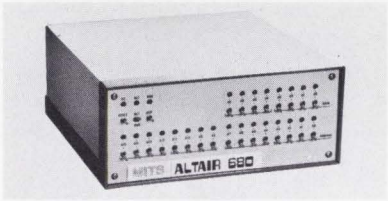
Intel Corp. would rather do its own thing. The Santa Clara microrevolutionary recently made that clear when it decided to produce its own "complete, ready-to-assemble, preprogrammed microcomputer design kit" *a la* the likes of CramerKit, *et al.* Called the MCS-80, the kit centers around a CPU group consisting of an 8080A, 8224 Clock Generator and 8224 System Controller. Other kit components include communications and peripheral interfaces, decoders, PROMs and RAMs, connectors, manuals, and a system monitor. The $350 price even includes a PC board with pre-drilled areas for system expansion.
Circle No. 76 on Inquiry Card

A kit built around Intersil's IM6100 12-bit C-MOS μP is reported to be on the verge of announcement from *PCM Inc.* (San Ramon, CA) the PCM-12 Micro is expected to be offered as a $600 hobbyists' kit with 4K words of static RAM, octal console, power supply and space for "considerable internal expansion." The IM6100 chip has a lot to recommend it to hobbyists. A single-voltage, single-clock machine, it is architecturally consistent with DEC's PDP-8/E (compatible instruction set and interface) and features the low power dissipation typical of C-MOS devices. Less than a year ago the chip sold for $375. It presently is available for $35.
Circle No. 77 on Inquiry Card

Data Works Instrumentation (Chatsworth, CA) is offering a "large family of microprocessor cards" which we presume includes cards for different μPs. In any case, DWI's first card is the Model 226, consisting of Intel 8080, DMA address and data bus drivers, status latches, crystal clock, and 8-bit vectored priority interrupt. No price was given.
Circle No. 78 on Inquiry Card

muPro Associates (Cupertino, CA) has developed an 8080 development system distinguished by a console as handy as it is pretty. Moreover, the console's substantial control and status monitoring functions are performed by software which is transparent to the user. For example, the hex console displays the status of registers, flags and memory without utilizing user memory or stack pointer. Some other features: Breakpoint at program or data addresses without altering memory, and program trace of up to 64 instructions prior to breakpoint or halt.
Circle No. 79 on Inquiry Card

MITS (Albuquerque, NM), the company that offered the Altair 8800 computer kit in January at $439, now has a computer built around the 6800 chip available from Motorola and AMI. The Altair 680 comes with power supply, front panel con-



The Altair 680 from MITS

sole, 1024 x 1 RAM, RS232 or 20mA current loop I/O, and provisions for 1K of ROM or PROM. Price as of December 31 was $293 in kit form and $420 assembled.
Circle No. 80 on Inquiry Card

International Microsystems, Inc. (Gaithersburg, MD) offers a PC module that fits in a standard 4-1/2 by 9-inch Cambion bin and contains a 4040 μP with crystal clock, 1K RAM and provision for 1K ROM. A test PROM for system I/O is included. The firm also provides an RS232 interface card, and a front panel board with three hex LED displays and seven switches. Price of the CPU module is $395.
Circle No. 81 on Inquiry Card

MINI/MICRO SOFTWARE NOTES

If you develop programs for any of Intel's μP families by way of a commercial timesharing firm, you can expect to pay 25 percent less for computer charges. Intel has cut in half the royalty rate it charges T-S firms for use of its compilers, macro assemblers and simulator packages, and half the cut will be passed on to the user. Paul Rosenfeld, Intel's software products manager, explained the cut as "designed to rollback recent increases in computer timesharing charges and to prevent those increases from inflating the cost of using Intel software.". . . . . *Interdata* has developed a new multitasking operating system called OS/16 MT2 which optimizes the use of its 16-bit minis in real-time, program development and computational applications. The new OS is said to be fully upward compatible with the Interdata OS/32 MT operating system for 32-bit computers, and able to operate with or without disk storage. . . . . *Digital Equipment* is releasing a new support package for laboratory data acquisition hardware that features mathematical accuracy to 17 digits. Called FOCAL/RT-11, the new package combines high-level language programming with the RT-11 operating system, supports DEC's AR11 or LPS laboratory peripheral hardware options, and allows the user to control multiple digital I/O options or special-purpose devices through its Unibus access function. FOCAL/RT-11 will be licensed at $300 . . . . . *Wintek Corp.* (Lafayette, IN) offers a 6800 μP software support system consisting of a cross assembler, simulator and PL/M-like language written in standard Fortran IV. Both the assembler and the Wintek PL/M produce relocatable code that can be link-loaded with previously assembled or compiled programs and then fed to the simulator, read by a 6800 system, or used to program a ROM. The cross assembler and simulator are $600 each, or both for $1,000. The Wintek PL/M is $1,000.

COURSES AND CONFERENCES

Microprocessors and LSI in Telecommunications Applications and *Software Development Techniques for Microcomputers* are two- and one-day courses (respectively) scheduled for presentation in various U.S. cities between mid-February and April 1. For information as to places and dates, call *Ms. Julie Schneider* at *Integrated Computer Systems: 213/559-9265.*

The Sixth Annual Institute in Computer Science will be held on the Santa Cruz campus of the University of California between July 12 and August 13. Among the offerings are courses in microcomputer theory and use. For a brochure, call *Ms. Joleen Kelsey: 408/429-2761.*

Unique Aspects of Microcomputer Applications is the title of a tutorial to be presented February 23 at San Francisco's Jack Tar Hotel during "Compcon '76," the Twelfth IEEE Computer Society International Conference. Contact: *Jon E. Petersen, Compcon '76, IBM Corp. R62/123, 5600 Cottle Road, San Jose, CA 95193.*

The First Annual Mini/Micro Computer Conference and Exposition will be held October 19-21 at the Brooks Hall/Civic Auditorium complex in San Francisco. It will be sponsored by the Minicomputer Industry National Interchange (MINI), and is forecast to consist of about fifty papers and a product exposition of 300 booth units. Contact: *Robert D. Rankin 714/528-2400.*

MICROS WILL INCREASE CAPABILITY, NOT PRICES

Even though microprocessors in scientific instruments will dramatically increase the instruments' capabilities, manufacturers will not be able to charge higher prices. Such was the gist of a paper presented recently at the annual convention of the Scientific Apparatus Manufacturers' Association in Chicago. L.O. Eikrem, Director of Programs for Darling, Paterson & Salzer (formerly Darling & Alsobrook), Los Angeles-based management counsellors, said that "the overall size of the instrument markets is not going to increase just because of the use of the microprocessor. Manufacturers will not be able to enjoy any significant increase in price, excluding the effect of inflation." In fact, he continued, "cost may indeed remain much the same in terms of constant dollars because the price of microprocessors and associated devices is already low and getting lower. Expensive hardwired or relay logic would be eliminated and replaced by a software approach, and the development time and subsequent cost will be reduced."

An industry observer for over thirty years, Eikrem also noted that "The time and money required to make changes in relay logic and in hardwired logic will be tremendously reduced. In fact, the reduction in mechanical design and the shift to LSI electronic designs to replace mechanical designs will result in spectacular reductions in design time. Something like five years of design time was required to develop a square root capability in electromechanical calculators. Contrast this with the developmental cycle for new, complex functions in hand-held calculators," he said.

8080 PRICES PLUNGE FURTHER

The price of an 8080 microprocessor, still the most popular 8-bitter and now even more likely to retain that title, plummeted to the point where it now accounts for less than the cost of most microcomputer subsystems (interface chips, power supply, etc.). The new bottom price was established when Texas Instruments announced it would make its TI8080 available for $21.15 in quantities of 100-199, and for $34.25 in single units. The drop undercuts previous lows by 30 to 60 percent.

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EXHIBITORS

(Partial Listing)

ADDS
Applied Computer Systems
Atlantic Software, Inc.
Boeing Computer Services
Cincom Systems, Inc.
Computer Complements, Inc.
Computer Transceiver Systems, Inc.
Spectrom Corp.
Pulsecom, Inc.
Broomall Industries
Axel Electronics
Computer-Link Corporation
Computer Network Corporation
Computer Optics
Computer Sciences Corporation
Cooke Engineering Company
Cullinaine
DACOM
Datapoint Corporation
Decision Data Computer Corporation
Digital Graphics, Inc.
Data Devices International
Digi-Data
Digi-Log
Filegard Systems
Genisco Computer
Graphic Control Corp.
Recording Chart Division
Hazeltine Corporation
Hewlett-Packard
ICC/Milgo
Inforex, Inc.
Infodata
Tektronix
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Instrucom, Inc.
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Kybe Corporation
Lear Siegler, Inc.
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Zeta Corp.
MSI Data Corp.
MRI Systems

For our visitors from out of town, it is recommended that you make your room reservations early. The toll free number for the Sheraton Park is 800-325-3535.

FOR FURTHER INFORMATION REGARDING ATTENDING OR EXHIBITING, CONTACT:

ROBERT E. HARAR
EXECUTIVE DIRECTOR
FEDERAL DP EXPO
5012 HERZEL PLACE
BELTSVILLE, MARYLAND 20705
(301) 937-7177

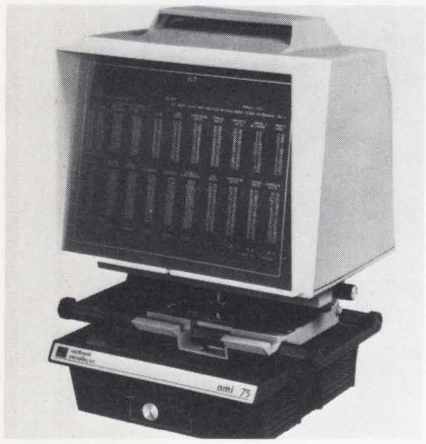
**In the event of a heavy snowfall during the 2-day show, Federal DP Expo '76 will be extended through Thursday, March 4, 1976.*

CIRCLE NO. 32 ON INQUIRY CARD

new products

COMPACT MICROFICHE READER

The NMI-75 portable 3/4-size reader weighs only 15 lbs and takes up 8-3/4 x 9-1/2 inches of desk space. New features include a universal aspheric condenser for all magnifications, a seven-



element lens, a fixed mirror and a safety interlock on the replaceable electronic component drawer. Standard features include front-loading for the pull-out electronic component drawer, roller and track carriage, and an automatic self-opening carrier. *Northwest Microfilm, Inc., Minneapolis, MN.*

Circle No. 133 on Inquiry Card

BRIEFCASE CRT

The Telecomputer II goes where you go. The terminal has a built-in acoustic coupler, 5" CRT, and RS-232 *and* current loop interfaces. It has 40/80-character switch-selectable line lengths, 15 switch-selectable baud rates, and 64-character ASCII code set. The unit can be plugged into any 115-volt outlet. Single quantity price for unit with acoustic coupler is $1795. *Digi-Log Systems, Inc., Horsham, PA.*

Circle No. 148 on Inquiry Card

PORTABLE KEYPUNCH

The Model 404 Vari-Punch captures source data on 80-column cards. It can be operated manually, or automatically when combined with the Series 600 Recording System. Automatically, it can print or punch with input from digital time clocks, and paper or plastic ID cards. The 404 can punch simultaneously up to three cards or forms bound together by a perforated stub. It has a 10-key numeric keyboard along with Space, Backspace, Hold, Tab, and Card Return keys. *Vari-Punch, Inc., Austin, TX.*

Circle No. 149 on Inquiry Card

A/D CONVERSION ON A CHIP

A series of single-chip CMOS A/D converters is available in 8, 10 or 12-bit configurations. The 8700 Series uses an integrating conversion technique called incremental charge balancing to achieve high linearity and monotonic performance. With this technique, the charge on the integrator's capacitor is continuously referenced rather than measured at the end of the cycle. Latched parallel binary outputs make the converter logically compatible with micro and mini processors. The 8700 Series outputs are not encoded and operate at standard logic levels. Prices start at $16 in quantities of 100. *Teledyne Semiconductor, Mountain View, CA.*

Circle No. 145 on Inquiry Card

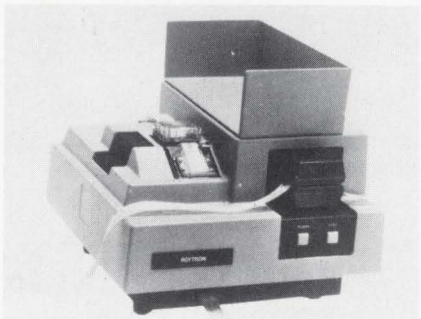
WANG-COMPATIBLE RECORDER

The 2181W accepts data from analytical instruments on a continual basis and stores it on a digital cassette for offline analysis. The recorder accepts parallel ASCII and serial RS-232C data at rates to 1200 baud, formats and buffers the data, and then writes it on a certified digital cassette. The cassettes may then be inserted into Wang Laboratories Computers, Series 2200B/C/T/S (with Option 22) and Series WCS-10/20/30 systems. Price is $1,695. *Memodyne Corp., Newton Upper Falls, MA.*

Circle No. 139 on Inquiry Card

PAPER TAPE READER/PUNCH

The Series 1560 is an asynchronous combination reader/punch desktop unit. It features an LED-type, 150-cps photoelectric reader housed with a 60-cps Roytron punch. Series 1560 will purnch and read metallized mylar, sandwich paper, color and standard 5,



6, 7 or 8-level paper tape in 1", 7/8" or 11/16" widths. $2000 with integral power supply. *Litton Automated Business Systems, Pine Brook, NJ.*

Circle No. 147 on Inquiry Card

RO TELEPRINTER

Extel's 30-cps RO Teleprinter is a microprocessor-controlled printer. The self-contained unit operates at a low sound level. Special features include built-in service diagnostics and a large selection of type including upper- and

lower case characters, expanded and bold-face type, and true underlining. Printing of an 8-1/2" original plus two copies is provided with a choice of standard teleprinter paper with ribbon, or with coated (ink-encapsulated) paper. *Extel Corp., Northbrook, IL.*

Circle No. 130 on Inquiry Card

FLOPPY DISK

The 142 double-density floppy disk drive records up to 802K bytes of unformatted data per diskette. Transfer rate is 500,000 bps and access time is 6 ms track-to-track. Features include a modified frequency modulation (MFM) selfclocking recording code and a new ceramic recording head. Single quantity OEM price is $650. *California Computer Products, Inc., Anaheim, CA.*

Circle No. 131 on Inquiry Card

HPT DISK

The Series 700 is a small head-per-track disk system with a capacity up to 19.2M bits. The average access time is 8.5 ms; the data rate is up to 4.5 MHz. It fits a standard 19-in. rack. Features include field-interchangeable head assemblies and a drive that slides out for easy top access. Price in quantity of 100 is $3985. *General Instrument Corp., Hawthorne, CA.*

Circle No. 126 on Inquiry Card

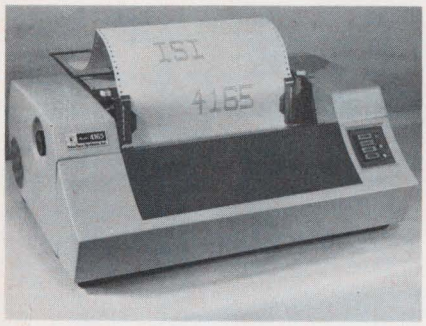
DATA ENCODER

The Model 86 encoder allows appropriately designed diskette drives to operate in a double capacity mode. The unit, which is a single printed circuit board, is easily connected to a diskette drive interface. It can be made logically transparent to the host unit, except for data capacity and throughput. A two-position siwtch allows the user to select single or double capacity operation. When placed in a single capacity position, the encoder is effectively bypassed; information to and from both the host unit and diskette drive is then double frequency encoded. In the double capacity mode, the Model 86 operates as a two-way translator. Communication to and from the host unit still takes place in double frequency encoding, but at twice the data rate. However, a group encoding format is used to and from the disk drive. *Orbis Systems, Inc., Costa Mesa, CA.*

Circle No. 142 on Inquiry Card

PRINTER FOR IBM 3270

The Model 4165 Printer is comparable to IBM 328X model printers for IBM 3270 display terminals. The 4165 prints at 165 characters per second and



has vertical forms control, a 9x7 dot matrix technique, and audible alarm. It is plug-to-plug compatible with 3271/3272 controllers. Price is $6,750. *Interface Systems, Ann Arbor, MI.*

Circle No. 141 on Inquiry Card

NEW 1100 SERIES PROCESSOR

With the 1100/10, Sperry Univac extends the capabilities of large-scale multiprocessing and multiprogramming to the medium-scale price segment. The 1100/10 is fully compatible with the entire 1100 large-scale family and can be connected to Sperry's TRACE center in Roseville, MN, for online diagnostics. Memory size ranges from one to four 131 Kword modules. *Sperry Univac, Blue Bell, PA.*

Circle No. 134 on Inquiry Card

FLOPPY DISK DRIVE

The RFD 7400E is a "universal" drive featuring media versatility, i.e., the drive will accept IBM-formatted soft-sectored diskettes and 32-hole hard-sectored disks in the same unit. The addition of a sector generator option allows the user to create his own hard-sectored format using IBM-compatible diskettes. Consequently, capacity is from 1.9M bits to 3.2M bits. Track-to-track access is 6 ms; average random seek is 176 ms. Other features are its own unit select decoding circuitry and multi-drive seek capability. Price is $650 in single quantity. *Remex, Santa Ana, CA.*

Circle No. 136 on Inquiry Card

CARTRIDGE RECORDER

The TDC 3000 digital cartridge recorder adapts the 3M tape cartridge to a built-up tape drive. All electronics are on three PC boards mounted on a

mother board. One formatter handles four recorders. Data transfers to and from the formatter can be either eight bits parallel or bit serial, buffered or unbuffered, depending on the I/O controller. Recording is 1600 bpi. *Tandberg, Berkeley, CA.*

Circle No. 143 on Inquiry Card

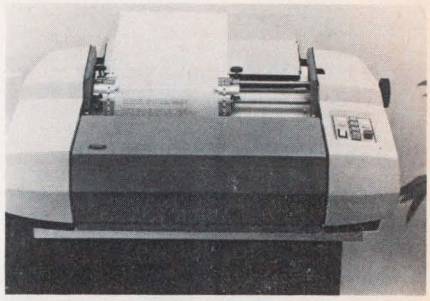
30-MB DISK SYSTEM

The 4091-N ten-platter, moving-head disk system is compatible with Data General, Digital Computer Control, and Keronix minicomputers. Storage capacity is 30M bytes with a recording density of 2200 bpi. Average random access time is 55 ms; data is recorded on 20 surfaces at 100 tracks per inch, 203 tracks per surface. Transfer data rate is 312K bytes per second; write frequency is 5 MHz ±0.3%. Storage media are IBM 2316-type disk packs which rotate at 2400 rpm. Price for the disk drive and controller is $9,995. *Datum, Inc., Anaheim, CA.*

Circle No. 132 on Inquiry Card

WORD PROCESSING PRINTER

The System 1222 Line Printer option to the Wang Word Processing System operates at 155 characters per second, equivalent to approximately 115 lines per minute with a standard 60-character line length. The print character resembles 10-pitch Roman type, with



spacing at 10 characters per inch, six lines per inch. The Line Printer option comes with an adjustable pin feed platen that accepts continuous form papers from 5 to 14.9 inches in width. The printer can produce up to four carbon copies along with the original document, and features an alarm to signal when paper is running out. Price is $6,600. *Wang Laboratories, Tewksbury, MA.*

Circle No. 125 on Inquiry Card

CRT DISPLAY UNIT

The 8277 Display Unit for A/N displays, graphics, and security systems is intended for use where 1000 line resolution and quality images are required. The OEM model consists of a monitor display, styled case, pedestal and power supply. *Computer Optics, Inc., Bethel, Connecticut.*

Circle No. 129 on Inquiry Card

TURNKEY SMALL BUSINESS SYSTEM

The BCC 80/340 system combines a complete range of standardized BCC business applications software and DEC's disk-oriented Datasystem 340 hardware. Applications packages include Accounts Receivable, Accounts Payable, General Ledger, Financial Reporting and Payroll. All generate master files compatible with DIBOL, DEC's high-level language. System 80/340 hardware includes a DEC PDP-8/E processor with 16K bytes of memory, expandable to 64K; two removable cartridge disk drives; a CRT; and a 165-cps printer. A complete BC 80/340 system sells for $29,900. *Business Controls Corp., Nutley, NJ.*

Circle No. 135 on Inquiry Card

new software & services

SOFTWARE EXCHANGE SERVICE

The Computer Software Exchange offers a proprietary service for the exchange of computer software. The Exchange accepts any and all sound software, communicates availability via a catalog, and provides complete distribution services for user requests. *Computer Software Exchange, San Francisco, CA.*

Circle No. 234 on Inquiry Card

INVESTMENT PACKAGE

INVEST is a collection of user-oriented financial utilities designed to perform basic investment analyses. Directed to insurance companies, banks, accounting firms, investment analysts, bond traders, portfolio managers, corporate accountants, and financial planners, the package will focus initially on three major areas of analyses: general flows, loan refinancing and bonds. The service is available on this company's nationwide timesharing network. *Informatics, Woodland Hills, CA.*

Circle No. 235 on Inquiry Card

A/R FOR PDP-10,11

Available in DEC COBOL, the Computerized Account Receivable Information System (CARIS) produces five outputs to automate checking,balancing, and invoicing functions. The outputs are register, open item balance, open item proof, age trial balance, and invoices. The user can enter data online or through cards. The system is available for DEC's PDP-10, 11/45 and 11/70. Price is $2,500. *RLD Associates, Los Gatos, CA.*

Circle No. 224 on Inquiry Card

PRINT UTILITY

MMISPU is a selective print utility designed for use on IBM 360 and 370 systems operated under DOS, DOS/VS, OS, or OS/VS. Primarily a debugging aid, this program will read QSAM, QISAM, and BDAM data sets and print out all records meeting any combination of the conditions Less Than, Equal, Greater Than, Not Less Than, Not Equal, and Not Greater Than connected by either And or Or statements. Up to 15 conditions may be specified at one time. Packed decimal, external decimal, hexadecimal, and character field types may all be read and printed on the same run. Price is $300. *MMI Software, Wichita, Kansas.*

Circle No. 206 on Inquiry Card

DG KEYED FILE SYSTEM

The Keyed File Access System (KFAS) is a library of subroutines which allows users of DG's Fortran IV to access RDOS files randomly, using alphanumeric strings to specify particular records. Through calls to KFAS routines, users can create keyed files in either random or sequential format, and can add and delete records without the need for sorting. KFAS allows up to 20 keyed files to be opened simultaneously, and provides protection for files accessed in a multitasking environment. The maximum allowed key length is 22 bytes, the maximum record size is 512 bytes, and the maximum file size is over 4 million bytes. Price is $700. *DPRS, Inc., Boston, MA.*

Circle No. 210 on Inquiry Card

ARITHMETIC SUBROUTINES FOR NOVA

MINI-LIB provides Nova users with Fortran-callable arithmetic subroutines. The BCD to binary conversion (BCDBI) inputs a 16-bit word containing four BDC digits and outputs a 16-bit binary value faster than a software multiply. Binary to BCD conversion, fixed point square root (SQRTF) and square root for floating point numbers (SQRT) are also included. Price is $625; subroutines may be purchased separately. *Cyber Associates Inc., Pittsburg, PA.*

Circle No. 236 on Inquiry Card

MINI LINEAR PROGRAMMING

The simplex linear program helps minicomputer and timesharing users allocate resources for capital investment analysis, production planning, media selection, and portfolio evaluation. The program allows for data changes during execution, making it possible to test many alternatives on a "what if" basis. Output from the system lists all variable data used, and the results of each run. Users may insert variable names, titles for constraining equations, and descriptions of the data entered for later review of the output. The application is written in Basic for modification between systems. It requires 12K of memory. Price is $185. *Reynolds Advertising, Decatur, IL.*

Circle No. 231 on Inquiry Card

WANG DISK MANAGERS

Two new versions of Wang Lab's KFAM (Keyed File Access Method) disk file management system, designated KFAM-2 and KFAM-3, support essential file access and maintenance functions, including interrogration of a file in random or sequential order, and addition or deletion of records to a file. All maintenance functions are handled through a system-supported "Key File" which uses an elaborate "B-tree" structure to access individual records. The Key File also facilitates housekeeping operations required when the file is updated. In addition to day-to-day file maintenance, the system also provides special routines for reorganizing and relocating keyed data files on the disk. KFAM-2 is designed to run on any Wang System 2200 series or WCS model which supports disk operations. KFAM-3 requires a system equipped with the Sort Instruction Set. Both KFAM-2 and KFAM-3 consist of a system disk or tape, and a manual which describes the architecture and explains the operating instructions for each program. The handling and processing fee for either version of KFAM is $100. A maintenance agreement is available for $200 annually. *Wang Laboratories, Inc., Tewksbury, MA.*

Circle No. 228 on Inquiry Card

COBOL CROSS REFERENCE

This program accepts a deck of COBOL statements, prepares a listing, and assigns line/card numbers. It then prints a table of file, data, index, and paragraph names used in the program in alphanumeric sequence. This table shows whether the symbolic name originated in the file, data, or procedure-division of the program. Undefined and unused words are flagged and all standard reserved words are recognized. Source decks are furnished. *Evansville Data Processing, Evansville, IN.*

Circle No. 223 on Inquiry Card.

new literature

EDUCATIONAL COMPUTERS

Minicomputers, systems and software for use in colleges and universities are discussed in this 12-page brochure. Sections are devoted to instructional applications, software packages, user services, administrative tasks, systems and networks. Each section in turn offers a complete listing of available H-P products and literature. *Hewlett-Packard, Palo Alto, CA.*

Circle No. 269 on Inquiry Card

VOICE RECOGNITION SYSTEMS

The concept and application of voice recognition systems are described in this ten-page brochure. Included are discussions of voice data entry, voice programming for numerical control, multiterminal systems and speaker verification. *Threshold Technology, Inc., Cinnaminson, NJ.*

Circle No. 257 on Inquiry Card

DAISYWHEEL PRINTER

This 8-page booklet, aimed at OEM system designers, explains why and how the Qume 45- and 55-cps "daisywheel" serial printers were developed. Described are proprietary features contributing to printer reliability and built-in service provisions. *Qume, Hayward, California.*

Circle No. 260 on Inquiry Card

DATA CODE CONVERSION CHART

The *Universal Code Chart* provides a cross index of Alphanumeric, hex, and octal for ASCII-8, ASCII-7, EBCDIC, EBCD, Field Data, 6-bit Transcode, Selectric and Baudot codes. The *Hex-to-Character Code Chart* provides an additional quick reference. *Atlantic Research Corp., Alexandria, VA.*

Circle No. 261 on Inquiry Card

MINI DATACENTER

This 12-page color brochure details timesharing, business and science/engineering applications of the HP 3000CX Mini DataCenter, which has an operating system that provides spooling, virtual memory, a communications subsystem, data base management software and concurrent access to multiple interactive terminals and batch devices. *Hewlett-Packard Co., Palo Alto, CA.*

Circle No. 272 on Inquiry Card

DISK CONVERSION GUIDE

"Disk Conversion: A New Approach" offers suggestions on how to simplify disk conversions and use the time saved to improve systems documentation, as well. The disk conversion method suggested in the 24-page booklet applies to a manual conversion as well as the automated approach made possible with the use of the company's software package DOSSIER. *Computer Concepts, Inc., Portland, OR.*

Circle No. 254 on Inquiry Card

NETWORK SOFTWARE

Brief descriptions of 29 computer software programs available through the CDC Cybernet data services network are described in this brochure. Included are programs for use in structural analysis, electrical/electronic engineering, nuclear fuel management and reactor operations monitoring, graphics design, project control, data base management and others. *Control Data Corp., Minneapolis, MN.*

Circle No. 263 on Inquiry Card

AUERBACH CATALOG

Features of the entire line of Auerbach Computer Technology Reports are described in this catalog, from the one, two and three-volume services on specialized areas of operations – such as minicomputers, software, input-output and others – to the complete 18-volume Auerbach Corporate EDP Library. Other subscriber services are also described. *Auerbach Publishers, Inc., Pennsauken, NJ.*

Circle No. 252 on Inquiry Card

PLUG-COMPATIBLE MEMORY

This 6-page brochure describes the design philosophy behind Dataram's new DR-100 memory and provides information on the specifications, features, configurations and options available. A review of the company's add-on/add-in mini memories is also included. *Dataram Corp., Cranbury, NJ.*

Circle No. 255 on Inquiry Card

DATA COMMUNICATIONS CATALOG

This 16-page catalog briefly describes the complete Codex product line, provides warranty information, and lists service and sales locations. *Codex Corp., Newton, MA.*

Circle No. 253 on Inquiry Card

MINI PROBLEMS

Twelve mini problems and their solutions are described in this 8-page brochure. Discussed are problems encountered by multiterminal users such as the "unoperating" system; upward compatibility; foreground, background and middleground; the language question; extending the software; data management; application software; I/O; the "glutted" MUX; speed; single source; and service. *Educational Data Systems, Irvine, CA.*

Circle No. 256 on Inquiry Card

CRT CATALOG

This 7-page catalog describes RO and KSR models available in six standard display sizes, outlining their characteristics in chart form. Special services for modification of standard terminals are also discussed. A variety of terminal configurations made possible through different case options are illustrated, showing the user the ways he can best match the terminal to his specific application. Block diagrams accompany many of the descriptions. *Ann Arbor Terminals, Ann Arbor, MI.*

Circle No. 262 on Inquiry Card

TELEPHONE LINE PROBLEMS

Of interest to 4800- and 9600-bps data network users, this brochure shows oscilloscope photos of transmitted data with various kinds of line distortion. It explains how users can identify typical line degradation problems such as amplitude and delay distortion, harmonic distortion, noise, and phase jitter. The ability to spot trends in line degradation is often the key to preventing line failures. *Intertel, Burlington, Massachusetts.*

Circle No. 258 on Inquiry Card

THERMAL PRINTING

This 12-page application guide discusses seven-column thermal printing using a full parallel BCD input. A timing diagram explains the operation of the input storage register and typical timing for a three-line-per-second application. Several detailed block diagrams and wiring diagrams illustrate how to connect a thermal printer to an autoranging digital panel meter and to a printing data logging/data acquisition system. *Datel Systems, Inc., Canton, MA.*

Circle No. 251 on Inquiry Card

Don't just wish you had.

Upgrade your skills now with the EDP Seminar Series.

In today's tight-fisted economy the pressure is on every data processing department to improve efficiency and cut costs. That's why *Computerworld* sponsors the EDP Seminar Series - to bring you the detailed information you need in a concentrated, practical form.

Each of our seminars is structured for immediate, practical application at your own installation. You'll gain a basic understanding of the material in lecture and review periods, and then you'll go on to apply what you've learned in the open book workshops. You'll be learning by doing in a shirtsleeve environment while you enjoy the interaction and interchange of experience with your peers. And you'll gain from the experience of the seminar leader, who will personally direct every phase of the course work.

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So put the Seminar Series to work for you. Whatever your specialty, they'll sharpen your skills - and show you the pitfalls to watch out for, so you can avoid making costly mistakes. They can benefit your installation, your organization - and you.

A list of current seminars is given below. To register for any seminar, or if you'd like more information, just check the appropriate box and send in the coupon.

How to Increase Programming Productivity

A 2-day seminar for technical managers on the state of the art of Software Engineering. Led by John W. Brackett, PhD, Vice President of SofTech, Inc., and Clement L. McGowan, PhD, Consultant. Fees: $300, including continental breakfasts, luncheons, and all course materials. $250 for additional registrants from the same company. Schedule:

New York	**Essex House**	**Jan. 26-27**
Chicago	**Hyatt Regency O'Hare**	**March 8-9**
Wash., D. C.	**Stouffer's National Center Inn**	**April 6-7**

Legal Tools for Computer Contracting and Protection

A 2-1/2 day seminar that shows you how to increase your advantage in dealing with vendors that supply your installation. Includes discussion and review of your own contracts. Led by Roy N. Freed, the nationally known lawyer, author and educator in the field of computer law. Fees: $325, including continental breakfasts, luncheons and all course materials. $275 for additional registrants from the same company. Schedule:

Wash., D.C.	**Marriot Crystal City**	**Feb. 4-6**
Orlando, Fla.	**Sheraton Towers**	**Feb. 18-20**
Seattle	**Airport Hilton**	**May 19-21**

Performance Evaluation and Improvement

A 2-day seminar on measurement techniques that are designed to save your installation money. Led by Saul Stimler, author of *Data Processing Systems: Their performance, evaluation, measurement and improvement.* Fees: $250 per registrant, including continental breakfasts, luncheons, and all course materials. Schedule:

San Francisco	**Dunfey's Royal Coach**	**Jan. 19-20**
New York	**Summit Hotel**	**Feb. 9-10**

Data Communications Course #1010 - Practical Data Communications Systems & Concepts

A 2-day seminar on the newest advances in data communications, including SDLC, DDS, new tariffs, equipment characteristics, and the impact of satellite carriers. Led by Dr. Dixon Doll, Teleprocessing consultant. Fees: $350, including continental breakfasts, luncheons, and workbook and reference materials. $300 for additional registrants from the same company. Schedule:

New York	**Essex House**	**Jan. 26-27**
Chicago	**Hyatt Regency O'Hare**	**Mar. 15-16**

Data Communications Course #1020 - Advanced Teleprocessing Systems & Concepts

A follow-up to course #1010, this 3-day seminar emphasizes techniques that minimize operating costs in commercial data communications networks. Also led by Dr. Dixon Doll. Fees: $450, including continental breakfasts, luncheons, and an extensive set of customized course materials. $400 for additional registrants from the same company. Schedule:

New York	**Essex House**	**Feb. 23-25**

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CIRCLE NO. 35 ON INQUIRY CARD

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