1957
DATAMATION®
77
1977

November
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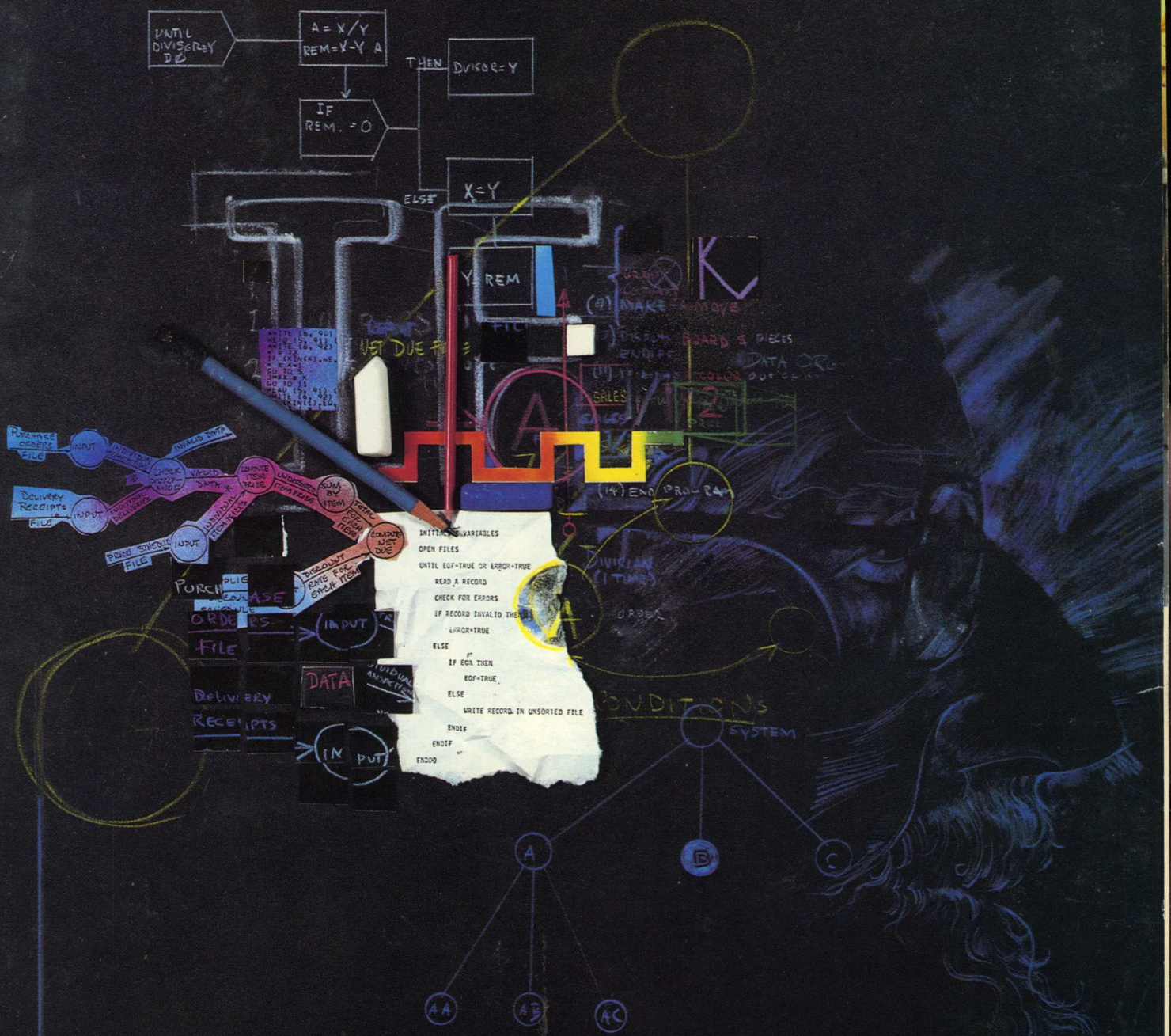


SYSTEMS ANALYSIS: THE PERSONAL SIDE

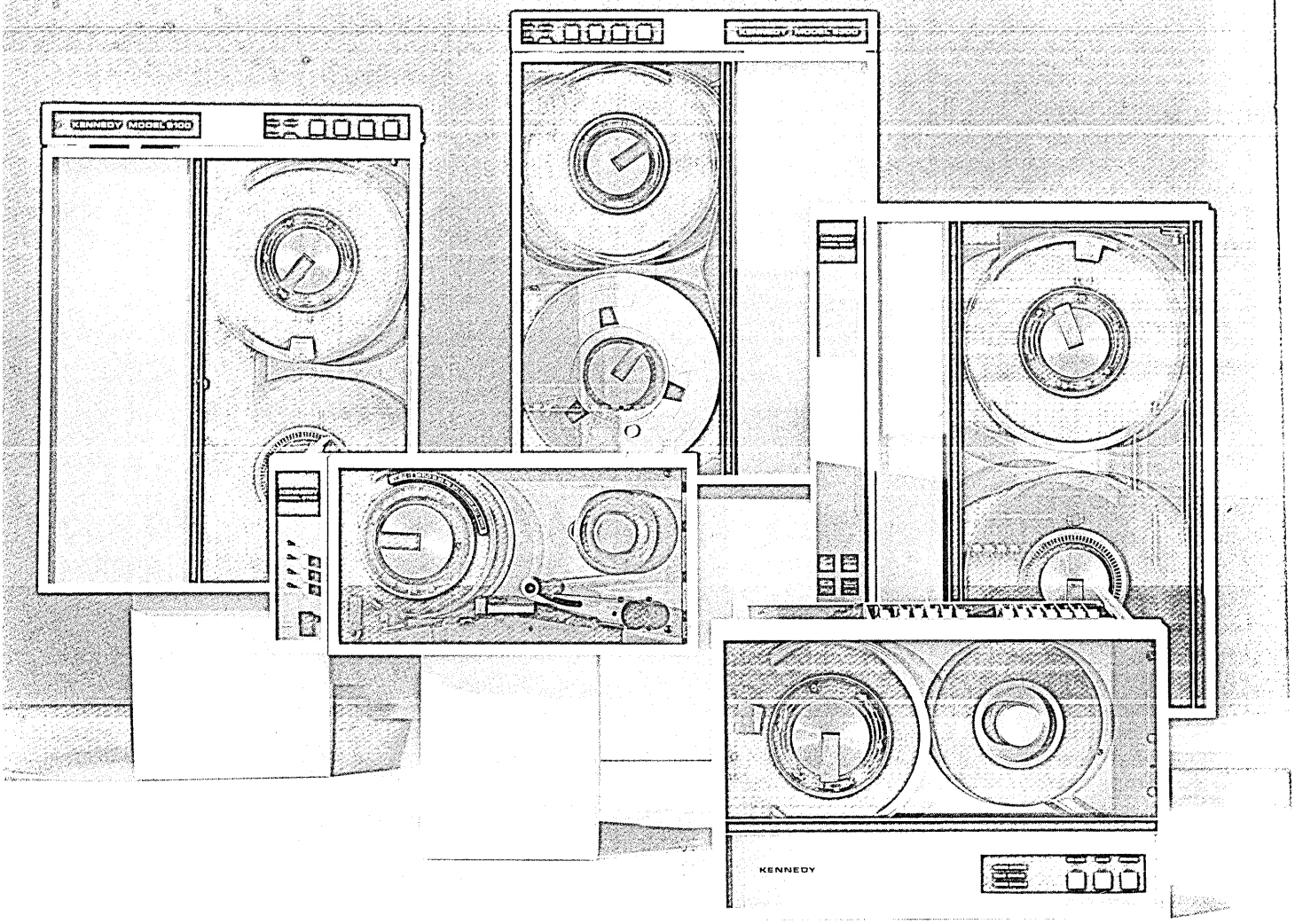
Also: DP salary survey, satellite business systems, and copyright questions . . .

The Class of '77

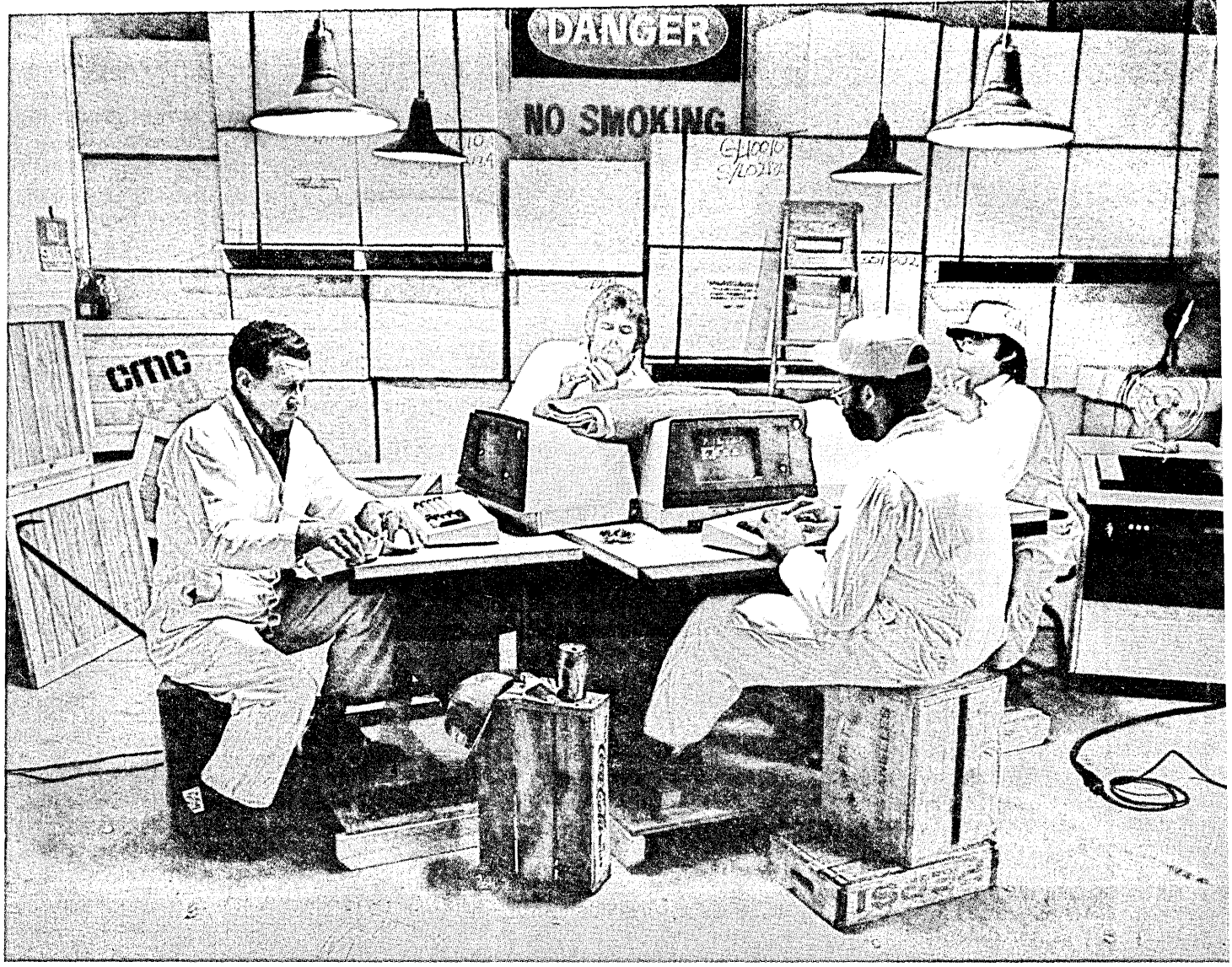
It's the Kennedy 9000 Series Digital Tape Transports—
the culmination of years of experience in defining,
designing and refining a product line. All Kennedy
Tape Transports possess features found in no other
line — features such as front accessible off-line
test panel, linear non-contact (Mag Pot) position
sensor, interchangeable electronics and capacitive
linear-loop sensing on our vacuum column machines.
Performance is equally impressive, with data
transfer rates to 200KHz and tape speeds to 125 ips.
But features and performance are only part of the story.
Kennedy products have always been designed and
built to be the finest in the field.
We call it class. So will you.

KENNEDY CO.

540 W. WOODBURY RD., ALTADENA, CALIF. 91001
(213) 798-0953



CIRCLE 1 ON READER CARD



You'd be surprised how well the XL40 performs... even in your most demanding applications.

The XL40 and you—a winning combination
The XL40 Distributed KeyProcessing® System is the solution you've dreamed about for your organization's distributed processing requirements. That's why we call it The DREAM Machine for Data Retrieval, Entry And Management—the vital components of effective distributed processing.

Distributed—for responsiveness at the source
Data quality improves—and costs are reduced—when information is managed by the people who know it best. The XL40 was designed to be operated by source department personnel, not highly specialized operators. And PCC's professional education program will smooth the transition even more. In fact, you may be **very** surprised at some of the converts to your XL40.

Turnkey—for instant productivity
It doesn't take magical machinations to get the XL40 up and running fast. Designed for simplicity, the XL40 combines modular hardware and flexible, COBOL-based software to enable your staff to go right to work when the system is installed.

Concurrent—for timesaving operations
In addition to putting processing muscle at the source, the XL40 operates concurrently. While operators are entering data, the XL40 can generate a report and communicate with your central computer at the same time. Files can be retrieved, accessed and updated from source departments, creating a real-time data base and providing up-to-the-minute information.

Reliable—Pertec Computer Corporation
The XL40 is manufactured, marketed and serviced by Pertec Computer Corporation, the world's leading independent manufacturer of computer peripheral equipment and producer of distributed processing and data entry systems, with over $100 million in revenues. And a reputation to boot.

Write to us today for more information about the XL40 Distributed KeyProcessing System—it's your ace in the hole.

PCC PERTEC COMPUTER CORPORATION

CMC Division
12910 Culver Boulevard, P.O. Box 92300
Los Angeles, California 90009
(213) 822-9914 TWX (910) 343-6451

CIRCLE 4 ON READER CARD

Getting and keeping timeshare business:

Remote computing services and batch service bureaus face a number of problems.

Problems which, if not solved, could mean the beginning of the end for most of them.

Maybe even your company.

Batch, but only batch.
There's no denying the demand for on-line services. (Look how some of the remote computing services have prospered.)

So there's the problem of adding a timeshare capability. At low cost, so you can offer a low-cost service. But with the capability to grow with your business.

There's the problem of security for proprietary software and data. The problem of delegating control of system resources, without losing overall control. The problem of accounting for system use—especially use of added-value software. And the problem of knowing what is happening anywhere in the system, at any time.

Solving these problems could make you successful in timeshare as well as batch.

Remote, but losing business.
For remote computing services, keeping customers is often the biggest problem.

After a time, many customers begin to feel they're putting out too much money for your service. They check out your competitors. Or think about an in-house system.

Finding a way to extend your services downward in cost could turn your biggest problems into even better customers.

Small, or just starting out.
You may already have a small timesharing company. Or you're planning to start one. Your first problem is finding a computer you can afford. One that's also a real timesharing computer. With the management features the big timeshare computers offer.

Solving this problem could make your small company a big success.

Problems solved here.
These problems you're facing in your firm, timeshare or batch, large or small, can be solved with the computer made by us:

Basic Timesharing, Inc. We're the computer manufacturer with timeshare experience. We understand the unique problems of your business.

And that's what has helped us produce a computer so uniquely right for the timesharing business.

The BTI 4000 Interactive Timesharing System.

A remote computer's computer.
The BTI 4000 was built from the drawing board up for timesharing. To maximize operational capabilities. To minimize operating costs. To give you more.

You can start for just $35,950. For that you get a ready-to-go system with 10 megabytes of storage and 8 ports—just add terminals.

You also get BASIC-X, an unusually powerful extension of the BASIC user language, enhanced for business programming.

You get hierarchal account organization, allowing you to "sublet" portions of the system. Which lets you earn income without overhead, while still maintaining total control.

You get protection for your proprietary software that allows *you* to sell systems with your software on them—and still keep your software proprietary.

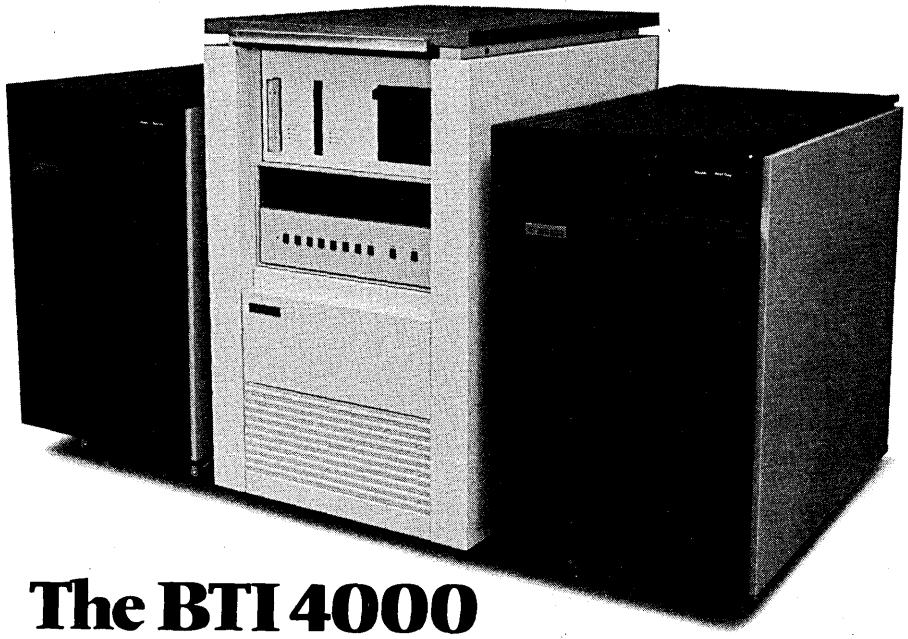
You get continuous system availability, because software housekeeping can be performed with users on-line.

You get room to grow, because the BTI 4000 is a modularly-expandable system. Add disk storage to 400 megabytes; expand user capacity to 32 ports; add peripherals like industry-compatible magnetic tape and a line printer.

And you get around-the-clock, on-line support for all your systems, no matter where they're installed.

The BTI 4000. To help you get more timeshare business, and keep the business you have.

Get the complete details today.



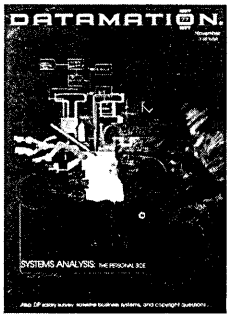
The BTI 4000 Means Business.

Basic Timesharing Inc., 870 W. Maude Ave., Sunnyvale, CA 94086. Sales Offices: East: Cherry Hill, NJ (609) 662-1122; Midwest: Minneapolis, MN (612) 854-1122, Chicago, IL (312) 298-1177; South: Dallas, TX (214) 630-2431; West: Sunnyvale, CA (408) 733-1122, Anaheim, CA (714) 533-7161

DATAMATION®
1957 77 1977

VOLUME 23 NUMBER 11 This issue 134,109 copies NOVEMBER 1977

FEATURES



NEWS IN PERSPECTIVE

DEPARTMENTS

About the cover
The analyst behind the system emerges. The problems, politics, frustrations, and triumphs are all part of a collage of the tools of the trade. Our design is by Bill Robles: Joan Lesser/Etcetera.

DATAMATION.

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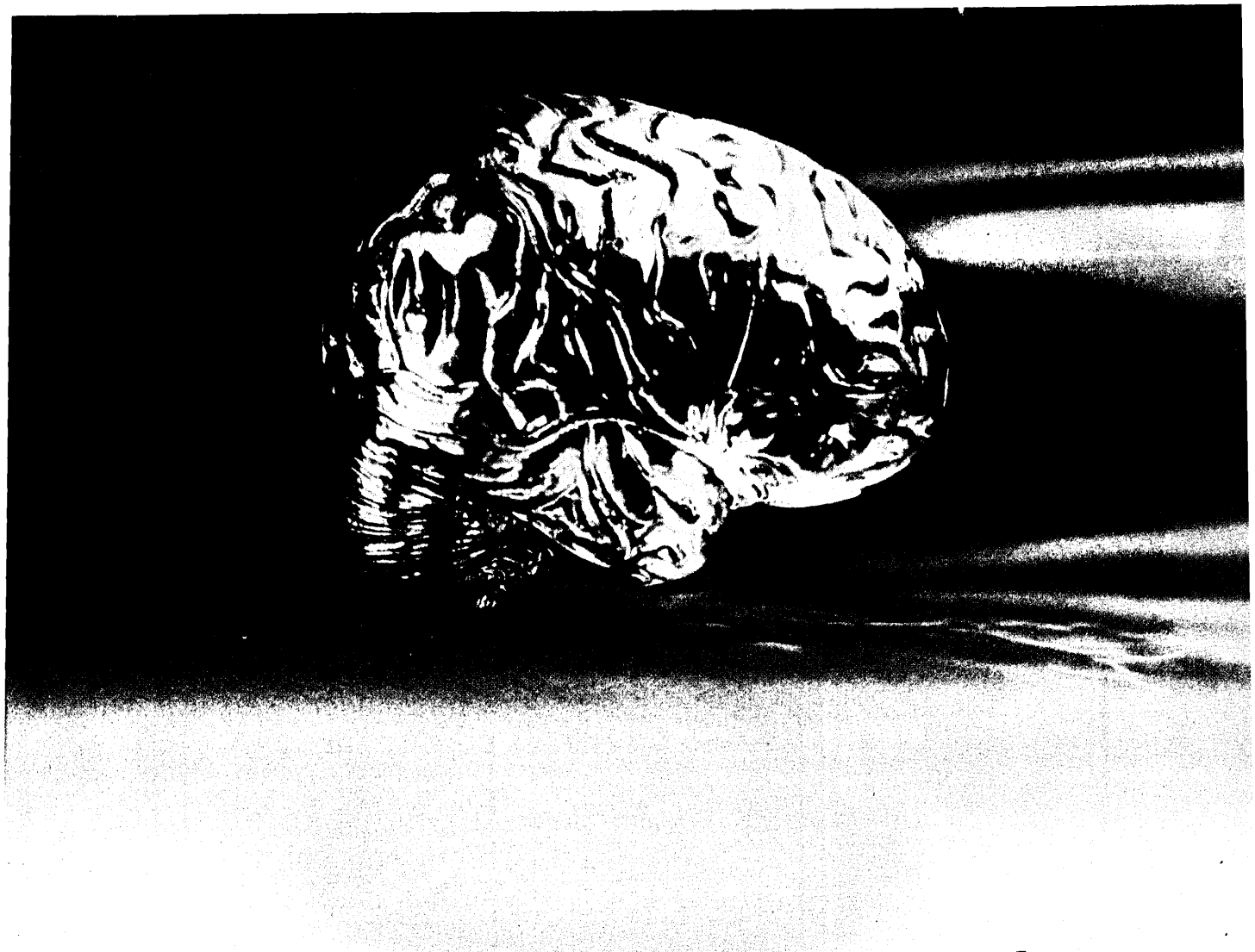
BPA Circulation audited by Business Publications Audit

ABP Member American Business Press, Inc.

DATAMATION is published monthly on or about the first day of every month by Technical Publishing Company, 1301 South Grove Ave., Barrington, Illinois 60010; Arthur L. Rice, Jr., Chairman of the Board; James B. Tafel, President; Gardner F. Landon, Executive Vice President. Executive and Advertising offices, 35 Mason Street, Greenwich, CT 06830, (203) 661-5400. Editorial offices, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. Published at Chicago, Ill. DATAMATION is circulated without charge by name and title to certain qualified individuals in the United States and Canada who are employed by companies involved with automatic information handling equipment. Available to others by subscription at the rate of $24. Reduced rate for qualified students, $14. Foreign subscriptions $42.50, or £25.00; for airmail, additional charge $40, or £23.75. Japan and Australia $60, or £34.50 (air shipped). Sole agent for all subscriptions outside the U.S.A. and Canada is J. B. Tratsart, Ltd. 154 A Greenford Road, Harrow, Middlesex HA13QT, England. No subscription agency is authorized by us to solicit or take orders for subscriptions. Controlled circulations paid at Columbus, OH.

Microfilm copies of DATAMATION may be obtained from University Microfilms, A Xerox Company, 300 No. Zeeb Road, Ann Arbor, Michigan 48106. Printed by Beslow Associates, Inc. Circulation Office: 34 East Putnam Avenue, Greenwich, CT 06830. POSTMASTER: Form 3579 to be sent to Technical Publishing Company, P.O. Box 2000, Greenwich, CT 06830.

Publication Number: 148800. Single copy: $3.00 in U.S.A.



Introducing the MAS-80 family.

The brains for your manufacturing systems.

When you need advanced software for manufacturing application systems, our new MAS-80 family can cover you through the 1980's.

MAS-80 combines the best features and proven experience gained from our original Modular Application Systems (MAS)—over 600 modules successfully installed—with entirely new capabilities. So you can benefit, now, from today's . . . and tomorrow's . . . technology.

Six basic systems form MAS-80's core. Engineering control. Inventory control. Production control. Financial planning. Distribution order entry. Business planning. These systems in turn are comprised of 20 individually purchasable elements (system modules).

So, MAS-80 is designed to serve all of your company's operating requirements.

But there's more. MAS-80 utilizes the latest in data base management technology; plus, MAS-80 family members have been designed to run on mainframes or minicomputers via on-line or batch processing. And to do so in the most cost-effective way.

In fact, MAS-80's users have a wide choice of Data Base Management Systems (DBMS). Each user is provided a unique data base access module to interface with his DBMS (such as IMS or TOTAL or IDMS or ADABAS, etc.). No alteration in data base handling logic is required.

MAS-80 will configure to your total manufacturing environment, both functionally and technically, without any loss of efficiency. This is only possible because MAS-80 is designed to be flexible, while providing a wide choice of options which you control.

The first member of the MAS-80 family is MAS II. You can plan your MAS II installation now, for implementation first quarter 1978. Because engineering control, inventory control, master scheduling, and forecasting, along with full MAS-80 data base capability, are ready to go.

But this is just the beginning. MAS-80 is already growing more versatile.

Coming in 1978 will be additional application systems for MAS II. At the same time, additional family members will be introduced . . . covering on-line processing for both minicomputers and mainframes.

To find out more about MAS-80, the answer to your manufacturing application systems requirements, write for our free MAS-80 brochure.

Or, if that isn't fast enough, call Dick Nemerson at MMDS headquarters . . . (301) 321-5744. He can give you the answers—and then some.

Martin Marietta Data Systems

We Build & Run Systems

300 East Joppa Road, Baltimore, Maryland 21204

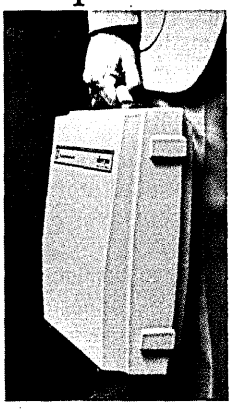
CIRCLE 23 ON READER CARD

TI's new portable means remote

Until now, remote order entry meant expensive on-line operation with a computer via a telephone line.

But TI has changed all that.

The new *Silent 700** Model 765 Portable Memory Terminal has built-in bubble memory. So it can remember, even when the power is off, while it waits to talk to your computer.



With the 765 you can enter sales and order information all day long using the typewriter-like keyboard.

Then you can edit when you have time. The 765's powerful, yet easy-to-use text-editing functions let you add, delete, locate, and correct data on the spot. So you can transmit more accurate data when the phone rates are lower. At a fast 30 characters-per-second.

Traveling companion.

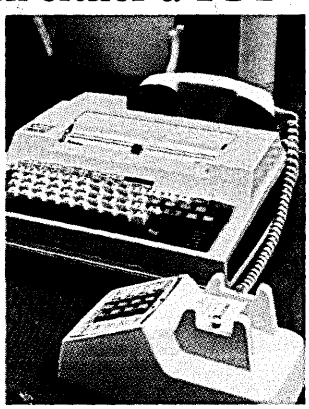
Lightweight portability is the key to convenient field use. And at 17 pounds, the 765 is really compact.

But it's no lightweight when it comes to features. With its built-in numeric cluster, keyboard with upper and lower case characters, quiet 30-cps printer, and acoustic coupler for telephone connection, the 765 is a heavy-duty operator.

And the 765 gives you plenty of storage space. The basic terminal comes with 20K bytes of memory. And it can be expanded to 80K bytes—the equivalent of up to 20 fully typed pages.

memory terminal order entry.

Office companion.
Many people want a terminal with the features of the 765 for applications where portability is not required. So we designed the Model 763. A table-top version of the 765, the 763 has the same performance capabilities in a compact unit, and comes standard with either a TTY current loop or EIA interface instead of the acoustic coupler.



Small price for remembering.
TI's new Model 765 Portable Memory Terminal is priced at only $2,995.† Additional 20K increments of bubble memory are $500† each.

And, the table-top Model 763 at $2,695† is another price/performance leader. Of course, quantity discounts and a complete range of lease programs are available.

TI terminals mean business.
Ask TI how the new *Silent 700* Memory Terminals can help your business. Return this coupon today for more information. Or call Terminal Equipment Marketing at (713) 494-5115, extension 3286.

TEXAS INSTRUMENTS
INCORPORATED

Yes! I am interested in the 765/763. **SILENT 700**
☐ Please have your representative call.
☐ Please send me more information. ☐ 765 ☐ 763

Name _____
Title _____
Company _____
Phone _____
Address _____
City _____ State _____ Zip _____

Mail to: Texas Instruments Incorporated, P.O. Box 1444, M/S 784, Houston, Texas 77001 13-11-DM

*Trademark of Texas Instruments
†Qty. 1, U.S. Domestic Price

TEXAS INSTRUMENTS

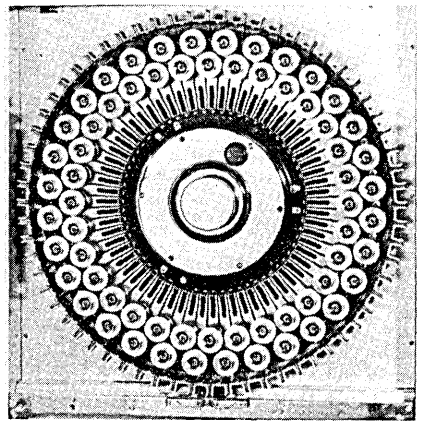
Looking Back in DATAMATION®

On our 20th anniversary

November/December 1958

Technology: "The words *large memory* imply, for me, a store of at least a million alphanumeric-coded, machine-readable characters," said IBM's Dr. Morton M. Astrahan in his article, "The Role of Large Memory in Scientific Communications."

Hardware: Although this looks like the business end of one of the meanest Gattling guns we've ever seen, it's ac-



tually a 3.1MB mass storage device. The ECM-64 FACIT contained 64 randomly selectable tape cartridges on its carousel.

Conferences: The majority of this issue previewed the eighth annual Eastern Joint Computer Conference. "What is the status of the transistors, cryotrons, thin-film memories, and other devices?" and "Are we teaching computers to learn?" were among the questions for which the conference chairman promised answers.

This issue also carried a note that about 200 members of the Bendix G-15 Users Exchange Organization met in Chicago during September.

November 1967

General overview: The space age was in full bloom, and roughly half of this issue dealt with computers in aerospace. Time-sharing, touted as a tool for increasing programmer productivity, received a critical look in "Time-Sharing Tally Sheet," subtitled, "It's Harder Than It Looked."

Protecting programs: In an article on legal protection of computer programs, Allen W. Puckett opined, "Under current law a combination of limited copyright protection, trade secret protection, and contractual agreements," suited the software industry better than patents. ❋

Give us 3 minutes

and we'll show you how to cure your 2501 headache

We're that sure of our new 6501 Buffered Card Reader. Call us and we'll tell you more about how:

- The buffered DOC 6501 can be installed on ANY position on the channel and puts an end to channel OVERRUNS.
- The buffered DOC 6501 gently handles and increases the life of repetitively read card decks.
- The buffered DOC 6501 saves you 25% or more than a 2501.
- The buffered 6501 can be purchased or leased NOW.

If you aren't convinced in three minutes, we'll send you some buffered aspirin. With an unbuffered 2501 you'll probably need it.

Call John Sterling at (800) 327-6424 or (305) 724-1111.

DOCUMATION
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Or call, Atlanta, GA (404) 955-0309; Boston, MA (617) 890-2650; Chicago, IL (312) 782-0551; Dallas, TX (214) 661-9902; Detroit, MI (313) 353-8181; Greenwich, CT (203) 869-4123; Hartford, CT(203) 278-2010; Houston, TX (713) 780-1432; Los Angeles, CA (714) 752-8782; Miami, FL (305) 592-9655; New York, NY (212) 695-4195; Oakbrook, IL (312) 920-0551; Philadelphia, PA(215) 574-0950; San Francisco, CA (415) 574-4060; Washington, DC (703) 356-2050. **International Offices:** London — Staines 61124; Paris 686 8207; Toronto (416) 622-8720; Germany 06 11/728 128; Spain 416 87 60.

CIRCLE 45 ON READER CARD

The voice of experience in audio response terminals and modems.

Now hear this.

Audioport 160.®
The portable alphanumeric audio terminal with built-in speakers.

CIRCLE 61 ON READER CARD

Audioport 012/016.
New models, perfect for field data entry.

CIRCLE 62 ON READER CARD

Audioport 116.
The portable numeric terminal with built-in speaker.

CIRCLE 63 ON READER CARD

Audioport 400.
Multiple modem pack holds up to 12 modems in the space of a single 403 E or two 401 J modems. Low cost Audioport 400 pays out against telephone company rental in 12–18 months. It's the space-saving, cost-saving interface for Transcom terminals, push-button phones and other portable pads.

CIRCLE 64 ON READER CARD

Transcom is the single source for a full line of audio terminals and modems. Transcom products enjoy wide acceptance after a decade in this still-new field. For order or data entry: from auto and tractor parts distributors, from beverage, food and drug distributors.

For inquiry/response: from banks, transportation and insurance companies.

Names on request. Customers will tell you our product support measures right up to the products.

Write or call Transcom, a Subsidiary of Hi-G, Incorporated, 580 Spring Street, Windsor Locks, Connecticut 06096 (203) 623-2481.

TRANSCOM
A Subsidiary of Hi-G, Inc.

CIRCLE 65 ON READER CARD

The impact of privacy laws on personal information records. And what to do about it.

Few legislative acts will exert greater pressure on your information management facilities than current and proposed privacy protection laws.

Designed to protect you, your employees and others, these far-reaching laws will demand cost-effective control of the collection, maintenance, and dissemination of an increasing variety of personal information.

This will include the control of source documents now stored in *conventional paper files,* as well as the control of your computerized personal data files.

System 200™ by A.B. Dick/Scott is an advanced, updatable micrographic record processing system that can provide the cost-efficient controls needed to satisfy three basic objectives of privacy laws:

1. Ready access to information.

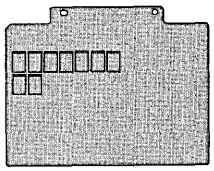
Under privacy protection statutes, it will be necessary to provide individuals having a need or right to personal information with ready access to their records.

You also will be required to furnish authorized individuals with a copy of pertinent information for their reference and use.

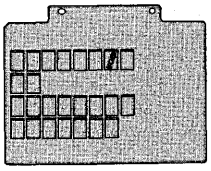
System 200 can help you satisfy both of these requirements by permitting ready access to individual records as well as providing suitable file copies without undue effort or expense on your part.

2. Protection against unauthorized access.

Privacy laws will also require recordholders to *safeguard* source documents against privacy invasions thus assuring complete security and confidentiality.



A single piece of 4" x 6" File Film accommodates 60 legal size or 98 letter size documents. Images can be recorded or updated in just 8 seconds.



File Film has an add-on capacity and prior recorded documents can be amended or voided to reflect specific changes.

System 200 can fulfill this requirement with built-in storage and referral controls that make it a highly effective yet completely practical "security screen."

All records related to an individual file are imaged on a master File Film which never leaves the central file area.

3. Accurate, up-to-date information.

A further requirement of privacy laws will involve the continuous need to control the *quality* of information subject to referral by authorized individuals.

This means the maintenance of accurate, up-to-date records which can be readily amended, voided or annotated for reliable audit trails or compliance with legal requirements.

System 200 is a completely *updatable* system already being used to maintain accurate, up-to-date personnel, medical, credit, law enforcement, insurance, and tax records in both the public and private sectors. To date over 30 million records have been imaged and stored on System 200 File Film.

Free brochure contains vital information.

Personal Information Records Management With System 200 covers a variety of record management subjects related to privacy protection laws, including file integrity, audit trails, and various legal requirements. Send for your free copy now. A.B. Dick/Scott, South Hadley, MA 01075. Telephone (413) 538-7550.
A.B. Dick/Scott is a joint enterprise of A.B. Dick Company and Scott Graphics, Inc., A Subsidiary of Scott Paper Company.

A.B.DICK/SCOTT

CIRCLE 31 ON READER CARD

Intelligence enters the Now big-screen graphics in better time.

The 4014-1 Computer Display Terminal has just added time-saving local control. Now you can put local graphics intelligence to work on the 4014-1's 12 million viewable points. You can decrease transmission delays and time-sharing costs, while increasing throughput dramatically.

You can easily cut data transmission and computer time in half. Save graphics, symbols and alphanumerics for instant recall. Display 28K of graphics with one keystroke. Develop your own symbols and character sets locally. Program any key or keys to contain picture segments, interactive menus, nested design symbols, or local commands.

Design. Map. Plot preview. With the depth of detail you need for sophisticated graphic applications. With new capabilities like local dragging, scaling and rotation of locally refreshed symbols.

The 4014-1's built-in bus structure allows easy add-on of enhancements and peripherals. Like our own hard copiers. Plotters. Graphic tablets and storage devices.

Complete the picture with our Plot 10 family of graphic software. With easy interfacing and excellent after-sale service. We're there when you need us. So call your local Tektronix Sales Engineer soon. Have him show you how our newly-enhanced 4014-1 can mean a world of difference to your workload.

Or write:
Tektronix, Inc.
Information Display Group
P.O. Box 500
Beaverton, Oregon 97077

Tektronix Datatek NV
P.O. Box 159
Badhoevedorp
The Netherlands

Display courtesy of Dr. Eric Teicholz
Laboratory for Computer Graphics and
Spatial Analysis Harvard University

Get the 4014-1. Get the master of detail.

Tektronix®
COMMITTED TO EXCELLENCE

CIRCLE 86 ON READER CARD

picture: does bigger jobs

Commercial ECLIPSE Systems. Because a computer should be a vehicle for growth.

For most companies, buying a computer is a big step forward. So you want to be sure the computer you invest in will keep rolling with your company. That's why you want a Data General commercial ECLIPSE data processing system.

Our systems can be expanded in several directions at any time. For instance, as your transaction volume grows, you could move from two to eight, sixteen or more terminals. And as your files and records expand, you could add disc capacity from 10 megabytes and grow to over 1500 megabytes. And with our powerful communications capabilities, system configurations can range all the way up to a multiprocessor network with distributed processors as more applications are added.

Plus our commercial ECLIPSE data processing systems also work easily with larger commercial computers. They use the same high level ANSI '74 COBOL larger systems use, the same language your staff is already used to. So, even if you start with our smallest configuration, you're really beginning farther up the ladder than with any other small computer system.

Data General commercial ECLIPSE systems. They can take the pain out of growing. Now put your future on the line and send for our booklet.

☐ Send me your commercial ECLIPSE brochure, "Smart answers to your data system demands."
☐ Send your brochure and have your sales representative call.
Mail to: Data General, Westboro, MA 01581

Name
Title
Company
Address Tel.
City State Zip

Data General, Westboro, MA 01581, (617) 366-8911. Data General (Canada) Ltd., Ontario. Data General Europe, 15 Rue Le Sueur, Paris 75116, France, 50-006-06. Data General Australia, Melbourne (03) 82-1361.

DM11

Data General
It's smart business.

CIRCLE 48 ON READER CARD

LOOK AHEAD

FAMILY EXPANSION PLANNED BY HONEYWELL

Honeywell has a basketful of goodies to add to its level 6 minicomputer family early next year, including two new cpu's, a new top, and a new bottom for the line. New topper will be the 6/46, faster and more powerful than the 6/36 and the 6/43. Low end will be the 6/20, aimed primarily at data entry applications and considerably smaller than the current low-end level 6 machine, the 6/30. Honeywell's basket also will include new options for the 6/43 and the 6/36 including a Cobol instruction procedure; writeable control storage which permits definition of instructions; read only memory; and an intersystem link (level 6 to another level 6) for building up multiprocessing capability.

SNEAKING IN BUBBLE MEMORIES AT THE LOW END

IBM's eagerly awaited bubble memory introduction may come in the spring of 1978 when the colossus offers its System/36 and System/38, upgrades of its System/34. One of these systems, it's understood, will have a large fixed disc with the bubble memory. It's always seemed likely that IBM would launch its bubble memory on new machines rather than on existing machines and at the low to medium end of its models.

System/36, like the 34 before it, is aimed at replacing System/3s eventually. The 36 will be pitched at the System/3 model 12 level, whereas System/34 initially was concerned with plugging the ugly hole left by the poor performance of the model 4.

And there also is talk that IBM is developing a line of products that will bridge the System/3 and 370 levels. Called the E-Series (sometimes referred to as System/4), its top end could be as powerful as the 370/135 and 145. And that means that both the General Systems Div. and the Data Processing Div. would be locked in competition to offer replacements for these mainframes. That lends support to the talk that DPD constantly mutters that GSD is their toughest competitor.

ANOTHER JAPANESE COMPETITOR IN THE U.S. MARKET?

A major Japanese computer company which hopes to enter the U.S. market currently is negotiating with OPM Leasing to represent it over here. The company, which manufactures IBM plug-compatible systems in the 148 to 158 range, is looking for a U.S. leasing firm to represent it on the marketing side. The agreement, if it works out, would be similar to that between Itel and Hitachi, sources say.

THE LATEST IN ELECTRONIC MAIL

Innovative TDX Systems, Inc., has found a unique way of hopping on board the electronic mail bandwagon. The Vienna, Va., company, which peddles a telecommunications service based on shared use of least-cost routing gear, has set up a new company, Digital Broadcasting Corp., to use FM radio stations to send electronic mail messages. TDX' digital broadcasting approach to electronic mail transmission is previewed in the Yankee Group's latest electronic mail report due out in December.

Under this ingenious setup Digital Broadcasting will get channel authorization from 50 commercial FM stations throughout the U.S. At each station, it will install and interface its computer-controlled digital encoding devices to the FM transmitters which will then be able to broadcast digital computer data. Systems access will be through Telenet's packet network or in-wats. System pluses include cheap transmission costs (as low as 2 1/2 cents per page for a group address), low error rates (less than one in 10^6 characters), and the elimination of modems, local loops, and data access arrangements (DAA's). Targeted markets for the novel new service are businesses needing an intracompany communications capability.

DEC's 32-BIT ENDORSEMENT: IS DATA GENERAL FAR BEHIND?

Now that Digital Equipment Corp. has entered the 32-bit market with the introduction of its VAX-11/780 multiuser system, look for other firms--notably Data General--to come up with 32-bit machines. DEC will begin deliveries early in 1978. Data General is expected to offer its version within one to six months and competitors see the Data General offering as a teeth-baring, low priced offering that would undercut DEC's "nonpredatory" pricing structure in the $200K to $300K range.

But other companies which traditionally have committed to 32-bit architecture are pleased that the architecture has gained broader acceptance, although they're not necessarily applauding additional competition. "We feel it (DEC's announcement)

endorses the market," a Systems Engineering Laboratories (SEL) spokesman said. "It will make competition keener, but should help those companies which are already in the market and have the software to go with the 32-bit architecture."

MORE THAN ONE ROUTE TO INTERSTATE BANKING

While lawmakers succumb to bank pressures to restrict EFT experiments toward the end of limiting interstate banking activities, prestigious Citibank of New York may have found a more effective route. Citibank's consumer finance subsidiary, Citibank Person-to-Person, unfettered by the regulations constricting its parent, has been active in making loans in Phoenix, New Orleans, Denver, and St. Louis for several months now, and last month moved into San Diego, Calif. And in Denver it has added industrial finance capability, which almost gets into commercial banking. Next step nationwide EFT? California's banks are worried.

CABINET LEVEL PRIVACY GROUP TO BE FORMED

The much belabored privacy issue once again has moved back into the spotlight in Washington. The White House, apparently at the urging of the high powered National Security Council, is reportedly preparing to set up a new cabinet committee on the sensitive subject. Focusing on the currently hot international topic of transborder data flow, the high-level committee also will zero in on other sticky information policy questions related to privacy. Heading up the presidential privacy pow-wow will be key Carter cabinet officials.

ANOTHER SKIRMISH WON IN TAX FIGHT

Robert M. Sherin, who has been waging a multifront campaign against the imposition of sales taxes on software and services, has won a minor victory in Tennessee. A judge in the Middle District of Tennessee denied Sherin's motion for a summary judgment against the state in the Floridian's class action charging the state violated the 14th amendment to the U.S. Constitution when it passed a law taxing software in spite of a state Supreme Court decision calling software intangible and therefore, non-taxable. The Middle Court judge did grant Sherin legal standing to sue the state and passed the issue up to the Sixth Appellate Court. The next step, said Sherin, is the Supreme Court. "I think we'll win."

CALIFORNIA'S TEALE CENTER TO TRY PROCUREMENT AGAIN...PEACEFULLY

The state of California's Teale Data Center, object of a three-year-long, $40 million procurement controversy when it was established (March 1974, p. 122) as the state's first consolidated center, is out to procure again. In the long, drawn-out original procurement battle, IBM and Univac were the principal protagonists, but Univac won't figure in this time.

"We're at the end of the line with what we have now (two IBM 168s)," said center director Ira Isbell, "and the upgrade has to be an IBM solution." This limits the possibilities to IBM itself, the Amdahl Corp., and third party suppliers of 168s (Teale will keep the two it has). Isbell wants a solution that will serve the state for at least four more years. The Teale center, originally slated to serve 34 state agencies, currently is serving what Isbell calls "69 state entities" but not the Dept. of Motor Vehicles, whose conversion was a pivotal point in the original procurement. DMV is still with Univac. Hopefully, Teale's new procurement won't be as stormy or as long as its first.

BELL'S DATA NETWORK READY BY 1979

AT&T's grandiose plans for its Bell Data Network (BDN) are moving right along, but not as fast as the mighty communications giant had anticipated. According to a source privy to a recent AT&T internal briefing, the aborning network is now scheduled to be ready by 1979, with Illinois Bell to be the first operating company to offer it. Another big operating arm, New York Telephone, also has been running internal prototype system tests for the last several months.

The BDN setup initially will consist of two different systems--one, dubbed BDN which will use Bell's home-grown equipment, and another system called BANCS which will run off outside mainframes. Both systems will run concurrently until BANCS is gradually phased out in favor of the pure BDN with all Bell-supplied gear.

(Continued on page 196)

"We purchased a General Ledger accounting system from a major vendor. After investigating, we found that we were going to have to drastically change the Cobol programs in order to generate all the required reports.

"Rather than this, we concluded that it would be far better to start from scratch and use MARK IV/Reporter for the 75 to 100 daily, weekly, monthly and year-end accounting reports that we produce. We made the right decision. If we had tried to modify the Cobol report writer that came with the system, it would have taken us at least two months longer to complete the project.

"MARK IV/Reporter was installed on our 370/145 within a few hours. The four people who attended a basic MARK IV/Reporter class were using it comfortably within a week. We also have a competent Cobol programmer who took the MARK IV® manuals home and read them over a weekend. He started using MARK IV/Reporter the next Monday morning.

"It runs very efficiently and it's helped increase the productivity of our systems and programming staff. With the confidence we've gained in MARK IV/Reporter we can commit to new projects now that would have been impossible before. We'll be using it for 50% of our new work, which includes a new student records information system. MARK IV/Reporter will be a key part of this new system. "As for Informatics Support, our staff here is very impressed; their people have been extremely competent and the systems engineering support has been excellent."

WHAT IS MARK IV/REPORTER? MARK IV/Reporter is an information processing system which handles all reporting requirements for existing file and/or data base systems. Although extremely flexible and powerful, the system allows non-programmers to produce error-free reports in a fraction of the time required with conventional programming methods. MARK IV/Reporter can be installed and implemented in the U.S. and Canada for as little as $306.00 a month. MARK IV/Reporter is upward-compatible to MARK IV whose 1,300 installations worldwide make it one of the most successful software products of all time.

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The acquisition of Mark IV was made possible by a grant of the University of Kansas Endowment Association. Mr. Magnuson oversees administrative DP activities for the Lawrence campus. The views expressed are those of Director Jerry Magnuson and not necessarily those of the University of Kansas.

CIRCLE 17 ON READER CARD

Beckman Instruments had an idea that called for developing a new order service system within 90 days.

When a typical customer order consists of hundreds, or even thousands of precision components, an automated order service system becomes a key element in customer satisfaction and [illegible]

Success would take a radical departure

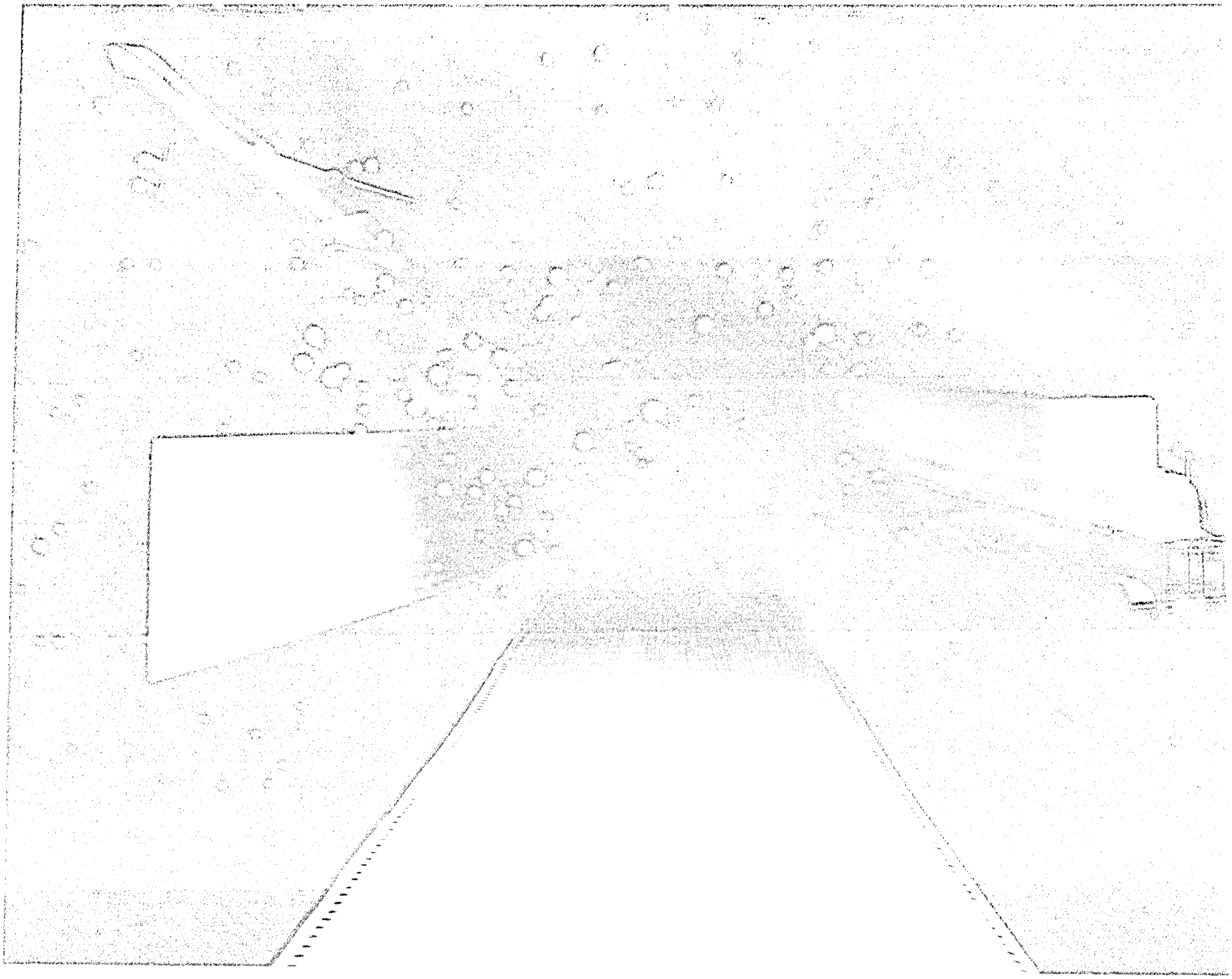
According to Robert B. Thompson, [illegible]

[illegible] Beckman's ability to [illegible] started to drop below the level of 95%. [illegible]

GE systems helps schedule by 22 days

Because of its worldwide data processing network and customized programming capability, General Electric Company, Services was called upon by Beckman to assist in providing a solid solution to their order service problem.

That "solid solution"... customized order service system hosting Beckman's Puerto Rico operations and its Fullerton, California headquarters.



General Electric computing services helped bring it to reality in just 68 days.

[illegible] represents [illegible] developed by GE to complete [illegible] trade system.

totally compatible with in-house system

The new system has eliminated customer service snags and enabled Beckman to turn around orders quickly and efficiently.

And, the system is totally [illegible] with Beckman's in-house [illegible] department. MARK III [illegible] information [illegible] ready for transmission to the parent company in Fullerton.

After evaluating several alternatives, Beckman's MIS staff determined that a worldwide computer service was a sound approach for this application. That's when they selected General Electric.

Computing services... think of the possibilities.

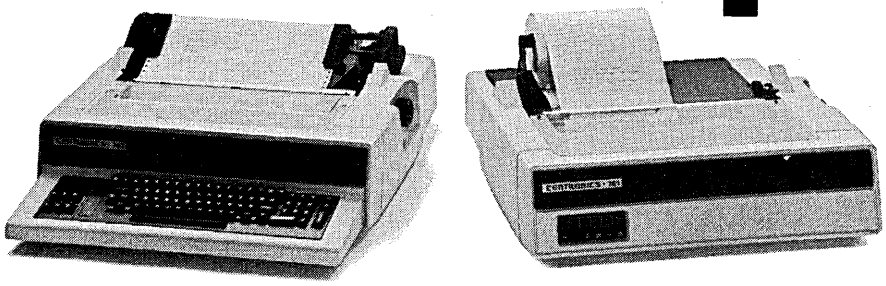
To see how other managers have harnessed the power of MARK III Service to their ideas, drop us a note on your company letterhead. We'll add your name to our award-winning executive magazine "LEADER", and forward you a current issue. Write to Roger Hobbs, General Manager, Sales Department, General Electric Information Services Division, [illegible] N. Washington Street, Rockville, Maryland 20850.

And, the next time you have an idea that you'd like to bring into sharper focus, give our local GE Information Services Branch Manager a call. He can marshal all the people, programs, network, and computer power you need to help you make things [illegible].

GENERAL ELECTRIC

CIRCLE 47 ON READER CARD

You won't find a more versatile teleprinter for the price. It's that simple.



The New Centronics Model 761.

No other teleprinter offers you more operating features—or a lower price. Because the 761 gives you microprocessor-control for maximum flexibility *and* lower-priced options.

Plus, the 761 gives you easier, more versatile operation . . . with maximum printout visibility . . . typewriter-style electronic keyboard that anyone can use without special training . . . table-top or free-standing installation . . . pinch roll, pin-feed platen or tractor paper handling systems . . . and a wide choice of 300 baud serial interfaces . . . in KSR and RO models.

And when you need fast, dependable service, remember the 761 is backed by one of the industry's best service programs. More than 100 professionally staffed service offices worldwide . . . a unique on-line diagnostic test center . . . central dispatch with toll-free phone access . . . and maintenance contracts as attractively priced as the 761.

More versatility, better service and reliability proven by more than 80,000 Centronics printers installed, make the 761 teleprinter simply a better choice. The *only* choice. Call today for details. Centronics Data Computer Corp., Hudson, N.H., 03051, Tel. (603) 883-0111 or Centronics Offices in Canada and throughout the world.

CENTRONICS® PRINTERS
Simply Better

letters

Take your bow, gang

To paraphrase Marvin Minsky (who once opened an ACM speech by saying that he would be interested to hear what he had to say), I was interested to see what I had to say (September, p. 10). Solid editing, gang.

I also appreciate the fact that you ran a composite photo that combines the best features of myself, Paul Newman, Fred Gruenberger, Jackson Granholm, and a youthful Howard Bromberg.

But I was sorry to see that nowhere in the issue did you pay tribute to or recognize the talent and dedication of Cleve Marie Boutell. Every month of every year that I have been reading the publication, she has come up with an artistic, provocative, and pleasing cover . . . 'way too good for a mere trade publication. This in addition to seeing (with Marilee Pitman) that the book came out on time.

It was, for many years, Bill Rolph who recruited an outstanding stable of authors, came up with article and issue ideas, and helped turn the work of the outside and inside writers into readable prose. Rolph's reward: he now works for Surly Sandy Lanzarotta.

While we're at it, we should remember Ham "Silver Fox" Styron (now retired). He suffered through the first three editors. At the same time, he was selling the space that paid their salaries.

It was Don Prell (now a biggie bank executive) who convinced F.D. Thompson Publications to convert *Research & Engineering* into a magazine about computing, whatever that was.

It was publishers Joe Landon and Jim Morris who gave the editorial staff the freedom to produce a magazine that was (and is) honest, fair, and livelier than most.

And from almost Day One, it has been the Cheerful Curmudgeon, Mr. Abrasive, Bob Patrick, who has coaxed, prodded, and browbeat the editors into doing a halfway decent job. He even filled in as the editor once when Hal Bergstein was seriously ill. Without him, DATAMATION never would have been half as good as it is.

There are a lot more unsung heroes and heroines, but I guess the readers—God bless them all—win first prize.

One final word: it sure was fun.

ROBERT B. FOREST
Freelance Writer
Sparta, New Jersey

Placing in perspective

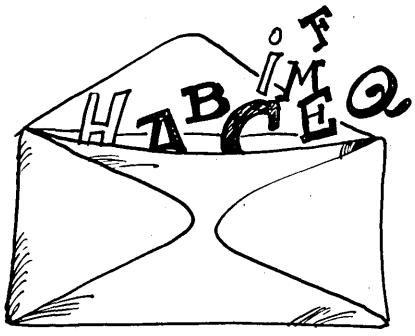
Your account of my paper at the Toronto IFIP Congress reported me to have said that "total dp expense has declined by more than 25% in ten years" at Ford (September, p. 260).

My actual statement in this paper referred to total systems expense "measured as percent of company revenue." Since this was a period of growth at Ford, this phrase was an important qualification.

MAYFORD ROARK
Executive Director—Systems
Ford Motor Company
Dearborn, Michigan

Tex tells us

Your generally well-researched article on terminal distributors (September, p. 159) I believe demands correction regarding our company. We were mentioned in context with Data Access Systems and Selecterm, but the description of those two companies as "two of DEC's most substantive regional resellers" was not applied to Tel-Tex.



DEC will confirm that Tel-Tex was their first regional reseller in 1974, that we are substantive ($5 million sales, $500,000 net worth, 500 DECwriters/year), and that we have been in Houston, not Dallas, since 1969.

Incidentally, the Virgin Islands meeting was not secret and was not to discuss merger. Several other regional distributors were invited to attend.

THOMAS W. MOORE
President
Tel-Tex
Houston, Texas

Rescued from the scrap heap

Regarding the statement (September, p. 271) that ". . . the artifacts of dp history are being discarded. McCracken said the last working Vannevar Bush analyzer . . . likely will be sold to the scrap dealer who bid $100 . . . because the university (UCLA) needs the space for vending machines.

May I tell you:

1. The UCLA differential analyzer was disassembled the week of June 13-17, 1977, to make room for a library for the Dept. of Nuclear Engineering. Great care was taken in the dismantling to ensure that the machine could be reassembled and made to work should anyone ever wish to do so.

2. Daniel McCracken arrived at UCLA on June 21 and purchased the differential analyzer for slightly more than $300 in the name of the ACM. Mr. McCracken thus became responsible for the machine and for all efforts to find it a permanent home in a suitable institution.

3. The Smithsonian Institution was contacted. After several month's consideration, the Smithsonian has accepted the UCLA mechanical differential analyzer into its collection. The machine was shipped from UCLA to Washington, D.C., on Sept. 23.

4. The Smithsonian now also is in possession of all the analyzer's associated papers, including the daily operations and maintenance logs, the correspondence, the set-up diagrams for all the machine's jobs, and the schematic diagrams for the machine itself. These diagrams will prove invaluable should the Smithsonian ever attempt to reassemble the machine and place it in working order.

L.B. MERIMS
Assistant Editor, Perspective
UCLA
Los Angeles, California

Meaning restored

While I am very happy with my contribution to the September Forum ("The Dimensions of Complexity," p. 315), there is an unfortunate omission on p. 318. The final sentence of the third paragraph should read, "I believe that we will come to depend *upon productivity improvement architects in the same way that we now depend* upon architects of more traditional bents." The italicized portion was left out and the containing paragraph loses its principal meaning.

ALONZO G. GRACE, JR.
President
A.G. Grace and Company
Glastonbury, Connecticut

Now they're included

In reading your article, "A Survey of Hardware Maintenance Firms" (August, p. 102), we immediately were struck by your fourth paragraph which began, "We have excluded associations. . ." Indeserv is the association of independent service companies and as such provides contract third party maintenance to manufacturers and users of data processing and communications equipment throughout the United States and Canada.

As a third party maintenance service, the association is made up of over 100 independent, local service companies, some of which were listed in your compilation, and currently represents 50 data processing equipment manufacturers and/or assemblers, including some of the vendors in your listing

In 7 months, I placed 5000 foxes and owls in good homes.

– Jim Folts, Vice President, Terminals Division

Seven months ago, Perkin-Elmer introduced two new CRT terminals. The Model 1100, a very simple terminal that's dumb-like-a-fox for $907.* And the Model 1200, a smart editing terminal known as The Owl for $1383.*

Right away, the big wheels in the terminals business gave us plenty of encouragement. "Who needs another inexpensive CRT?" they said.

"Every OEM and system builder who knows true value," we said.

And, sure enough, smart OEMs and system builders ordered 5000 Perkin-Elmer terminals and really started sales rolling.

Now it's Pussycats.

But, that's only the beginning.

This month we're unleashing a new thermal printer called The Pussycat – a 100 cps CRT page printer that should make hard copy a lot more affordable and send our competition running for cover. Especially when they hear we're tooling up for thousands of Pussycats the first year. Turn the page for a closer look. Then call your nearest Perkin-Elmer Data Systems office.

And while you're at it, get more information on the rest of our menagerie. The Model 1100 Terminal that's dumb-like-a-fox and The Owl, our Model 1200 Editing Terminal.

Perkin-Elmer products. You'll become attached to them in no time.

*Quantity 75.

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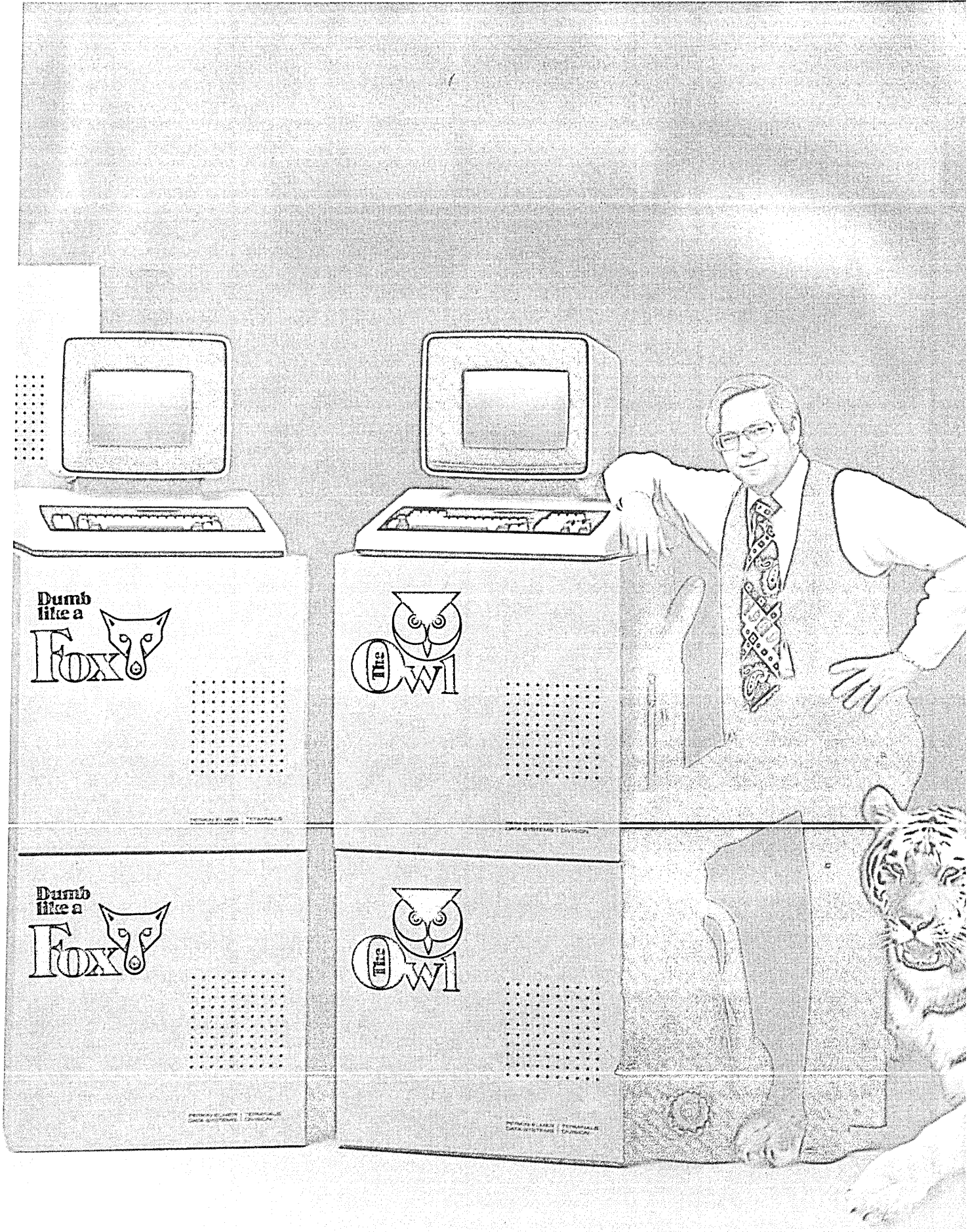
CIRCLE 32 ON READER CARD


Dumb
like a
Fox
The
Owl
Dumb
like a
Fox
The
Owl

letters

who require more remote coverage than they themselves are able to provide.

We sincerely hope that the next time you survey the alternate sources available for third party maintenance you will include Indeserv.

WILLIAM J. HERBERT
Association of Independent Service Companies
Littleton, Massachusetts

Shuffling along

It is said that generals usually prepare for the next war in terms of the experience gained during the past, and those who have not enough imagination to expect and prepare for something entirely different may subsequently lose that next war.

It seems to me that Mr. Knox, in his diatribe against the IBM 3800 ("9,453,600 papers to shuffle" September, p. 21), is a pupil of that school. He fails to see that new equipment with a different and higher level of performance should not be explained and ridiculed in terms of use for which it has not been designed.

In my country, the Netherlands, the first IBM 3800 is being used by the Postal Giro (Postal EFT), and the hundred thousands, perhaps millions of daily statements which are dispatched continuously may justify or even necessitate the use of this type of equipment. Banks, which also have to cope with a large volume of daily statements, certainly are investigating this machine or may already have ordered one.

I can think of a multitude of applications in which large volumes of data must be processed and produced on short notice, perhaps coupled with word processing facilities, and which are far removed from the conventional data processing output. We have been complaining for years that our programs and systems were I/O bound, and used that limitation as an excuse for not producing efficient code. Now that the O-bound has been removed to a certain degree, one should not fear the consequences.

DRS. M. DE VRIES
Management Consultant
Haarlem, Netherlands

Who's the servant?

The Los Altos "High School Students Responsible" (September, p. 26) have demonstrated a tremendous insight into what I consider a major concern regarding our increased reliance on data processing: we are beginning to think of the computer as an end unto itself rather than a tool to achieve an end. We have forgotten who is (or should be) the master in the man-machine relationship. I commend these students for their recognition that the machine should serve man rather than vice versa.

GEORGE M. DICK
Communications Editor
Auerbach Publishers Inc.
Pennsauken, New Jersey

It's new math

Normally, I'm easy going and let little things slip by, but in this case, since no one else has mentioned it, I think I will. 3 + 5 = 8, not 9. (Please note the circled equation.)

Happy 20th birthday and many, many more.

HARVEY KARLIN
Senior Programmer
First Pennsylvania Bank
Philadelphia, Pennsylvania

New lamps for old

We read with interest the article which mentioned that Digital Equipment Corp. is seriously considering entering the used computer market (July, p. 16). In fact, Digital has dealt in the used computer market for years. Our Traditional Product Line (TPL) purchases used DEC computers when they are used as a trade-in on new DEC computers. The used computer then is refurbished by TPL and prepared for resale. TPL also is a source for used peripherals. Part of TPL's charter includes continued support of a successful DEC product line for those customers requiring additional processors, original peripherals, and compatible peripherals.

CYRIL F. SPRATT
Digital Equipment Corporation
Hudson, New Hampshire

A calculator is not a computer

Maybe it isn't all that important, but it seems to me that DATAMATION ought to be able to establish what a computer is, and who invented it. The work of Stibitz, Atanasoff, and Zuse in the '30s was brilliant, novel, original, and pioneering, and it ought to be given due credit. But whatever their achievements were, none of them invented the computer and it's a mistake to report that they did.

At the time those men did their work, the word "computer" was used to mean anything that could calculate, including adding machines and IBM tabulators. Today the word has a more restricted meaning, and lesser devices than those now known as *computers* are called *calculators*. (Notice that every company that makes both types of equipment carefully preserves the distinction in the names of its machines. Thus, for example, Texas Instruments advertises its Model 990 *computer* and its TI-59 *calculator*. Every maker of a programmed device that is less than a computer, whether for pocket or desktop, calls it a programmable calculator.)

Now the line of demarcation is blurring rapidly. The people who have only recently discovered all these lovely machines have been debating the dividing line furiously for the past year, perhaps in the wistful hope that their $100 pocket calculators will somehow turn into real computers at midnight.

All in all, the debating is probably a healthy thing. But that doesn't excuse DATAMATION's lack of editing on "George Stibitz and the Bell Labs Relay Computers" (September, p. 80). If Ms. Loveday, the author, doesn't know the difference between a calculator and a computer, the editors certainly should. Dr. Stibitz' machines—brilliant for their day—were programmed calculators, and were hardly forerunners of the device that today makes our industry. Babbage was a lot closer.

Perhaps DATAMATION should encourage some articles on just what a computer is and who invented it. Meanwhile, let's not encourage loose treatment and faulty derivation of the term.

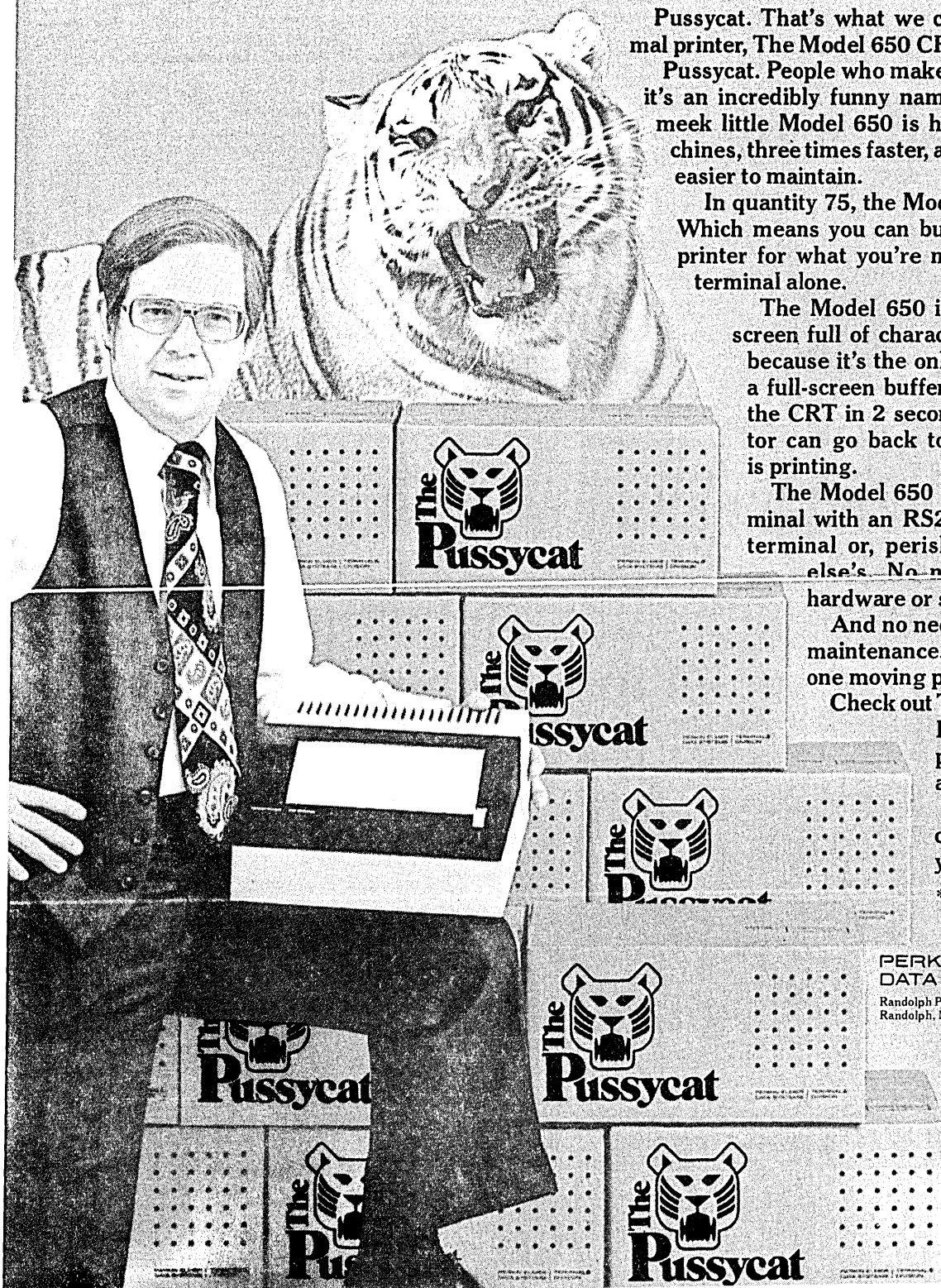
FRED GRUENBERGER
Editor
"Popular Computing"
Northridge, California

❋

We welcome correspondence from our readers about the computer industry and its effect on society, as well as comments on the contents of this magazine. Please double-space your letter when you write to DATAMATION, 1801 S. La Cienega Blvd., Los Angeles, CA 90035. We reserve the right to edit letters submitted to us.

Smile, when you say pussycat!

Pussycat. Perkin-Elmer's $795,* 100 cps CRT Page Printer.



Pussycat. That's what we call our new 100 cps thermal printer, The Model 650 CRT Page Printer.

Pussycat. People who make 30 cps printers will think it's an incredibly funny name. Until they realize our meek little Model 650 is half the price of their machines, three times faster, and a whole lot quieter and easier to maintain.

In quantity 75, the Model 650 is only $795 each. Which means you can buy a CRT and a Pussycat printer for what you're now paying for a printing terminal alone.

The Model 650 is fast. It prints an entire screen full of characters in 20 seconds. And, because it's the only printer in its class with a full-screen buffer, the Model 650 can free the CRT in 2 seconds or less. So the operator can go back to work while the printer is printing.

The Model 650 connects to any CRT terminal with an RS232 port—a Perkin-Elmer terminal or, perish the thought, someone else's. No need to replace existing hardware or software.

And no need to worry about noise or maintenance. The Model 650 has only one moving part—the platen.

Check out The Pussycat from Perkin-Elmer. It's a great little printer at a very reasonable price.

And, if you're one of our competitors...Smile, when you say pussycat!

*Quantity 75.

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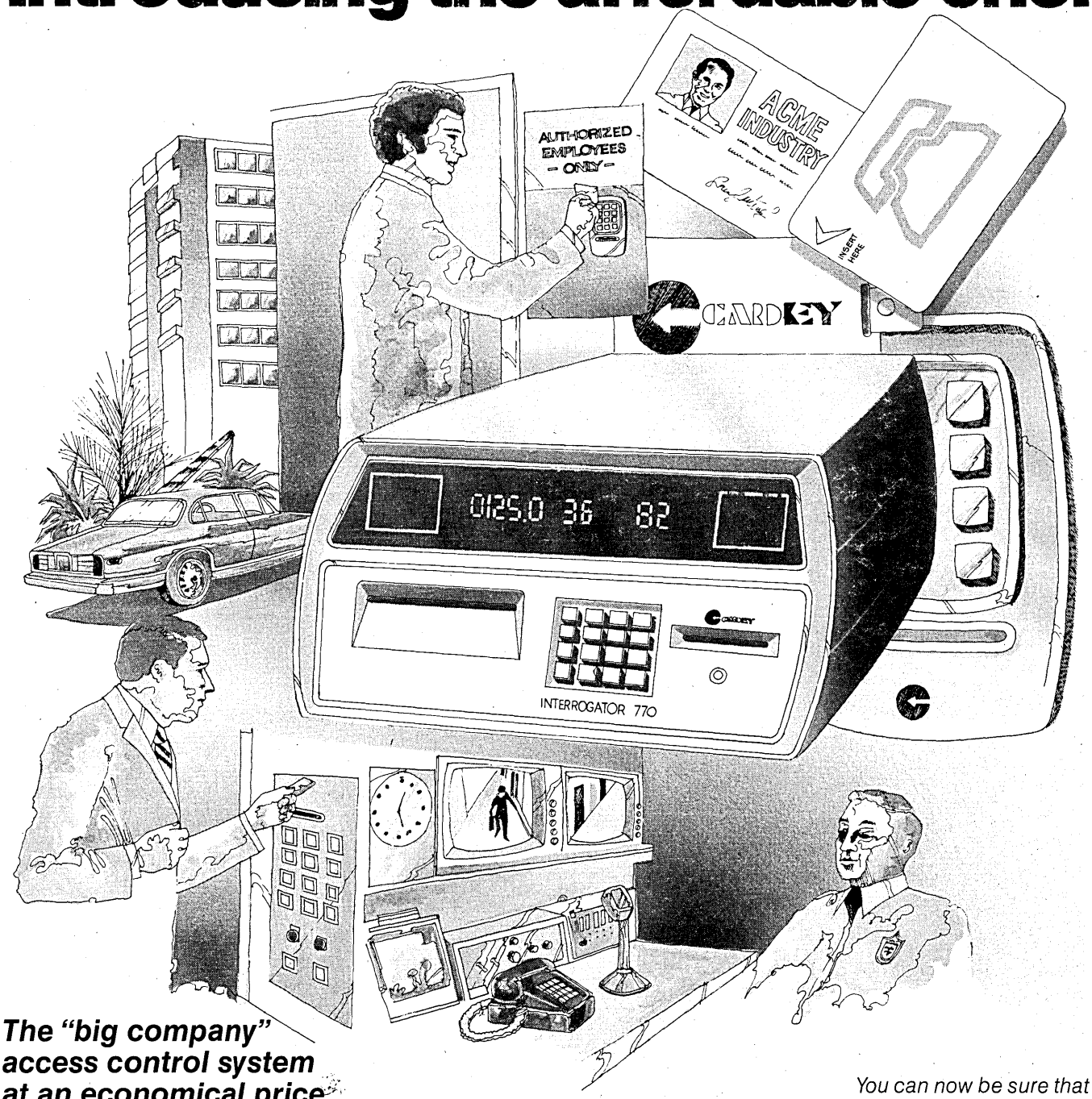
CIRCLE 35 ON READER CARD

Introducing the affordable one.



The "big company" access control system at an economical price.

You've always wanted a centrally-controlled card access system, but until now it was too costly. Now, Cardkey introduces the Interrogator 770™ Central Control System with the economy that brings total security access control within the reach of virtually every business.

Recognizing that smaller companies have security and access problems similar to those of larger organizations, Cardkey designed the Interrogator 770 to deliver the same performance and versatility of larger systems, but at a much lower cost.

You can now be sure that every gate, door, elevator—every entry and exit in your facility—is protected.

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Cardkey has over 30 years of experience in designing access control systems for some of the largest companies in the world. Call us for a free security analysis, or send for our brochure.

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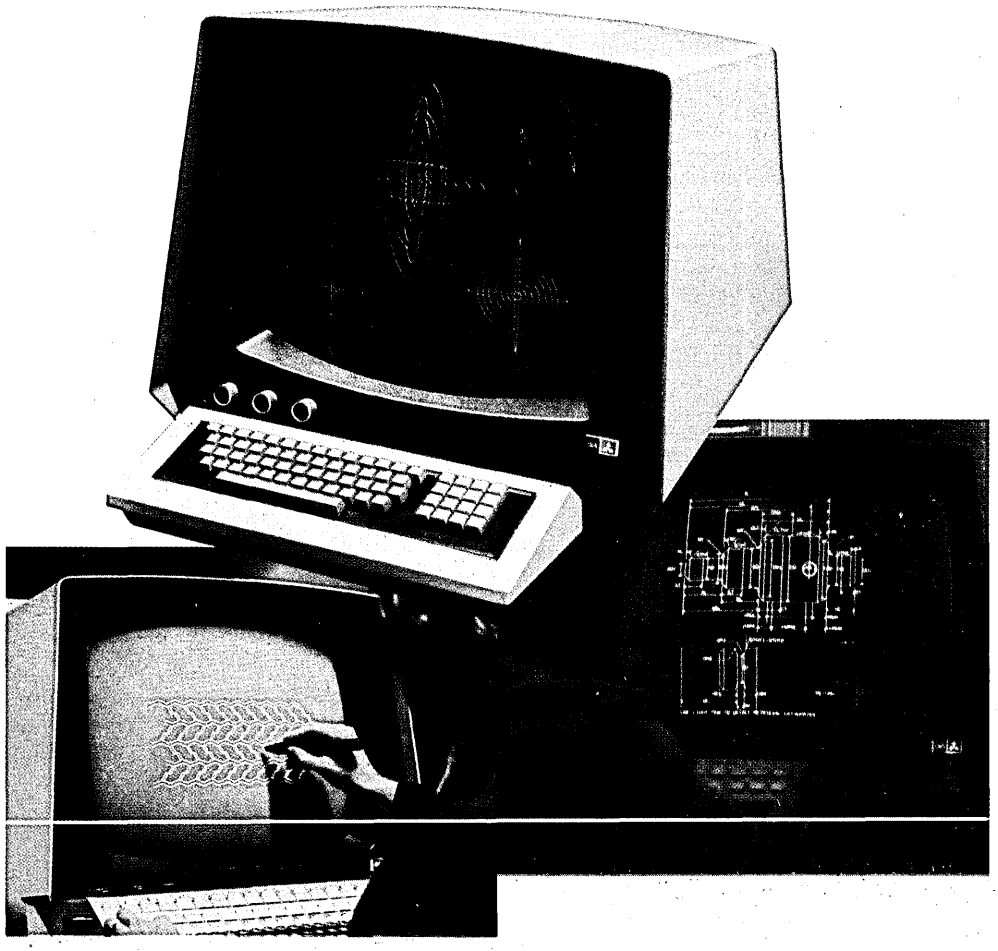
Telephone: 0734 582804/Telex: 847733

Compare the new Sanders Graphic 7 with other interactive terminals.



You'll draw a graphic conclusion.

Sanders' new Graphic 7 is an intelligent terminal with all necessary hardware and software as standard —not cost-you-extra—features.

But the Graphic 7 doesn't just save you money when you buy it. It also saves you money after you buy it.

Simply wheel your Graphic 7 through the door and plug it in. No installation problems.

Your programmer won't have to spend much time with your Graphic 7. It comes pre-programmed.

And your operators will be able to handle your Graphic 7 after a 10-minute briefing, because it works with a one-button initialize.

Application programs? Our Fortran-based graphic support package can reside in any host that supports Fortran.

And with the intelligence at the terminal, there's minimum impact on the host. You can do more work faster.

Sanders experience? Our graphic terminal systems are used in computerized production projects. Tire-tread design. Avionics defense systems. Flight training. Land-use management. Air traffic control. And dozens of other areas.

Compatible, fully equipped, low priced. What other graphic conclusion can you draw than the new Sanders Graphic 7? Send for specs and specific applications. Sanders Associates, Graphic Systems Marketing, South Nashua, NH 03060. 603-885-5280.

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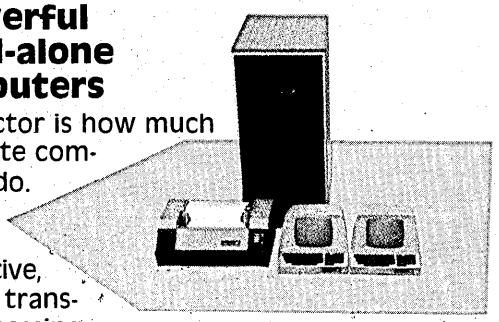
Introducing Basic/Four distributed data processing.

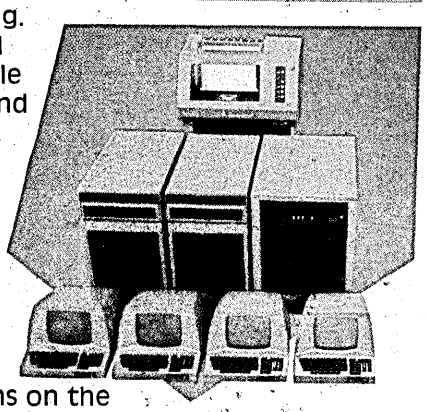
Right system, right price!

The right system should make each remote location an independent data processing center. That's what Basic/Four® computers do. And at the right price. Because there's a model to meet the exact needs of each location.

Powerful stand-alone computers



The key factor is how much each satellite computer can do. Basic/Four computers are interactive, for instant transaction processing. Each is powerful enough to handle all accounting and payroll for each location, plus its specialized function–manufacturing, distribution, warehousing, whatever.

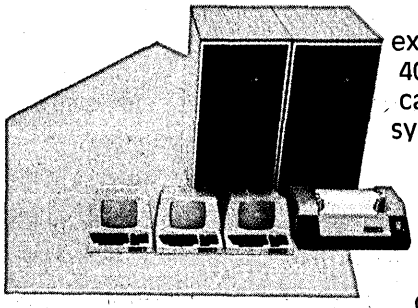


No more costly time-drains on the host computer. No more waiting for processing.

Easy to install, program, use

The data processing needs of your remote locations are like those of an independent business. And that's our specialty!

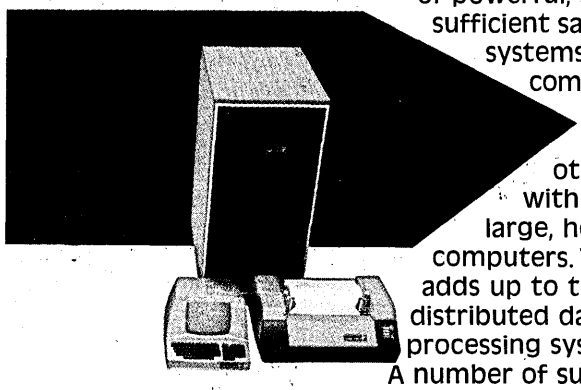
We offer proven software packages, with special application modules that are easily adapted to your particular needs. The language is BUSINESS BASIC, so programming is a snap. So is operation: we can teach a clerk to run a system in less than a day.



After 6 years experience, with some 4000 installations, we can put in Basic/Four systems fast.

We talk to IBM all the time

Our tie-in capability means your network of powerful, self-sufficient satellite systems can communicate with each other, and with most large, host computers. That adds up to the ideal distributed data processing system.



A number of such Basic/Four systems are up and running in the U.S. and abroad.

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Basic/Four Systems are also marketed in more than 30 foreign countries.

people

Seeking New Horizons

He's put close to 40 years into high technology industries, including the formation of two companies. Now he's looking for a new career which will last at least 25 years and he wants it to be in high technology.

For awhile, when he was in high school, J. Reid Anderson, founder, chairman of the board, and chief executive officer of Information Terminals Corp., Sunnyvale, Calif., computer media manufacturer, wanted to be a musician. He plays the clarinet and, by his own estimation, "plays it well. But I decided I'd make more money as an engineer."

Anderson earned an AB from Denison Univ., Granville, Ohio. He went on to earn an MS in electrical engineering and an MS in Physics at the Univ. of Michigan. While still in college he worked summers at Bell Labs which he joined full time after graduation, and where he worked, even before World War II, with magnetic tape recording.

His span of service with Bell was 17 years, including four spent on military leave which he spent with the Navy in mine sweeping research and development. Today, Anderson holds 30 U.S. patents which, he says, mostly were the result of his work at Bell where, "I had more fun than on any other job I've ever held."

"After the war," he remembers, "three magnetic tape recorders developed by the Germans were brought to the U.S. One went to Ampex, one to Bell Labs, and one to the Army Signal Corps. This led to floppy discs which then were paper backed cellophane."

Much as he enjoyed his work at Bell Labs, Anderson couldn't resist "an offer I couldn't refuse," made to him by NCR in 1956 which took him to Dayton, Ohio, as the "Cash's" director of Physical Research. "They (NCR) were supposed to be about to take off on a lot of things then. I worked on development of a solid electronic POS (point-of-sale) machine. It became a product 15 years later."

His career with NCR was much shorter-lived than that with Bell. While on the West Coast on a business trip, visiting NCR's Hawthorne, Calif., research and development operation, he managed a visit to the San Francisco Bay area and, "I liked it so much I decided I wanted to stay." He joined Stanford Research Institute as manager, Computer Technology Laboratory. This was in 1958.

"We got Friden into the electronic desk calculator business," he recalls, talking of his work at SRI. The lab he headed developed Friden's first office product. The lab, he explained, was much like an entrepreneurial operation. It derived half its business from government and half from the private sector and "I had to go out and get the business for myself."

J. REID ANDERSON
Music, photography and high technology.

Doing this gave Anderson a taste for the life of an entrepreneur that made him leave SRI in 1963 to start his own company. It was back to music which, in a sense, he never really gave up. While working at Bell Labs he played in a symphony orchestra, and while at SRI he played in a reed instrument quartet.

His new company, he called Electronic Research Products. Its initial products were an electronic instrument for musical translation, an electronic tone generator, and an electronic metronome. "I was concerned because most people play out of tune," said Anderson. The products sold but the market was fast saturated. "But I still get inquiries for them, even now."

In 1966, he began looking around for new and different products. He met Roy Jacobson who was thinking of forming a company to make crt displays. Together they formed Anderson Jacobson Inc. but they didn't make crt displays. The company became the pioneer in the acoustic coupler field, starting with a license to produce a coupler developed by SRI.

But few companies can afford two chiefs. "By a toss of a coin" Jacobson became president of Anderson Jacobson and, in 1969, Anderson was looking for new pastures. "I decided there was a need to replace punched tape. Data cassettes looked good. There were a few recorders around."

He formed Information Terminals and, at the time, he was seriously thinking of going into terminals but, "I soon realized there was enough of a challenge there to warrant staying in the media business."

Information Terminals' products today are magnetic tape and certified magnetic media products including digital cassettes, minicassettes, one-quarter inch cartridges, flexible disc heads, magnetic cards, test cassettes, and test instruments for cassettes and cassette decks.

The company "started in the back room of one of our reps in Los Altos," soon moved to Mountain View and, in 1974, to its present Sunnyvale, Calif., location where it occupies seven buildings and employs 700 people. Annual sales in the year ending last June were $15,460,000 and, Anderson says, the current rate points to $20 million this year.

Anderson's interests transcend high technology and music. He's an avid photographer and recently completed a three week "camera safari" in Africa from which he came away with some great pictures and a knowledge of game life in Africa that is hard to match away from that continent.

Maybe he can put all of these capabilities together in the new career he's seeking. He seems to feel Information Terminals will prosper without his active participation by mid-1978 under Peter A. McCuen who succeeded him as president last year.

Into Engineering Early On

"This is a creative time, and I think I can do a lot," said Donnamaie E. White of her new job as director of engineering at Telefile Computer Products, Inc.

Telefile produces computer enhancement products dedicated to prolonging the lives of older Xerox, Univac, General Electric, and even some IBM computers. White said the fact that she was

people

hired from Burroughs doesn't mean the firm is getting into the Burroughs market.

At Telefile White is responsible for all hardware and software design, and her staff of 25 also has responsibility for microprocessor development, documentation control, and data base management, and supports the firm's research and development department.

"I have a lot more power here," she said. She was a data base product manager for Burroughs. "I moved up three to four levels and there is more potential for doing things without a lot of red tape . . . more room for ingenuity."

White joined Burroughs in 1974 in Pasadena and moved to that firm's Western Application Center in Irvine, Calif., where Telefile is headquartered, in December 1975.

She gravitated to engineering at an early age. "I was tested in the eighth grade and placed in an early algebra class. I hung in and grabbed onto it." She also recalls that she was doing blueprints "when I was a Brownie." She remembers helping with blueprints for a number of family homes. "We built a lot of our own houses. My stepfather showed me how to do blueprints. I liked it."

A native of Hartford, Conn., White received a BSEE from the Univ. of Hartford and went on to receive her master's and Ph.D. degrees from UCLA.

Her first job after receiving her BSEE was with Pacific Telephone as an equipment engineer. She joined Pacific in 1964 and left in 1966 to join TRW Systems as a member of the technical staff, where she participated in design review of the Minuteman missile and the LEM (lunar excursion module). From TRW she moved to Northrop where she again was a member of the technical staff. While at TRW and Northrop she wrote and published her master's thesis, "A User's Guide to Computer-Aided Circuit Analysis Programs." A paper based on the thesis won her a "certificate of recognition for contributions to technology," from the National Aeronautics and Space Administration (NASA).

DONNAMAIE E. WHITE
"I think I can do a lot."

Between Northrop and Burroughs, White taught computer courses at California State College, Fullerton, where she also assisted in developing a computer science program. She left the college shortly before establishment of a computer sciences department which she helped into being.

White is in the process of finishing up a book co-authored with UCLA's Antonin Svoboda, under whom she studied. It's titled *Advanced Logical Circuit Design Techniques*, and will be published by Garland Publishing in the spring of 1978.

As a part-time lecturer with a rank of associate professor, she currently is conducting a course in advanced logic design at the School of Engineering, California State Univ., Los Angeles. She also has served on the faculty of CSULA's School of Business.

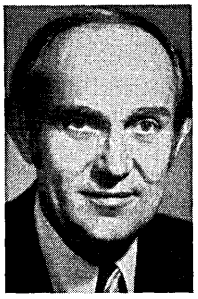
White describes herself as "both a hardware and a software person," and says her husband is the same. He's acting program manager in the data processing department of the San Gabriel Valley *Tribune* by night and a student at the California Polytechnic Institute in Pomona, Calif., by day.

As for their 19 month old son, Charles Lee Hanrahan, he may be both those things and then some. White says he understands both Chinese and English (the couple's sitter is Chinese), types, and plays with soldering irons and oscilloscopes—"whatever's around the house."

In New Posts

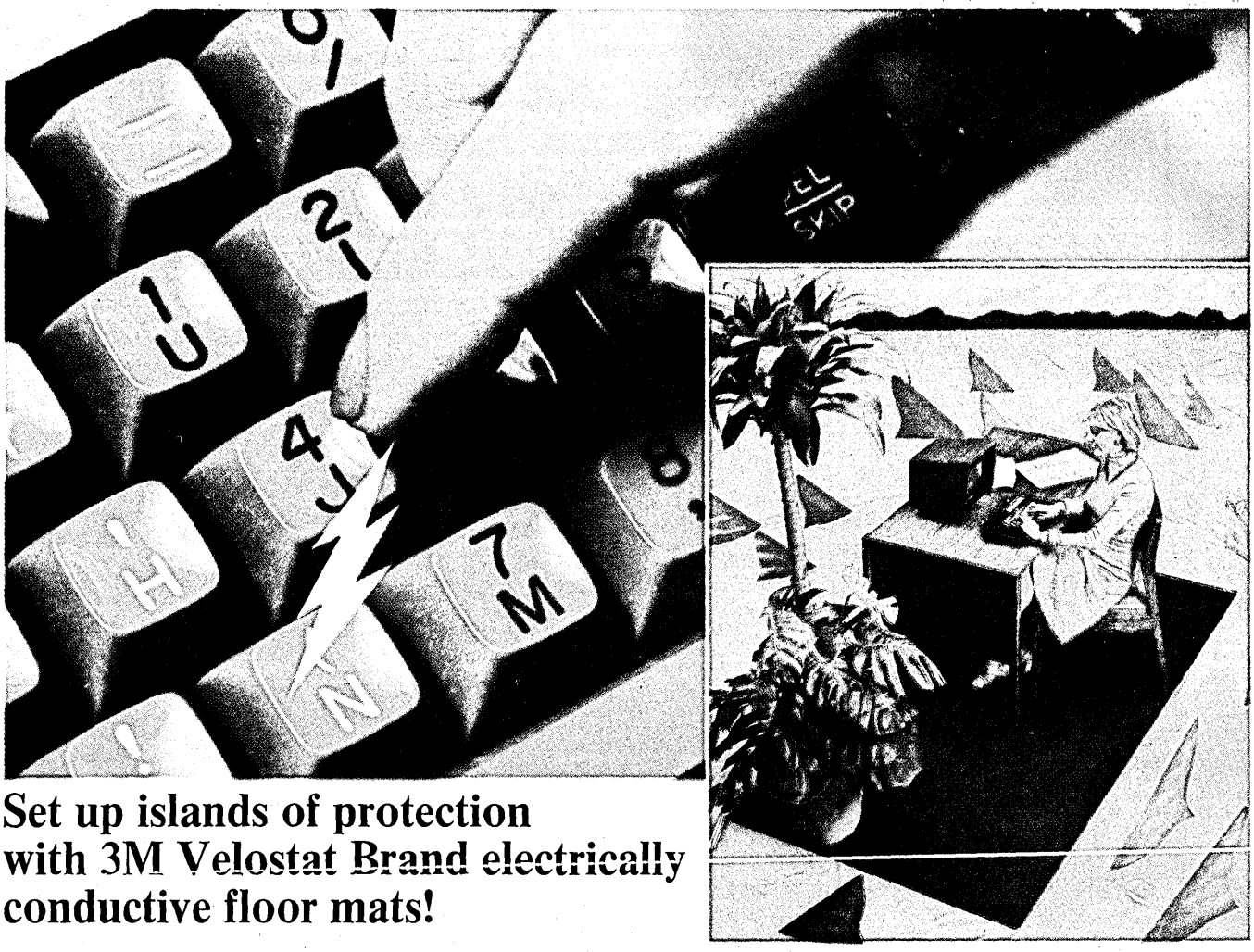
JOHN A. YOUNG was elected president and chief operating officer of Hewlett-Packard Co. Young, 45, joined HP in 1958 and has been an executive vice president and director since 1974. He succeeds WILLIAM R. HEWLETT, a co-founder of the company and its president for the past 13 years. Hewlett, 64, will become chairman of the company's executive committee and will continue as its chief executive officer. DAVID PACKARD, 65, who founded the company with Hewlett in 1939, continues as chairman of the board . . . JOSEPH W. ROONEY and L. EDWIN DONEGAN, JR., are together again. Rooney, whom Donegan brought to RCA from IBM when he (Donegan) headed up RCA's ill-fated computer activity, has moved from Itel Corp. to Keydata Corp., of which Donegan is president and chief executive officer. Rooney becomes vice president, field operations, for Keydata, a computer time-sharing service company. . . LOUIS E. NAVIN, vice president and treasurer of Honeywell Inc., was given additional duties as chief financial officer, and SIGURD UELAND JR., who was assistant secretary, became secretary. . . CARL D. SELPH, JR., joined Florida Software Services as manager of financial analysis and corporate taxation. . . Digital Equipment Corp. appointed DANIEL RIORDAN as European business manager of its business distributor product line. . . ROBERT E. JACOBSON was appointed manager of data systems for the Western Development Laboratories Div. of Ford Aerospace and Communications Corp. . . . JERRY J. DONAHUE was appointed manager, data services marketing, for the RCA Services Co. . . JAMES F. ZINKOVITCH is the new general manager of The Hartford Insurance Group's Northeastern processing center in Utica, N.Y. . . . MAX D. HOPPER, assistant vice president marketing automation programs, American Airlines, Inc., was appointed a regent of the Data Processing Management Assn. (DPMA) Education Foundation. . . JOSEPH R. LEONARDI joined Pertec Computer Corp.'s Data Systems Operations Div. as vice president, engineering. . . JOHN K. KNIGHT was advanced to the corporate staff position of director-management information systems of the IPCO Hospital Supply Corp., White Plains, N.Y. ❁

YOUNG



ROONEY

Don't let static kiss your computer's memory good-bye!



Set up islands of protection with 3M Velostat Brand electrically conductive floor mats!

Static on personnel, discharged into a terminal, can upset the logic of your terminal, mini, or CPU . . . can send erroneous data . . . permanently damage circuits causing costly downtime and repair. No equipment is 100% immune. Some computer equipment makers report that as little as 200 volts of static can cause serious problems!

VELOSTAT Mats create positive paths to ground . . . drain static away from terminal operators . . . keep them static free. Simply place the mat where the operator must step on it to reach the keyboard, and the VELOSTAT Mats provide passive protection in such key areas as these:

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- At Minicomputer and Word Processing Stations
- As a floor runner in Computer Room Entrances
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3M Company, St. Paul, MN 55101

3M COMPANY

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☐ Please have a 3M Static Analyst call.

☐ Send more information.

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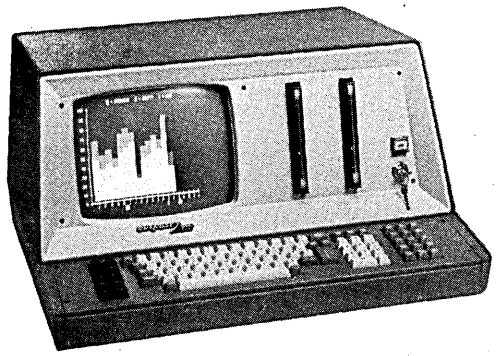

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Program it yourself with our BASIC-7 package which supports Record I/O, character string handling and TRACE in only 12K Bytes of memory.

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Compare Outpost 7 with any other terminal on the list at right. It's part of a comprehensive checklist we've prepared so you can evaluate Outpost 7 for yourself. Call or write for a copy today.

We don't claim the lowest price around for *a* terminal.

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COMPARE	OUTPOST 7 ($2,660)*	OTHER ($ ____)
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Self Diagnostics	✓	
DISPLAY FEATURES		
Reverse video	✓	
Two-level brightness	✓	
Blinking	✓	
Paging	✓	
Upper/lower case	✓	
Formatting	✓	
PROGRAMMABILITY		
Host assembler	✓	
IDET-7000	✓	
Extended BASIC-7	✓	
PERIPHERALS		
Expanded data entry keyboard	✓	
Serial I/O port	✓	
250K Byte cartridge drive	✓	
Internal Clock	✓	
COMMUNICATIONS		
Half or full duplex	✓	
Up to 9600 baud	✓	
Down line loading	✓	
Current loop or RS-232C	✓	

**Quantity–100 list price.*
Options: Up to 64K Bytes RAM, 4 Serial I/O ports, dual cartridge drives.

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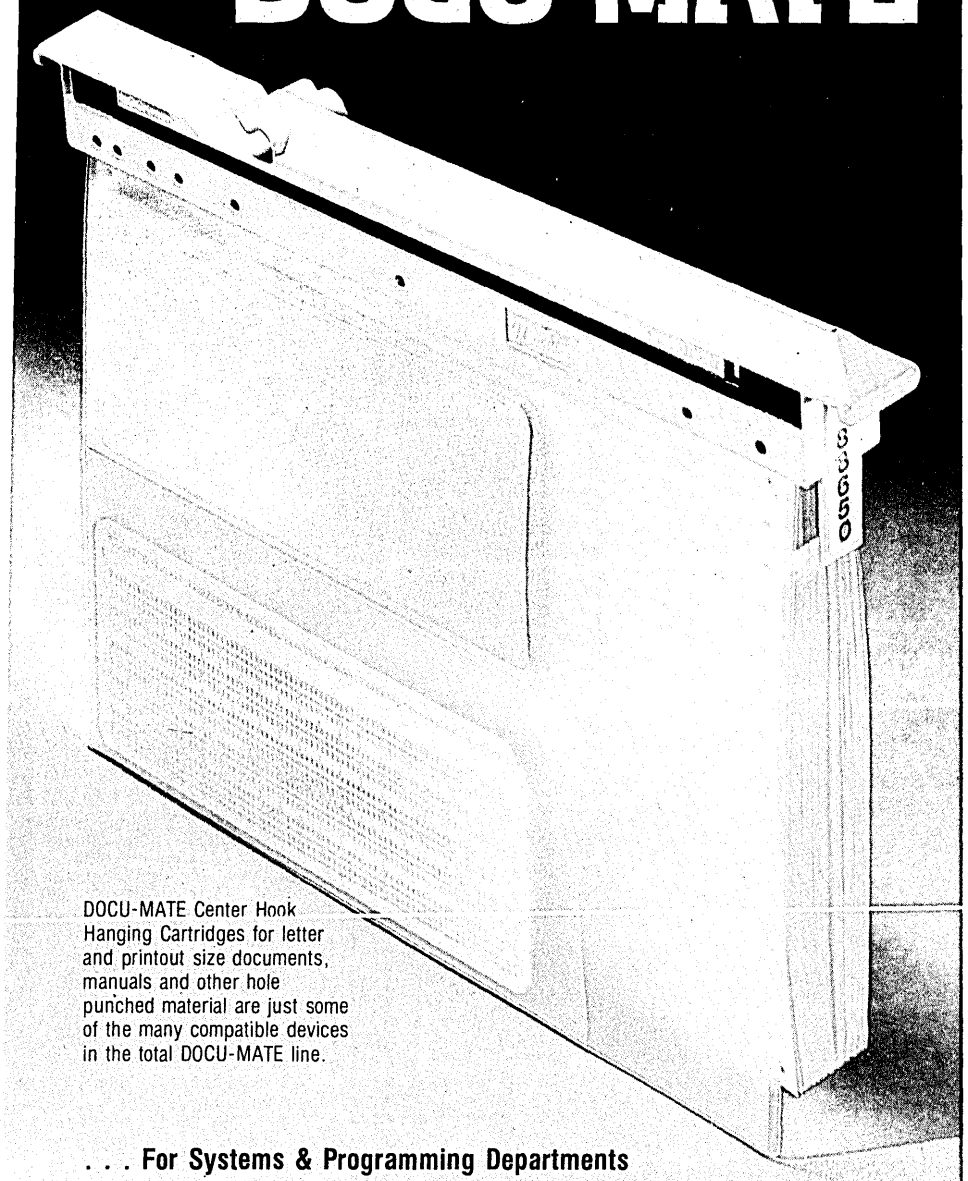

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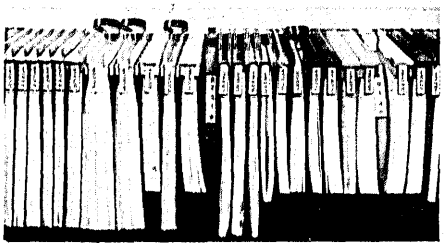

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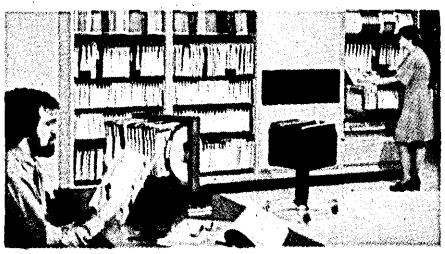

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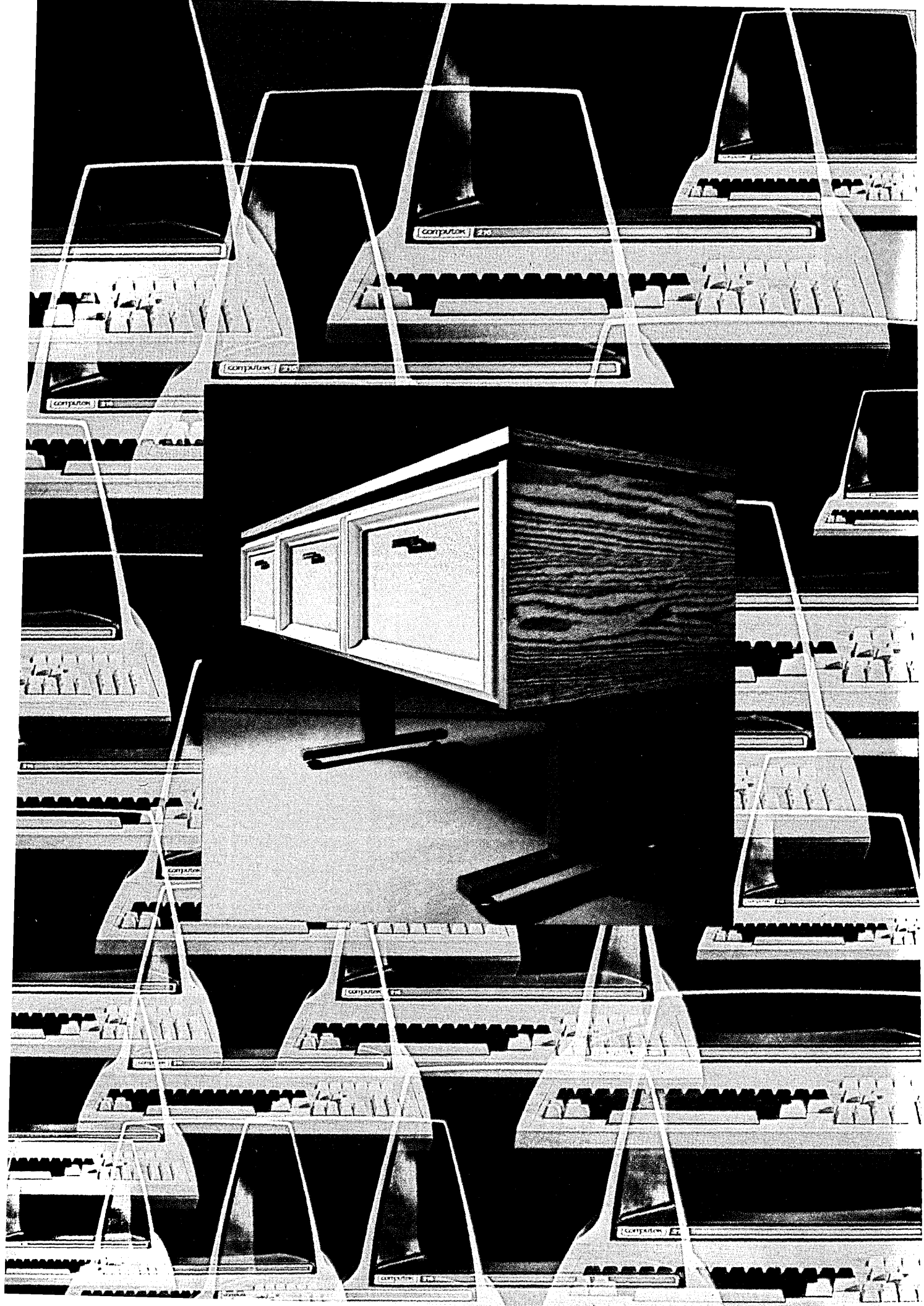

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And count on the lowest cost per terminal. Available now, General Automation's new 440 Data Series, starting below $45,000, recognized for the best price/performance package in the computer field: "...It always works...far superior to any other full systems less than $80,000. Any comparable system will cost over $175,000."*

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CIRCLE 18 ON READER CARD

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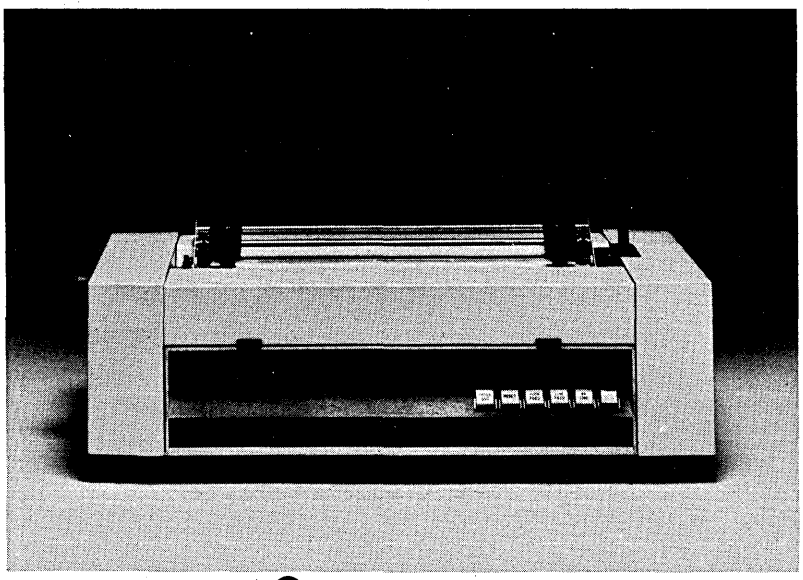

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calendar

NOVEMBER

Computer and Communications Industry Assn., Nov. 15-16, Beverly Hills, Calif. Two days of special presentations will highlight this annual membership meeting of the CCIA. Seminars on Tuesday, Oct. 15, will feature a talk by Peter Cunningham on issues affecting planning and decisions in the computer and communications industries; Tom Franklin on "U.S. vs. IBM: halfway . . . or all over"; Billy Oliver of AT&T Long Lines with a look at AT&T's future transmission capabilities; and a panel including Congressman James Corman, Ned Heizer, Ryal Poppa, Thomas Caps, and Jack Biddle on the impact of President Carter's tax reform package on small and medium-sized high technology companies. The second day's program will include an analysis by Eugene Lowenthal of software/firmware systems solutions; a luncheon address by Dr. George Mueller, president of Systems Development Corp.; and a discussion of electronic mail, facsimile, and computer-based message systems by Howard Anderson. Those non-CCIA members interested in attending should contact Stephanie Biddle, CCIA, 1500 Wilson Blvd., Arlington, Va. 22209 (703) 524-1360 for an invitation.

DECEMBER

Mini/Micro Computer Conference, Dec. 6-8, Anaheim, Calif. This three day event will feature 25 sessions covering many aspects of mini/microcomputer applications and design including peripheral devices and interfacing, solution procedures, development aids, technology, distributed processing, networks, and future trends. Fee: $50, conference and exhibits, three days; $20, conference and exhibits, one day. Contact: Robert D. Rankin, Mini/Micro 77, 5528 E. La Palma Ave., Anaheim, Calif. 92807 (714) 528-2400.

1977 College and University Systems Exchange Conference, Dec. 7-9, San Diego, Calif. Following the theme of "Information Systems in Higher Education: Expectation Versus Realities," the conference will explore the implications of information systems in higher education; the development of information; and the impact of information systems on colleges and universities. It primarily will deal with the trade-off of advantages and disadvantages inherent in the use of information systems, and will be structured along the major topics of: information systems development and management's expectations; information systems benefit analysis; the small college and information systems; vendors; and contributed papers. Fee: $100, members; $135, non-members. Contact: CAUSE, 737 29th St., Boulder, Colo. 80303 (303) 492-7353.

CALLS FOR PAPERS

Many conferences now are soliciting participation for the coming year's events. In an attempt to give each conference some exposure, we are printing only abbreviated information from their calls for papers. Please contact the person designated for further information on those conferences which claim your interest.

NCR is out to put the world of business on a new computer series called the I-8100.

Low price plus instantaneous entry, reporting and data base updating provide the most cost-efficient man/machine interaction in the industry.

The NCR I-8100 Series is exciting news for those who thought computers were too expensive and complex for their operations. And for those who have or are moving into a distributed processing network.

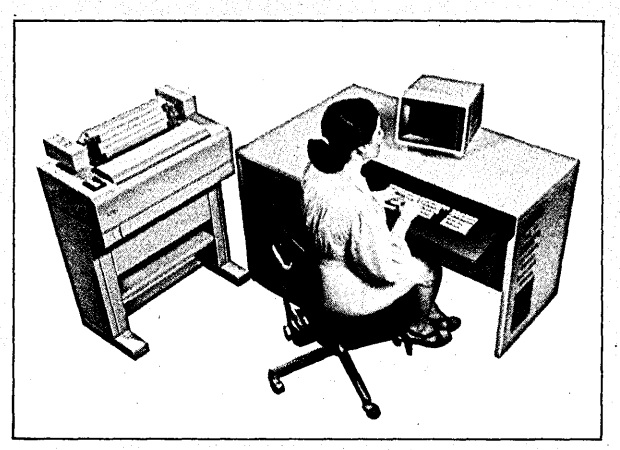
Everything about the interactive 8100 Series (I-8130 and I-8150) reflects simplicity. It's small, about the size of an office desk. It requires no special environment. It's preprogrammed for easy operation—in fact, any office employee can handle the most sophisticated data processing transaction.

Preprogramming also means your system starts paying off as soon as it's unboxed. Operating instructions appear automatically on the video display terminal to lead your operator through every transaction. Whether the application is budgetary accounting, revenue and expenditure, or

payroll, your organization enjoys the profitable benefits of computer-assisted management from the word go!

Now is the time to learn how a computer series called the I-8100 can focus the power of automation on the big problems of business. Contact the NCR office in your area. Or write to 8100 Marketing Systems, NCR Corporation, Box 606, Dayton 45479.

NCR
Complete Computer Systems



...and still more computer systems to come.

CIRCLE 79 ON READER CARD

calendar

Assn. for Educational Data Systems, **May 15-19,** Atlanta. Papers are solicited in all categories of the educational use of computers, including computer assisted, computer-managed, and computer-designed instruction; computer-assisted test construction; administrative applications; hardware configurations and developments; and software systems. Contact: Dr. James E. Eisele, Office of Computer Activities, Univ. of Georgia, Athens, Ga. 30602.

Data Bases: Improving Usability and Responsiveness, **Aug. 2-4,** Hiafa, Israel. The conference is soliciting papers which contribute to improving the usability of data base management systems in a wide variety of applications. Suggested topics include: data manipulation and data description languages, system reliability, access methods, new hardware and software architectures, human factors, and systems evaluation. Papers having a range of 3,000 to 8,000 words should be submitted by Dec. 1 to Ben Schneiderman, Univ. of Maryland, Dept. of Information Systems Management, College Park, Md. 20742.

Third Jerusalem Conference on Information Technology, **Aug. 6-8,** Jerusalem. Primary emphasis for this conference will be on the role of computers in the transfer of technology between large and small countries and between developed and developing societies. Papers describing a successful application, giving an account of original research, reporting on the state of the art, or presenting a case study related to technology transfer are invited. Four copies of the manuscript should be submitted by Dec. 15 to Stanley Winkler, ACM, 1133 Ave. of the Americas, New York, N.Y. 10036.

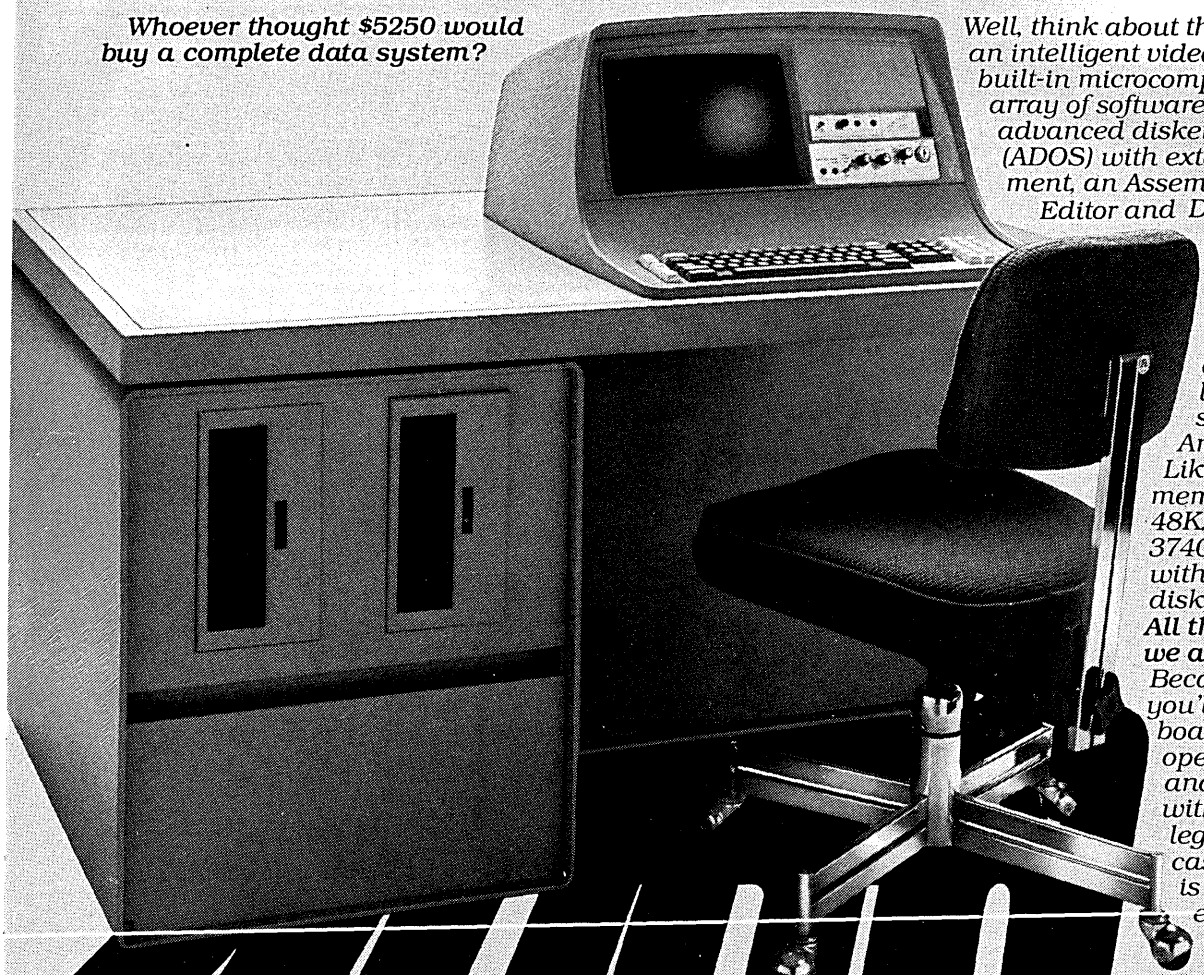
Southeast Asia Regional Computer Conference, **Sept. 4-8,** Manila. The conference will focus on three major areas: computers, management, and applications. Four copies of papers reporting on successful application areas, accounts of state of the art, or expectations of future trends should be submitted by Dec. 30 to Dr. P. F. Baraoidan, Philippine Computer Society, MCC P.O. Box 950, Makati, Metro Manila, Philippines.

ON THE AGENDA

Western Educational Computer Conference, Nov. 16-17, San Francisco. Contact: Paul Black, Dept. of Computer Science, CSULB, 6101 E. 7th St., Long Beach, Calif. 90840. **SOVEXPO, Dec. 7-15,** Moscow. Contact: Clapp and Poliak, Inc., 245 Park Ave., New York, N.Y. 10017. **Computers and Peripheral Equipment Edp Exhibit, Jan. 16-20,** London. Contact: George Kemp, U.S. Dept. of Commerce, Room 4217, Washington, D.C. 20230 (202) 377-3459. **Edp Exhibit Tokyo: Computers and Related Equipment, Feb. 6-10,** Tokyo. Contact: Robert Levine, U.S. Dept. of Commerce, Washington, D.C. 20230 (202) 377-4379. **Computer Network Protocols, Feb. 13-15,** Liege, Belgium. Contact: A. Denthine, Univ. of Liege, Ave. des Tilleuls, 49, B-4000, Liege, Belgium. **1978 ACM Computer Science Conference, Feb. 21-23,** in conjunction with **SIGCE Conference, Feb. 23-24,** Detroit. Contact: Seymour Wolfson (313) 577-2477. **COMPCON 78, Feb. 27-March 2,** San Francisco. Contact: IEEE (301) 439-7007. ❋

SYSTEM 50. $5250

The Video Processing Station that saves you a bundle



Whoever thought $5250 would buy a complete data system?

*Well, think about this. $5250 buys you an intelligent video terminal with a built-in microcomputer and a vast array of software. Such as an advanced diskette operating system (ADOS) with extensive file management, an Assembler, Editor and Debug package. You also get extended ADDS*BASIC and ANSI standard ADDS*FORTRAN IV. So besides an affordable price, you get languages you can speak.*

And there's much more. Like System 50's 32K memory, expandable to 48K. Plus a single IBM 3740 compatible diskette with an optional second diskette.

All those features. And we aren't finished yet.

Because with System 50 you'll have both a keyboard designed for operator convenience and a large 12" screen with 25 lines of 80 legible upper and lower case characters. All this is integrated into an elegant office-quality desk.

If you thought buying an advanced video processing station was out of the question, System 50 is the best answer around.

Quality, Reliability and Integrity. It all adds up to ADDS.

ADDS

ADDS *Applied Digital Data Systems Inc.*
100 Marcus Blvd., Hauppauge, New York 11787 516-231-5400

I want information on System 50.

*Name*_____

*Firm*_____ *Title*_____

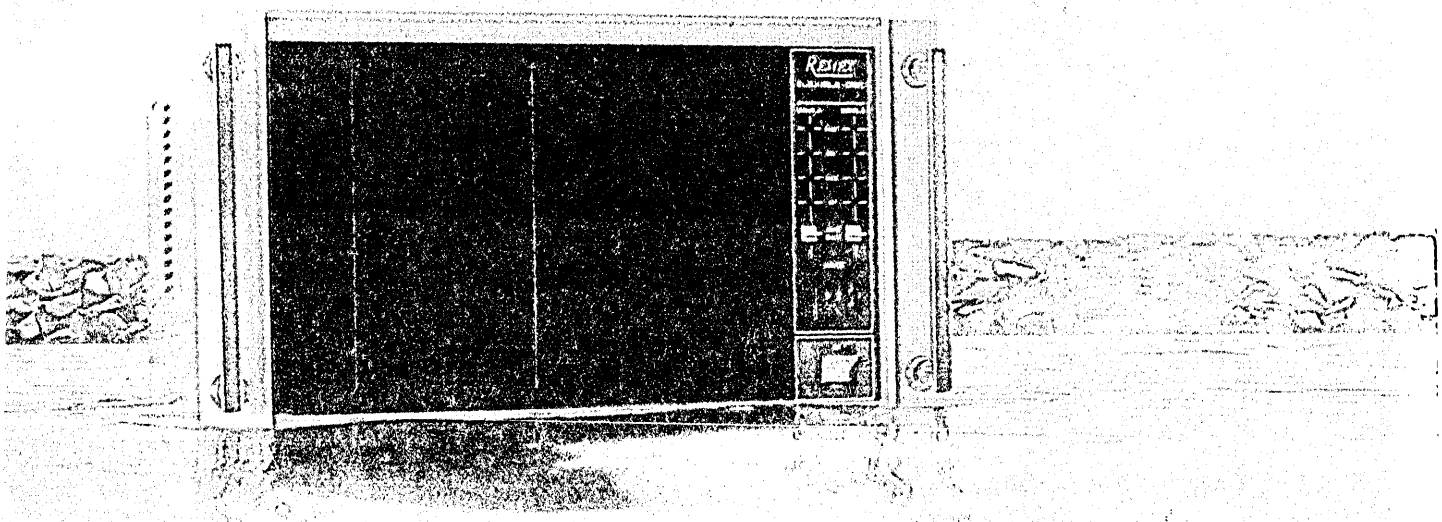
*Address*_____

*City*_____ *State*_____

*Phone*_____

CIRCLE 11 ON READER CARD

Remex launches a PDP-11 floppy disk system with above DEC performance



If's an integrated hardware/software system so compatible with DEC's RT-11 operating system that we named it Remex-11.

It connects directly to the PDP-11 or LSI-11 bus, offers about 25 percent greater storage capacity than Digital's RX11 disk system, and it costs less.

In addition, the Remex-11 provides faster throughput than standard DEC configurations with more efficient sectoring, by far. A single command transfers up to 65K words.

A full array of switches and indicators makes operation easy.

If you're a PDP-11 user, set sail for Remex. High quality peripherals and their service are our only business. If you've bought any of our more than 100,000 punched tape and flexible disk units, you know what we mean.

Contact your nearest Remex Sales Office or the factory direct: P.O. Box C-19533, 1733 Alton St., Irvine, CA 92713. Phone: (714) 557-6860

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REMEX DIVISION

CIRCLE 49 ON READER CARD

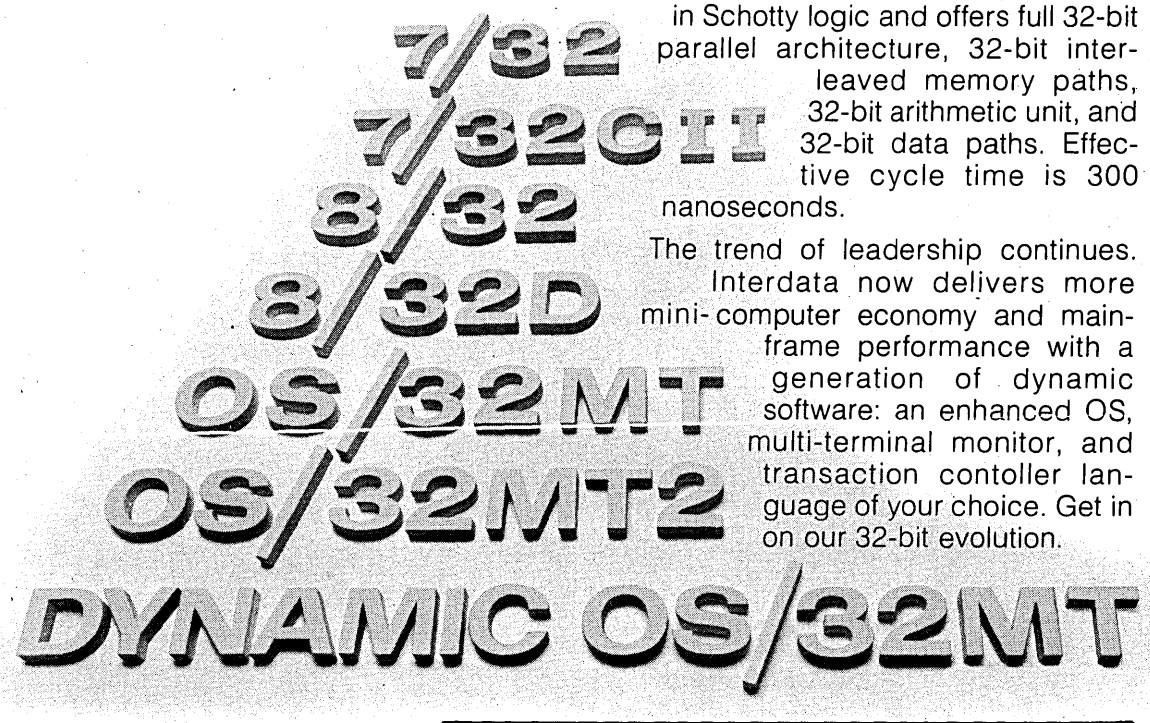
OUR 32-BIT EVOLUTION

Since 1973, we've led the field in 32-bit architecture.

Interdata introduced the first minis with true 32-bit architecture, formerly thought to be exclusively with expensive mainframes . . . the first minis to directly address one million bytes of memory . . . the first 32-bit minis with single and double precision Hardware Floating Point Arithmetic . . . 16-general purpose registers . . . Writable Control Store . . . Multiport Shared Memory. The trend goes on.

The Interdata 7/32 is your entry-level system into the world of 32-bits. Our latest . . . the 7/32CII is roughly equivalent to the IBM 370/135. Its flexible I/O structure makes it easy to configure, and easy on the pocket.

Our Model 8/32 enables us to offer one-half the speed of the IBM 370/158 at a remarkable one-seventh the cost. The 8/32 is implemented in Schotty logic and offers full 32-bit parallel architecture, 32-bit interleaved memory paths, 32-bit arithmetic unit, and 32-bit data paths. Effective cycle time is 300 nanoseconds.



The trend of leadership continues. Interdata now delivers more mini-computer economy and mainframe performance with a generation of dynamic software: an enhanced OS, multi-terminal monitor, and transaction contoller language of your choice. Get in on our 32-bit evolution.

Send me specs on your 32-bit computers and dynamic software.

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Company _____

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A UNIT OF
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Oceanport, New Jersey 07757, U.S.A.

D-11

CIRCLE 8 ON READER CARD

All at once, it's Harris.

Harris now delivers the most cost/performance effective multi-use computer system in the industry.

Our new family of high performance systems—S115, S125 and S135—together with our powerful VULCAN Virtual Memory Operating System supports more than 50 terminals. Simultaneously.

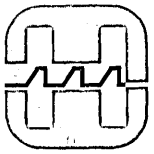
This is a whole new line of medium-scale, multi-use systems with increased reliability and new state-of-the-art technology. You get greater I/O throughput. MOS memory with error correction. Powerful micro processor based CPU. Broad selection of highly reliable peripherals. And all operate with ANSI 74 COBOL, FORTRAN, RPG II, FORGO, SNOBOL, and extended BASIC.

The Harris S100 systems take on many different jobs all at the same time. Multi-stream batch processing. Multiple concurrent RJE's, both host and remote. Multiple interactive time sharing. Real-time processing. And this new generation of high performance computer systems from Harris delivers these all to you, *concurrently.*

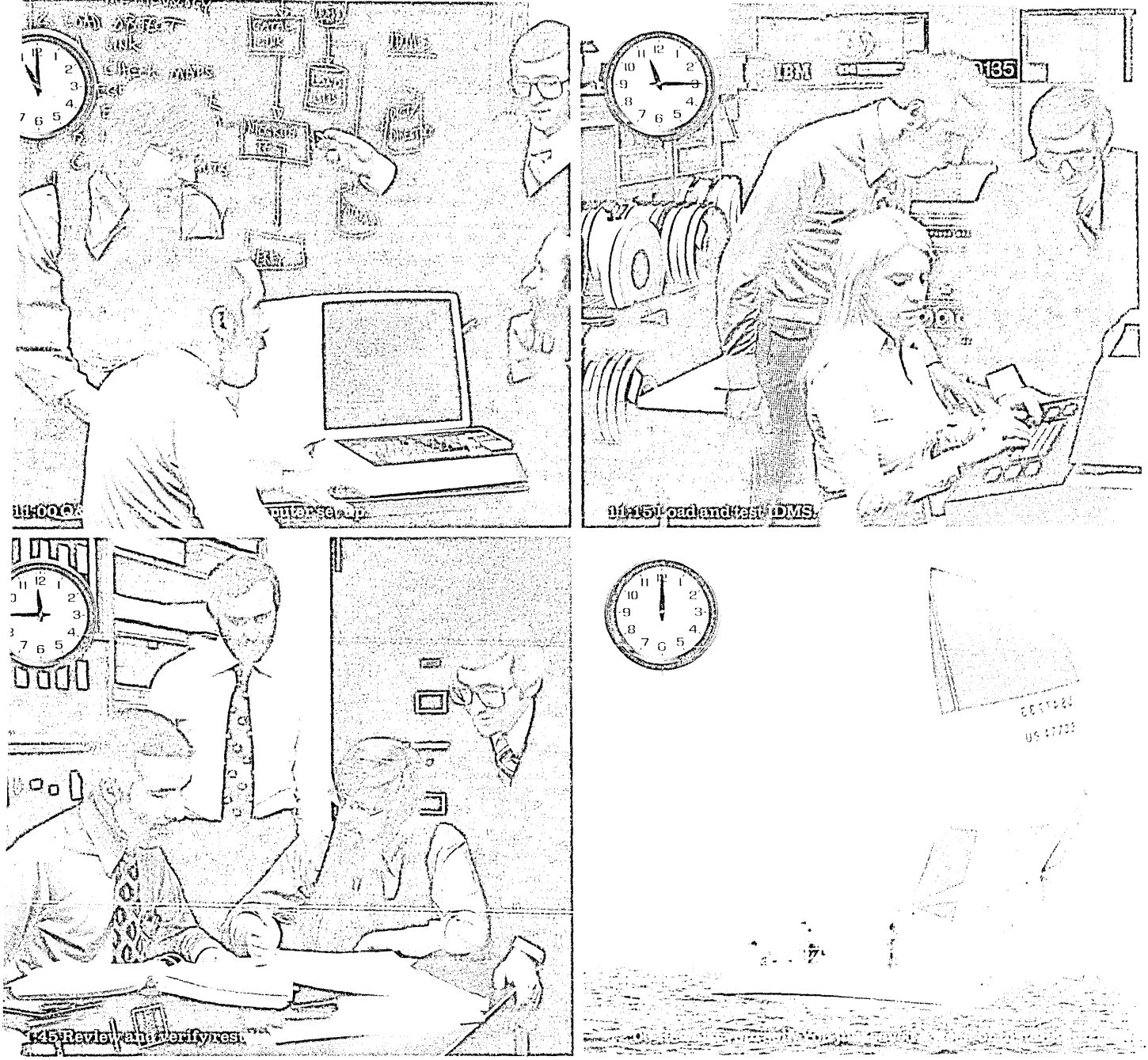
If your need is distributed processing, time sharing, data base management, or any type of concurrent multi-use application, *benchmark our new computer system against any other system in the industry.*

Harris Computer Systems, 1200 Gateway Drive, Fort Lauderdale, Florida 33309. Telephone (305) 974-1700. Europe: Harris Intertype, Ltd., 145 Farnham Road, Slough, SL1 4XD, England.

All at once, it's Harris.



HARRIS
COMMUNICATIONS AND INFORMATION HANDLING



"IDMS is the easiest DBMS to install"*

***say users in Datapro study**

In the fourth annual Datapro Research survey of software users, Cullinane's IDMS was rated #1 among all Database Management Systems. #1 in Overall Satisfaction. #1 in Documentation. #1 in Training. #1 in Vendor Support. #1 in Ease of Use. And #1 in Ease of Installation.

We were rated "easiest to install" because IDMS goes in in one or two hours – not one or two weeks like IMS or DL/1. This is possible because we've worked hard to develop a simple installation process. Yet it's thorough – every system module is proved operational on your computer system.

Following installation, you also get a three-day training session in IDMS for as many of your people as you want. This training program was rated #1 in the Datapro study. For the complete story – including technical literature on IDMS and a schedule of seminars for your area – send this coupon, or phone us at (617) 237-6600.

Think twice. You'll choose the database system users rate #1.

Name/title _____

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Tel. _____ My computer is _____

Cullinane Corporation

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CIRCLE 24 ON READER CARD

source data

SOURCE DATA provides information on books, courses, references, reports, periodicals, and vendor publications.

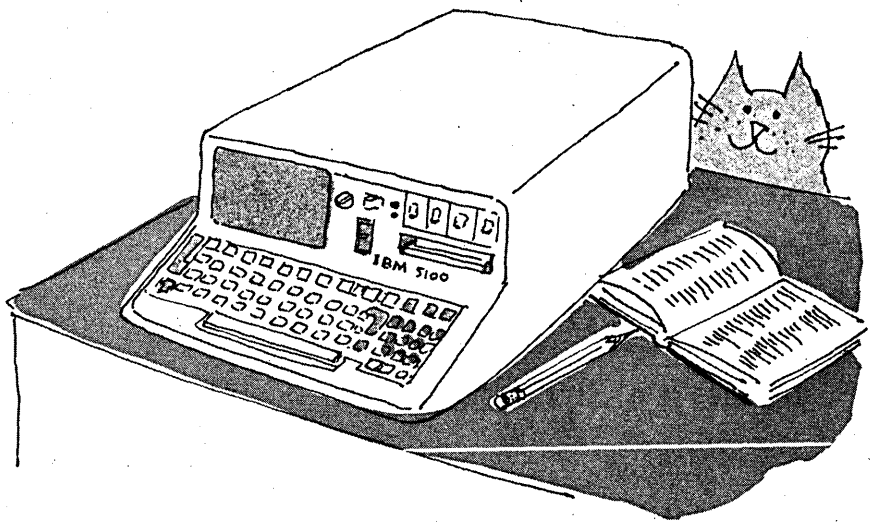
books

Meet the Computer

by Bruce Lewis
Dodd, Mead & Company,
79 Madison Ave., New York, N.Y. 10016
1977
47 pp. $5.25

Let's say it up front: this book is a perfect example of how *not* to introduce computers to seven- to ten-year old children. Having said that, we wonder if it's possible—or even necessary—to write such a book. Are there books on the joys of using calculus written for this age bracket? Is there a good way to teach second graders how binary arithmetic works? The example in the book isn't even clear to adults, but then again, maybe it can't be done using little words. Can your third grader fathom this description of how a supermarket check-out system works? "There is a special machine called a scanner that can 'read' (bar code numbers). The scanner is part of the supermarket's checkout counter. It has a little window over which each grocery item must pass. As the computer codes go by, the scanner shines a strong light on them and 'reads' the reflections." And should we ever suggest to anybody that computers are good? "That's what a computer is—a machine that helps people."

The admittedly difficult task is compromised throughout by sketches of IBM products clearly showing IBM logos—which is understandable considering that the author works for IBM. The little kitty cat smiling from behind



the IBM 5100 approach simply doesn't work. The great danger in all of this is that some school administrator somewhere will decide to buy thousands of these things and subliminally mold oem quantities of unsuspecting school children into equating computers with IBM.

—Michael Cashman

vendor literature

Reports Catalog

The 1977-1978 catalog from Auerbach Publishers is said to list reports "covering every facet of electronic data processing, data communications, management of information, systems, and general management." The 32-page, two-color booklet covers the vendor's series of Computer Technology Reports, Notebooks, Datacomm 80 Reports, Information Management Series, Buyers' Guides, and Executive Checklists. Computer State of the Art Reports, Guides, and Special Reports also are listed. Titles include "Standard Edp Reports," "General Purpose Minicomputer Reports," "Data Communications Reports," "Edp Notebook International," "Distributed Systems," and "Buyers' Guide to Word Processing." AUERBACH PUBLISHERS INC., Pennsauken, N.J.

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Print Head Brochure

A six-page, two-color brochure describes the Precisa series of print heads available from this vendor. The pamphlet includes detailed specs, drawings, and timing diagrams to allow the user to interface the print head with micro-

processor systems. The print heads, which print up to 21 columns, are used in security systems, weighing systems, test equipment, and point-of-sale terminals. MASTER DIGITAL CORP., Costa Mesa, Calif.

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Remote Computing Services

The overall capabilities of this nationwide remote computing service are described in this new 16-page bulletin. The pamphlet merely presents overall capabilities (for brevity's sake); each of the company's services are described in detail in separate product bulletins. Capabilities described include timesharing, walk-in and remote batch, and specialized operating systems on a variety of computers from IBM, Control Data Corp., Honeywell, Amdahl, and Digital Equipment Corp. Micrographic capabilities and the vendor's "personalized service" also are described in the four-color brochure. CALLDATA SYSTEMS, INC., Woodbury, N.Y.

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Transparency Composer

Step-by-step operation of this vendor's Transparency Composer, a desktop printer for producing overhead projection transparencies, is illustrated in this four-page, four-color brochure. The brochure also includes samples of seven type fonts available for use with the

source data

composer. A brief overview of the company's complete visual communications system concludes the brochure. 3M CO., St. Paul, Minn.
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Small Business Computers
This vendor says its new booklet contains, "(Almost) everything you always wanted to know about computers, but were afraid to ask!" Designed to answer questions about small business systems, the booklet gives a step-by-step approach to matching computer capabilities to business needs. DIGITAL EQUIPMENT CORP., Northboro, Mass.
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Business Systems Brochure
An explanation of how a small or large business can select the model from this vendor's 3000 Series I and Series II computer families best suited to its needs is provided in this eight-page, two-color brochure. Sections are devoted to the 3000's Multiprogramming Executive Operating System (MPE), data base management software, system configurations, distributed networking, service, and support. HEWLETT-PACKARD CO., Palo Alto, Calif.
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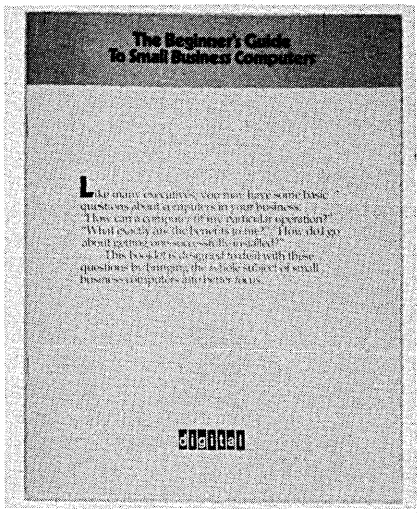
Small Business Systems
A new line of small business systems, the Commercial System cs/40 family, is described in this brochure entitled "The Merger The Business World Waited For: Data General and Small



Business Systems." Topics covered in the 12-page, four-color brochure include ANSI-standard COBOL, applications, interactive real-time systems features, and sample configurations. DATA GENERAL CORP., Westboro, Mass.
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Photo IDs
Methods for using photo ID cards for employee time and attendance reporting, payroll calculations, and inventory and production monitoring are described in this vendor's new catalog. Typical ID card designs in use by major companies, mounting the cards on pin-

fed forms so information may be preprinted, and techniques for issuing cards in 90 seconds also are discussed, as are the differences between polyester based cards and paper or photo-insert types. IDENTICARD SYSTEMS, INC., Lancaster, Penn.
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Distributing Processing
The text of a presentation given by Rowland H. Thomas, Data General v.p. of product marketing, has been published as a management-oriented discussion of distributed processing. "Minicomputers as Hosts in Distributed Data Processing: Selective Criteria," covers topics including the role of the corporate organization, the development and present role of minicomputers, minicomputer data management techniques, communications in distributed processing, and management and the data processing function. DATA GENERAL CORP., Westboro, Mass.
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reports & references

Programmer Productivity
Two reports now are available which describe specific cases of the achieve-

(Continued on page 57)

source data

(Continued from page 48)

ment of increased productivity and allied side benefits.

Increasing Programmer Productivity I describes the application of improved programming tools at the McDonnell Douglas Automation Co. The emphasis of the report is on management considerations and the implementation of structured programming techniques, including program design language, structured code, top down development, and walk-throughs.

Increasing Programmer Productivity II details the experience of the Chase Manhattan Bank in the use of structured walk-throughs. The report links programmer productivity with project manageability and end user satisfaction, with emphasis on product quality improvement through inspection. The walk-through inspection process is detailed; there is an outline of the Chase Manhattan data processing organization and an explanation of its in-house training course. Based on the original implementation procedures developed by IBM, Chase is unable to support certain of IBM's concepts, but they do claim significant increases in programmer productivity as a result of their program. The results are documented in the report. Price: $25 each. FAIM TECHNICAL PRODUCTS, INC., Box 1013, Melville, N.Y. 11746.

Codasyl Publications

The Canadian government has made available the text of the *Codasyl FORTRAN Data Manipulation Language J.O.D.* The loosleaf publication forms a companion volume to the *Codasyl COBOL J.O.D. 1976.* The basic COBOL J.O.D. is $7.50 per copy; page changes for 1976 are $7.50 per set. The FORTRAN Data Manipulation Language J.O.D. is $4.00 per copy. Prepaid orders (make check payable to the Receiver General of Canada) should be sent to: THE MATERIEL DATA MANAGEMENT BRANCH, Dept. of Supply and Services, Metcalfe Bldg., 5th Floor, Ottawa, Ontario, Canada K1A OS5.

Electronic Mail Report

According to this report, by 1980 347 of the *Fortune* 500 will have electronic mail systems up and running. This market will affect the existing market for facsimile, word and data processing terminals, and minicomputer/communications processors. The topics covered in the report include: electronic mail systems in insurance companies; Japanese technology; optical character reading; lasers and non-impact printers; Satellite Business Systems; the French PTT; low cost word processing from Exxon Corp.; the U.S. Postal Service; and office-oriented information systems. Price: $475 (includes basic report and four quarterly updates). THE YANKEE GROUP, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138.

New from the British Computer Society

Despite a few British idiosyncrasies and some news of interest only to members of the British Computer Society, it seems these two new periodicals published by the society would be of considerable interest to other nationals in the computing field.

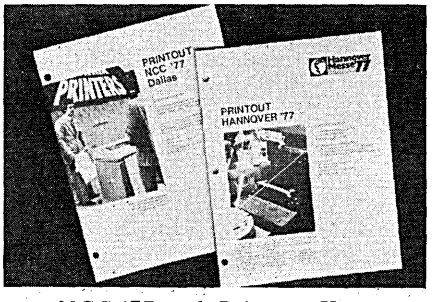
About 30 pages long, the *Computer Bulletin* has an academic flavor, but is aimed at a largely general interest audience, with articles covering a wide range of topics. For example, the June issue carried stories on structured systems design, performance enhancement projects, teaching linear algebra through CAI, and program network charts. The *Bulletin* features two nicely done columns, one on economics and one on art in computing. There also are excellent book reviews, to which a healthy amount of space has been devoted. The yearly subscription rate for nonmembers is £6 (about $10.50).

The *Computer Journal*, which runs about 100 pages, carries more technical articles on the subjects of business applications, advanced and systems programming, computer science theory, hardware and logic design, and technical applications. There also is a section called "Discussion and Correspondence," with recent inclusions being: "A note on the Oscillating Sort," and "KATE: A Macroprocessor for Extending Command of Languages." The *Journal* is liberally sprinkled with book reviews.

Both the *Journal* and the *Bulletin* are available from: THE BRITISH COMPUTER SOCIETY, 29 Portland Place, London W1N 4HU, England.

Printout Devices

New printout devices introduced this year at the NCC in Dallas and the Hannover Fair in Germany are described in these two new 24-page reports, *Printout NCC '77* and *Printout Hannover '77*. Each report includes photographs of the printers discussed, technical information on each printer, background information on the shows, and an ad-



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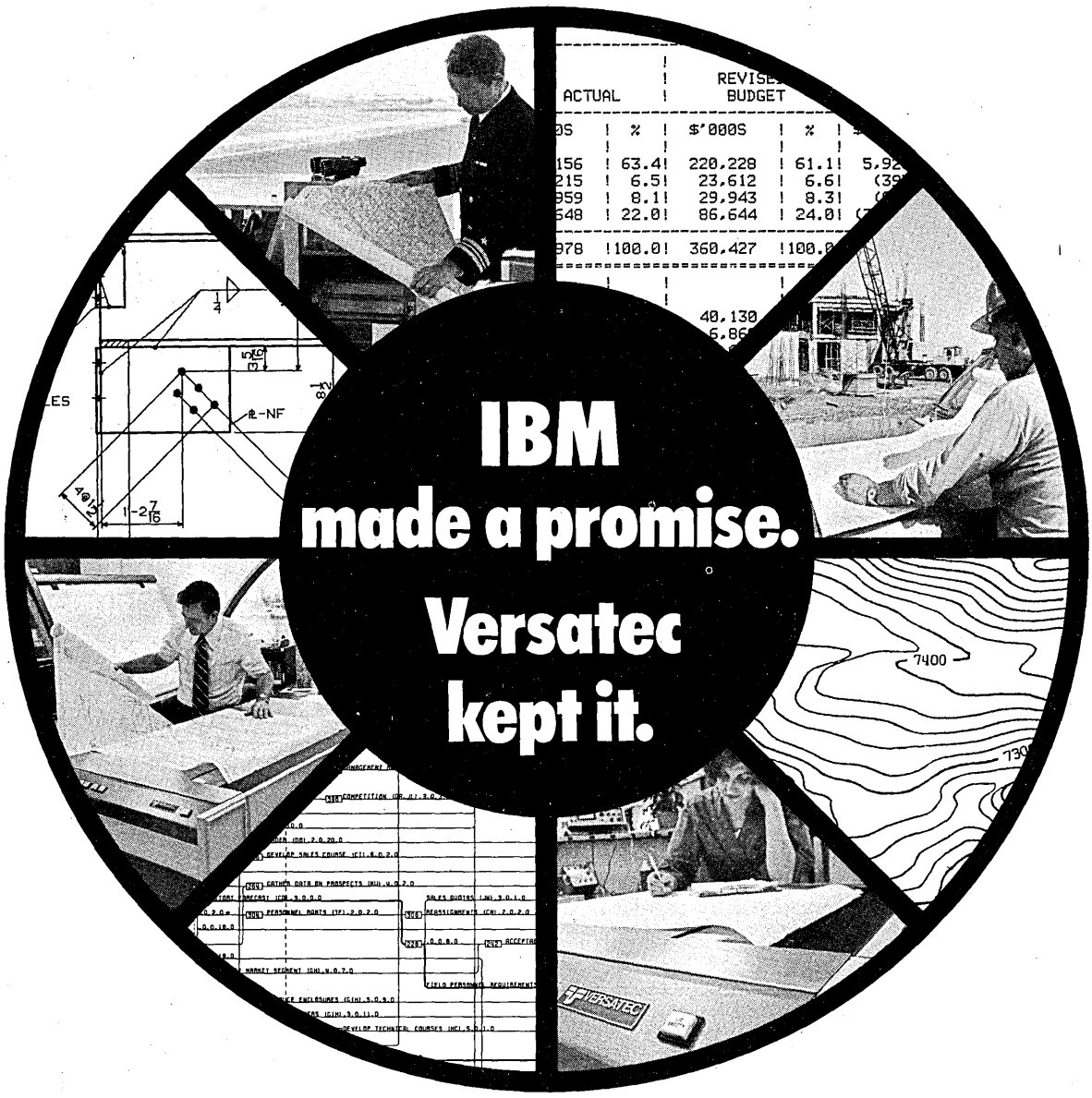
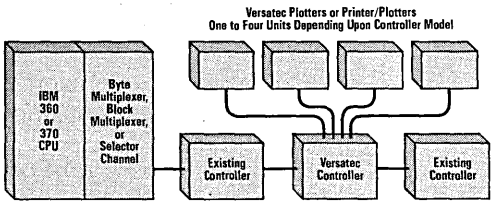


With the designation "360," IBM promised to satisfy the "full circle" of applications—business and scientific. One output system, designed specifically for IBM 360 and 370 computers, has kept that promise.

The Versatec 360/370 output system is plotting E-size drawings in sixty seconds. It is producing operating statistics, maps, financial data and management reports, complete with graphics. It is drawing six-foot wide IC plots and 200-foot long PERT charts.

Fast. Versatile. And thousands of hours more reliable than the pen plotters, line printers and CRT hard copy devices it replaces. Yet the total package costs less than a flatbed plotter.



No changes are required in IBM hardware, operating system or application software. Emulating a standard IBM printer/controller, the Versatec programmable controller can adapt to changes in computer models, channel protocols or new applications.

Operating at a comparable I/O transfer rate, the controller accepts data in any form—print, vector, raster or simultaneous print/plot information. Output is delivered on up to four plotters or printer/plotters, up to 1000 feet away.

IBM gave you the total computer. Versatec gives you total output.

VERSATEC
A XEROX COMPANY

2805 Bowers Avenue
Santa Clara, California 95051
(408) 988-2800

Please send literature:
- ☐ The 360/370 output system
- ☐ Plotters, printers and printer/plotters
  Plot widths: 8½", 11", 20", 22", 24", 36", 42", 72"
- ☐ Hard copy direct from CRT
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Please send samples
- ☐ Computer aided design
- ☐ Business graphics
- ☐ Scientific applications
- ☐ Production drawings
- ☐ Mapping

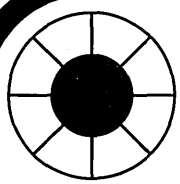
computer model and operating system

name telephone

organization

address

city, state and zip



360/370 users report:

"We use our Versatec for straight line printing, program listing, 370-directed plotting and for hard copies from Tektronix display. You can't get better utilization than that."

"We're doing salary administration reports and engineering plots on one machine (Versatec). Either application would have justified purchase."

"A CalComp drum plotter needed 175 24-hour days to plot the 9000 drawings. Versatec did the job in less than 15 hours."

"Sure, we're saving $50,000 a year in direct cost, but the economic value of timely graphics is incalculable."

"Our first Versatec system is performing beautifully. I've recommended purchase of Versatec systems for our 370's in every operating division."

"The turnaround is fantastic. Not days, not hours, but seconds."

"The programmer couldn't believe it. Before he could order a second plot, the first one was done."

"Resolution is great, even on long curves. We can use Versatec for final drawings."

"Our 36-inch wide Versatec plotter is in an engineering building half a mile away from our 370, but we're operating on-line without a hitch."

"CPU time is no problem. Total I/O and CPU time for 33,000 vectors is less than ten seconds."

"This is the first plotter that gives us interactive graphics with E-size and J-size drawings."

"Our engineers call it a super design tool. We have ordered another Versatec 36-inch plotter."

"It took us longer to make tapes for our off-line Gerber than for total turnaround on Versatec."

"This is the best thing that ever happened to CADAM. Fast turnaround has significantly improved engineering efficiency."

"We are plotting PERT charts almost 200 feet long in less than ten minutes."

"I don't think Versatec realizes the enormous economic advantages of this system. Immediate turnaround of drawings is improving our procedures, engineering productivity and design quality."

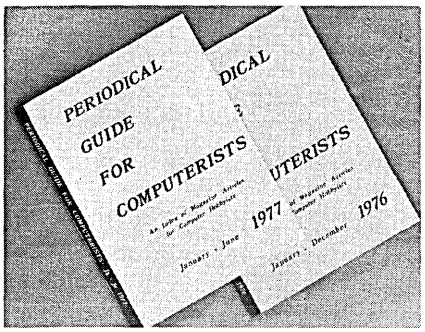
source data

(Continued from page 57)

dress listing of all firms exhibiting printout equipment. Price: $15 each. DATEK OF NEW ENGLAND, 150 Main St., Fitchburg, Mass. 01420.

Guide for Computerists

The January to June 1977 *Periodical Guide for Computerists,* including 1,080 articles from 23 hobby and professional computer publications, is now available. The articles, editorials, book



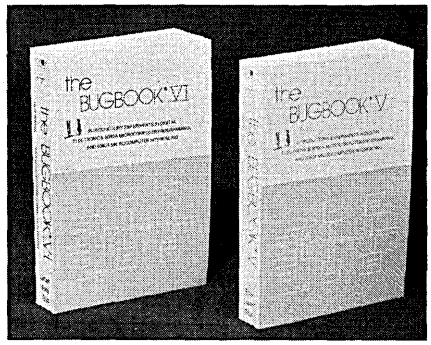
reviews, and letters from readers are indexed by subject under 90 categories. The 32-page book is available for $3 from E. BERG PUBLICATIONS, 1360 S.W. 199th Ct., Aloha, Ore. 97005.

Oem Data File

Over 200 Western European companies are included in the current listing of oem's and systems houses that purchase mini/microcomputers, miniperipherals, and related media for resale as turnkey systems. The *International OEM/Systems House Prospect Data File* is designed to provide marketing assistance to those participating in the international minicomputer systems marketplace. The file contains information on each company, including annual sales revenues, annual hardware expenditures, specific hardware purchases in 1976 and 1977, and the name of the individual responsible for buying decisions. Extensive coverage of Great Britain currently is available, and oem's and systems houses in Germany and Western European countries presently are being identified and added to the file. The total number of listings is expected to reach 500 by January 1978. Price: $1,500. A U.S. version of the report, including 1,700 companies, is available for $2,500. INTERNATIONAL DATA CORP., 214 Third Ave., Waltham, Mass. 02154.

Bugbooks

Introductory experiments in digital electronics and programming and interfacing an 8080A-based microcomputer are integrated in the two volume course, *Bugbooks V and VI.* The books are intended for study and guidance in the performance of hands-on experiments with the aid of a microcomputer, breadboarding kits, and other components. The course is organized for teaching microcomputer programming and the interfacing of a microcomputer with external digital devices for practical applications. The first book contains 493 pages covering the basics of 8080A microcomputer programming and instructions. The second book contains 490 pages, and integrates digital concepts discussed in the first book into the treatment of



8080A microcomputer interfacing and programming. Other topics included are: advanced input/output concepts, and interrupt servicing. Complete appendices for both volumes at the back of *Bugbook VI* include references, definitions, and descriptions of available breadboarding accessories and microcomputers recommended for use in the experiments. Price: $9.50 each. E & L INSTRUMENTS, INC., 61 First St., Derby, Conn. 06418.

periodicals

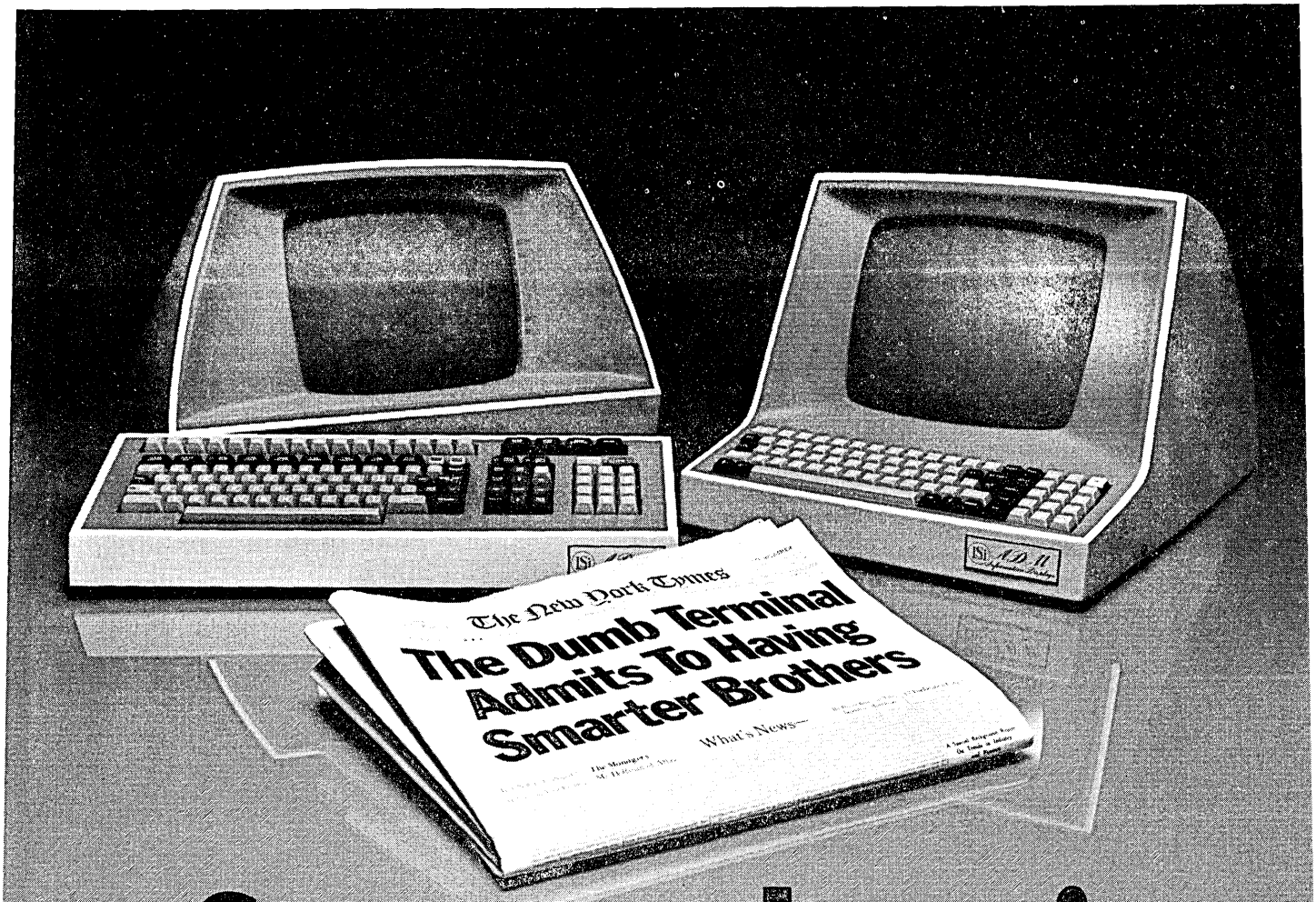
Bar Code Monthly

A new monthly magazine devoted entirely to bar code scanning and its many applications began publication in September. *Scan* will cover the latest innovations in applying bar codes to count and track the movements of goods, and will highlight the companies, applications, and equipment in this industry. The first few issues will include articles on such topics as: bar code scanning as used by the Dept. of Defense; UPC as a marketing tool; hospital and library use of bar codes; and the outlook for a standard shipping container symbol for all industries. Subscription: $60/year, U.S. and Canada; $70/year all other countries. SCAN NEWSLETTER, P.O. Box 702, Great Neck, N.Y. 11022.

International Report

Computer Products International, a publication having its first printing in

(Continued on page 65)



Sooner or later it was bound to get out.

Yes, the Dumb Terminal™ really does have two smarter brothers.

At first, they weren't quite as well known, because their Dumb Brother's smashing success was stealing the show. Although they had been selling quite well all along, even without getting constant headlines, like their Brother.

Now, however, Dumb Brother has pulled them into the limelight. And ADM-1 and -2 have decided, after all, that perhaps it's time you knew a little more about how smart they really are.

ADM-2 is the more intelligent of the two, providing you with flexibility of format, security, editing, interface, and transmission. You'll find, among a variety of other outstanding features, up to 8 screen status indicators and a numeric key pad. And a detachable keyboard with 16 function keys. Which give you the ability to access your special program, or form, or instruction.

The ADM-2 is also available in a model compatible with your Burroughs TD-800 Series. The ADM-2B. The ADM-2B adheres to the standard Burroughs poll and address line discipline.

On top of all that, we've made the ADM-2 micro-programmable. And taken all the mystery out of the procedure. Which makes user-micro-programmable simple, quick, and cost-effective. The ADM-2's versatility is limited only by your imagination.

CIRCLE 92 ON READER CARD

You could call the other Smarter Brother, ADM-1, the "with-or-without" terminal. Starting with some pretty smart standard features, like a standard 24-line display, a field protection feature with dual-intensity and switch-selectable operating modes — block mode and conversation mode — you build up from there. With options like a hardcopy printer interface, and display editing capabilities (line insert, line delete, line erase, character insert, and character delete). Just add the options you need, and leave the rest of the "bells and whistles" for someone else. That way, it's more systems adaptable. And it's up to you just how smart you want it to be.

The Smarter Brothers have it all. Intelligence, appropriate functions, and sensible cost-per-performance.

So, you might as well get used to seeing more of the ADM-1 and -2 in the future. Because we suspect they're going to be in the spotlight from now on.

After all, there's really nothing wrong with exposing your Smarts.

LSi®

The dumb terminal's smarter brothers.

Lear Siegler, Inc., E.I.D./Data Products, 714 N. Brookhurst St., Anaheim, CA 92803; (800) 854-3805. In California (714) 774-1010.

Sycor announces that's shamel (Except for

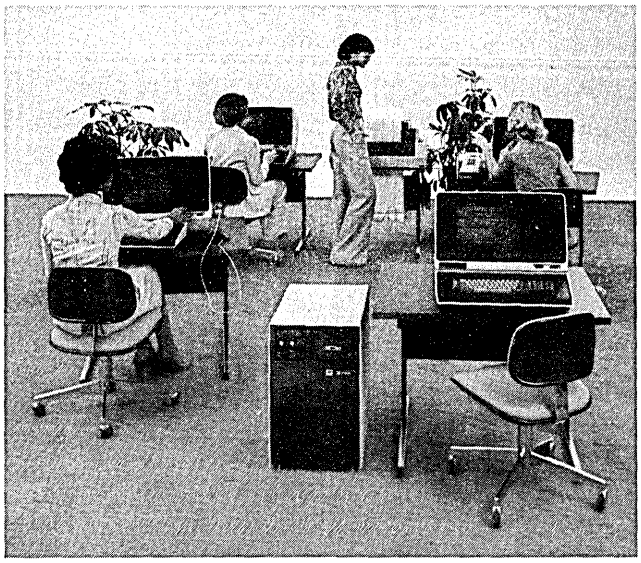
We're proud to introduce an on-line system that offers as much as the big guy's system. For a lot less.

It's the new Sycor 290—a 3270-compatible display system that can save you up to 25% over a three-and-a-half-year lease. And even more when you purchase.

An outgrowth of our long experience with on-line systems, the Sycor 290 is available in remote and local configurations-that support up to 16 CRTs and printers in any combination. And in a remote mini-cluster unit that supports a combination of up to eight CRTs and printers.

Remote configurations use either Binary Synchronous (BSC) or Synchronous Data Link Control (SDLC) line protocol at speeds from 1200 to 9600 bps. This fast transmission time allows you to better control your line costs and to configure your network for optimum performance.

Our new, larger display screens are adjustable for character intensity and contrast. And our movable keyboards and glare filters help your operators work comfortably and productively.



Special diagnostics mean fast service.

Service for the Sycor 290 can be sped up by using our sophisticated diagnostic programs. You can run them to pinpoint problems quickly and easily. And alert the Sycor field engineer to the problem when you call for service.

an on-line system essly "me, too." the price.)

Trouble-shooting is on target from the moment he walks in. With more than 400 Sycor field engineers within a half-hour drive of 1750 North American cities, downtime stays way down.

Get a reliable Sprinter running for you.

The Sycor Sprinter™ can satisfy your printer requirements, too. The bidirectional, microprocessor-controlled printer is available in 66-, 120- and 180-cps models to give you system-tailored flexibility.

Sycor builds every unit, controls every phase of Sprinter's design and production. So you're assured of more operational reliability. By eliminating many of the mechanical parts that can go haywire, our Sprinters stay running longer.

Sycor also has light-pens, badge readers and key locks. In fact, we have just about everything you need for on-line applications.

Get a line on Sycor. Call 800-521-2838.

Most importantly, Sycor can really help you save big on your system lease or purchase costs. To find out how much, call Tony Fazio, V.P. Sales, at our toll-free number: 800-521-2838. Or write Sycor, Inc., Corporate Offices, Ann Arbor, MI 48104.

Better yet, call a nearby sales office. We're in the Yellow Pages under "Data Processing Equipment."

Sycor puts computer power where the work is.

SYCOR

HOW WE HELP SOLVE THE 1403-N1 USER'S TWO BIG PROBLEMS:

TOO MUCH SPEED. AND NOT ENOUGH.

The IBM 1403-N1 is a great printer. Trouble is, 1100 lpm is an awkward speed for lots of systems.

Either it's too slow for your 360/370's high-speed needs, and you can't afford the jump to 2000 lpm.

Or you're paying for speed you don't need, but it sure beats trying to live with 600 lpm.

Well, we offer two more *logical* printers to fit your needs: one substantially faster, the other slightly slower than 1100 lpm. Both can save you money. (Also floor space and power.)

For instance, for less than you're now paying for the 1403-N1, you can get our 1500 lpm printer. And up your speed by 400 lines per minute.

Or, for a whopping $500 per month less than you're now paying for that 1403-N1, you can have our 900 lpm model. At only a slight reduction in speed.

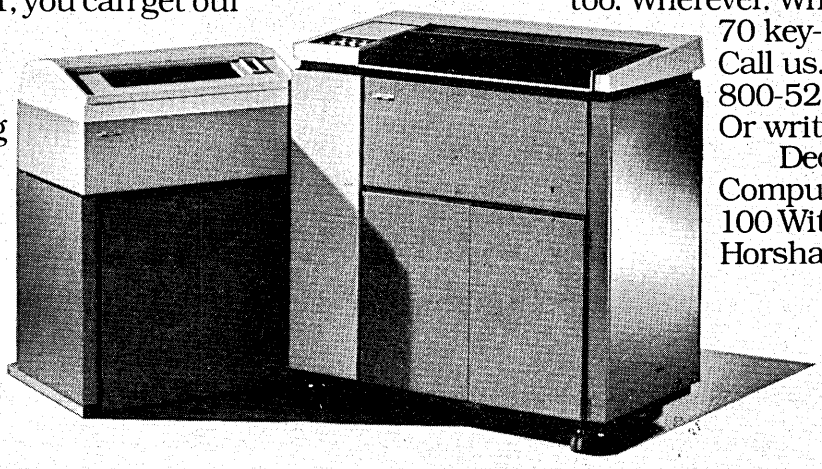
In fact, you can mix and match our 300, 450, 600, 900, and 1500 lpm printers to meet all kinds of performance needs. And economy ones. Same goes for our complete line of card peripherals, too.

Just talk to us.

We're already saving money and improving performance for over 6,000 IBM customers. With over 13,000 add-ons, plug-ins, and auxiliary units installed. Including hundreds and hundreds of printer installations.

And better yet, we don't sell, and then send you off in search of service. We service, too. Wherever. Whenever. From 70 key-city locations. Call us. Toll-free: 800-523-5948. Or write.

Decision Data Computer Corp., 100 Witmer Road, Horsham, PA 19044



DECISION DATA®
COMPUTER CORPORATION
makes computing cost less

CIRCLE 25 ON READER CARD

source data

(Continued from page 60)

September, is a journal of interest to those responsible for purchasing data processing equipment or for specifying or designing systems. Its editorial concentration will be on the new products—peripherals, terminals, memory products, minicomputers, microprocessors, word processors, and software packages—which are being launched. There also will be a news review, an oem page, and a product review. IPC ELECTRICAL-ELECTRONIC PRESS LTD., Dorset House, Room 125, Stamford St., London SE1 9LU England.

Folio

Devoted to topics related to the documentation of computer application systems, *Folio* is designed to provide information for managers in the area of computer communications. Volume one, number one included articles entitled, "The Hidden Expense of Software Packages," and "Six Steps for Estimating Writing Time." The quarterly publication also will include regular departments such as: "Manager's Bookshelf," "Management Decisions," and "You Can Write . . . Effectively." Subscription: $25/year. SANDRA PAKIN AND ASSOCIATES, INC., 6007 Sheridan Rd., Chicago, Ill. 60660.

Used Computer Newsletter

A monthly used equipment newsletter began publication in October. *Used Computer Equipment Newsletter* will be entirely devoted to this vendor's line of used DEC and Data General computers, terminals, and peripherals. Free subscriptions to the newsletter are available from: ACP, 472 Pepper St., Monroe, Conn. 06468.

courses

Graphics Seminar

Industrial, business, government, and utility applications for computer graphics will be discussed at *Computer Graphics '77: the Complete Computer Graphics Seminar.* Presentations on computer cartography, computer graphics hardware, distributed graphics, business graphics, and on organizing for graphics will be featured. There also will be a live demonstration of a computer graphics system. The seminar will be presented Dec. 14-15 in Milwaukee, Wisc. Price: $400. COMPUTER GRAPHICS '77, 12201 W. Burleigh Rd., Wauwatosa, Wisc. 53222.

Minicomputer Seminar

This three-day seminar will examine the uses, economics, programming, and implementation of minicomputers. It also is designed to assist decision-makers in planning and installing minicomputers on a standalone or decentralized basis. The seminar will include instruction on minicomputer architecture, peripheral equipment, minicomputer software, microprocessors, distributed processing, communications support for distributed networks, application-oriented systems, intelligent terminals used in distributed systems, mini-based business systems, and word processing. Presented by the Univ. of Chicago Center for Continuing Education, the seminar will be offered in San Francisco, Nov. 14-16; Chicago, Dec. 12-14; and Atlanta, Jan. 23-25. Price: $435 per person, plus $60 registration per company (includes all workbook and handout materials). UNIV of CHICAGO, Center for Continuing Education, 1307 E. 60th St., Chicago, Ill. 60637.

System/3 Course

A new course designed to upgrade IBM System/3 personnel now is available from this vendor. The course is said to begin where the IBM PI course ends, and is said to cover the full range of System/3 usage, including special techniques in RPG II, data handling, and altering the processing order in the calculation section. The course also explains the system control language, OCL, and the utilities necessary for file and system maintenance. Subject titles of currently available modules are: RPG II Program Cycle Features; RPG II Programming Techniques; RPG II Tables, Arrays, and Matching Records; OCL and Utilities; Advanced OCL, OCC, and Spooling; Disc Sort and Additional System Utilities; and File Design and Organization. Other modules presently are under development. A single module consists of a self-instructional workbook and a "synchro-pâk," a synchronized filmstrip cassette capable of housing up to 200 frames of film and 60 minutes of sound. Price: $215/module; $1495, complete set of seven modules. THE EDUTRONICS GROUP, 3435 Broadway, Kansas City, Mo. 64111.

Basic Self-Instruction

The EC-1100 self-instruction course in BASIC language programming techniques has been designed to teach those with little or no computer experience the skills necessary to converse,

(Continued on page 72)

There isn't a single single- that can touch Tandem in

To begin with, we're twice as good. With multiple processors. It's as simple as this. On-line means on-demand, and one processor won't do. Because any processor, even one of ours, can fail. And if that failure occurs during a peak period of transactions, you're out of business while it's down. And out of luck if you miss your re-start point or clobber your data base. And out of control if you lose or duplicate the transactions in process when the failure occurs.

You need a NonStop™ System.

Tandem has built the world's first multiple processor system, designed from scratch in both hardware and software, to provide non-stop processing—even during a failure—with no penalties in the speed, capacity, throughput or memory utilization of the system.

And it can grow without penalty. Starting with a basic two processor system, users can add processors, memory or terminals incrementally all the way to a fully expanded system of sixteen processors supporting 2048 data communications lines, with individual files of up to four billion bytes fully supported by a comprehensive data base management system. But the best part is that you never have to reprogram. Ever. Your Tandem NonStop System just gets bigger and better. At remarkably low cost.

Why the big ones fail.

The big mainframes are expensive to begin with. And even they can fail. Which can leave you high and dry in the on-line environment. But there are other difficulties with the big numbers, too. Of prime consideration in the on-line world, they offer very limited throughput for their price. And by the time you've hung a lot of communications lines on them, they suffer a derating which makes their performance even less attractive.

And whereas you may eventually need that kind of horsepower in your on-line system, chances are it's an expensive overkill at the outset. What you need is a system which will do the job efficiently on the way in, and grow as your needs grow, in modest price increments. It makes the big systems people wish they were more flexible.

One mini just won't make it.

Minis have made a name for themselves, justifiably. But in the world of on-line, where needs keep growing, the one mini system just can't cut it. With the architectural limitations inherent to a single mini system, growth can build system overhead so fast you'll grind to a halt before you know it.

And strap-ups will kill you.

The answer might seem to be to strap two processors together. One goes down, and the other takes over. Right? Wrong. It's not that simple. System software for a single processor system won't run on the strap-ups. And the fate of any transactions-in-process at the time of a failure is unknown. As is the state of any records being updated. And growth beyond the original system capacity is well nigh impossible.

What you really need is the one multiple processor system designed for multiple processor operation. Tandem's NonStop System.

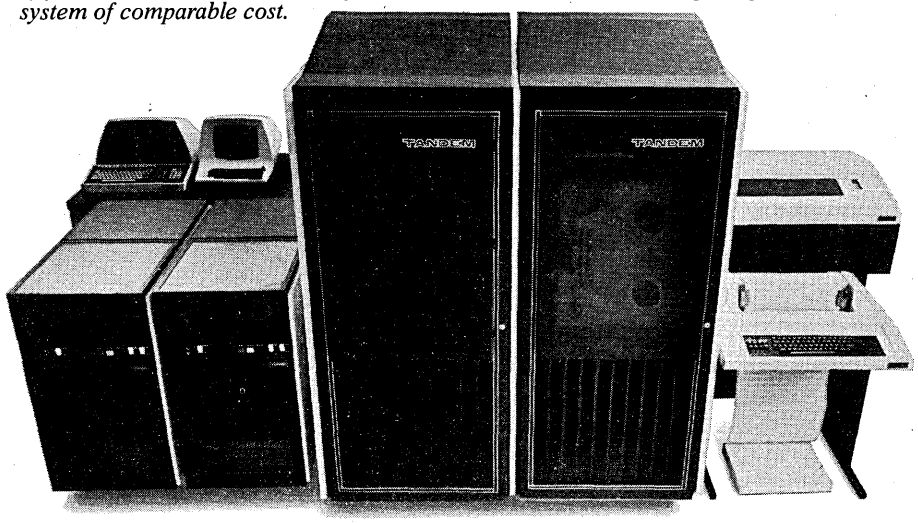
The four major "on-line" considerations.

When anyone is considering an on-line system, regardless of size, there are four primary points to consider. Throughput. Availability. Data Integrity. Transaction Protection. The system must be able to handle the job. It must be there when you need it. You must be sure of the integrity of your data base. And you must be sure you don't lose or duplicate a transaction. Even during a failure. No single processor system anywhere can provide that assurance. It takes a multiple processor system designed for the on-line environment, and Tandem is it.

For better throughput, spread the files.

We built the Tandem NonStop System with geographic independence of programs and files. They're handled automatically under Enscribe, our Data Base Record Manager. And instead of having one processor with one bottlenecking channel and a

The Tandem 16 NonStop System is composed of multiple, independent processors with dual redundant communications paths. The unique interaction between Tandem hardware and software assures not only continuous operation, and the integrity of your data base, but also throughput unmatched by any other computing system of comparable cost.



processor system anywhere an "on line" environment.

fixed priority system, Tandem's NonStop System distributes the work and the files across multiple processors, multiple discs, and multiple channels. Enscribe controls the pattern and the flow for maximum efficiency. Because of simultaneous disc accesses, there's a dramatic improvement in response time. It's one of the performance benefits about a multiple processor system which you can't get on a single processor system.

Ease of programming, by design.

Historically, multiple processor systems have been a bear to program. Not with Tandem. Guardian, Tandem's operating system, lets you write your programs as usual. You can add more processors, or memory, or terminals as you need them. No need to rewrite programs. Ever.

And we make it easy to write the programs in the first place, with COBOL or with TAL, a powerful language designed for fast, flexible programming. The software development tools of this mini-based system rival those of far more expensive systems, and include NonStop operation, data communications, mirror volume capability, full file protection, screen formatting programs, and a host of housekeeping utilities.

When you're thinking "on-line," think in Tandem.

Which means think in multiples. Few, if any, "on-line" systems can be installed and forgotten. The number of transactions, the number of terminals on-line, or the number of applications programs to be run on the system keep growing. Most likely, all three will multiply.

Which is traumatic unless you've started with the one system on the market which can grow with you—even if the growth occurs during the initial configuration phase—without having to start all over again.

NonStop growth and NonStop protection, too.

Because the Tandem System was designed for NonStop operation in both hardware and software, it offers an extraordinary measure of protection against a failure in any processor, I/O channel, disc drive, or in the software. No other system offers this measure of assurance.

When a failure does occur in any segment of the system, its back-up counterpart completes the task, without a hitch. Since all programs are geographically independent, and the operating system both distributes and monitors all work-in-process, recovery from a failure is instantaneous. There is no restart; no backing up to a hopefully safe point.

The system monitors its own operations, performing all tasks in a distributed fashion across the multiple processors. Even when a CPU goes down, another CPU is immediately aware of the failure and picks up the task in process and completes it. No data and no transaction need ever be lost or duplicated. The integrity of the data base can be fully protected. It is truly unusual, but it's one reason why we say no single processor system anywhere can touch us in the "on-line" environment.

NonStop software.

Guardian: Operating System.

NonStop operation.

Automatic re-entrant, recursive and shareable code.

Virtual memory system.

Geographic independence of programs and peripherals.

Enscribe: Data Base Record Manager.

Provides relative, entry-sequenced and key-sequenced files.

Each file may be up to four BILLION bytes.

Up to 255 alternate keys per file.

Optional mirror copy by disc volume.

Envoy: Data Communications Manager.

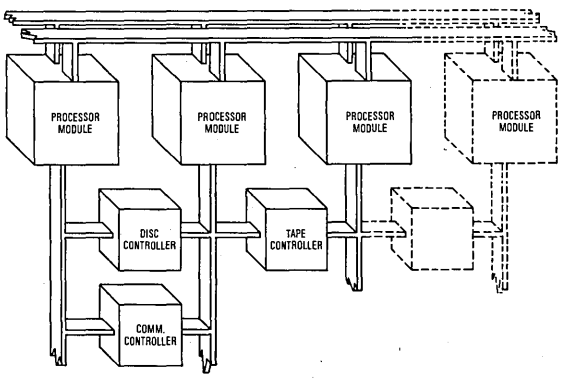
Languages: COBOL, TAL.

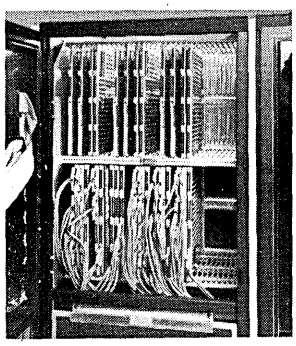
TANDEM

Tandem Computers, Inc.,
20605 Valley Green Drive, Cupertino, California 95014 or Tandem Computers GmBH, Bernerstrasse 50, Frankfurt 56, West Germany.

Toll Free 800-538-9360 or 408-255-4800 in California.

Photo and schematic show three processor modules with space for fourth module, interconnected to disc controllers, tape controllers and communications controllers.





Take a profitable trip to France

Exhibit your **Computer** and **Peripheral** Equipment at

PRINTEMPS INFORMATIQUE

a four-day exhibition being held at the

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Paris, France, March 14-17, 1978

The Market:

- Growth rate—14 percent a year
- 1980—$2 Billion
- French Government encourages the use of computer-based technology in all sectors of the economy
- Imports—$1 Billion
  U.S. Share: Over 47 percent

The U.S. Department of Commerce will provide:

- Market promotion campaign
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SPACE IS LIMITED. Act now to get more information about this MUST exhibition for growth-oriented manufacturers. Call Helen Burroughs at (202) 377-4941 or send the coupon.

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Office of International Marketing
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U.S. Department of Commerce
Washington, D.C. 20230

Subject: PRINTEMPS INFORMATIQUE
U.S. Trade Center
Paris, France
March 14-17, 1978

☐ We'd like more information. ☐ We want to participate.

☐ We are ☐ are not represented in France.

Name _____ Title _____

Company name _____ Telephone _____

Address _____

Our exhibition-related products are _____

_____

HOW TO IMPROVE YOUR MEMORY IN ONE EASY STEP.

If your computer ever suffers from a lapse of memory, here's what you can do to help:

Always remember to use Maxell magnetic products. Because we put a lot of things into them to ensure that nothing ever drops out.

Our digital cassette tape, for example, is so good some of the biggest OEM's in the business use it.

And we firmly believe that our new floppys are every bit as good.

They're made to the strictest ISO and IBM Diskette specifications.

They're made of computer grade, super-fine magnetic materials for high density recording at 3200 BPI.

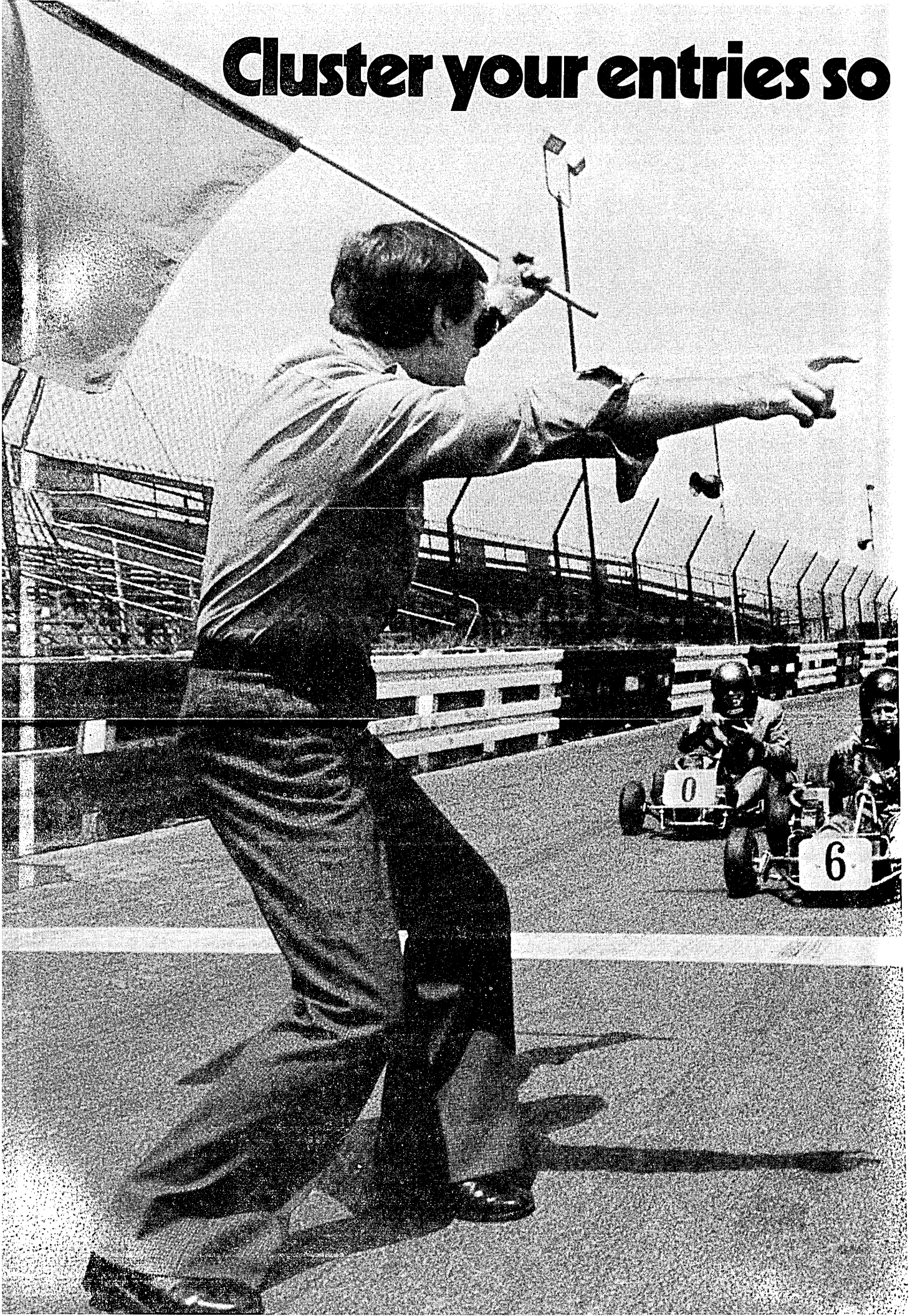
And they have a specially developed binder for improved particle dispersion and an incredibly smooth coating surface.

So if your computer has a problem remembering things, contact a Maxell sales representative and ask about the data products with the good memories.

But you better do it soon. Before you forget.

Maxell Corporation of America, 130 West Commercial Ave., Moonachie, N.J. 07074

Cluster your entries so



everybody wins. Mainly you.

You run a wholesale business. Two locations, 3000 customers and growing. But rather than hire more order clerks, you put a computer in your main office. Trouble is, feeding it orders keeps your clerks queued up, your direct line tied up, and your computer idling while your slowest operator taps out 30 words a minute.

We have a solution: A system that features our newest Dataspeed® 40 terminals clustered on a common controller in each of your two locations. Information is entered on a simple keyboard, with your own display forms to guide the operator, then held until all corrections are made and your computer is ready to receive it. Saves time. Avoids billing and shipping errors. Helps reduce inventory. Improves your cash flow.

Solving problems in data communications is an all-out commitment of the Bell System. If you haven't talked systems with your local Bell Account Representative lately, you're missing something.

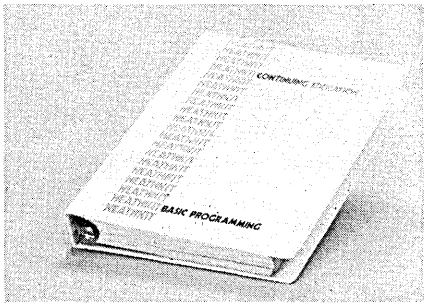
The system is the solution.

Bell System

source data

(Continued from page 65)

create, and program in BASIC. Language formats, commands, statements, and procedures are taught by a course of programmed instruction texts combined with practical demonstration programs and practical problems. The course is keyed to the Health computer



systems, but because of the nature of the BASIC language, the course can be a supplement to any other computer system using BASIC. Price: $29.95. HEATH CO., Dept. 350-450, Benton Harbor, Mich. 49022.

Market Impact Report

On August 25, a large consumer retailer began advertising a "home" computer system for business that sells for $599.95, and allows the businessperson to assign clerical tasks such as inventory control, accounting, and payroll. The effect of this and the home computer on the existing computer industry and communications industry will be the subject of a seminar to be presented in New York on Dec. 6, and in Anaheim, Calif., on Dec. 9. Keynote speakers at *The Impact of Personal Computers on Traditional Edp and Communications Markets* will be Alan Kaplan, Carol Ogden, and Howard Anderson. Price: $300. THE YANKEE GROUP, P.O. Box 43, Harvard Square, Cambridge, Mass. 02138.

Microcomputer Seminar

Aimed at people who are interested in implementing computer solutions to real problems, but who may have no experience in actual computer interfacing, this series of two-day courses deals with the microcomputer at bus level. Each student works with a MMD-1 microcomputer with an Intel 8080A cpu. Each participant in the course will retain the computer with power supply, and Bugbooks V and VI so that study, experimentation, and design can be continued. The course will be offered Nov. 17-18 in New York, and Dec. 15-16 in Mt. Laurel, N.J. Price: $695. SHORTESS-RAWSON AND ASSOCIATES, 155 U.S. Route 22, Springfield, N.J. 07081. ❁

Absolutely no distributed processing system offers you all these 10 features except Series 21 from MDS:

1. An intelligent data entry system which installs as easily as a keypunch and is fully operational as soon as you plug it in.

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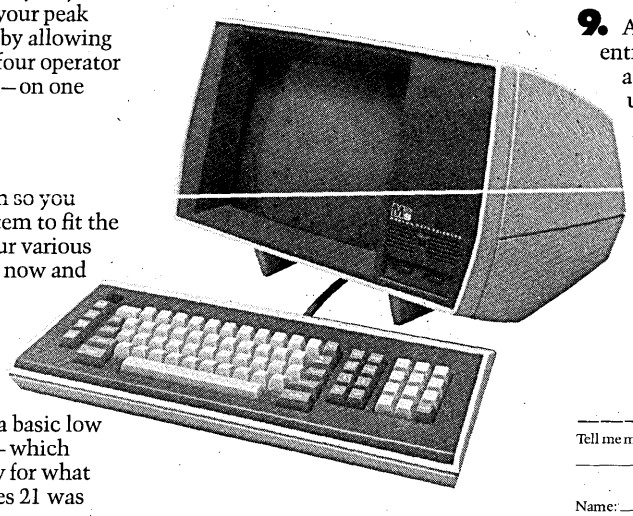

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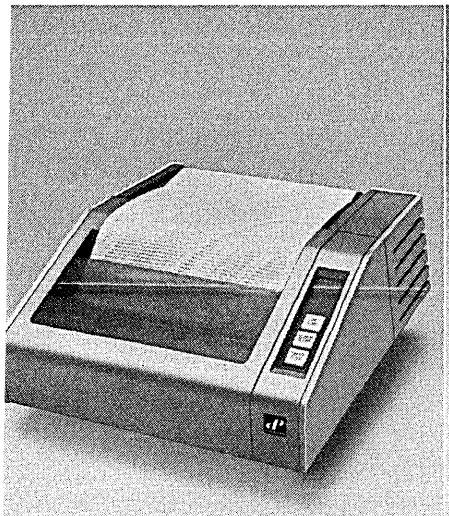
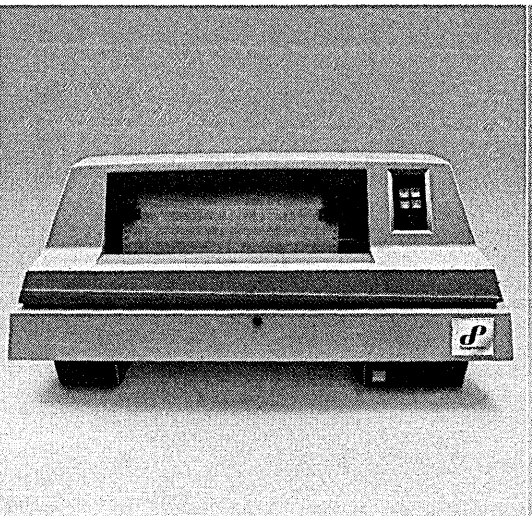


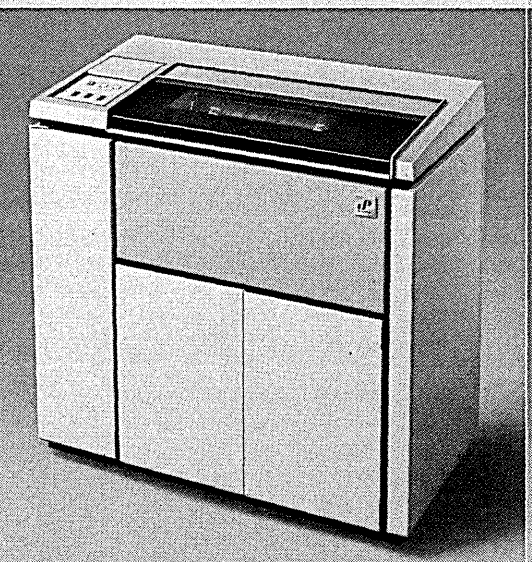
T-80 THERMAL PRINTER—80 CPS



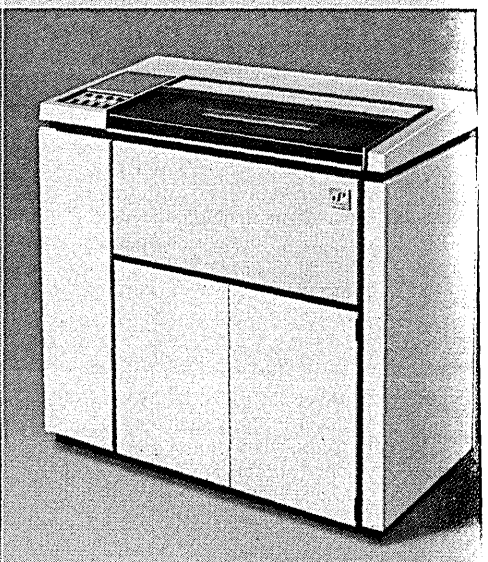
B-180 BAND PRINTER—180 LPM

M-200 MATRIX PRINTER—200 LPM

2290 LINE PRINTER—900 LPM



2470 LINE PRINTER—1250-2000 LPM



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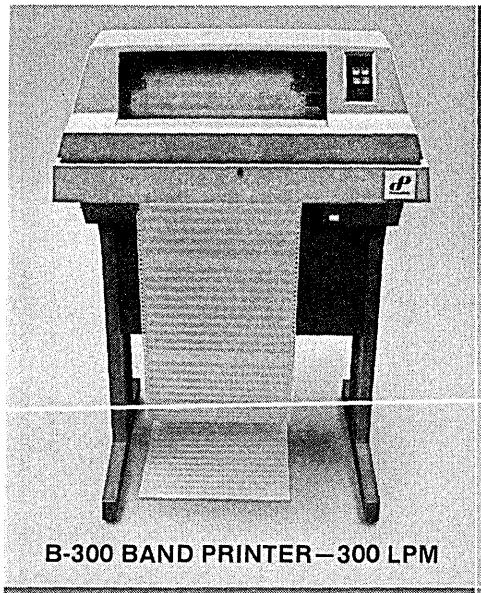
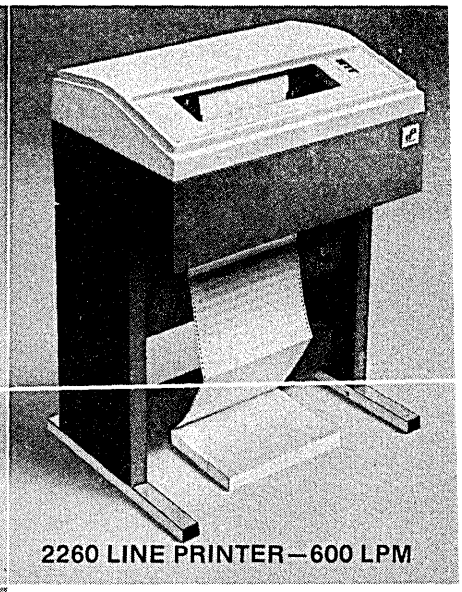


B-300 BAND PRINTER—300 LPM

2230 LINE PRINTER—300 LPM



2260 LINE PRINTER—600 LPM

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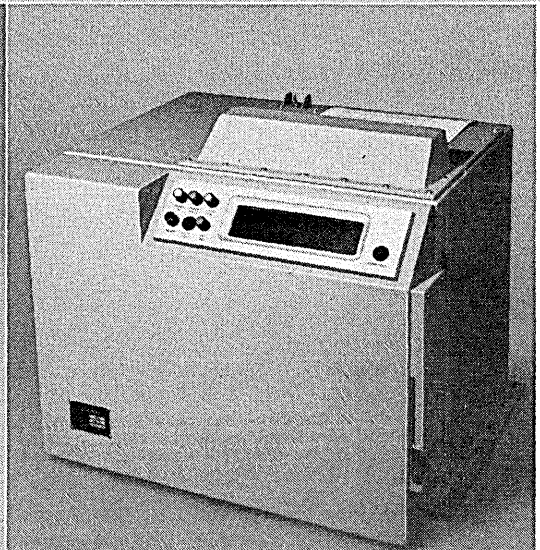

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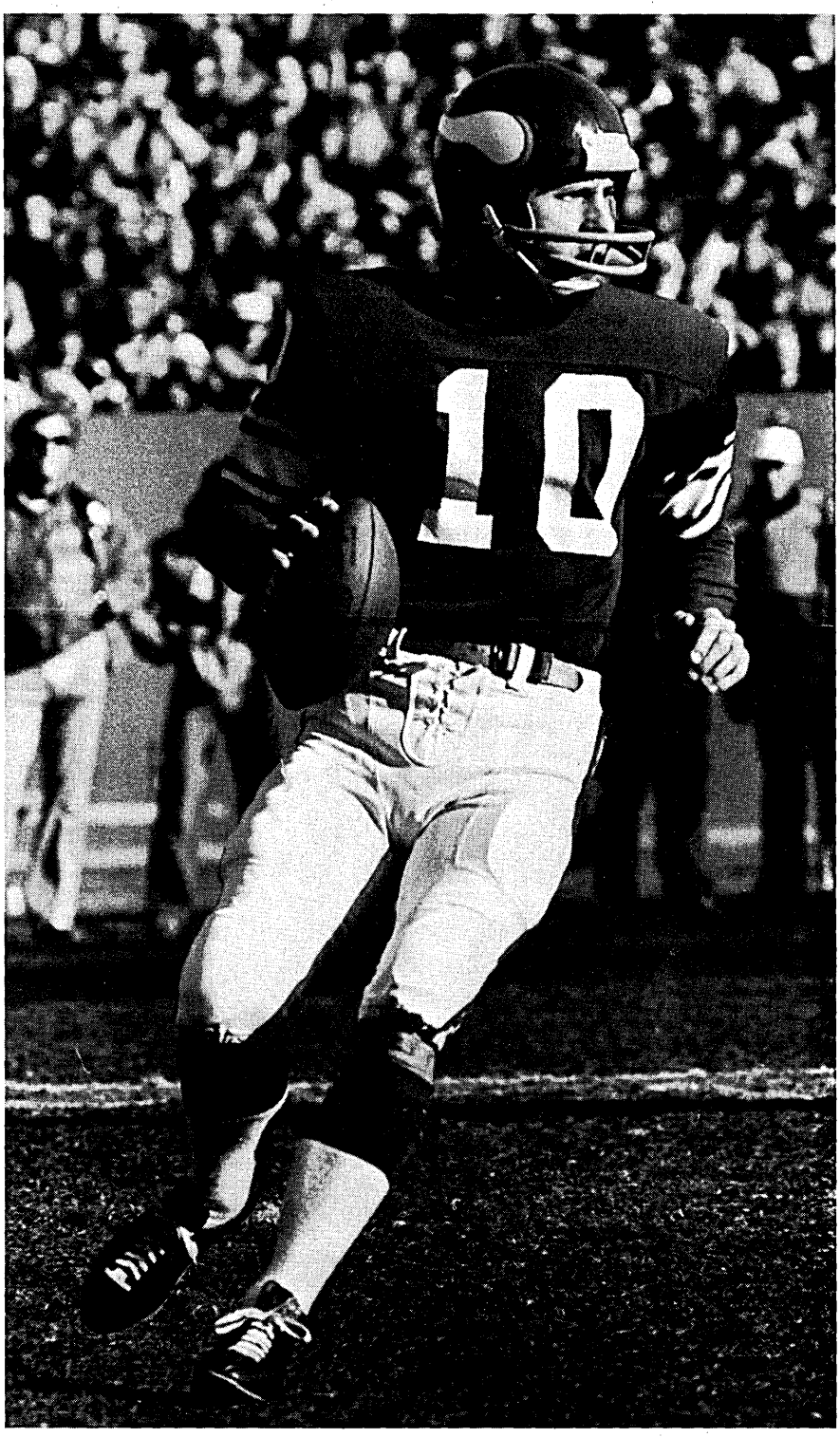

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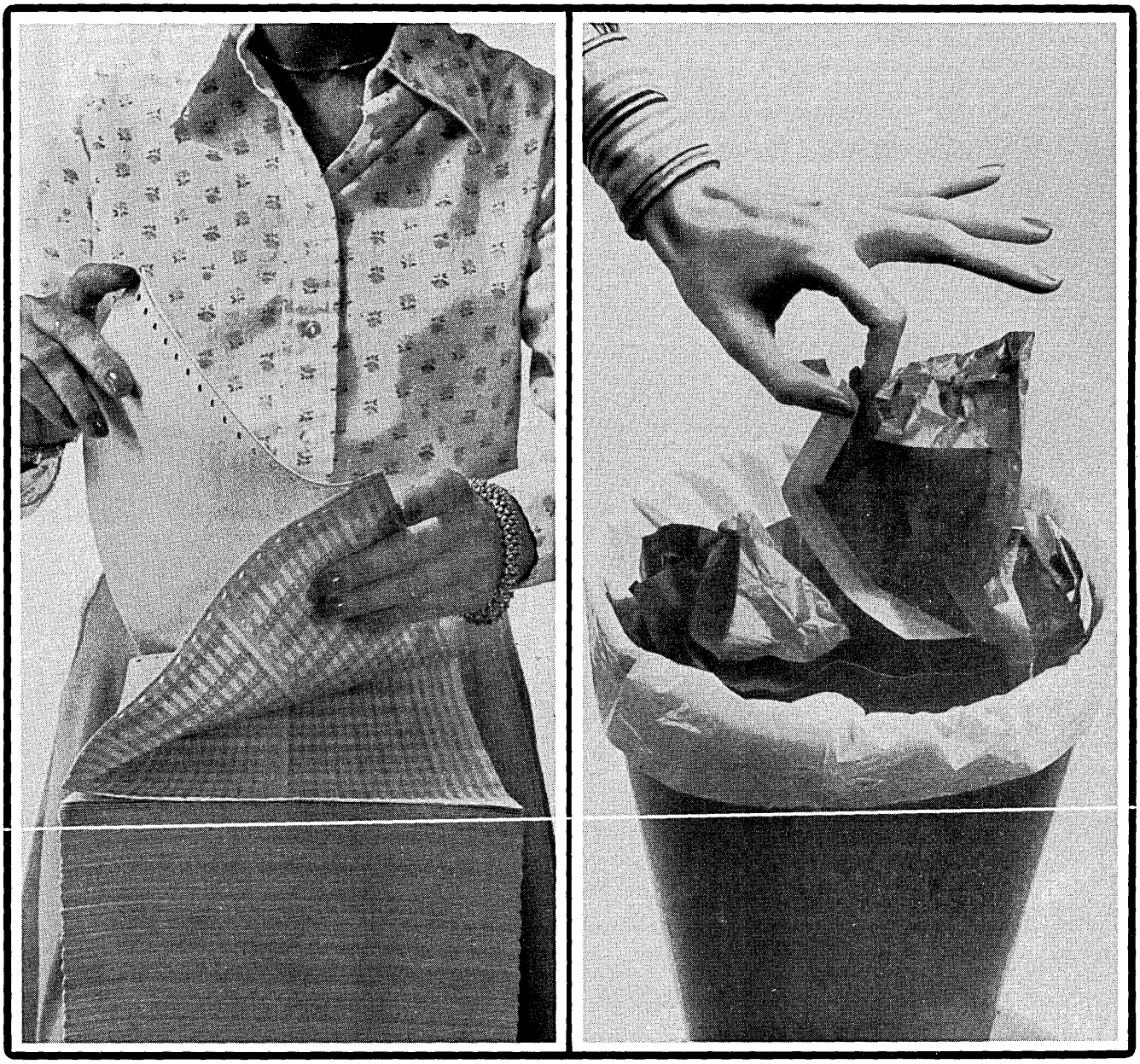

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---

1. Keybatch is:

(a) a multifunction intelligent key-to-disk data entry system.

(b) a brand new multifunction system from Data 100.

(c) a multifunction system which supports high volume concurrent batch capabilities.

2. Keybatch is also:

(a) a multifunction system offering stand-alone RPG for expanded user flexibility.

(b) a multifunction system that can operate with on-line file inquiry capabilities (3271 compatible) via common key-stations for both data entry and on-line file inquiry.

(c) a system capable of handling mail sorting and other office tasks.

3. As a data entry system:

(a) Keybatch has up to 20 megabyte disk storage capacity.

(b) Keybatch is proven with approximately 900 units now in use.

(c) Keybatch can be configured with 2 to 16 keystations.

4. For the end user:

(a) Keybatch meets short range goals such as appreciable dollar savings.

(b) Keybatch provides for long range system growth.

(c) Keybatch offers both of the above.

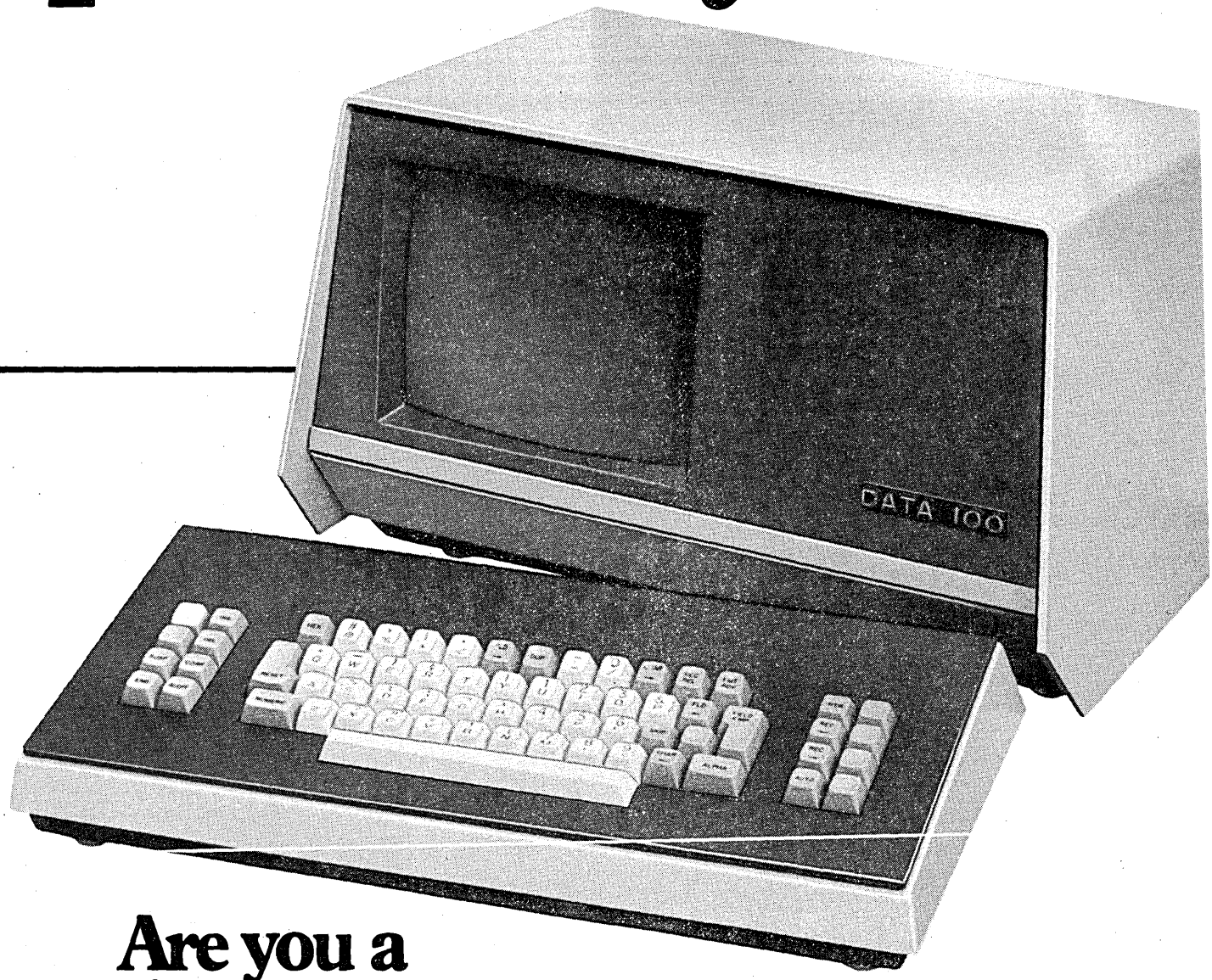
5. For more information on Keybatch, you should:

(a) search frantically through your EDP literature files.

(b) write Data 100 at 6110 Blue Circle Drive, Minnetonka, MN 55343.

(c) call your nearest Data 100 sales office or one of the numbers we've listed.

quiz on Keybatch.®



Are you a multifunction expert? Check these correct answers.

All answers but four are correct.

1b: Keybatch isn't brand new, was introduced in 1974.

2c: Sorry, Keybatch can't do everything.

3b: There are actually 1500 Keybatch systems on the job worldwide.

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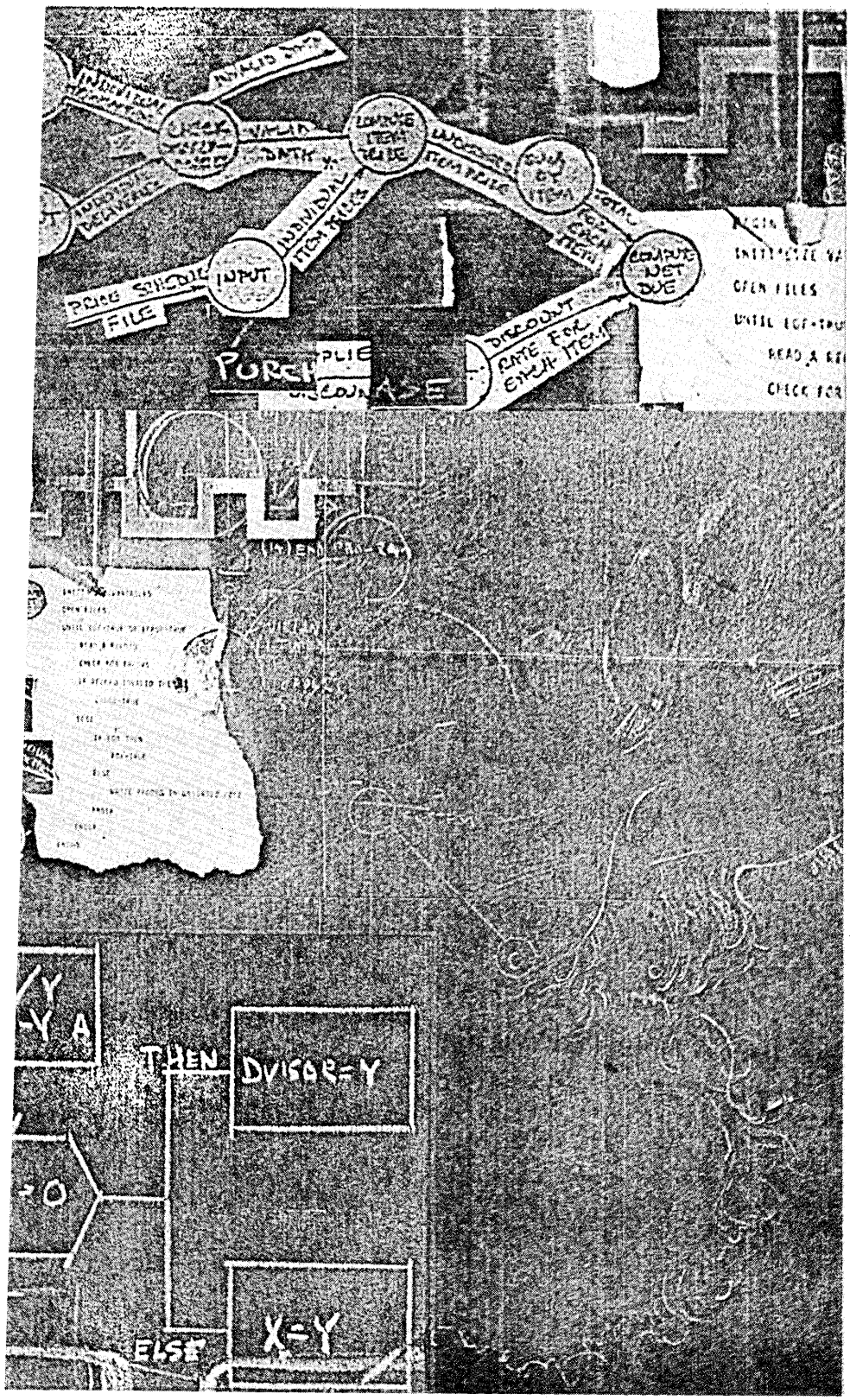


by Peter G. W. Keen
and Elihu M. Gerson

The Politics

Neither technical sophistication nor inspired project management can rescue a good design from a bad political situation.

Resolving design or implementation problems involves a choice between alternative approaches and strategies. In many cases, the designer can rely on a clear analytical model to estimate results before committing resources.

One class of system design problems, however, has proven resistant to this approach. "Wicked" problems, such as the design of complex software systems, have no definitive solutions; it can never be shown that a proposed answer must succeed. Instead, only time will reveal if a system even works, let alone whether it will be "good" enough.

So the only way to find out if a complex software system solves a problem is to observe the experiences and reactions of users in a production environment. Such a method can lead to expensive failures. There are innumerable cautionary tales of costly software systems which were built but never used. For unexpected and often unexplained reasons, the client was unwilling to accept the project—even when the project was completed on time, the documentation was clear and accurate, and the program code read like poetry.

When such a failure occurs, particularly when the system has been technically well executed, the designer may be tempted to ascribe the disaster to psychological traits of the users. He may wonder if they are too stupid or ignorant to exploit the system—perhaps they are irrational, unable to recognize their own interests. But this explains only a small number of failures.

# of Software Systems Design

More often, the problem is caused by an oversight on the part of the designer. He may have overlooked the fact that his innovative software project is inevitably embedded in an organization with a *political* order which acts to shape, constrain, or define every phase of systems development and use.

Technical quality alone is insufficient to ensure an effective solution to a political problem. The design and implementation process requires an understanding of political constraints just as much as technical choices. By recognizing and dealing with political forces, the systems developer can reduce the risks inherent in large-scale projects and improve the likelihood of success.

The analysis of political issues in organizations has not yet gone much beyond case studies and tentative theorizing. To the computer specialist, the literature seems vague and incoherent in contrast to his own tidy and detailed areas of knowledge. Nonetheless, some clear conclusions can be drawn from the research on the politics of implementation and technical development in sociology, political science, and management science. Four such useful insights involve:

1) the multiplicity (and frequent incompatibility) of desired system features;

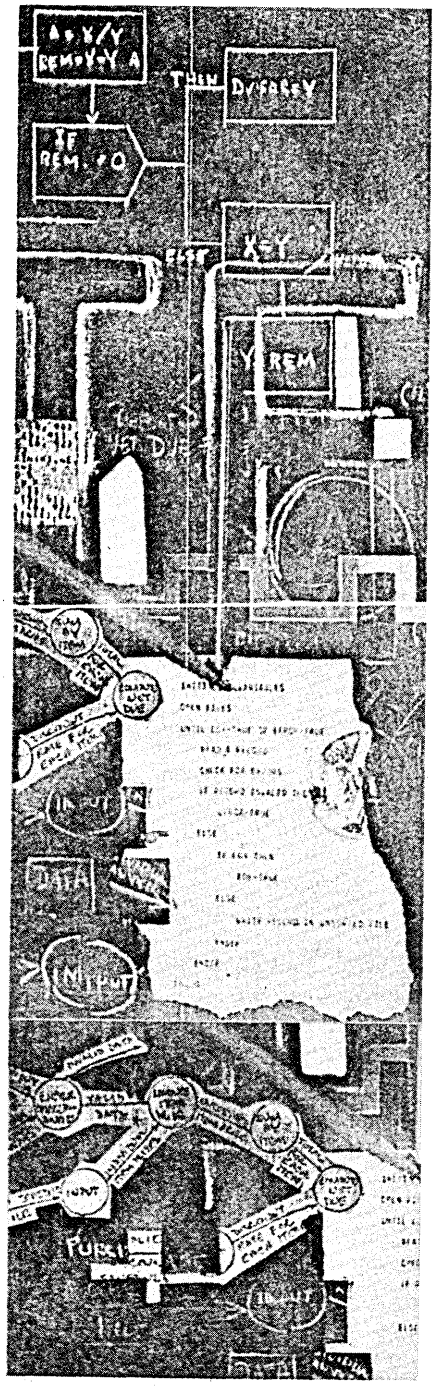
2) the unpredictability of system uses;

3) the unstructured nature of the component activities and relationships in systems development; and

4) the incommensurability of definitions of "success."

Who decides on features?

At the start of a systems development effort there is usually some ambiguity in defining what the system will do and look like when it is "finished." Users have an idea of features they would like the system to include. Some



of these are essential. Others are very desirable, but the users will be willing to do without them—temporarily at least—to get the system operational more quickly. Unfortunately, when there are multiple users (as, for example, in the case of operating systems or data base management systems) one group's "must have" often will be another's "not needed."

System designers and implementors sit in the middle. Generally, they are unable to resolve the trade-offs and conflicts implicit in clients', users', and senior managements' "wish lists," especially in the case of a major project. There is always pressure to add features to the initial design specifications as each group identifies what it would like the system to be. A bargaining situation results, where conflicting ideals must be reduced to a single practical specification.

The system designer, then, faces a poorly defined work requirement and well-defined accountability system which will hold him responsible for delays in implementation. There is rarely any direct method for ensuring that users develop a clear, complete

> The system designer faces a poorly defined work requirement and a well-defined accountability system—he's always to blame.

agreement on the specifications for a system. The designer may be forced to appeal to higher authority, or to protect himself by claiming that particular features cannot be provided with existing technology. This specialized knowledge of technical feasibility is one of the few effective negotiating chips which the system designer can exploit. However, if it is misused or successfully challenged, it may back-

fire. Moreover, it becomes less effective as users become more sophisticated.

Defining system specifications is as much a political as an intellectual process. Thus, the value of recent techniques for involving users in the design process (structured "walkthroughs," prototype development, IBM's HIPO procedures, etc.) is that they *encourage* the emergence of potentially conflicting goals. If conflicts are left unidentified and unresolved, they may emerge later when the systems development effort is most vulnerable to changes, withdrawal of support, or loss of momentum. These techniques force users to deal directly with each other, rather than through (or over the body of) the system designer. If the designer lacks effective authority over users, he cannot negotiate with or for them. Attempts to do so threaten his overall effectiveness and credibility. He should obviously press for a standardized process of direct negotiations among users and formalized procedures for defining and assessing the technical features of the proposed system.

When users cannot agree on a complete and compatible list of specifications, there is simply no point in trying to develop a system. This has become a truism in software engineering, but it is interpreted in technical terms rather than political ones. If agreement cannot be reached, no level of technical sophistication nor inspired project management can rescue the situation. *Technical responses to political problems are a misapplication of resources, attention, and expertise.*

Who decides on uses?

Early in the history of software engineering, systems designers learned—painfully—that they must define the range of legitimate inputs to a system. This insight is an instance of a more general principle, not so well-recognized: users will always find new ways to exploit an existing system. A system is not a neutral intellectual resource. The user group has specified areas of autonomy and authority. Both the developer and the "owner" of the system decide how it may be used, and by whom. Any limitations placed on what users may try with the system are thus largely political. And as newer generations of software tools permit more flexible, powerful, and generalized systems to be built, these issues become increasingly important.

The more a problem can be predefined, the more easily the range of uses may be controlled. For example, users will probably not attempt complex statistical analyses with a payroll package. If they try, the system designer can hardly be blamed for their failure. However, many data base management systems which operate on payroll or personnel data permit such analyses. Also, sophisticated decision support systems used by managers in planning and decision making are largely under the managers' control, and those managers are not limited to predefined ways of using the system.

Such complex software tools present problems for defining what users will do with them. Are users to be allowed to insert new entries in a data base used by other groups? Control over such entries must be lodged with some authority. Users may be unwilling to delegate that responsibility tacitly to a clerical unit, data processing department, or system designer.

In practice, the user defines the uses of the system. An apocryphal but not a typical story illustrates this point. A university computer science department used the central campus computer to support courses in programming. Each student, of course, eventually reached a skill level that allowed him to write a program whose sole purpose was to crash the operating system. There was keen competition among the best students to crash it elegantly, irreparably, frequently, and undetectably. Several generations of accumulated and transmitted experience had resulted in a considerable level of skill distributed over an ambitious population. The computer, of course, spent most of its time being crashed or initialized. Threats of punishment only led to more effort to develop a code that could not be traced. The solution was a purely political one: every Thursday morning was set aside as "crash time" and students could run their programs from the operator's console and reinitialize the system themselves.

> The best the designer can do is negotiate and hope—not just hope.

Most idiosyncratic usage of systems is not as anarchistic as this, but the general point holds: users will use the system *their* way, and often have the power to resist centralized control. This is increasingly true as computer technology becomes more democratized and decentralized through time-sharing networks, distributed systems, interactive languages, and other evolving techniques. The best the designer can do is *negotiate* and hope—not just hope. If one relies on hope alone, one is doomed to a bitter and frustrated interpretation of human nature.

Who's in charge?

The two aspects of systems development and use discussed above imply a third: the unstructured relationships between participants. Coordinating widely differing concepts, design aims, and uses in a context of diffused authority is a task that cannot be reduced to a routine. Conflicting demands and requests for the impossible must be handled on a case-by-case basis. Knowledge of technical details of the system must be supplemented by a less easily obtained understanding of users' preferences, quirks, regulations, and tasks, plus the organizational context in which they operate.

The system designer's challenge is to develop flexible arrangements that provide each party with the minimum level of service necessary to prevent defection or revolt. This implies almost continuous negotiation to reach compromises that permit the overall system to function adequately. Often, improved or expanded technology can facilitate this, but there is a limit to the degree that extra hardware or more powerful software can resolve conflicting demands. In general, the system designers' solutions create new problems for the manager of the installation; in turn, their use of technical "fixes" to reach acceptable compromises among the interested parties is apt to alarm the financial watchdogs of the organization.

The problem in resolving this and related issues is greater than the technical difficulties involved in expanding and maintaining a package of hardware, software, and services. The larger problem is the *overlapping responsibility and authority of the designer and users.*

The designer may plausibly argue that he cannot permit arbitrary or unpredictable usage to interfere with others' work or to damage the overall reliability of the system. Users may just as plausibly reply that the system designer has no right to intrude on their sphere of discretion; they may add that it is *their* system, and *their* work, which is of course the contention's central point.

In this situation of checks, balances, and balancing acts, success requires effective alliances and coalitions. Participants must remain loyal to each other and to the overall effort even when this means giving up something they might be able to grasp by an all-out war. This strategy of carefully placed loyalty is the most effective means of bringing stability to the inevitable political pulling and hauling among organizational units.

In general, system designers and managers are at the center of the conflict and thus at the center of negotiations. Unfortunately, the designer rarely has the authority and skills to deal with this; he also tends to assume that

structuring the process through project management techniques and bureaucratic procedures will somehow make relationships and activities fall into an orderly sequence. For structured situations, such procedures are clearly efficient and effective. *Wicked problems unfortunately often compound themselves when they are handled in a highly structured manner.*

Who defines success?

One of the most difficult aspects of implementation is determining when a system is "finished" or whether the effort is a "success." Software engineers generally recognize the need for the system's maintenance and enhancement. Many researchers and practitioners too have commented on the evolutionary nature of systems, which grow, mature, change into entirely new shapes, and sometimes even die. Users never have all the features they want; as they adjust to and learn from the system, they identify new opportunities and needs. As the technical and organizational environment changes, the system must adapt and evolve. Revisions are also made to maintain compatibility with externally supplied software such as operating systems.

In such situations, it is very difficult to define "success." A system is never really finished, which means it cannot be completely evaluated. There is no effective way to determine if it is accomplishing what was intended. This is particularly true of more generalized systems. A payroll system is "complete" and "successful" when it generates the required outputs, with acceptable error rates and reasonable levels of satisfaction among its users. A customer information system, on the other hand, is not intended to generate predefined outputs, and has a variety of uses. Generally, no one can decide unequivocally that the customer information system has failed and must be abandoned, or that it is finished and should be left alone. There is always another enhancement available or another adjustment underway.

When criteria for success are ambiguous and lack a simple measure, decisions concerning system extensions will appear arbitrary from the perspective of some of the interested parties. As a result, they are likely to create controversies, arguments, pleas for "one more chance," and spates of wheeling and dealing in the corridors. Similarly, decisions to commit resources to particular enhancements rather than others tend to generate resistance and counterattacks.

The situation is often seen as a zero-sum game with "winners" defending their gains as being beneficial to the organization as a whole, and "losers" complaining loudly about favoritism and incompetence. But, decisions reached by negotiation and "muddling through" are both the best we can do under the circumstances *and* irrational in the literal sense of term in that they do not aim at optimization as recommended by the rational, analytic tradition. Still, the negotiating process is the natural way organizations operate in day-to-day decision making. On the whole, it works fairly well and with relatively little cost and conflict.

Political issues are central to technical change.

There's no need for systems designers to avoid this process. In fact they must participate in it and recognize that "technical" choices emerge from inherently political processes. *The less clear the definitions of success and completion, the more political the decision making will be.*

Hints for a defense

The four issues discussed above (multiplicity of goals, unpredictability of uses, unstructured realtionships between participants, and lack of clear criteria for evaluation) are of varying relevance for particular systems development efforts. Some systems can be designed and implemented with little attention to them, because the problem is clear, the range of practical options limited, and users are ready to cooperate. Some other systems should not even be attempted; the attempt might divide the organization into armed camps. Most systems fall between these extremes; the problem is one of diagnosis. The system designer must identify in advance where there is likely to be trouble, how it will reveal itself, and who it will come from.

A diagnostic approach to the politics of systems development will not guarantee success, but it will help head off ugly unanticipated consequences. Compared to the well-defined field of systems analysis, this political analysis is not an elegant process. Given our present state of knowledge—and our very recent awareness of the issue—we can only provide rules of thumb. These are, however, more than most systems designers now have. Here are a few such diagnostic rules:

1. Define Scenarios.

Many of the political demands of users are hidden. In his book, *The Implementation Game* (Cambridge: MIT Press, 1977), E. Bardach suggests that the implementor/designer write "scenarios" to anticipate ways in which the development effort could be obstructed. For example, if salesmen dislike an expense accounting system, all they need do is write illegibly on the sales ticket or leave off the expense code. This code is of no direct value to them; it's simply another "bureaucratic nuisance." Such a scenario makes it clear that the designer must either bring the salesmen into the design process, or make sabotage very difficult.

Any group that can thwart the system is a relevant party in the design process. "Secondary" users, the people and units that provide the data for a system without benefiting from its outputs, often have immense influence on its success. The risks of overlooking them or deciding that they need not be involved in the design negotiations are substantial.

2. Enlist user support through design meetings and walkthroughs.

This technique is best illustrated by the experience of two consultants in building a simple reporting system for the United Farm Workers. They recognized, belatedly, that their first proposals ignored political realities. The system was attractive to senior union personnel and to the college volunteers who would be saved from tedious manual operations, but the field staff (the UFW's solid core who had built it and made it a success) were far less cooperative. They could destroy the system. The consultants presented a complete but not specific design to the union staff at a specially arranged retreat. They said they would feel unhappy if at least 50% of the specifications were not changed. By insisting that they were there to listen rather than to command (and not by overpowering their audience with state of the art slide shows) the consultants encouraged the union staff to discuss their real concerns. Staff members pointed to aspects of the system they disliked and then expressed their preferences. This sequence accomplished many things:

1) it acquired the benefit of users' knowledge;

2) it transferred responsibility for system design from the technical "experts," who were outsiders, to the group as a whole;

3) it built user commitment to the project, since the design was the users', not outsiders' nor managements'; and

4) it got the systems designers out of the uncomfortable position of being caught in the middle.

Prototypes, structured walkthroughs, and similar techniques bring user groups together in neutral territory. They are told that this is their chance to rip the design of the system to pieces. The design team gives them a graphic description of the proposed system, preferably with sample outputs and simulated procedures. These meetings reveal the potential resistors and give them their chance to negotiate openly. They also undercut later attempts to attack the design.

Resistance should be *encouraged,* not ignored or suppressed. Well before the system is designed in detail, all constituents must be brought into the conceptualization and specification process. Commitment must be built, a "contract" made between the users and design specialists; realistic mutual expectations must be developed. This is a social and political process that provides the criteria for technical design.

These design meetings and walkthroughs are not excuses to sell the latest software or hardware technology, nor to browbeat users into passive acceptance. The aim of scenario writing is to identify who is relevant to the design negotiations. Meetings then give these constituents an opportunity to tear the current proposals and their proponents to pieces verbally before implementation instead of after it.

3. Do not mediate disagreements.

Since users' goals and demands are so often incompatible, the worst position for the system designer is that of arbitrator between two groups competing for limited features and resources. Often this occurs without the users being aware of the situation. From their viewpoint, they are simply receiving poor service from the data processing staff. The system designer must not be in the position of trying to serve many masters. He must force the *users* to confront the shortage of resources.

For example, if there is not enough hardware capability he must communicate that fact. He can suggest that the competing groups share the available pie or make requests for additional facilities to the relevant senior authorities. The designer must also ensure that *potentially* competing users are kept aware of each others' existence and demands.

Obviously, this strategy must not degrade into an elaborate game of "that's not my responsibility." This approach aims at educating users about the constraints under which the systems staff operates, the need to get involved more actively in the planning process, and the value of joint efforts in expanding the available pie. The best way for the system staff to accomplish this is to provide *more* service of the right sort; consultation, technical assistance, seminars, and the like. Certainly, systems staff members must avoid being forced into roles that are far more effectively played by line managers. The best way out of the middle is to *establish oneself as a facilitator, consultant, and advisor.*

4. Decouple contingencies.

Many small problems are far easier to solve then a few big ones. This is a fundamental rule of politics but often makes analysts, engineers, and economists uneasy because they are trained to appreciate economies of scale. Over the past few years there has been increasing recognition that in the world of computers "Big is Beautiful" has been a slogan of disaster. The last decade, especially the end of the 1960s, saw evangelical investments in massive corporate planning systems, "integrated" data bases, and other large scale efforts. But no longer.

It now seems essential to break complex systems into relatively small modular units to reduce the risks associated with complex innovation. Such small-scale "entry" systems can be expanded in self-contained phases. If goals, uses, and trade-offs among users can be identified only through experience, it obviously is advisable to build on experience. Adjustments can be made at intervals instead of waiting until the lessons become apparent from the collapse of the Grand Design. Every commentator on effective implementation stresses the value of simplicity and evolutionary strategies. The same is true for political problems. The rule of thumb is: do the technical work "top-down," but *do the political work "bottom-up."*

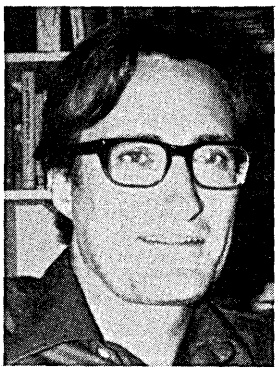
Conclusion

These strategies largely imply decentralization. The centralized data processing center, physically, psychologically, and socially isolated from the organization it serves, is ill-equipped to resolve the political problems discussed above. The systems staff must learn to decentralize the design process by coopting users; decentralize negotiations; diffuse their own skills into the organization by adopting a service perspective; go to the users rather than hiding from them; ensure responsibility and accountability are shared; and reduce risks by breaking big problems into little ones.

Decentralized technology has made it unnecessary for computer personnel to be high priests guarding the Colossus and speaking in Delphic obscurities. They can affect, and are certainly now much affected by, the broader organization. They cannot claim to be above politics. Like members of all of the other units of the organization, they are involved in a dynamic process of change, commitment, collaboration, advocacy, conflict, and compromise. Unfortunately, these words are not often used by systems analysts.

The advice offered here will not solve the problems of systems development. Anticipating all roadblocks is impossible. Resolving inherently incompatible demands is not a process that is optimizable. Similarly, maintaining political order is not something that can be planned. However, a political approach to systems design that recognizes that political issues are *central* to technical changes at least allows the system designer to assess risks, match the system to its context in an implementable way, and build for himself a more comfortable situation.

As long as software development is seen as merely a form of engineering, rather than as organizational innovation as well, we will continue to be plagued with ineffective implementations of creative ideas, and the weak, unacceptable excuse of, "It wasn't my fault—it was organizational politics." ❋



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The Systems Analyst as a Change Agent

by William Feeney and Frea Sladek

How well a systems analyst performs, and how long he survives, depends on his ability to play the right role with the right people at the right time.

Change occurs all the time in our world. People, technology, and companies change. At this moment people are being born at a rate faster than one per second. Men and women are changing their lives by getting married or divorced. Engineers and scientists are designing bombs to kill easier, vehicles to move people faster, and medical instruments to save lives more efficiently. From one day to the next, our lives and world change.

If the change happens too rapidly, people can go into a state of shock. On the societal level, this is "Future Shock"; on a company level, decreased productivity results. In contrast, change which is too slow causes stagnation and boredom. Look at the great civilizations in Europe and Asia which disappeared because they became static and could no longer change or adapt. Or consider the companies forced out of business because their products were no longer in demand.

Whether change comes rapidly or slowly, people are responsible for introducing it. They are known as *change agents.* Revolutionaries, educators, consumer groups, and women's libbers act as change agents. Some have mastered contemporary change theory. Others have not. Their success depends upon their ability to understand change and customize their roles as change agents to achieve their goals.

And how about the systems analyst? His task is to plan and gain acceptance for organizational change. Yet while great care is taken to provide the analyst with technical skills for analyzing, designing, and developing new systems, rarely is much attention paid to training him to gain acceptance for organizational change.

Organizations are complex systems which have interacting parts. Each part influences all the other parts. For example, a new system in the accounting department may impact marketing and—ultimately—the company's suppliers and/or buyers. Further, organizations are made up of people, and it is with people that the change agent deals directly.

People find change difficult. Some theorists believe that extensive change is altogether impossible. Hoffer, in *The Temper of Our Time* (New York: Harper & Row, 1967), pointed out that the Jews spent 40 years in the desert primarily because the older generation could not change from being slaves to being free men. On the other hand, Toeffler, the author of *Future Shock* (New York: Random House, 1970), believes that some change is possible. When people experience deep change, a kind of trauma sets in, but often they finally do adapt.

Revolutionaries, educators, consumer groups, and women's libbers act as change agents. So do systems analysts.

Then too, people accept change at different rates. The young, for example, are more likely to accept and even introduce change. Mozart completed his first symphony at age eight, causing far-reaching changes in the world of music. Alexander the Great had conquered the civilized world by the time he was 27, forever altering national boundaries.

Too much change can cause people to become ill, or even die. For widows or widowers going through the first year without their spouse, the death rate is 10 times higher than it is for others their age. Holmes, a psychiatrist at the Univ. of Washington, has quantified personal change, ranking a list of commonly stressful events which may lead to illness. Almost 20% of these events are work-related. Sample events (and point scores assigned them) are: fired at work (47 points); retirement (45); business readjustment (39); change to different line of work (36); change in responsibilities at work (29); trouble with boss (23); and change in working hours or conditions (20). According to Holmes, if a person's total points during a year approaches 200, the person may become ill.

The successful change agent knows that people: (1) find change difficult, (2) accept it at varying rates, and (3) can become ill and ineffective because of too much change.

Because the systems analyst most often brings about change during a project, the sequence of activities followed during a systems effort is mentioned here. Fig. 1 shows in flowchart form typical tasks to be performed when putting a new software and/or hardware system into operation. (The tasks are listed as reminders of what should be done, not what absolutely has to be done, during a systems effort.)

While the systems effort is going on, the systems analyst uses his technical expertise in three major ways. These are shown by the hexagons in Fig. 1. Early in the effort he provides problem structure at a time when projects lack definition and scope. Later in the systems effort the analyst leads the project team in building the new system by choosing alternatives, designing soft-

ware and procedures to perform the system tasks. Last, the analyst gets the new system running by guiding customer personnel in the use of the system.

Although the system effort is represented in Fig. 1 by neat, clearly distinct boxes, in practice there is no clear distinction between the stages. Further, in most systems efforts the activities are performed sequentially, but in some efforts they are worked on simultaneously.

How *should* a systems analyst act when he wants to change people in an organization? Should he use candy? Or a stick?

By being sensitive to his organizational setting, the systems analyst will have a better idea of the extent and force of change which will be acceptable and which will accomplish his project goals. In addition, the systems analyst has a variety of change agent roles to select from. Specifically, he may assume the role of persuader, catalyst, confronter, or imposer:

Persuader

The systems analyst attempts to persuade employees to accept change dictated by the company and management. This is the mildest form of intervention for a systems analyst, merely helping people to change their attitudes and to adjust.

Catalyst

The systems analyst introduces new ideas to the change process, but lets the customer determine changes for himself. The amount of intervention is greater here than in the persuader role, but still the analyst is acting as a helper.

Confronter

The systems analyst sets himself in opposition to the customer because in the analyst's best judgment the customer will not achieve satisfactory change unless he is jolted into a completely different approach. This role frequently generates conflict and should be used with care.

Imposer

The systems analyst, with authority given by company management, imposes his plan for change on the customer. Severe ill feeling and even job reassignments are common when this role is assumed.

The nature of roles the analyst can assume as a change agent is best shown by examples. The following case histories illustrate the reasons for the choice of roles.

Persuader

An analyst was hired by a wholesale electrical distributor to design a computerized ordering system. The company management had received a sales briefing from a crt terminal sales team and was impressed with the capabilities of that kind of device. They wanted a time-sharing computer system using terminals.

The analyst, in conducting his own analysis, had determined that an online ordering system would indeed be best for the company. But when talking with the order clerks, the employees who would use the terminals, the analyst discovered they were uneasy about the new devices. They were concerned about typing on a keyboard connected to a computer. What if they made a mistake? Certainly the computer would catch it! Further, if the computer made the ordering task considerably more efficient, some of them would lose their jobs!

In choosing a role as a change agent the analyst could have imposed the use of terminals on the clerks as a dictate of management. Take it or leave it! Some clerks might have done just that, leaving with a bad feeling and leaving behind them a group with a coerced feeling.

The analyst could have confronted them with their fears, pointing out how groundless these were. He could have

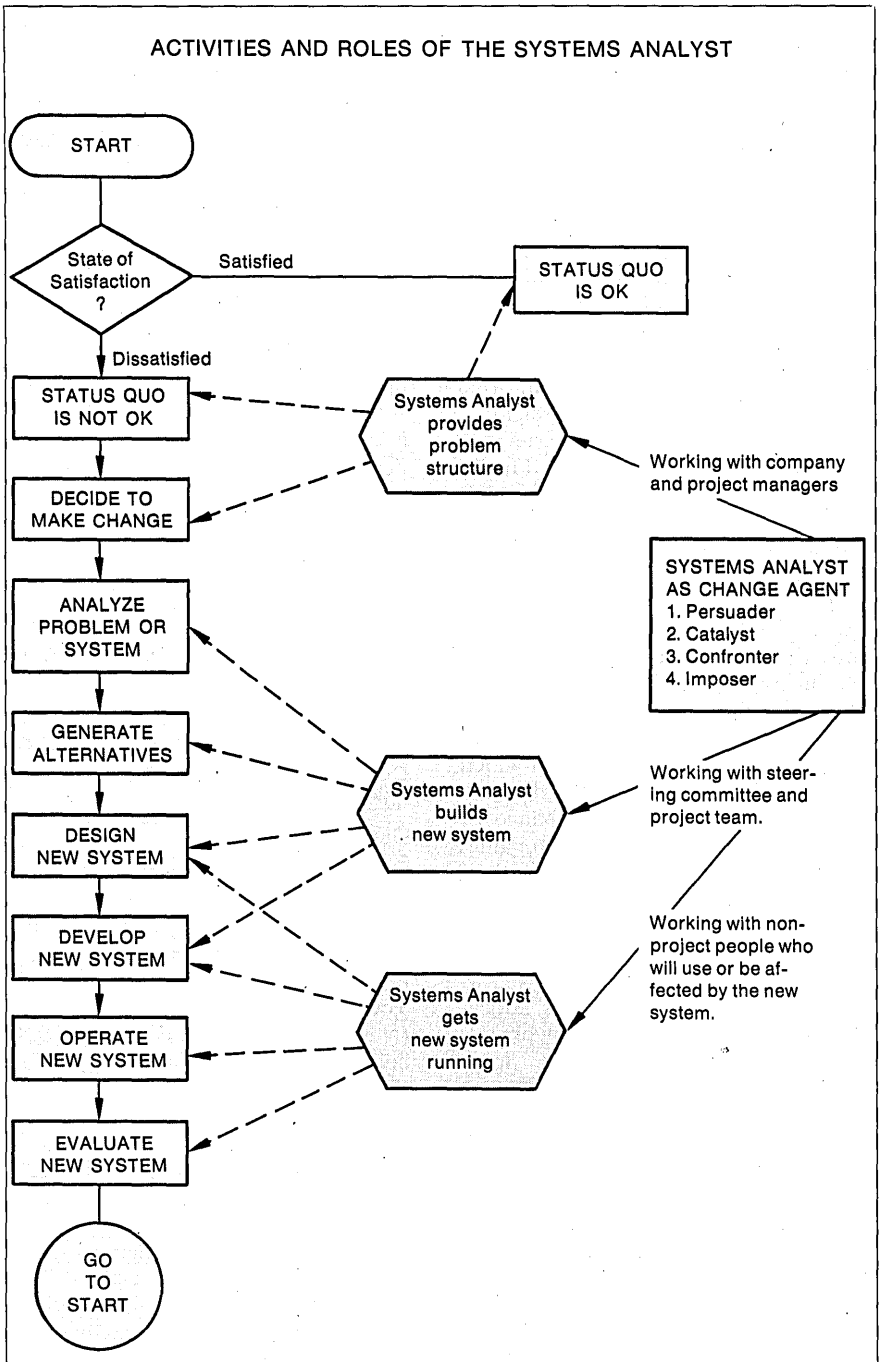


Fig. 1. The systems analyst may work with many people at various stages in the development of a system, including managers, programmers, operators, and users. He may have to play a different kind of role—persuader, catalyst, confronter, or imposer—at each stage.

explained that the clerks' not wanting the new system stood in the way of company growth, etc. Although the potential users might have bowed to this frontal attack, it is unlikely that they would have been won over.

The analyst could have acted as a catalyst, helping the employees to make their own decision about what they wanted. But if they hadn't come to the same conclusion as management and the analyst, the problem would have been still further from solution.

Last, the analyst could have, by patient and understanding listening, persuaded the clerks that the new system was best for all. And, in this case, he did. He arranged for the clerks to spend several hours each playing computer games on terminals similar to those they would be using. He pointed out the advantages of the new system to them, reminding them that they would be relieved from typing orders after having handwritten them, that they would not have to manually check each item ordered against a master catalog, and that instant credit information on all customers would be available.

By persuading the clerks that the new system would not embarrass them or cause them to lose their jobs, but would in fact make their jobs easier, the analyst won new allies. Even though persuading may have taken more time and effort than some of the other methods, it certainly worked to the advantage of the project in this case.

Catalyst

The chief analyst for a large savings and loan association on the West Coast heard during a lunch conversation that his firm was thinking about buying an automated portfolio selection system, instead of continuing with the manual method they had been using. The analyst made further inquiries in the trust department, and was asked in turn to help in the decision process. The new system was quite expensive. The analyst did a quick investigation of the success of the new system in firms which were using it, and compared these findings with the traditional manual portfolio selection success rates. There appeared to be no clear-cut advantage to the automated system, but several developments in selection simulation being made in three schools of business were promising better automated systems in the near future.

Because of his other commitments and because portfolio selection was new to him, the analyst did not exhaustively investigate the question. In meetings with the trust department, he chose a catalyst role, raising points which he felt were pertinent and providing structure to the conversations. In his catalyst role he did not come to the discussions with his own decision already made. Instead he came as a facilitator, to help others make a decision.

Another role the analyst could have assumed was that of confronter. He could have made a preliminary judgment about the new system, either for or against. If the trust department judgment had polarized on the opposite choice and the analyst had stuck with his choice, a confrontation would have been impossible to avoid. It is unlikely that the best interests of the company would have been served by the confronter approach. The portfolio selection process is based on subtle factors, not at all evident at a casual look. It is certainly best to let those most familiar with portfolio selection make the choice.

The analyst could have become an imposer if he had sold his decision to the trust department decision makers, and they had made the others in the trust department follow. But, given the analyst's involvement with this project, this role would have been even less appropriate.

The softer role of persuader would not have worked well either. The trust group was uncertain about what they wanted to do. They might have been persuaded to do something, but they really were the ones who should have made the decision, not the analyst, with his built-in limitations.

Confronter

A company which manufactured custom engine heads and other parts for vans and four-wheel vehicles wanted to install a system to keep track of items it had sold to distributors and auto stores. Frequently the company received requests for products which it no longer had in stock. The person wanting such an item could purchase it from a retail store, if he knew where it was. One of the founders of the company, who had a large personal collection of microcomputers and various terminals, had determined that the company should acquire a minicom-

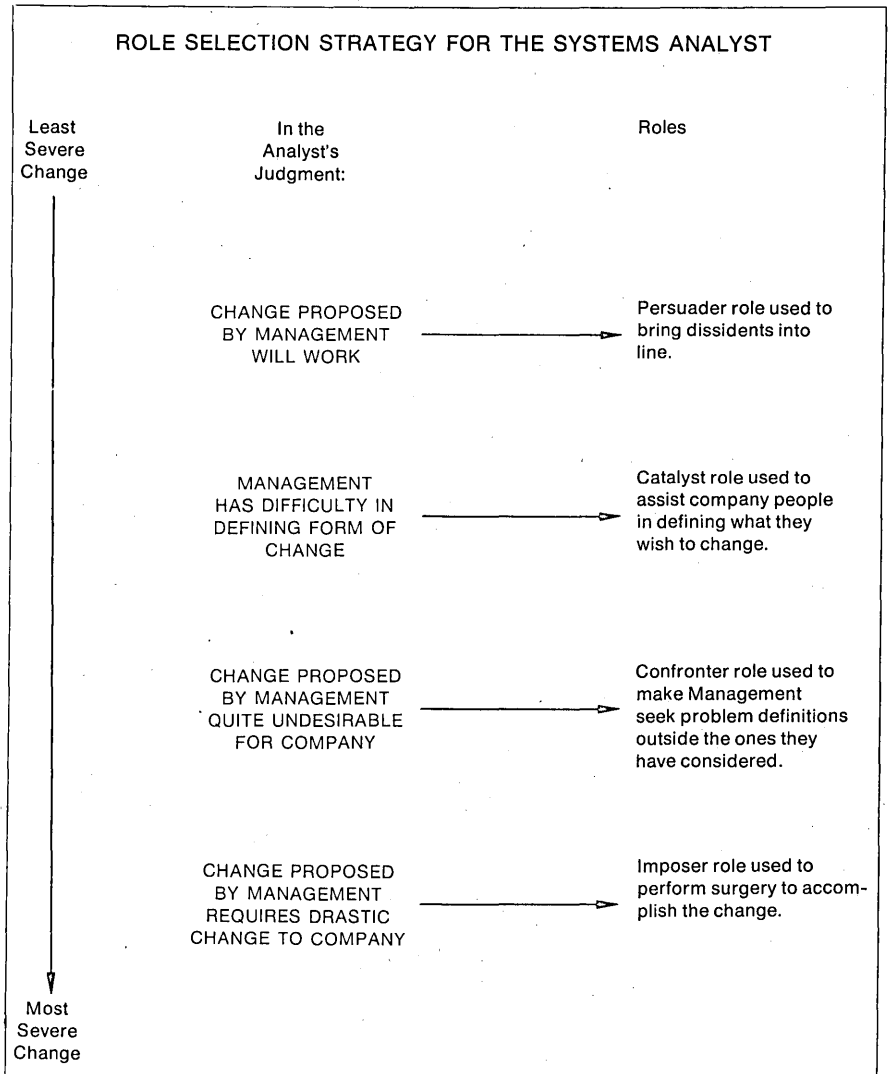


Fig. 2. The severity of the change is a major factor in determining the analyst's role. Making the wrong choice may be fatal both to the project and to his career.

puter for a parts location system. He had pointed out to his two cofounders the advantages of such a system and the prestige of being able to provide a locating service to their customers. The two cofounders, not realizing the programming costs for such a system, gave their okay.

An analyst was hired to design the system. He immediately determined that such a system would not be in the best interest of the company. Further, he knew of an informal, mostly manual, system used by auto dealers for decades; it could be implemented instead of the proposed minicomputer system. Reaction time on this older system was one day for parts in the same city and two days for parts 500 miles away or less.

The analyst called a meeting to discuss the proposed system and only the one founder who wanted the minicomputer showed up. The analyst presented his views, even though he knew they would conflict with the founder's ideas. The two men talked until both realized that neither was going to change his views.

The founder asked the analyst if he would design such a system, even though the analyst had recommended against it. The analyst was convinced that the company would suffer a financial loss for at least a year if it bought the kind of system advocated and contracted the required programming. The analyst said no, he would not design a system that was not in the best interest of the company. The system was never built.

Although the company management never fully appreciated the financial burden it was spared, the founders did become more aware of realistic applications for computers. The analyst was never used again by that company. The role of confronter chosen by him had cost him future contracts with that company; but given the circumstances, he must have felt that was the only way he possibly could have changed their minds about the system.

Imposer

A service bureau which had enjoyed considerable success in processing savings and checking accounts for small midwestern banks was in serious decline because the banks were acquiring their own equipment. The future of the service bureau looked dim. The manager/owner of the business asked an analyst who worked for him part-time for suggestions.

The analyst made his report the following month, suggesting the bureau contact physicians, dentists, architects, and lawyers, offering to provide bookkeeping and customer billing services. The service bureau was already servicing several such professional people with custom programs, and the analyst felt that these could be revised to provide general programs for a wider population of users.

The bureau's programming staff was asked to a meeting with the manager and the analyst. It became evident that the three old-line programmer/analysts were not impressed with the suggestions for a new market, having built up the banking accounts from a few to over twenty in the heyday of the bureau. The old staff presented some general, off-the-cuff ideas about regaining the banking accounts, even though they had been requested by the manager to present some formal proposals. The manager felt a large measure of loyalty to his staff, but felt his business would go under in six months if new accounts were not brought in.

A week after the meeting, the manager assigned the analyst to work full-time to develop the professional service area. The analyst actively sought the aid of the old staff, but since they regarded him as a threat, they not only did not aid in developing the new programs, but on several occasions also caused slowdowns. The analyst took their ill-will personally and reported their obstructions to the manager. The manager in turn called in the staff and asked for an explanation.

About this time the manager's health failed and he had to place someone else in charge of the business. A computer consultant, a friend of the manager, was asked to step in. Faced with near anarchy, the consultant imposed a solution to the problem. The analyst was told to work on two of the four new areas, programs for physician and dentist billing and bookkeeping. The old staff was told to develop the programs for architects and lawyers.

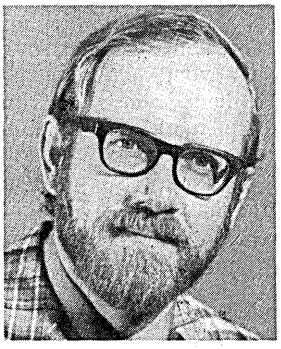
Displeased with the apparent demotion, the analyst quit. A recent graduate in information systems was hired to replace him. One of the old staff resigned also and was not replaced. The two remaining programmer/analysts covered the two other applications.

The consultant could have tried other roles, but it is doubtful that a less forceful approach would have saved the company. As painful as the results of the imposer role are, it is used quite often in businesses which are in a state of flux. Employees who are to be relocated, laid off, or fired are rarely asked to participate in such decisions about their future. The boss, acting in the imposer role, performs these tasks.

Selecting the right role

When does the systems analyst assume which role? Consider the kinds of situations he encounters. We've already talked about specific case histories. In Fig. 2 a theoretical framework of role selection strategies is presented. In general, the roles of persuader, catalyst, confronter, and imposer range from the mildest to most severe intervention. So when organizational conditions are not severe and people appear to have some tolerance for change, the persuader and catalyst roles are appropriate. On the other hand, when drastic change is required, it may be necessary to assume confronter or even imposer roles.

Over the life of a project, the analyst may take on any of the roles. No matter which role he selects, the goal is identical: to gain short- and long-term acceptance for the systems effort with a minimum of organizational agony. He can best achieve this goal by developing his awareness of change concepts, and insightfully becoming a persuader, catalyst, confronter, or imposer as the situation demands.



Dr. Feeney has worked in business data processing since 1959. He's had jobs with Univac, General Electric, and McDonnell Douglas and roles of programmer, systems analyst, and instructor. Presently, he is a faculty member in the San Diego State Univ. Department of Information Systems.

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Comparing Software Design Methodologies

by Lawrence J. Peters and Leonard L. Tripp

Software design has evolved to the stage where methodologies for handling classes of problems are proliferating. But just how helpful are they?

In progressing from infancy to adulthood, a human's approach to problem solving shifts dramatically. In infancy, a challenge such as locomotion is treated as new and different each time it is faced. After a while, it is recognized that a certain class of challenges can be met using the same approach. Similarly in software we have grown from treating each new development effort as unique to recognizing certain classes can be met by a specific approach. This type of evolutionary process quite evidently has already occurred in other professions such as architecture and engineering.

The last ten years in the software industry have been marked by a procession of new approaches to software design problems. The cause of this influx of software design methods is uncertain. Perhaps it is part of evolution or it may be due to the increasing complexity of the problems being addressed. In any event, the availability of so many approaches has left many wondering which—if any—they should adopt, which ones fit which classes of problems.

We've asked ourselves that question. We've studied several of the more promising or more popular approaches. And we think we can provide at least a partial answer.

Where do I begin? Now that I have begun, how do I measure my progress? How will I know when I am done? These questions have always tormented designers. Designers are also vexed by having to think intuitively, rationally, and procedurally at the same time during a design effort. As the effort progresses, the emphasis shifts, but all three modes often are involved simultaneously. At the outset, the designer initiates some idea or "spark" which sets a design into motion. He has an intuitive feel for the solution to the problem but suspects he may be wrong. So he scrutinizes his idea and then documents the conclusions. This process has been characterized as divergence, transformation, and convergence, in that order. The big problem is broken down into smaller problems, they are solved, and then reassembled into *the* solution. Simple isn't it?

Not so, say those who have attempted to develop non-trivial designs. Some even conjecture that software designing is somewhat diabolical. On examining the process of design, it becomes apparent that there is no agreement on how to describe that process and/or its products. The following definition may be a helpful start; at least it works for several individual methods in the latest procession: *A software design method is a collection of techniques based upon a concept.*

Many forms of this notion are being championed. A representative list includes:

- Structured Design
- The Jackson Methodology
- Logical Construction of Programs
- META Stepwise Refinement (MSR)
- Higher Order Software (HOS)

The author of each such software design method has structured his solution to address the design issue(s) he views as germane. Quite understandably, each holds a different opinion. Those that advocate "Structured Design" declare that the key to a successful software design is the identification of the data flow through the system and the transformation(s) that the input data undergo in the process of becoming output.

A view held by those who advocate either the "Jackson Methodology" or the "Logical Construction of Programs" (the "Warnier Methodology") is that the identification of the inherent data structure is vital, and the structure of the data (input and output) can be used to derive the structure (and some details) of the program.

Advocates of META Stepwise Refinement (MSR) state that success is assured if the problem is solved several times, each solution being more detailed and complete than its predecessor.

Last, supporters for Higher Order Software (HOS) provide a set of axioms which must be used to attain success.

In addition to making certain assumptions, each of the representative methods also prescribes a set of activities and techniques intended to ensure successful software design.

Structured design

Structured Design is based on concepts originated by Larry L. Constantine and later published by him while working with Ed Yourdon, and by Glenford J. Myers. (See Bibliography for exact references.)

The method consists of concepts, measures, analysis techniques, guidelines, rules-of-thumb, notation, and terminology. Reliance is placed upon following the flow of data through the system to formulate program design. The data flow is depicted through a special notational scheme which identifies each data transformation, transforming process, and the order of their occurrence.

The interpretation of the system specification is used to produce the data flow diagram, the diagram used to develop the structure chart, the structure chart to develop the data structure, and all of the results used to reinterpret the system specification. While the design process is iterative, the order of iteration is not rigid.

The process seems deceptively simple; but when attempts are made to use it, difficulties are encountered. For example, consistently identifying transformations of data is not easy to do. It is possible to be overly detailed in one part of the data flow and much less so in another. No formula is available to detect this condition.

Also, identifying afferent (incoming) and efferent (outgoing) flow boundaries plays an important role in the definition of the modules and their relationships. However, the boundaries of the modules can be moved *almost* arbitrarily, leading to different system structures. Again, no formal guide is provided.

Use of the structured design method does aid in the rapid definition and refinement of the data flows. The verification of the consistency of one data flow with its less detailed predecessor is crucial to this, but how to do the verifi-

cation is not satisfactorily addressed. Admittedly, this activity has been addressed for a military command and control application we learned of, but the technique used there is not an integral part of the structured design method. We find that this method and particularly its graphics do reveal previously unknown properties of some systems, though, such as the generation of information already contained elsewhere in the system.

This method turns out to be well suited to design problems where a well-defined data flow can be derived from the problem specifications. We found that some of the characteristics that make a data flow "well-defined" are that input and output are clearly distinguished from each other, and that transformations of data are done in incremental steps—that is, single transformations do not produce major changes in the character of the data.

Jackson methodology

The Jackson Methodology views data structure as a driving force to successful software design. The method was popularized in England through the efforts of Michael Jackson, hence its name, and more recently through efforts of Infotech Information Ltd.

In this methodology a program is viewed as the means by which input data are transformed into output data. An explicit assumption is that paralleling the structure of the input (data) and output (report) will ensure a quality design. One *im*plicit assumption is that the resulting data structure will be compatible with rational program structure. Other implicit assumptions include that only serial files will be involved and that the user of the method knows how to structure data.

Some claimed characteristics of this method include:

- It is not dependent on an analyst's experience or creativity.
- It is based on principles by which each design step can be verified.
- It is not difficult to learn and use correctly. (So if given the same problem, two designers working independently would arrive at very nearly the same design.)
- It results in designs which are easy and practical to implement.

Again, the process seems simple. But when we attempted to employ this technique, several difficulties were encountered. One was with the supporting documentation (Jackson's book) which is laden with examples and too few explanatory notes. We also encountered problems with the practicality of the method and began to question its basic premises. To illustrate, error processing had to be "wedged in" as erroneous data do not exist in a structural sense. Also, various file accessing and manipulation schemes took their toll. For instance, much data structuring is dictated by the data base management system employed. Thus, whether the data are tree-structured or not, we still may end up with an unimplementable program because there

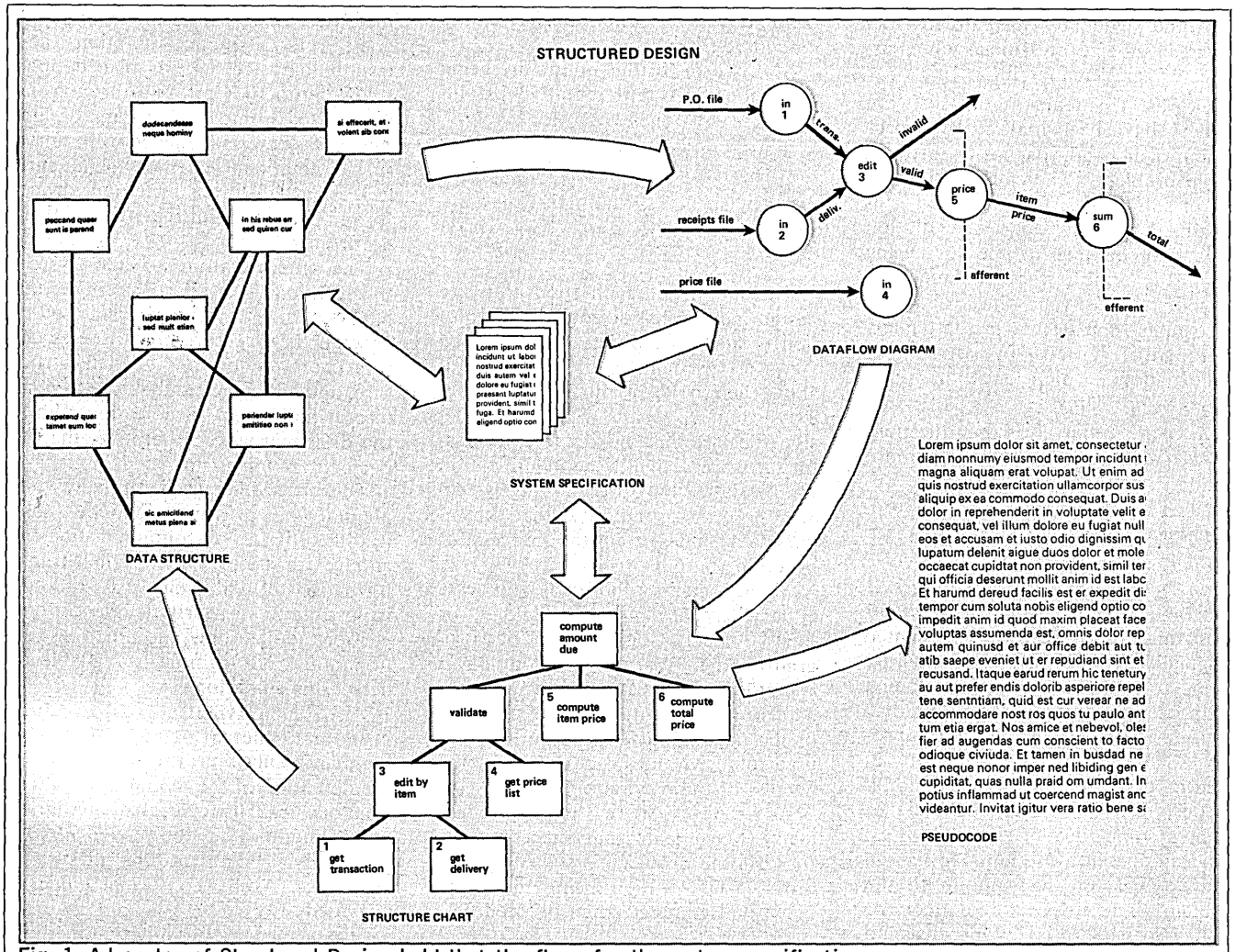

Fig. 1. Advocates of Structured Design hold that the flow of data through a system is the key to program design. The system specification is used to produce the data flow diagram, the diagram to develop the data structure, and all of the pieces to reinterpret the system specification.

As might be expected, the methodology works best where input data are transformed into output in incremental, easy to follow steps.

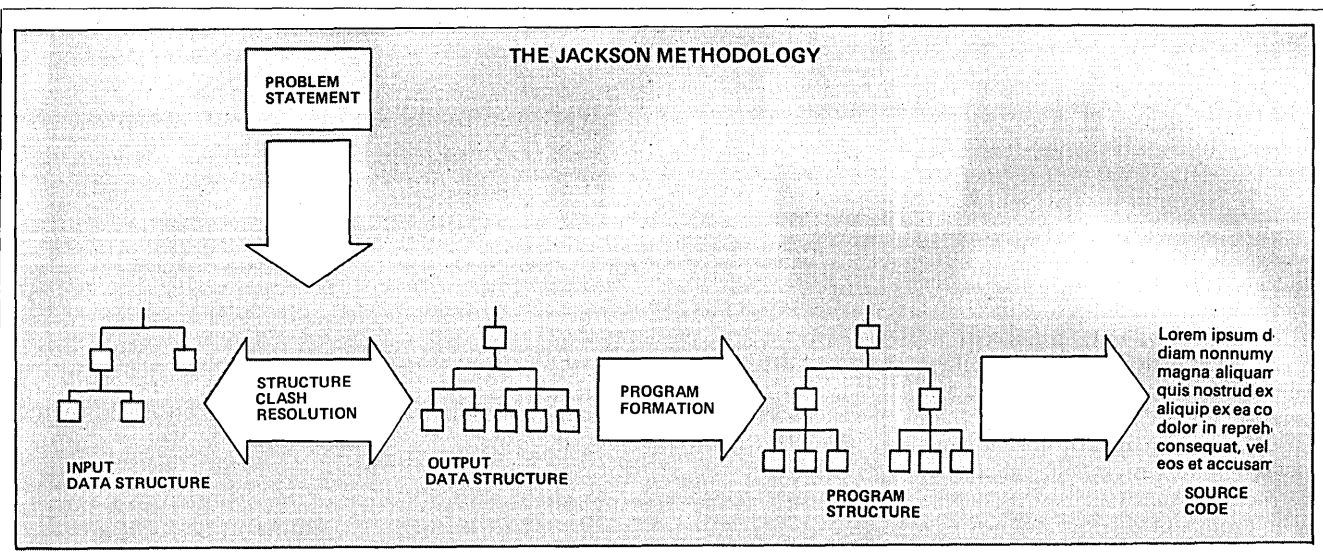

Fig. 2. The Jackson Methodology assumes that making the output data structure parallel to the structure of the input data will lead to a "good" design. (Some of the other methodologies share this assumption, too.) Unfortunately, the method may be practically limited to serial files. Also unfortunately, there may be no causal link between data structure and program quality.

does not appear to be a casual link between data structure and program quality; the basic assumption is invalid.

Logical construction of programs

LCP is a method similar in nature to Jackson's design methodology in that it also assumes data structure is the key to successful software design. However, this method is more proceduralized in its approach to program design than the Jackson method. Originated by Jean-Dominique Warnier in France, it has become popular outside the United States. It will now have its opportunity to become popular with English-speaking designers as English translations of the original French text are now available and the method has been incorporated into training offered by Infotech.

The LCP method is as follows:

1. Identify all input data to the software and organize in a hierarchical manner (files, records, entries, items). The exact format is not of concern here, but rather how the various parts of the input file are related to one another.
2. Define and note the number of times each element of the input file occurs, using variable names to relate the ratio of occurrences (such as: one active customer file, N customer records, each customer record has four entries: address, most recent payment, current balance, new charges).
3. Do step 1 and step 2 above for the desired output.
4. Obtain the details of the program by identifying the types of instructions contained in the design in a specific order: read instructions, preparation and execution of branches, calculations, outputs, and subroutine calls.
5. In flowchart-like fashion, depict the logical sequence of instructions using "Begin Process," "End Process," "Branch," and "Nesting" indicators.
6. Number the elements of the logical sequence and expand each

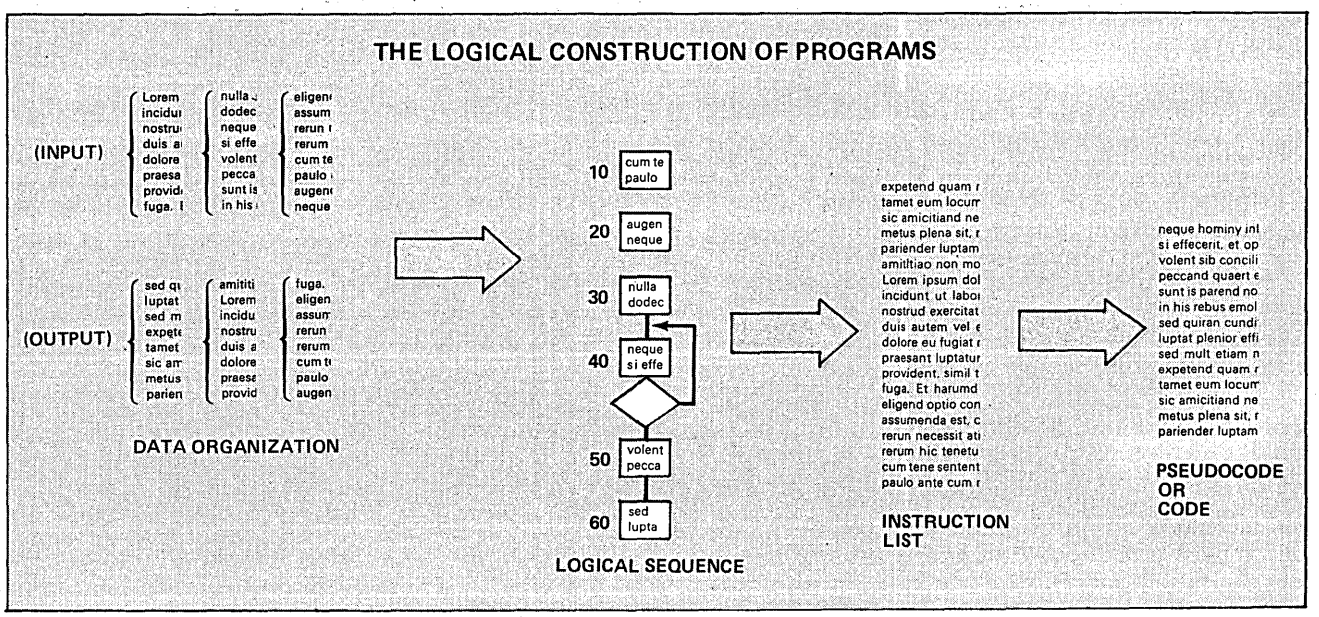

Fig. 3. The "Logical Construction of Programs" has become more popular outside of the U.S. than within its borders, possibly due to the lack of good English language documentation. The method again involves structuring the input and output data, using its own graphic conventions (Warnier diagrams), but adds a set of sequencing procedures and instruction types to translate the logical arrangement into pseudocode.

through the instructions identified in Step 4. (There exist several other guidelines regarding how data structure conflicts are involved, but they are not pertinent to our discussion.)

Many of the difficulties associated with the use of this method are similar to those encountered in using the Jackson Methodology. For instance, some problems force us to contrive a hierarchical data structure where none was previously apparent. Also, this method is somewhat misnamed in that it deals with program design issues and not construction issues (such as packaging, run environment, file access methods, etc.). Although for a problem with a readily apparent hierarchical data structure we get to a pseudocode statement of the program very rapidly, closer inspection often reveals that the resulting program is not what we would have chosen.

This method appears to be well suited to problems involving one module or only a few modules, and where the data are tree-structured. The latter leaves it susceptible to the same kind of problems as the Jackson Methodology.

Meta stepwise refinement

MSR is based on the premise that the more times you do something, the better the final results. It allows the designer to assume a simple solution to a problem and gradually build in more and more detail until the complete, detailed solution is derived. Several refinements, all at the same level of detail, are conjured up by the designer each time additional detail is desired. The "best" of these is selected, more detailed versions proposed, the best of these selected, and so on. Only the *best* solution is refined at each level of detail. Specific attributes of this method include:

1. It requires an exact, fixed problem definition.
2. It is programming language independent in early stages.
3. Design is by levels.
4. Details are postponed to lower levels.
5. Correctness is ensured at each level.
6. The design is successively refined.

MSR was authored by Henry Ledgard and later given this name by Ben Schneiderman. It is a synergism of Mill's top-down notions, Wirth's stepwise refinement, and Dijkstra's level structuring. It produces a level-structured, tree-structured program.

It is well known that by proper program organization it is possible to separate functionally independent levels

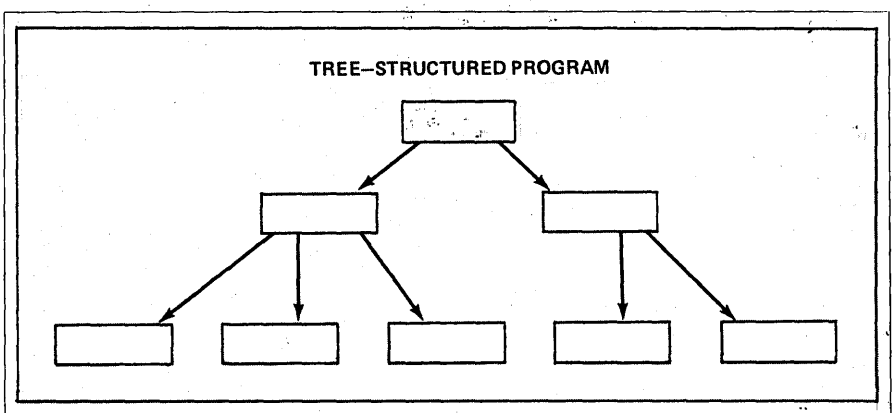

Fig. 4a. In a tree-structured program, the "root" module contains an outline or general image of the program, while the lower levels contain increased amounts of implementation detail.

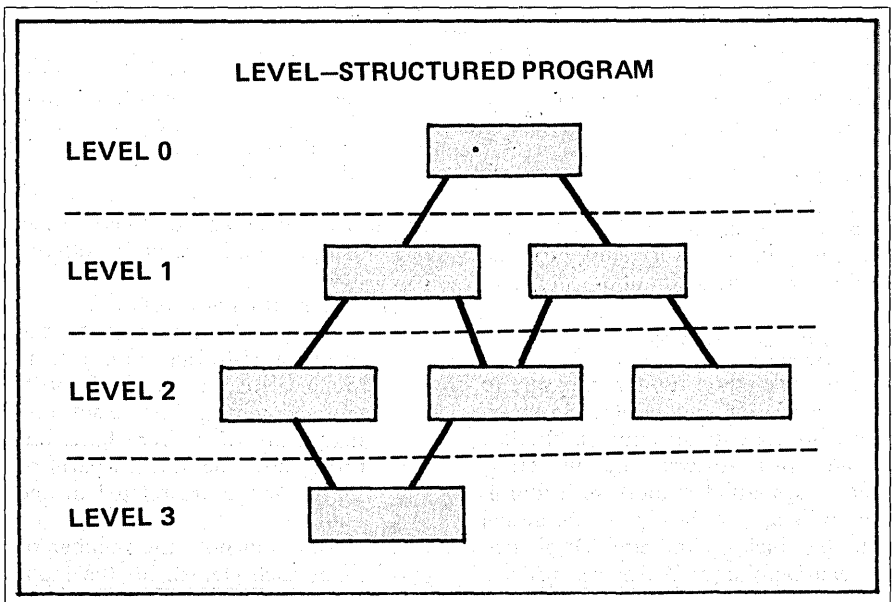

Fig. 4b. The basic rule of organization in a level-structured program is that modules at one specific level invoke only modules at the next lower level and never the reverse.

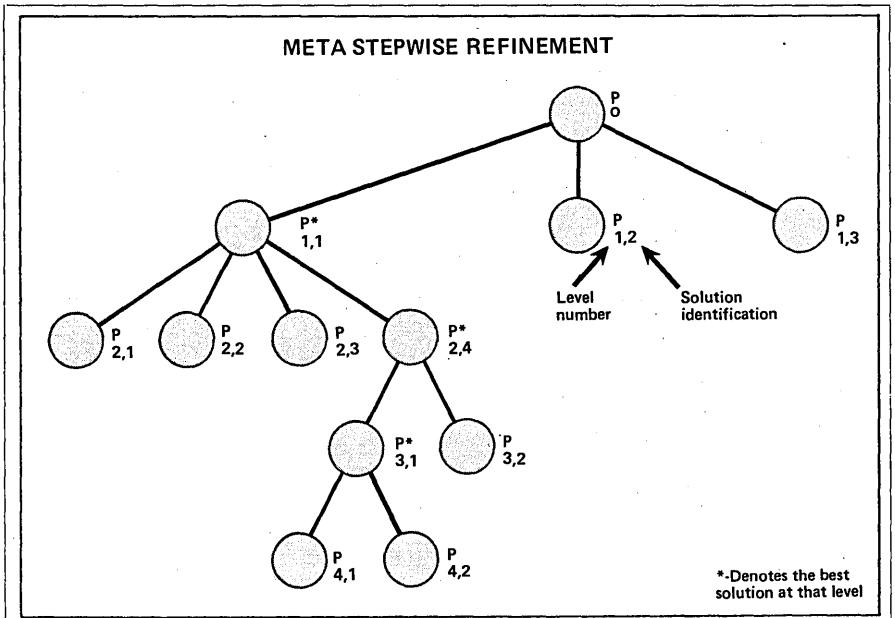

Fig. 5. In using Meta Stepwise Refinement, the designer starts with a simple, general solution and builds in increasing amounts of detail at lower levels in the design. MSR requires that the designer actually develop several potential solutions at each level, discarding all but the best of these. It may take a special kind of person to do this.

METHOD	Requirements Analysis and Specification			Design			Implementation	
	Problem Definition	Value System Design	Systems Analysis	Architecture Design	Data Design	Module Design	Code Construction	Testing
STRUCTURED DESIGN				1	2	2		
THE JACKSON METHODOLOGY				1-2	2	1	1	
LOGICAL CONSTRUCTION OF PROGRAMS					2	1	1	
META-STEPWISE REFINEMENT				2		1	1	
HIGHER ORDER SOFTWARE	2			3		1	1	

1 = addressed directly 2 = covered but no substantive guidelines offered 3 = supported by automated processor(s) blank = does not cover

or layers in programs (as is illustrated in Figs. 4a and 4b). The higher levels reflect the problem statement while the lower ones have increasing amounts of implementation detail. The basic rule is that modules at a specific level invoke only modules at the next lower level, and never the reverse. This is how MSR works.

Although the method's theory sounds good, the practice leaves a lot to be desired. For example, in real life, non-trivial problems undergo constant reinterpretation, reevaluation, and modification. They are not stable. If they were, this method would not be needed. Since the solution at any one level depends on prior (higher) levels, and since any change in the problem statement affects prior levels, our ability to produce a solution at any level is undermined until the changes are made.

One approach is to refuse changes until the design is complete. This results in the solution and the requirements being unsynchronized. The production of multiple solutions is another difficulty. Coming up with fundamentally different solutions to a problem is not a likely occurrence for an individual. Also, how to decide which solution is "best" is not addressed by this method.

Due to the number of times the problem is going to be solved, this approach works best on small problems, perhaps those involving only a single module. It is particularly useful where the problem specifications are fixed and an elegant solution is required, as in developing an executive for an operating system.

Higher order software

HOS initially was developed and promoted by Margaret Hamilton and Saydean Zeldin while working on NASA projects at MIT. The method was invented in response to the need for a formal means of defining reliable, large scale, multiprogrammed, multiprocessor systems. Its basic elements include:

1. a set of formal laws
2. a specification language
3. an automated analysis of the system interfaces
4. layers of system architecture produced from the analyzer output
5. transparent hardware

This design method is based on axioms which explicitly define a hierarchy of software control, wherein control is a formally specified effect of one software object on another:

Axiom 1: A given module controls the invocation of the set of valid functions on its immediate, and only its immediate, lower level.

Axiom 2: A given module is responsible for elements of only its own output space.

Axiom 3: A given module controls the access rights to each set of variables whose values define the elements of the output space for each immediate, and only each immediate, lower level function.

Axiom 4: A given module controls the access rights to each set of variables whose values define the elements of the input space for each immediate, and only each immediate, lower level function.

Axiom 5: A given module can reject invalid elements of its own, and only its own, input set.

Axiom 6: A given module controls the ordering of each tree for the immediate, and only the immediate, lower levels.

In practice, HOS has been used with an automated analyzer program which checks the solution design as expressed in HOS' own metalanguage. The need for the analyzer is not inherent in the methodology, however, and in fact we used pseudocode in examining the method since the analyzer was not available to us.

Our evaluation is that HOS is an asset in applications where the accuracy and particularly auditability of the algorithm are the primary concerns, applications such as scientific problems and detailed financial computations.

Our exposure to this methodology is limited, due in part to its very nature, its scale. We did use it enough to find some of its characteristics, however. For example, one objective of HOS seems to be to ensure correctness and consistency by interface definition and attention to detail. It was this emphasis on the details of system execution which first focused our attention on a

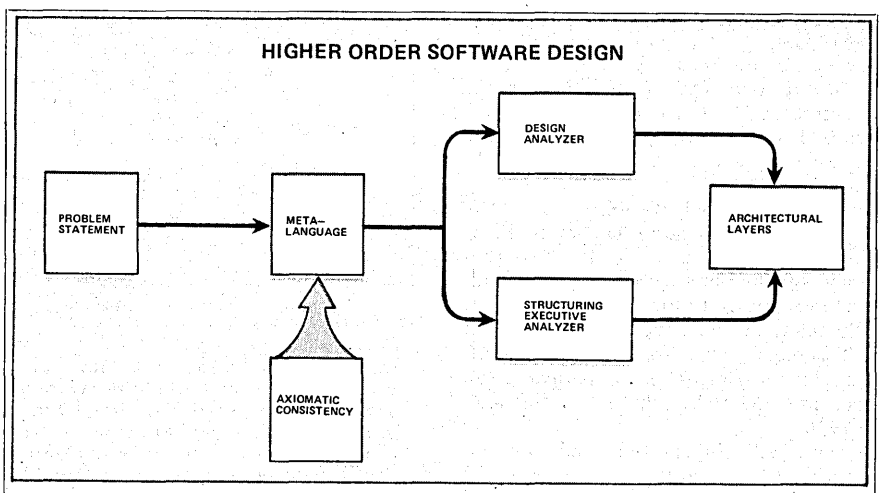

Fig. 6. Higher Order Software Design involves the use of a set of axioms to explicitly define the hierarchy of software control. It has been used with analyzer programs which check the design solution as expressed in HOS' own metalanguage. Developed for large scale NASA projects, the methodology may be well suited for such things as operating system design, but it does not address the structure of the data base very well.

COMPARING

METHOD	ATTRIBUTE								
	Specialized Graphics	Defined Procedure(s)	Training Support	Tutorial Documents	Requirements Traceability	Known Experience Base	Compatibility With Other Techniques/ Schemes	Area of Application	Evaluation (Quality) Criteria
STRUCTURED DESIGN	use structure charts for system architecture	an iterative framework which guides the solution development	two courses offered by Yourdon, Inc.	book by Yourdon & Constantine; book by G. J. Myers	designer's responsibility	up to 5 years experience within firms like IBM & Hughes	usable with any module design strategy	systems whose data flow can be communicated graphically	a well-defined set of design heuristics
THE JACKSON METHODOLOGY	tree-like charts for data structures	loosely defined guidelines to address various problems	two-week course offered through Infotech	book by Jackson (challenge to read) presented via examples	designer's responsibility	early versions available since 1972 with emphasis on business application	usable with other data structuring methods	business & other systems with well-understood data structure(s)	verify compliance with basic assumptions
LOGICAL CONSTRUCTION OF PROGRAMS	use Warnier chart for data structure	well-defined set of procedures at all levels of detail	incorporated in a course offered by Infotech	book by J.-D. Warnier	designer's responsibility	extensive use throughout Europe & other foreign countries	procedural nature would limit compatibility	business & other systems with well-understood data structure(s)	verify compliance with basic assumptions
META-STEPWISE REFINEMENT	use a tree diagram for program structure	high-level guidelines for the basic steps	no formal offerings	book by H. F. Ledgard	designer's responsibility	primarily limited to theoretical developments	would benefit from design evaluation criteria	applications with well-understood, stable requirements	no specific guidelines
HIGHER ORDER SOFTWARE	structured flowcharts for control structure	mostly theoretical discussion(s) with limited operational details	by arrangement with Higher Order Software	no formal text, several papers in journals	potentially available through an analyzer	proposed application on NASA Space Shuttle program	would benefit from design guidelines	applications with high reliability requirements	primarily automated analysis of design

fraction of the software design problem: we found that the issue of data base design was, at best, addressed implicitly, with the structure of the code appearing to be the primary problem Our experience with large systems has taught us that the design of code and data base must be synchronous.

Now what do we know?

Now that we've gone through all the experimentation, what have we learned?

The preceding remarks are based on our experiences and reflect personal biases, but four observations should be apparent by now. The first is that no single method exists which would be an asset in every design problem. That's no surprise. The second observation is that the assumptions made by each method are just that—things taken for granted and not provable. The third is that methods can only contribute so much to the design effort. Designers produce designs, methods do not. A design problem, although well suited to a particular technique, will always have some quirk which makes it unique. Software design methods merely assist in solving routine aspects of a problem. Using a methodology only reveals the critical issues in a design effort and gives us more time to address them.

The final observation is that designing is problem solving—a fundamental, personal issue. To many, design methods are something of an affront and are resisted if imposed. Adoption of a method or methods requires a behavioral change, an alteration in how problems (of a certain class) are solved. And accomplishing the desired behavioral change can be a very difficult undertaking.

Methods are important but their successful application occurs only in supportive environments. Specifically, the necessary management elements (planning, scheduling, control systems, etc.) must all be present and effective. The larger the system, the more important these "non-technical" factors. The balance between methods and environments is a delicate one. The merging of these may very well be the next evolutionary step. ❋

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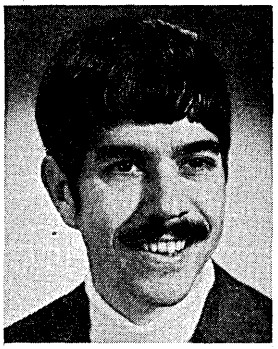


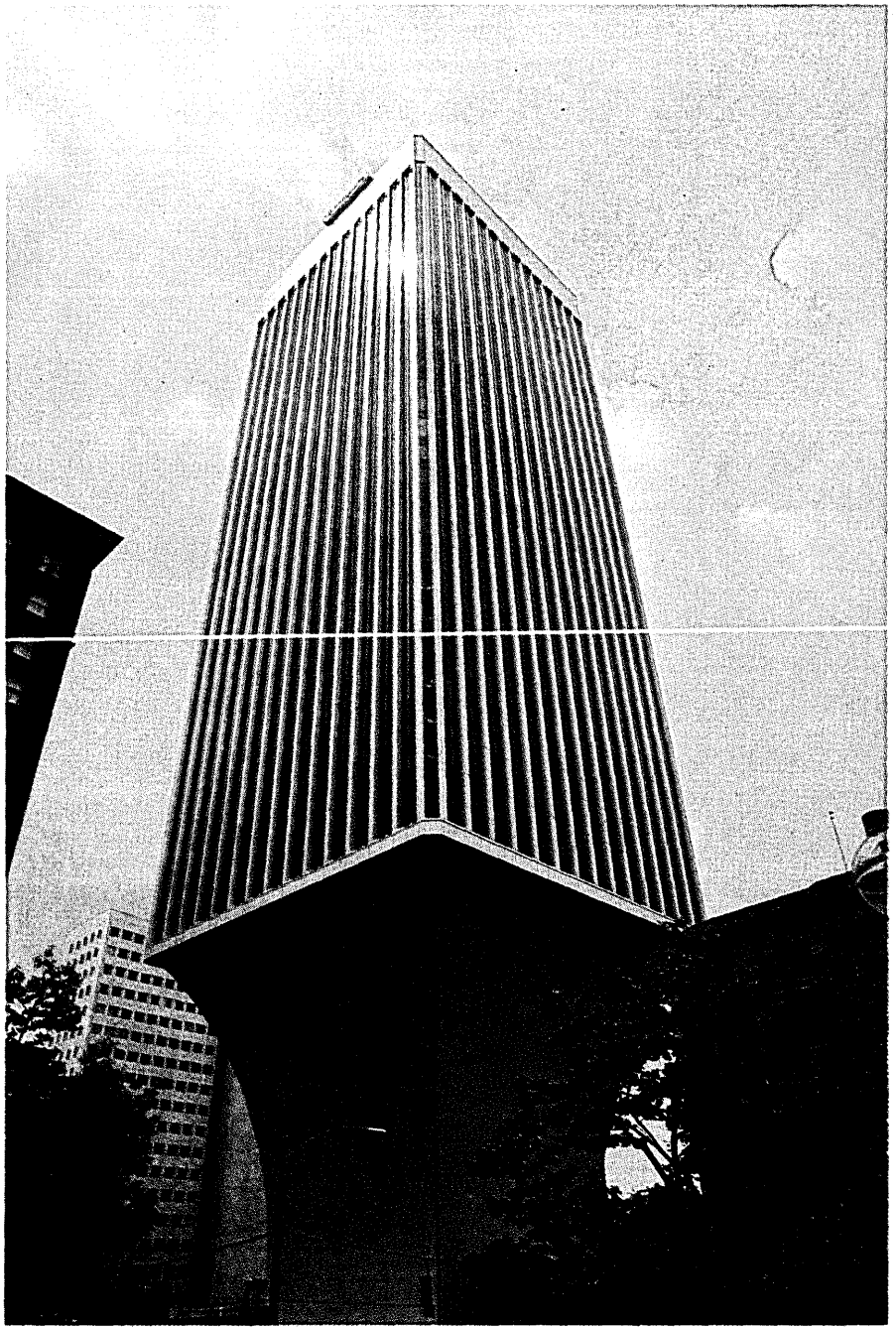
Mr. Peters is a software engineering consultant with Boeing Computer Services Inc. His ten years of dp experience include periods spent on commercial, scientific, and real-time applications while working at Aerojet Electrosystems, Bell-Northern Research (in Canada), and BCS. Since 1973 he has been involved in the development and promotion of modern programming practices within BCS.

Mr. Tripp started as a software engineer (although the title wasn't yet invented) at the Boeing Company in 1966, working on large matrix structural analysis systems and on non-linear differential solving. He too has been working on the programming practices project at BCS since 1973, lately in his capacity as manager of software methods development and implementation within the Advanced Techniques and Applications Div.

DP Dialogue

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

MVS Puts Rainier Bank Online Fast



Rainier Bank's dramatic new 40-story headquarters building in Seattle, Washington, rises within sight of its namesake: 14,408-foot Mt. Rainier.

"We did an 'initial program load' of MVS one day and never looked back. Everything was absolutely smooth and problem-free."

William Anderson, manager of system research and technical support for Rainier Bank, Seattle, is describing the bank's recent adoption of Multiple Virtual Storage (MVS) for its two System/370 Model 158's. MVS is IBM's operating system for large computers and multiple-processor installations.

"Now we run the two machines as a Multiprocessor (MP) system, and we move more than a thousand jobs a day through the data center, meeting our schedules consistently. One operator runs the whole system, and machine productivity has increased greatly since we let MVS dispatch the jobs to balance the workload. To meet a deadline, MVS can dynamically apply all the power of the dual system to a single job."

"Since we introduced MVS," notes Frederick S. Haines, senior vice president and manager of information systems, "we've been able to add many major applications on these machines. Our performance monitors show consistent improvement under MVS. System utilization has increased and continues to increase, thanks in equal part to MVS and to the talents of our system programmers. Processing times for production programs are diminishing, system idle time is diminishing, and jobs per hour are increasing. And the improved performance has let us accommodate more activity without increasing the total data processing resource."

Among the new applications are online teller transactions. "The first branch went online three months after MVS came up," Haines says, "and we've been on schedule ever since."

"We are processing over 100,000 transactions a day now," Anderson adds. "We expect that to rise to 120,000 when all the branches are online.

"The error recovery facilities of MVS have been superb," he continues. "It has been very easy to bring the system back up—almost like following a cookbook.

"Now we support online program development under Time Sharing Option (TSO) as well as online transactions. MVS and MP allow us to distribute the power of the 158 to the hands of the people who can make use of it."

Advertisement

TWA Computes $24 Million Yearly Fuel Saving

An IBM computer is helping Trans World Airlines conserve more than 70 million gallons of precious fuel a year. At current prices this means a yearly saving of $24 million. Key to achieving this are an online flight planning system and a preferential fueling program.

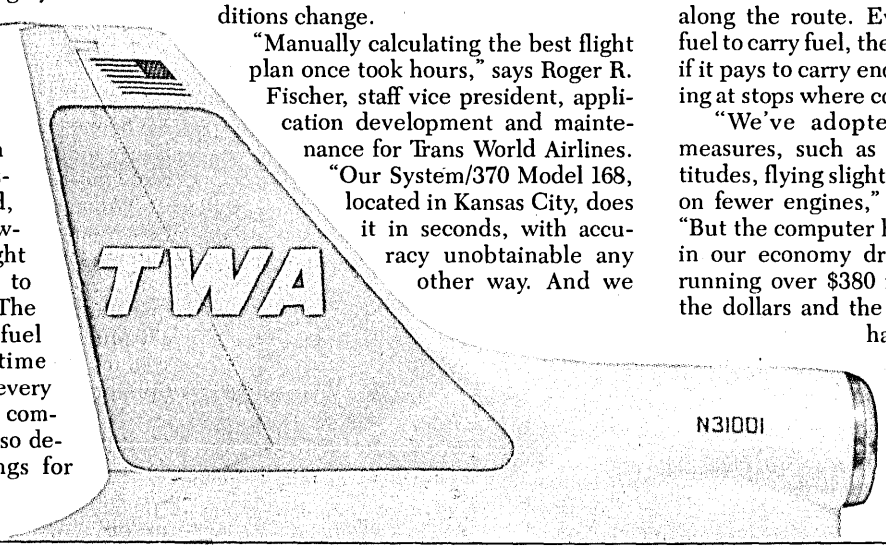
With online flight planning, information on aircraft performance and routes is stored in the computer. The system analyzes payload, fuel requirements, allowable takeoff weight, flight time, weather and up to five different altitudes. The system then displays fuel consumption, flight time and operating cost for every possible route/altitude combination. The system also determines power settings for climb, cruise and descent.

A dispatcher reviews the alternatives and recommends the optimum least-cost route and altitude to the flight captain. The flight plan can be revised at the last minute should the weather or other conditions change.

"Manually calculating the best flight plan once took hours," says Roger R. Fischer, staff vice president, application development and maintenance for Trans World Airlines. "Our System/370 Model 168, located in Kansas City, does it in seconds, with accuracy unobtainable any other way. And we plot over 1,500 flight plans a day for TWA's worldwide operations."

Preferential fueling helps TWA allow for wide variations in fuel costs at different points. The program helps TWA find the least-cost location to take on fuel along the route. Even though it takes fuel to carry fuel, the computer will show if it pays to carry enough to avoid refueling at stops where costs are high.

"We've adopted other economy measures, such as flying at higher altitudes, flying slightly slower and taxiing on fewer engines," Fischer points out. "But the computer has been a big factor in our economy drive. With fuel bills running over $380 million a year, both the dollars and the precious fuel saved have been vital to us."

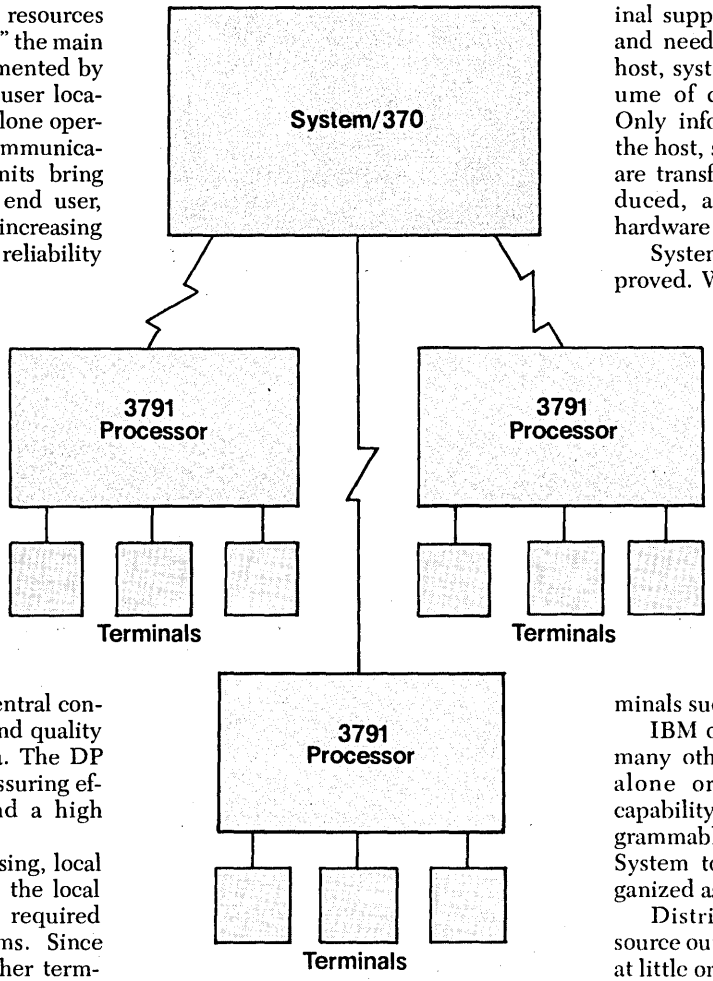


Distributing DP Resources Improves User Service

In the organization of DP resources called "distributed processing," the main or "host" computer is supplemented by smaller machines in selected user locations. Capable both of stand-alone operation and of terminal-like communication with the host, these units bring computing capability to the end user, simplifying the system while increasing its responsiveness, flexibility, reliability and availability.

The IBM 3790 Communication System extends distributed processing by preserving the benefits of the large-scale computer and protects investments in existing programs. Local processors have access to the central data base, and the full power of the large computer remains available when required. 3790 distributed processors can be programmed from the host computer, maintaining central control over program standards and quality and over the integrity of data. The DP staff can remain centralized, assuring efficient use of personnel and a high caliber of professionalism.

In 3790 distributed processing, local transactions are completed in the local processor, which stores the required data and application programs. Since screen display formats and other terminal support material are stored locally and need not be transmitted from the host, system response time and the volume of communication are reduced. Only information actually required by the host, such as transaction summaries, are transferred to it. Line costs are reduced, and the total cost of system hardware will increase little, if at all.



System reliability may also be improved. When the host computer is unavailable, the local processor can continue responding to requests for service, storing transaction data until the host is ready to receive it. If a single local processor is unavailable, the impact is limited.

The 3791 Controller brings transaction-oriented processing to remote sites, with each controller supporting one or a cluster of online terminals such as the 3277 Display Station.

IBM offers distributed processing in many other forms, which place stand-alone or communications-oriented capability at remote sites, from a programmable 3770 Data Communication System to System/370 installations organized as satellite processors.

Distributing some of the DP resource outward can improve user service at little or no increase in cost.

LOF Manages Rapid Changes with DL/1

"Our product now is technically more sophisticated and highly individualized, requiring many more stages of production. The part number count has zoomed from 400 to 8,000 and we're adding 200 new items a year."

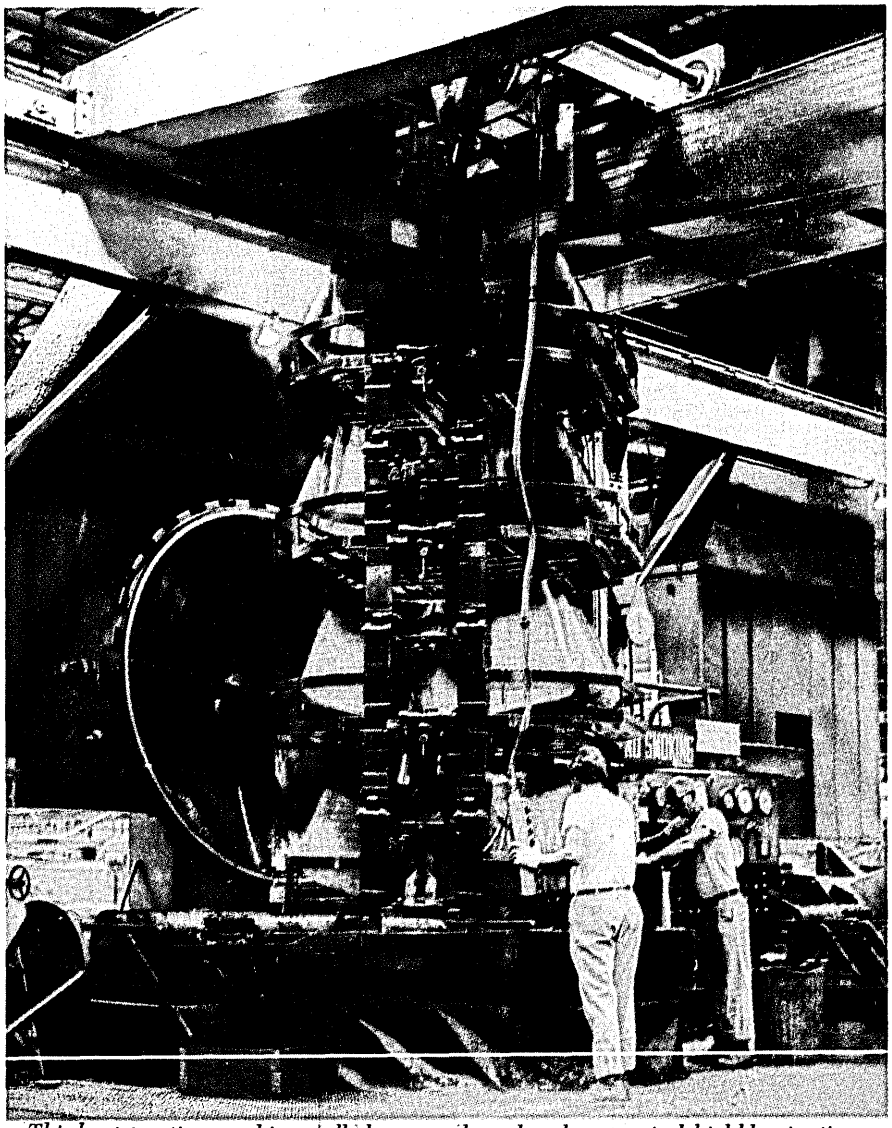
The product is automotive glass. The speaker is Robert Whittington, executive director of management information systems for Libbey-Owens-Ford. He is describing why LOF turned to Data Language/1 (DL/1) for data base management on its IBM System/370 Model 158 at Toledo, Ohio. To control a network of IBM 3277 Display Stations, which handle online transactions from the factory floor and throughout the plant, LOF uses the Customer Information Control System/Virtual Storage (CICS/VS).

"We're constantly called upon for more variations of the product," Whittington notes, "such as embedded antennas or defrosting elements, tinted glass, edge bands and etched designs. In addition, production and delivery must be precise because our customers don't carry inventory. We ship directly to their assembly plants and must accept order changes up to the last minute.

"All this means constant rework of our Production Information System," Whittington adds. "Before we had DL/1, a little thing like changing from seven- to eight-digit part numbers would require extensive reprogramming. Because DL/1 protects the program from any changes in data structure, we have complete device and data independence. Now we can direct the computer to track an entire new sequence of production stages simply by making an entry in our DL/1 data base. And the creation of data entry editing routines to catch errors is simplified.

"Through inquiry into the DL/1 data base, management and production control people can obtain a better picture of what's happening on the plant floor. The scheduling department can spot potential trouble before production is seriously affected and we consistently achieve better schedule compliance. Now we handle increased product complexity and volume without adding people to the scheduling department.

"We can readily apply the data base developed under DL/1 to such management functions as budgeting, cost control, and financial planning. But most important, we do more than cope with changes. We're able to manage them."



This heat-treating machine, called an autoclave, bonds auto windshield laminations. DL/1 helps Libbey-Owens-Ford control production to meet demand for a fast-growing list of part numbers.

Interactive and Data Management Aids

Three software products available from IBM extend the power of data processing systems:

1. **Virtual Storage Personal Computing** (VSPC) permits problem-solvers at terminals to interact with the computer in user-oriented languages.

2. **Generalized Information System (GIS)** provides facilities for creating and maintaining formatted files and for extracting data from them, particularly where information needs are spontaneous and varying.

3. **DB/DC Data Dictionary** supports data-base management, aiding the consistent and non-redundant definition of data and the establishment and administration of data standards.

For more information on these and other IBM software products, contact your local IBM branch office or write to the Editor of DP Dialogue at the address on the right.

DP Dialogue is designed to provide you with useful information about data processing applications, concepts and techniques. For more information about IBM products or services, contact your local IBM branch office, or write Editor, DP Dialogue, IBM Data Processing Division, White Plains, N.Y. 10604.

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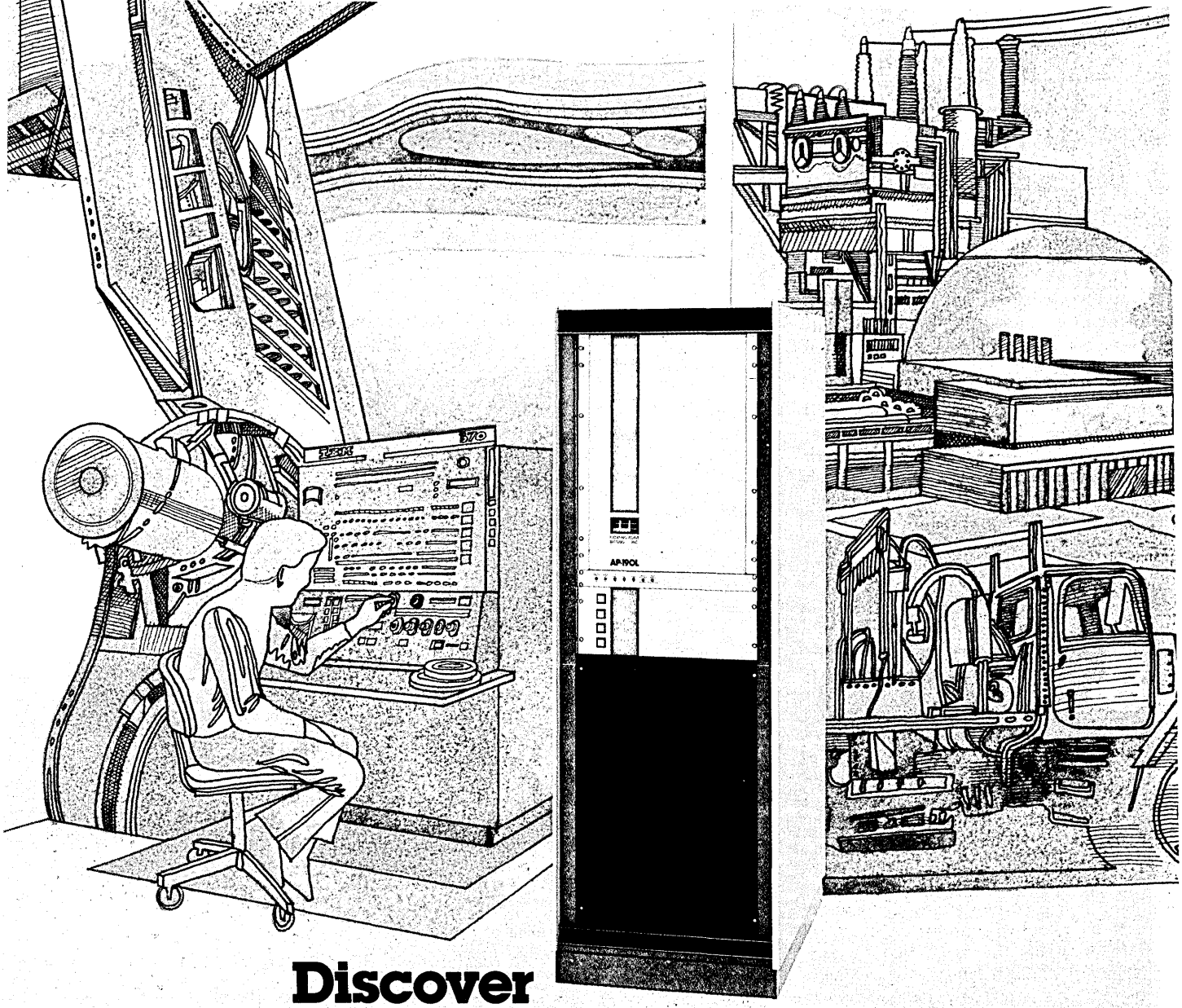

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DATAMATION 11/77

Structured Analysis for Data Base Design

by Thomas R. Finneran and J. Shirley Henry

Top-down design will work for data bases as well as it does for programs if the analysis is done by function rather than by department.

The data base approach to information processing has gained considerable acceptance within the data processing community. The concept of controlling data as an organizational resource, while easing many of the problems of traditional data management, has made the data base idea appealing to managers and technicians alike. Further, existing data base management systems allow previously unmanageable volumes of related data to be maintained and accessed under control of standardized software.

What is sometimes missed, however, is that the decision to adopt the data base philosophy should lead to other changes too, especially changes in systems design philosophy—a new way of organizing data, new design methods, and a different type of interaction between the designer and the user of the system. Rather than tying data to specific report output as he once may have done, the designer now must analyze the user's business functions, identifying not only the data needed to solve the user's present problems, but also that which will be necessary to solve future problems.

How is he to do it? A structured design approach using functional analysis offers what may be the only systematic and organized method of developing the data base design. This approach is becoming widely accepted as a technique for designing application programs, and also can be used in designing the data base itself.

But to apply that method, the business functions of the organization must be analyzed, not the organizational aspects of the business.

If the designer begins to look at the activities of the business from an organizational view, he will soon find that while tracing the operations and information flow, he becomes lost in a maze of sidetracks. This happens because a department or section within a department is concerned with only those operations on particular data, information, or documents for which it is responsible. In addition, one department may handle several unrelated operations; it may not logically fit into any one particular operation.

On the other hand, if the designer divides the "big picture" into business *functions*, rather than organizational entities, he can logically segment the organization, avoiding the problems inherent in a departmental analysis. This functional approach also gives a fresh overview of the total business and points out possible areas of omission or duplication of activity.

There's another bad route to avoid as much as the organizational one.

If the designer begins by examining the individual activities of a major area of a company, the time required to complete the analysis will be increased because of the difficulty of staying on a direct path to the logical conclusion of the study. It is much like trying to study the size, shape, and color of an individual piece of a jigsaw puzzle: the designer cannot place this piece (or activity) into its proper perspective because of the multitude of other pieces (or activities) surrounding it. Instead, the analyst must find a way to classify this activity as part of a logical group called a *function*.

However, the steps of functional analysis can be applied to a business system only when the analyst understands what makes up a business function.

All businesses are composed of activities. These activities may be simple or complex, large or small, continuous or cyclic in nature, depending upon the nature of the business. They may be performed by a computer or a drill press, a staff of people or an individual at a desk. However they are performed, they are the bases of the company's operation.

By studying these basic functions of a business, the designer can classify business activities by logical groups, thus placing the individual activities into sequence and giving order to the complete business analysis.

Building a paper tree

In doing such a functional analysis, the designer will find that a top-down approach is most logical and less apt to lead to blank walls and confusion. The analyst also will find that a graphical approach will lead to a clear, concise understanding of the functions, their relationships, and ultimately, their information requirements.

Applying a top-down graphics approach naturally leads to a functional analysis chart with a tree-like structure. One good way to do this is to make each chart element or box contain the name of a function represented by an action verb and an object. (For example, a box might contain a name, "Develop Market Forecast.") The top box of the hierarchy (tree) chart thus can constitute a description of the entire function performed by the business function being analyzed. Each level below the top box represents de-

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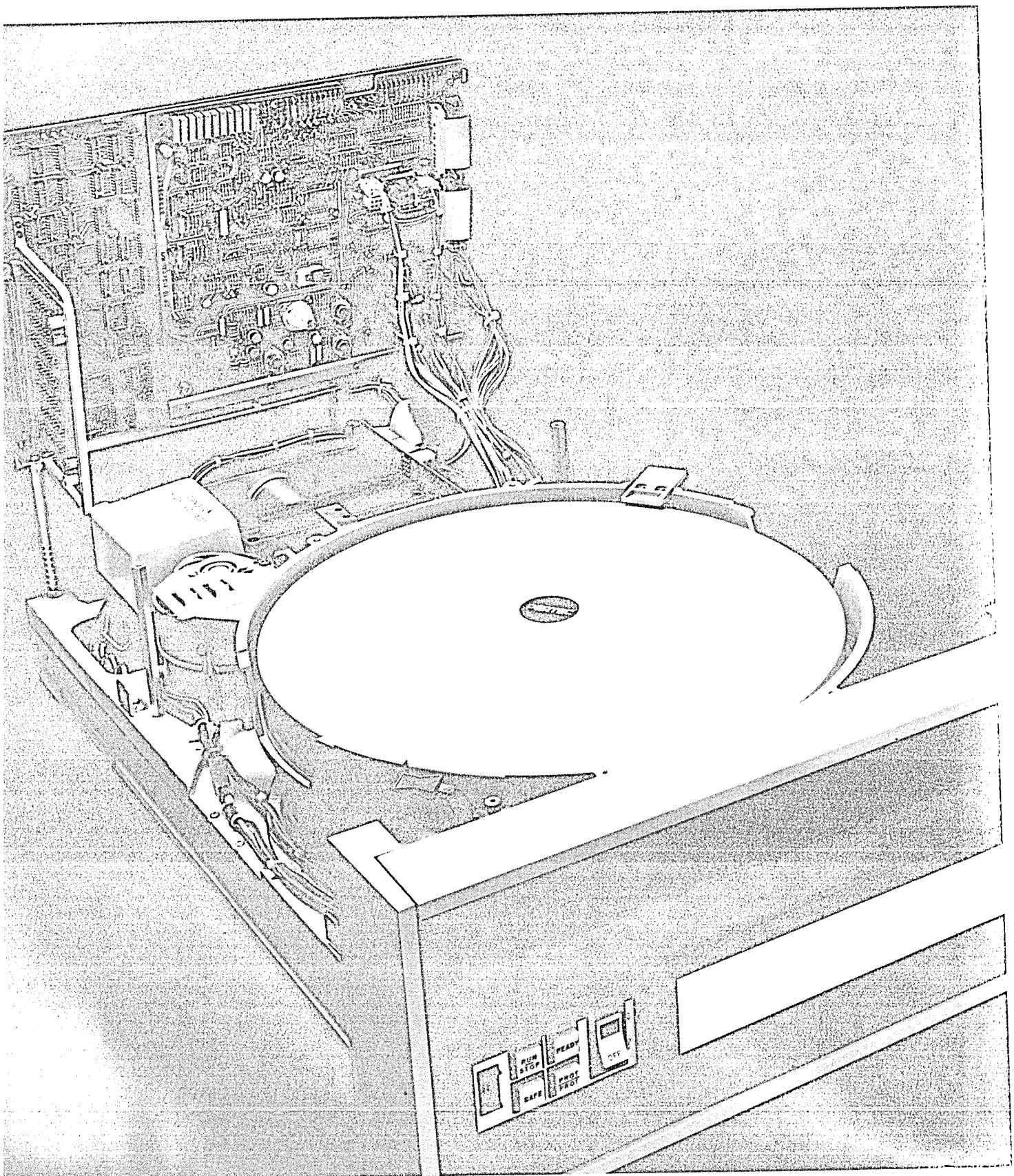

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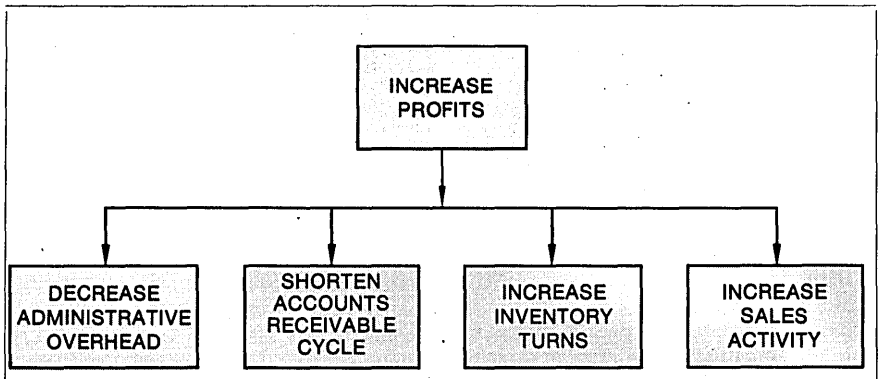

Fig. 1. The general format of the functional analysis tree calls for a top-down ordering of business functions, subfunctions, or goals, each of which is identified by a box with an action verb and object.

compositions of that function into subfunctions.

The structured design approach using functional analysis, then, is a technique for generating such a tree depicting the information requirements of the business function under study.

In determining the top box of the hierarchy, the designer should encompass as broad a base of subfunctions as possible. This is because the data base should be designed to satisfy more than one application system. Also, the content of the top box, and of all the entities below it in the functional tree, should be defined in concert with the user department. As is implied by the top-down representation of information in this scheme, the interview with data gathering processes also should proceed from functionally higher level individuals to lower. The analyst will ask the interviewee three fundamental questions: (1) What are the objectives of your job? (2) How do you accomplish these objectives? (3) What information do you need in order to solve problems, make decisions, or develop plans for meeting your objectives?

As an example, assume that the operating vice president of a distribution-oriented company has been given the task of increasing the profit margins of her organization. She decides to perform the functions indicated in Fig. 1.

Our v.p. will find that the intermediate functions within the hierarchy (just below those in Fig. 1) tend toward one of two forms. The first has to do with an activity that is solely the concern of a single organizational entity. In our distribution example, it is likely that a single department or individual would reorder stock when the inventory level on a given item fell below some point.

The second type of intermediate function is any which occurs many times in our functional tree. These objectives or tasks may be the common objective of many entities within the organization, and as such also may be candidates for consolidation at a higher level in the hierarchy. They may reflect informal objectives within the organization, and should be reviewed by the analyst in that light.

As the analysis continues, each function or task defined will spawn supportive tasks, until the steps to reach the top box objective all have been defined. The leaves of the fully defined functional tree will consist of elementary level functions which require no supporting activity. Then from each of the elementary functions a list of information elements needed to perform them can be determined by

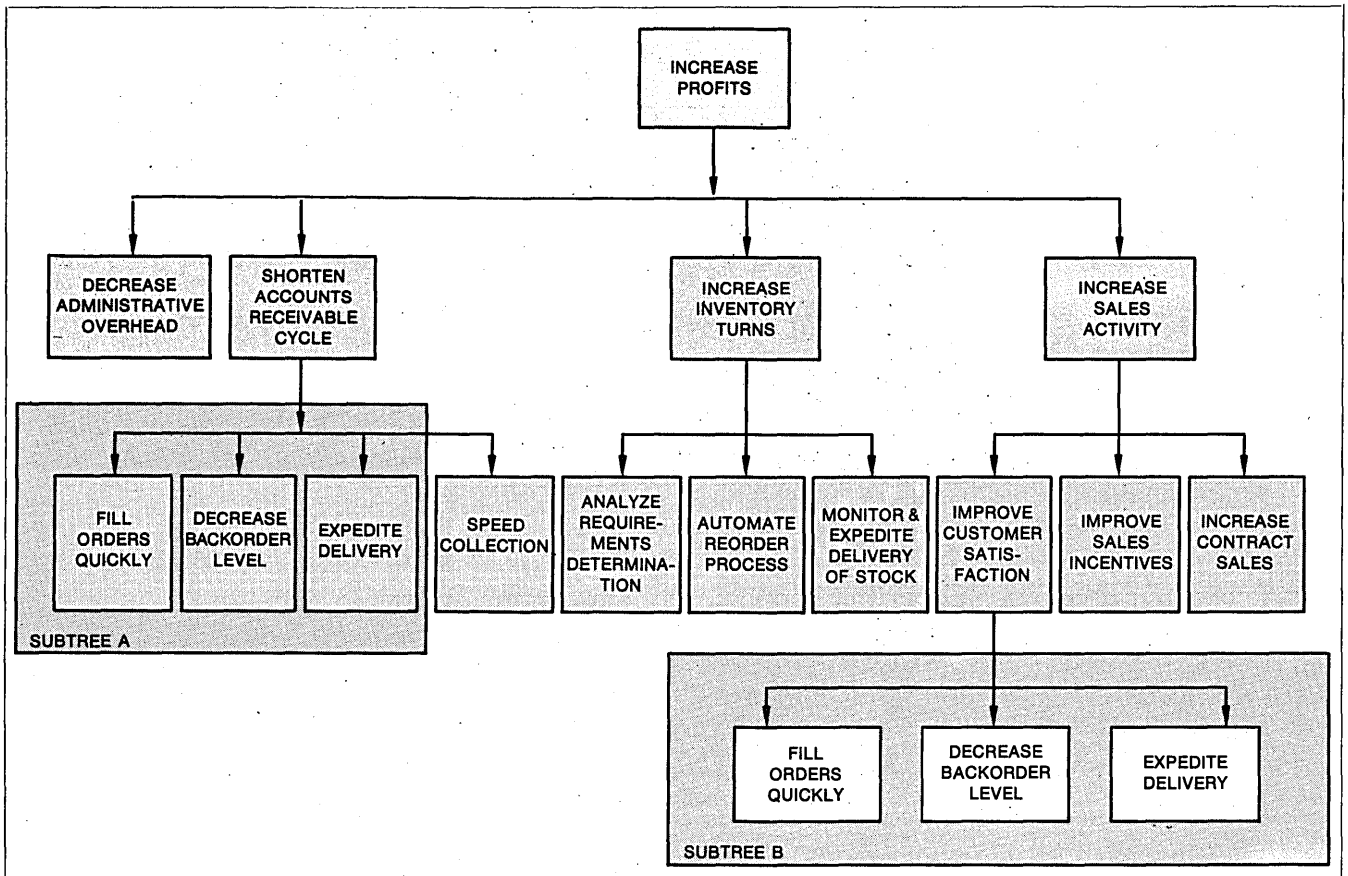

Fig. 2. As the tree branches out, the interrelations of functions and sub-functions quickly become apparent, as illustrated by Subtrees A and B. Performing those operations will shorten the AR cycle **and** improve customer satisfaction.

the user and the analysts.

Fig. 2 depicts a partial functional tree for the Increase Profit objective. Say that the v.p. delegates part of her task of increasing profits to the controller. Fig. 2 indicates the subfunctions that the controller sees as necessary to achieve his objectives.

The interrelated nature of information and objectives within an organization is exemplified by Subtree A and Subtree B. The controller determines that to Fill Orders Quickly, Decrease Backorder Level, and Expedite Delivery of Merchandise will serve the dual functions of Shortening the Accounts Receivable Cycle as well as Improving Customer Satisfaction. In instances such as these, the subtrees associated with the objective sets will be the same, even though the functions they serve are diverse. This illustration also points out that such common goals need not occur on the same level of the functional tree.

At this point in the development of our functional tree it becomes necessary to introduce a data processing analyst into our data gathering process. As the business requirements analysis process moves toward more fundamental tasks, the intermediate levels of the functional tree will begin to define data processing objectives.

For example, if we define an operational and data processing strategy to accomplish our Fill Orders Quickly objective in Subtrees A and B in Fig. 2, the result might be the lower level subtree described in Fig. 3. During this stage of analysis, the conventional systems task of balancing business requirements against the technological feasibility of various systems solutions will occur.

In Fig. 3, the information element lists are shown below the elementary functions. The Fill Orders Quickly subtree has been fully defined, and the data element lists required to fully support this function have been diagrammed. The full tree similarly will have every function resolved to the elementary function level, and each elementary function will have a list of supportive information elements.

Benefits of putting it on paper

Diagramming the information requirements in this fashion has a number of benefits:

1. At some point in the interview process, a point will be reached in each subtree where a single person or group will be concerned with all lower level functions and their data elements lists. The analyst will talk to the specific individuals who are manipulating and/or generating the data required to support higher level functions. The analyst, in short, will be led to the right people.

2. When an information element appears in a list, it must be either retrieved from a file, be entered by the user who is performing the elementary function, or be computed from elements which have been made available through retrieval or data entry. Information elements that are computed normally will have their computation described in the functional hierarchy as an elementary function. The data elements from which the computed element is derived will support the elementary function as part of the data element list. In this way all necessary elements are likely to be defined.

3. The top-down diagrammatic approach will allow the analyst to keep the overall objectives of the entity firmly in mind throughout the data gathering phase. It will also allow the subordinate individuals within the organization to see where their efforts contribute to the overall goals of the group.

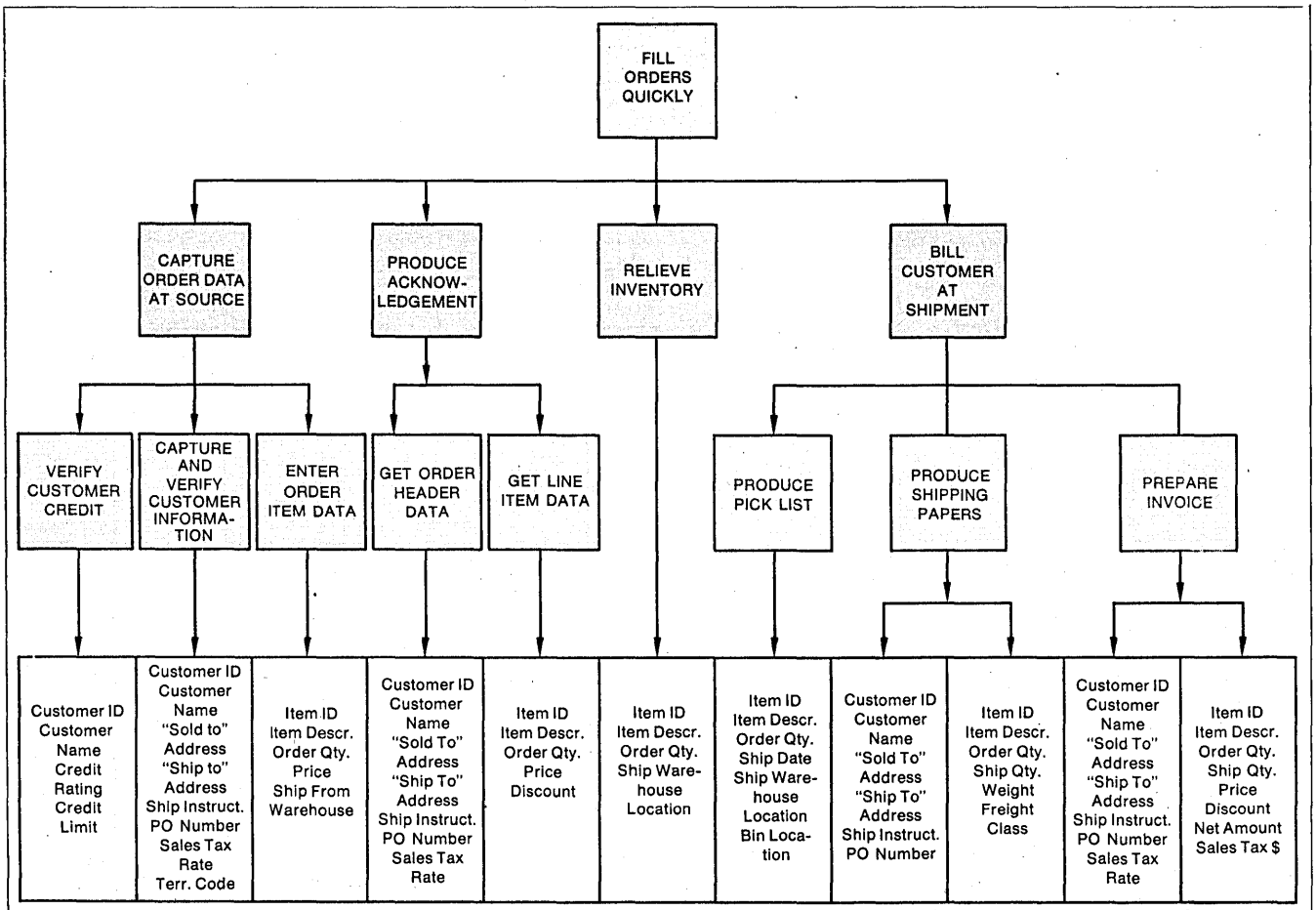

Fig. 3. Once the elementary functions are defined (those which are completely handled by one person or group), the information elements necessary for performing those functions should be collected and listed. These lists will define the elements of the data base.

4. The persons involved in the data processing function can be freed from the data gathering process. Where systems work is in fact envisioned (as in data base design), system personnel should at least be consulted, but the functional tree serves a useful purpose even without the data processing aspects of data gathering as it can define and clarify the functions performed by the organization being studied. It is a good documentation and training tool. Defining the objectives of one's department in functional terms and monitoring the changing work requirements placed upon the department can pinpoint reorganization and work-flow problems before they become costly.

Although all of the information requirements for all business functions and subfunctions of a large corporation cannot be identified and analyzed during one system project, it is best to begin high and analyze as broadly as possible, concentrating on specifics only in mapping the third or fourth level of functions.

The completed functional tree can yield a great deal of information about the mapped organization. It is a strategy chart for accomplishing the root functions of each functional tree. It graphically shows reporting requirements which must be met, as well as the implications of late or incomplete reporting on the higher level functions within the tree. The interrelated nature of individual activities, and their ultimate potential impact on company profits also can be derived from the tree, and previously unrecognized crucial decision centers identified.

If the functional tree can be mapped against the organizational chart, the combination may be useful in evaluating the scope of any one manager's responsibilities and contributions during a specific project. Such data may suggest possible project leader assignments as well.

From the standpoint of the data base designer, the tree produces a great deal of information. The aggregate of data elements required to support a function is the list of data elements which must be in the data base. Similarly, the objectives defined in the chart define the objectives of the computer system which will serve the function. The chart allows the system user to define and weigh the factors which determine system objectives. It also communicates this to the systems designer.

Even if the user department assumes the responsibility for data gathering, the data base designer will be exposed to the application problem analysis during the data gathering process. Periodic functional analysis "walk-throughs" should be held to keep the lines of communication open between all members of the project team.

We expect the functional tree to exhibit some basic characteristics, and our limited empirical evidence seems to support these expectations:

1. When dealing with all aspects of a business entity, we expect to see three similar trees, each supporting a different time frame of activity. These trees describe activities in the planning stage (future), the control monitoring stage (present) and the reporting/evaluation stage (past).
2. We expect to see particular subtrees repeating at many levels of the chart, and that this proliferation may pinpoint formal or informal organizational objectives. If such a situation appears, it may be reasonable to consolidate all occurrences of the subtree under a newly defined higher level function.
3. The tree will not be a static entity, in that it reflects the business requirements of an organizational entity *at a specific point in time*. As the functional requirements change, the structure of the functional tree also may change. Therefore, the functional chart must be seen as a working document, and must

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be periodically reviewed. (The changing requirements recognized here are not unfamiliar to the systems analyst/designer. All projects must be flexible enough to accept some change. One of the positive aspects of the data base concept is that the tools used to implement it, such as the data base management system and the data dictionary, are designed for changes.)

4. The critical characteristic exhibited by the tree is the proliferation of a few data structures throughout the data element lists. Our limited experience with this form of data analysis indicates that a large number of functional entities can be supported with a small number of data structures. These repetitive structures suggest data sets to the data base designer. There also appears to be enough information concerning data reporting requirements to define the relationships which exist between these data sets. This factor is the key to the application of functional analysis to the data base design problem.

It is important to note that the approach is aimed at isolating the objectives of the organization, and is not concerned with documenting existing procedures and systems. The functional tree is a good starting point for a comprehensive review of the procedures and work flow currently flowing through the department, but its orientation is toward the way things should be, rather than the way things are.

The data base design "falls out"

It will be necessary for the data base designer to work closely with the user departments to precisely define each element contained in the tree. This task is exactly the same task which must be undertaken in support of the data dictionary function, and such a tool may be introduced into the data base design effort at this time. As each data item is defined, it will be given an element name, and short descriptions of its content, data storage type (physical storage requirements), and data element size will be produced.

Once data elements are defined, a data element (field) list is made up. The list should show the data element name, the function where it will be used, and the number of times the element appears in the functions (for example, if history is kept by month, the monthly elements will occur 12 times). Table 1 is an example of part of a data element list.

At this point the data element names should be examined to determine if elements having the same name but different functions are indeed the same elements, or if the same element has different names for different uses. Either of these things can occur if more than one person is building the hierarchical requirements design, and can even happen if one person is performing the analysis over a long period of time. Fortunately, if data elements have been identified in a data dictionary, the dictionary can be checked to find if the element is already being generated and maintained by another system.

Once the data element list is compiled and the elements are defined to the dictionary, we can begin to investigate the data structures present in our tree. A large percentage of the data elements will repeat themselves many times throughout the chart. These repeating structures can be viewed as the first-cut layouts of logical files.

It is possible that some of the data structures may be obscured by the narrowness of the elementary function description. For example, if our distributor kept some stock in his own warehouses, some in supplier-owned storage, and some on-site at large customer locations, it is possible that each

class of storage location might carry a different data element name. Data structures that apply to all three types of data may appear to be three different structures, unless the analyst notes that all three data elements really refer to the same functional type of data—in this case an inventory location.

As a rough rule of thumb, data structures which have at least 80% of their elements in common should be closely reviewed to see if there is a more generalized description for the other 20% of the elements that can result in consolidating structures. The analyst should also identify those data element lists which are subsets of other lists. Functions which require a subset of the data contained within a logical data set can be served by the larger data set.

During this time, if a data dictionary is already in existence, it should be consulted. If the dictionary shows that many of the elements needed by the system have already been related and structured for use by other systems, the analyst need only review the functional analysis chart to determine whether the existing structure can support the newly identified requirements. If it cannot, either a new logical data base must be developed or the existing structure must be modified. In either case, the dictionary will help. If the existing structure can be used, the dictionary must be updated to reflect the new usage of the data elements.

If there is a data administration staff, its members should be available to assist the applications project group. As the elements begin to be defined and added to the dictionary, this involvement should increase. The data administration representatives ultimately should be responsible for ensuring that the system performs as efficiently as possible while still meeting the user department's requirements. The structuring discussed below may be done by individuals or groups within the project team, but periodic design "walk-throughs" should be held so that all appropriate persons are kept up-to-date on decisions made and can continue to participate effectively when needed.

Determining how the data base should be structured so that it meets present information requirements and also is flexible enough to withstand the inevitable changes caused by the business environment is more of an art than a science.

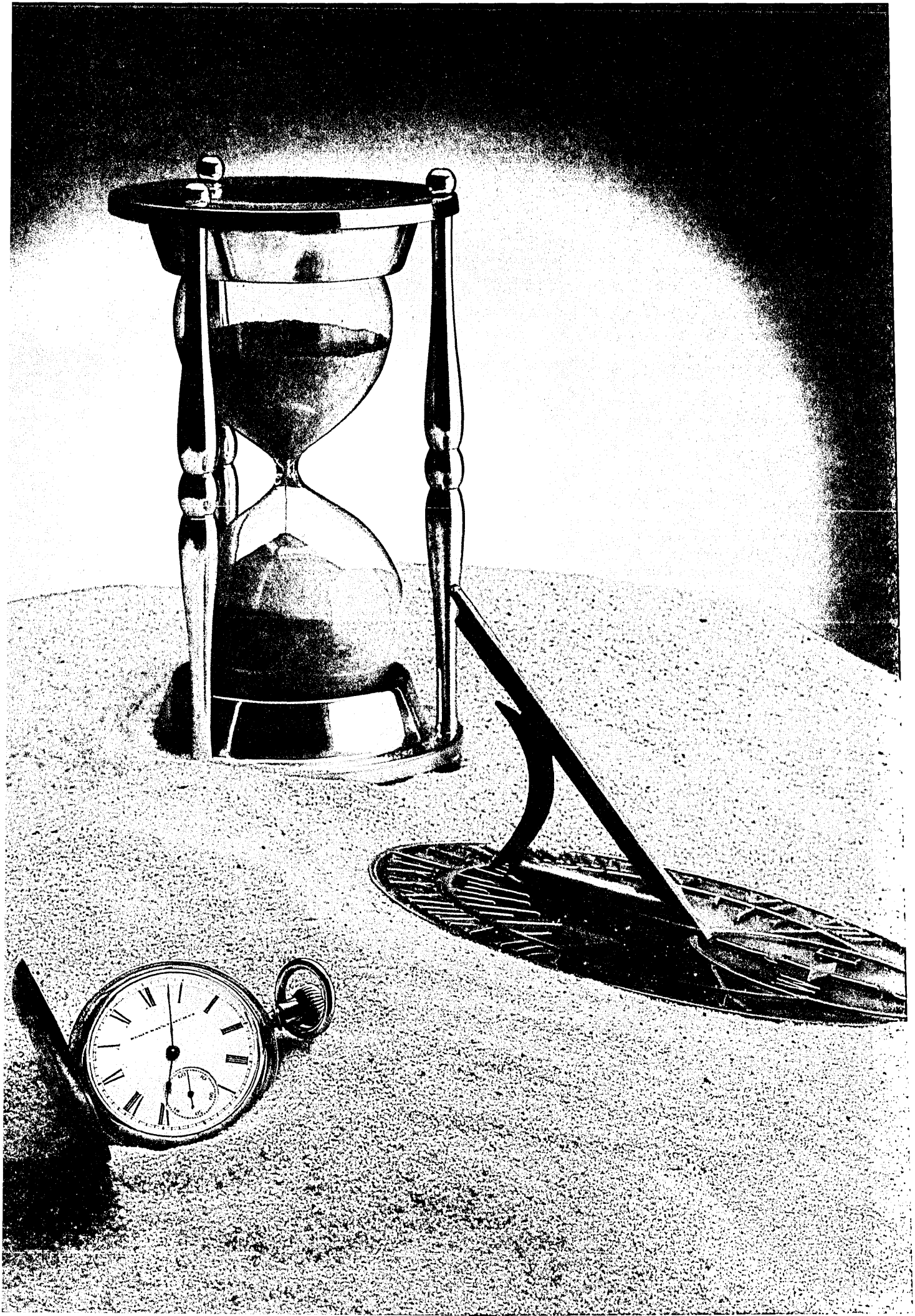
The example shows how

In the distribution company example, the following data structures suggest themselves:

1. A customer file containing the following data elements:
   - Customer ID (key element)

Data Element Name	Function Where It's Used	Occurrences
On Hand	Process Orders	Once within Part Number
On Hand	Determine Inventory Status	Once within Part Number
On Hand	Generate Purchase Recommendation	Once within Part Number
On Hand	Develop Accounts Payable	Once within Part Number
Part Number	Enter and Validate Orders	Number of Parts
Part Number	Keep Status of Orders	Number of Parts
Part Number	Develop Accounts Receivable	Number of Parts
Part Number	Track Shipments	Number of Parts
Part Number	Develop Planned Requirements	Number of Parts
Part Number	Determine Inventory Status	Number of Parts
Part Number	Process Orders	Number of Parts
Part Number	Generate Purchase Recommendation	Number of Parts
Part Number	Process Purchase Recommendation	Number of Parts
Part Number	Negotiate Contract	Number of Parts
Part Number	Process Purchase Recommendation	Number of Parts
Part Number	Develop Accounts Payable	Number of Parts
Part Number	Expedite Contracts	Number of Parts
Demand this Period	Process Orders	Once per Part Number
Average Demand	Determine Inventory Status	Once per Part Number
Average Demand	Generate Purchase Recommendation	Once per Part Number
Average Lead Time	Determine Inventory Status	Once per Part Number

Table 1. Merging the data element lists leads to production of a data dictionary.



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DATA BASE

- Customer Name
- Customer Address (Sold to)
- Credit Rating
- Credit Limit
- Territory Code
- Sales Tax Code

2. An invoice header file, containing one record per invoice, with the following data elements:
   - Customer ID (key element)
   - Invoice Number (key element)
   - Ship To Address
   - Shipping Instructions
   - Purchase Order Number
   - Shipping Warehouse Location Code
   - Sales Tax Amount
   - Net Invoice Amount
   - Invoice Date
3. An order line item file, containing one record for each line item on an invoice, with the following data elements:
   - Invoice Number (key element)
   - Item ID (key element)
   - Order Quantity
4. An inventory file, with a record per item per warehouse location, containing the following data elements:
   - Item ID (key element)
   - Warehouse Location Code (key element)
   - Item Description
   - Item Price
   - Discount Rate

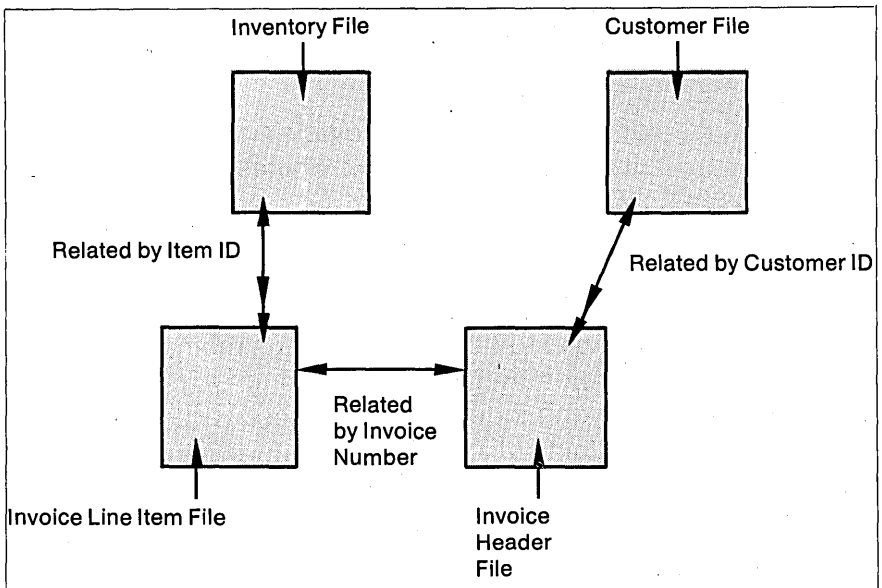


Fig. 4. The relationships between the files can be inferred from their common key elements.

The implied logical relationships which exist between these files can be discerned by evaluating the manner in which the data structures relate to each other. In our example application, the hierarchical nature of the order data suggests the structure found in Fig. 4. We will have multiple line item entries per invoice and multiple invoices per customer, as indicated by the single-direction complex mapping in our diagram.

Depending on the particular data base management system used (assuming that one is to be used), the logical data structure can be translated into a

series of hierarchies, a network, a list, or even a relational function.

Regardless of the dbms, once the basic logical relationships have been defined, the systems analyst should return to the functional tree to check the preliminary structure against the reporting requirements. The reporting cycle associated with certain report and/or query functions may suggest the addition of various control and summary data sets for use in creating periodic reports. The complete functional tree should be expanded to include frequency requirements and cycle data. Reporting information may also suggest secondary data elements to be used as keys or indexes.

In many cases, especially when large systems are involved, the data base designer may begin to build a conceptual system prototype, using the logical data base which has been generated as a starting point. The system prototype will consist of preliminary program and system specifications, as well as screen and report layouts. The prototype design should be presented to the prospective system users, and the proposed results approved before the implementation phase begins.

Another possible approach is to simulate the system using a data base simulator. While the results of the simulator may not be as useful to the system user as the results of a prototype, a great deal of information may be obtained at less cost.

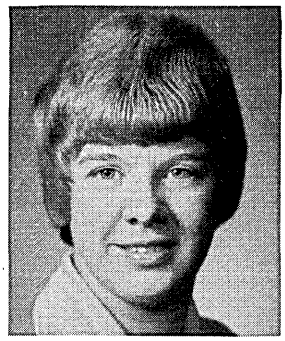
Regardless of the approach, the project leader now should be in a position to estimate the project implementation schedule and resource requirements and to develop an implementation plan.

Once the implementation plan is approved, the program design, development, and testing should progress as with other systems projects.

Conclusion

Functional analysis has been successfully used to design programs. It is logical that this technique can be used to design the data base processed by the programs. The functional analysis approach will result in not only a more complete requirements analysis and a data base structure flexible enough to handle predictable changes, but also in clear and concise deliverables which will be useful to both the project team and the potential users of the system. ❄

Mr. Finneran is a computer facilities evaluation specialist for Standard Oil Company in Cleveland. He has been involved in data processing for 13 years, both with Sohio and the U.S. Navy, and has designed data bases for several Cleveland firms.



Mrs. Henry is a sales representative with the Computer Systems Group of Hewlett-Packard in Cleveland. She has been in dp for 10 years, and for several years has specialized in minicomputer data base projects for The Systems Corp., TRW, and H-P.

DP Salary Survey

by Michael Cashman, Associate Editor

"There shall be weeping and wailing and gnashing of teeth."

Managing lots of people or punching lots of cards were the only two activities data processing personnel engaged in during 1977 that allowed them to at least stay abreast of a 6.9% inflation rate. We said pretty much the same thing last year; life clearly has not been all beer and skittles for programming and operational personnel.

(If you are visually oriented, look at the table outlined in black below and you may be able to skip the first thousand notes of this dirge.)

What's responsible for this anomaly? The U.S. is in the closing days of one of its more successful business years. Business was good in 1976 too, but the average dp raise last year was mediocre at best. And they are worse this year. Why is it that top management continues to enhance the salaries and perquisites of dp management while at the same time letting programming and operations personnel lose ground to inflation, much less get a raise?

Unhappy management

It's clear that management is unhappy with employing so many highly qualified people to program and run information processing systems. At National Computer Conferences over the years many a top management type has asked, "If you people know what the hell you're doing down there, why is the cost per instruction in our programs continually increasing?" Implied is that this highly trained body of mathematicians and other degreed personnel are part of the problem and not the solution. The dp manager seems to be rewarded for getting *something* up and running, and assuaging the salary concerns of the technical types.

We've heard another thread running through those same NCC discussions: "If you people had taken your history or math degrees into any other vocation, you probably wouldn't have gotten rich doing that either; I don't see why I should pay you any more just because you found your way into the glamour of dp."

The best explanation of how lower grade personnel have managed to keep pace with inflation is that they often are represented by a union and receive stock cost-of-living escalators. Still, one wonders why a data entry operator trainee is worth a whopping 15% more in salary over last year, and why a combined systems and programming trainee can expect to get about 1.2% less than last year. Dp is making its

JOB FAMILY	1971-72 Salary Increase	1971-72 "Real" Salary Gain/Loss	1972-73 Salary Increase	1972-73 "Real" Salary Gain/Loss	1973-74 Salary Increase	1973-74 "Real" Salary Gain/Loss
Management	6.5%	+3.6%	8.1%	+2.2%	10.2%	— .8%
Systems Analysis	4.8%	+1.9%	4.4%	—1.5%	8.7%	—2.3%
Systems Analysis/Programming	6.4%	+3.5%	3.6%	—2.3%	8.8%	—2.2%
Systems Programming	not surveyed		4.4%	—1.5%	10.8%	— .2%
Applications Programming	5.9%	+3.0%	5.2%	— .7%	4.8%	—6.2%
Computer Operations	4.6%	+1.7%	6.0%	+ .1%	7.2%	—3.8%
Data Entry	5.7%	+2.8%	3.1%	—2.8%	6.5%	—4.5%

Table 1. Except for managers, data processing personnel are losing the race with inflation. According to the Bureau of Labor Statistics, the consumer price index for urban wage earners and clerical workers in June of 1971 was 4.5% over what it had been one year earlier. Similar figures for the following years were: 2.9% in 1972, 5.9% in 1973, 11.0% in 1974, 9.3% in 1975, 5.9% in 1976, and 6.9% for 1977.

The compound change in the index from June 1970 through

contribution here to the tightening squeeze on the white collar worker's income.

Operations and programming may not be entirely to blame for this state of affairs. We should note that the programming professions have to work with products from vendors that are designed to enhance the supplier's bottom line far more than the productivity of the dp shop (advertisements to the contrary notwithstanding). This system is often specified and ordered by someone unfamiliar with a specific product's performance characteristics.

Massaging the numbers

Here's how the numbers were developed.

This year, 1,157 companies in the U.S. supplied confidential salary information to A. S. Hansen, inc. The information is current as of June 1977, for 66 dp positions. The total number of salaries reported on is 88,166. (There is far more information valuable to both salary administrators and victims in the Hansen report, and the product seems well worth the $95 asking price.) Some of the numbers developed for average salaries are undoubtedly better than others because there are more to go by. City pay levels are sensitive to the particular companies submitting data, and are not as reliable as the general nationwide averages. Here is how the respondents break down by industry:

	Employees	Firms Reporting
Manufacturing	21,961	390
Transportation	1,733	23
Communications	2,151	20
Utilities	3,764	58
Wholesale Trade	1,320	31
Retail Trade	4,689	61
Finance	17,230	200
Insurance and Real Estate	14,406	133
Services	11,027	170
Government	9,230	35
Other	650	16

Reading the numbers properly

Columns with two sets of numbers show first and third quartile averages, meaning that in the first case 75% of salaries are above that figure, and for the third quartile that 75% of the salaries are below that level. Columns having the letters *nd* were not filled in due to insufficient or nonexistent data. The salaries are weekly salaries. Percentages in brackets represent losses.

Hansen grades city pay levels by comparing them to a fixed reference city, Chicago. The highest paying cities go into what are called level 1, the remaining cities into levels 2 through 5. (This is not a measure of cost of living in those cities.)

Here's an example of what can be

MOVERS AND SHAKERS CONTINUE TO DO WELL.

In 1975, the A. S. Hansen, inc., *Weber Salary Survey on Data Processing Positions* showed that 34.8% of top dp managers in corporations were company officers. That figure jumped to 40.4% last year. It declined to 39% in 1977, but one could infer that since more people were surveyed this year, and because the total number of participating companies was up slightly, this figure does not represent a decline in the prestige of dp's leading professionals. On the contrary, the trend everywhere clearly points to increasing recognition of the importance of the dp function, and of the managing and controlling of the dp resource to improve a company's information management.

The specific title given this officer varies all over the lot:

Department Manager	24.0%
Director	33.0%
Asst. Vice President	2.4%
Vice President	27.0%
Senior Vice President	3.0%
Other	10.6%

These positions report to a variety of higher positions, some as high as Chairman of the Board or Directors of a corporation.

Chairman of the Board	2.7%
President	15.8%
Executive Vice President	10.8%
Senior Vice President	12.7%
V.P. of Finance	15.3%
V.P. of Administration	5.4%
Vice President (Other)	11.7%
Treasurer	3.4%
Controller	8.0%
Director	7.1%
Manager	3.9%
Other	3.2%

Half of the top data processing managers are rewarded with "key management" compensation, either in the form of a bonus or a profit-sharing plan.

Type of Bonus or Profit-sharing Plan	
Incentive (Individual Performance)	
% eligible	45.0%
Median award (% of salary)	15.0%
Profit-sharing	
% eligible	24.0%
Median award (% of salary)	8.3%
Management bonus	
% eligible	28.0%
Median award (% of salary)	15.0%
Stock grants	
% eligible	3.0%
Median award (% of salary)	10.0%
% Eligible for Stock Options	
Yes—26%	
No —74%	
Median exercise cost as % of salary	16.5%

Clearly managers are making out better than most, though not as much better as one might think. A comparison of country-wide salaries for *all* positions surveyed in both 1976 and 1977 shows an average increase of 5.10%, but management's increase was 9.4%.

1974-75		1975-76		1976-77		1970-77	
Salary Increase	"Real" Salary Gain/Loss	Salary Increase	"Real" Salary Gain/Loss	Salary Increase	"Real" Salary Gain/Loss	Compound Increase	Compound Gain/Loss
10.3%	+1.0%	4.8%	—1.1%	9.4%	+2.5%	75.1%	+18.7%
11.3%	+2.0%	3.6%	—2.3%	6.2%	— .7%	55.7%	— .7%
7.2%	—2.1%	6.9%	+1.0%	1.8%	—5.1%	43.9%	—12.5%
3.8%	—5.5%	7.7%	+1.8%	—	—	—	—
11.0%	+1.7%	4.9%	—1.0%	4.6%	—2.3%	46.1%	—10.3%
6.3%	—3.0%	6.7%	+ .8%	3.3%	—3.6%	44.7%	—11.7%
7.6%	—1.7%	8.4%	+2.5%	8.2%	+1.3%	56.4%	0.0%

June 1977 has been 56.4%. The compound increase in dp salaries for that period is shown above. Only managers and keypunchers can say they haven't lost ground in our profession. Last year systems analysts could brag that they were 0.3% ahead of the game, but this year their salaries have become a casualty of the loss column.

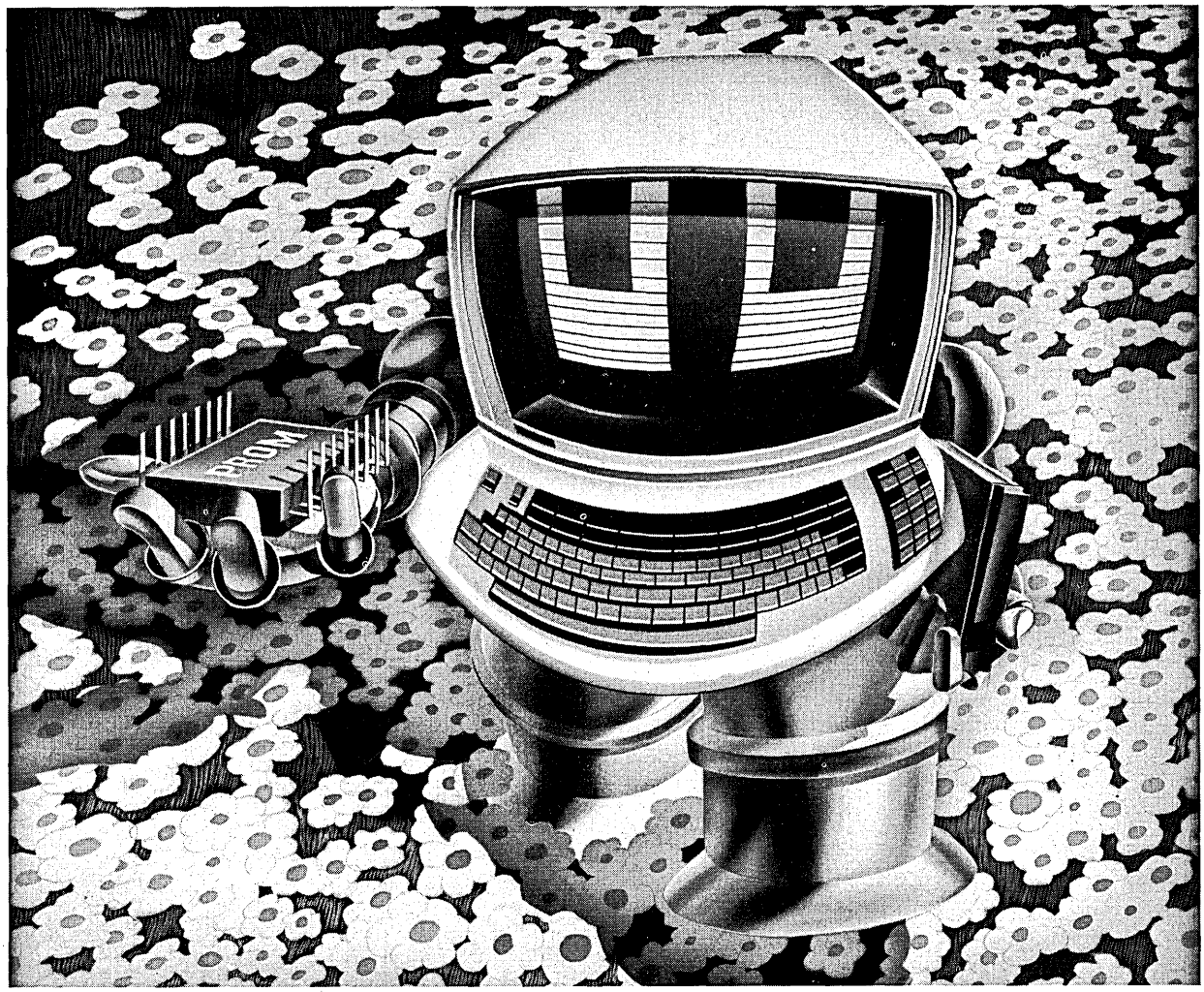
JOB TITLE	Number In Survey	Nationwide Weekly Averages Low	1st Q.	Avg.	3rd Q.	High	1976 Increase	1977 Increase	Weekly Salaries by Installation Size Determined by Monthly Hardware Rental to $12,000	to $25,000	to $50,000	to $150,000	over $150,000
Management													
Corporate Mgr of DP	907	350	553	693	788	1,667	9.5%	11.2%	393-615	491-714	439-769	519-790	520-998
Assistant Manager	244	265	456	563	640	1,227	6.3%	7.0%	314-492	393-571	351-615	415-632	416-798
Division Manager	332	300	452	573	673	1,303	nd	13.0%	338-529	422-614	377-661	446-679	447-858
Manager Admin. & Planning	140	254	442	534	615	834	nd	nd	314-492	393-571	351-615	415-632	416-798
Technical Assistant	171	262	416	495	553	1,059	0.6%	5.3%	295-461	368-535	329-576	389-592	390-748
Coordinator	197	192	338	437	535	854	1.7%	10.0%	255-400	319-463	285-500	337-513	338-648
Systems/Programming Combined													
Manager	1,383	260	438	506	560	885	8.8%	2.2%	nd	404-559	360-605	382-590	418-631
ead Analyst/Programmer	2,578	225	380	428	472	896	6.8%	1.4%	nd	351-486	313-527	332-513	363-549
Senior Analyst/Programmer	3,958	186	338	380	418	833	6.4%	3.5%	nd	303-419	233-454	286-442	313-473
Analyst/Programmer A	5,271	180	294	331	364	587	6.3%	2.4%	nd	263-363	233-393	248-383	271-410
Analyst/Programmer B	3,362	163	257	291	324	533	7.5%	1.0%	nd	226-313	201-339	214-330	234-353
Analyst/Programmer C	1,391	135	203	238	266	456	4.3%	(1.2%)	nd	198-273	176-296	187-289	205-309
Systems Analysis													
Manager	422	293	444	504	546	969	4.1%	5.0%	nd	445-610	370-589	436-601	450-641
Lead Analyst	1,059	245	389	434	471	769	9.2%	(1.1%)	nd	387-531	322-513	376-523	391-557
Senior Analyst	2,024	230	350	392	429	625	3.2%	0.5%	nd	334-457	277-442	324-450	337-498
Analyst A	1,708	195	312	346	381	511	4.6%	1.1%	nd	289-396	240-383	281-391	292-416
Analyst B	553	185	270	307	340	436	1.4%	4.4%	nd	249-341	207-330	242-336	252-358
Analyst C	204	135	220	242	265	383	(4.3%)	0.0%	nd	218-298	181-288	213-294	220-313
Applications Programming													
Manager	366	242	396	459	516	774	5.9%	6.7%	344-476	369-541	332-512	330-516	392-540
Lead Programmer	658	170	347	395	442	600	5.1%	6.4%	299-414	321-471	289-445	287-449	341-470
Senior Programmer	2,251	194	296	337	369	576	6.8%	2.4%	257-357	276-406	249-384	247-387	294-405
Programmer A	3,131	167	256	289	317	575	4.0%	2.1%	223-309	239-351	216-333	214-335	254-351
Programmer B	2,697	154	225	255	276	424	2.5%	4.0%	192-266	206-302	186-286	185-289	219-302
Programmer C	1,512	132	188	213	233	337	3.8%	(2.7%)	168-233	180-265	162-251	162-253	192-264
Systems Programming													
Manager	491	270	425	496	558	824	9.7%	3.9%	nd	399-565	352-579	384-634	438-614
Lead Programmer	697	224	388	433	475	630	8.6%	4.0%	nd	347-492	306-504	334-551	381-533
Senior Programmer	1,346	225	350	398	441	617	4.5%	6.7%	nd	299-424	264-434	288-475	328-460
Programmer A	1,460	207	308	345	382	509	6.1%	3.9%	nd	259-367	229-376	250-412	284-398
Programmer B	932	196	261	291	320	475	8.6%	4.6%	nd	223-316	197-324	215-355	245-343
Programmer C	258	150	216	243	266	372	8.4%	(0.8%)	nd	195-277	172-283	188-310	214-300
Data Base Resources													
Manager	192	269	417	467	510	755	nd	nd	nd	nd	358-475	399-580	417-594
Senior Data Base Analyst	162	243	352	398	445	572	nd	nd	nd	nd	312-413	347-505	363-517
Data Base Analyst	149	196	294	334	375	490	nd	nd	nd	nd	251-332	279-406	292-415
Data Base Analyst Trainee	26	204	248	277	308	325	nd	nd	nd	nd	215-278	239-348	250-356
Auditing													
Manager	98	240	392	467	535	790	nd	nd	nd	nd	378-518	325-657	303-607
Senior Auditor	168	198	323	398	427	634	nd	nd	nd	nd	303-414	260-525	243-485
Auditor	145	177	269	334	336	481	nd	nd	nd	nd	246-336	211-426	197-394
Auditor Trainee	42	168	211	277	286	356	nd	nd	nd	nd	196-269	169-341	240-345
Telecommunications													
Manager	138	250	433	506	577	895	nd	nd	nd	nd	379-580	368-617	406-662
Senior Analyst	159	250	339	403	460	660	nd	nd	nd	nd	254-470	298-499	329-536
Analyst	237	212	337	370	404	572	nd	nd	nd	nd	235-435	276-462	304-497
Analyst Trainee	75	170	248	278	315	360	nd	nd	nd	nd	176-325	206-345	227-370
Network Coordinator	132	147	217	290	332	540	nd	nd	nd	nd	176-325	206-345	227-370
Documentation													
Specialist	275	115	195	265	317	580	nd	nd	nd	177-356	155-355	157-419	157-345
DP Operations													
Manager	860	204	385	462	527	915	6.4%	2.4%	312-417	370-584	368-557	347-546	408-689
Assistant Manager	252	190	305	370	423	711	2.0%	4.2%	250-333	296-467	295-446	277-437	326-551
Technical Assistant	199	180	292	358	408	619	8.0%	2.5%	234-312	278-438	276-418	260-410	306-517
Coordinator	336	150	235	293	338	555	7.0%	(3.6%)	187-250	222-350	221-334	208-328	244-413
Scheduler	540	130	220	257	296	577	8.2%	1.9%	174-233	207-327	206-312	194-306	228-386
Tape Librarian	1,095	102	150	179	200	369	5.6%	5.9%	112-150	133-210	132-200	124-196	146-248
Computer Operations													
Manager	1,064	190	308	373	421	747	7.1%	2.4%	267-417	273-429	260-425	287-434	311-475
Lead Computer Operator	2,017	150	237	279	315	558	3.8%	2.5%	201-302	205-322	195-318	215-325	233-356
Senior Computer Operator	3,141	136	212	246	277	402	7.0%	7.4%	173-262	177-279	168-275	186-282	202-309
Operator A	4,496	111	183	211	236	349	6.3%	4.4%	154-225	153-240	145-237	160-242	174-303
Operator B	2,664	110	162	186	208	331	10.8%	1.0%	131-197	134-210	127-208	140-212	152-232
Operator C	1,689	92	140	160	179	272	6.0%	1.2%	112-169	114-180	109-178	120-181	130-199
Data Control													
Supervisor	808	135	183	258	311	538	(4.0%)	7.5%	191-257	193-296	193-305	185-321	205-360
Lead Clerk	922	115	173	212	242	395	1.5%	7.0%	154-208	156-240	156-247	150-260	166-292
Senior Clerk	1,948	106	160	185	207	330	(2.3%)	10.1%	133-180	135-207	135-213	129-224	143-252
Clerk	2,995	97	135	157	170	300	2.2%	7.5%	116-157	117-181	118-186	113-196	125-219
Clerk Trainee	511	92	112	134	148	225	5.9%	6.3%	101-136	101-157	102-161	98-170	108-190
Data Entry													
Supervisor	974	130	209	252	283	504	16.9%	7.2%	186-259	196-286	192-273	198-313	206-306
Lead Operator	1,417	115	172	198	216	394	6.8%	4.7%	150-209	159-231	155-221	161-253	167-247
Senior Operator	5,703	100	149	171	185	314	1.9%	6.8%	130-181	137-200	134-191	139-219	144-214
Operator	9,100	96	134	156	170	300	10.0%	7.5%	104-137	118-181	117-166	121-191	125-186
Operator Trainee	1,734	92	121	138	151	247	1.7%	15.0%	98-137	104-151	101-144	105-166	109-161

JOB TITLE	Weekly Salaries by Industry									
	Services	Mfg	Govt	Retail	Wholesale Trade	Utilities	Commo	Transport	Insurance	Finance
Management										
Corporate Mgr of DP	452-791	513-959	470-893	416-1046	551-862	486-803	586-1063	527-1059	520-797	490-906
Assistant Manager	361-633	410-767	376-715	333-837	441-690	388-642	468-850	422-847	416-637	392-725
Division Manager	389-680	441-824	404-768	358-900	474-741	417-691	503-914	453-911	447-685	358-779
Manager Admin. & Planning	361-633	410-767	376-715	333-837	441-690	388-642	468-850	422-847	416-637	392-725
Technical Assistant	339-593	384-719	352-670	311-784	413-646	364-602	439-797	395-794	390-597	367-679
Coordinator	293-514	333-623	305-580	270-680	358-560	315-522	380-690	342-688	338-517	318-589
Systems/Programming Combined										
Manager	411-612	400-606	405-562	381-574	428-564	443-691	507-664	429-555	372-608	391-633
Lead Analyst/Programmer	357-532	348-527	352-488	331-499	373-490	385-601	441-578	373-483	323-529	340-551
Senior Analyst/Programmer	308-459	300-454	304-421	285-430	321-423	332-518	380-498	322-416	279-456	293-475
Analyst/Programmer A	267-397	260-393	263-308	247-373	278-366	287-449	329-432	278-386	242-395	254-411
Analyst/Programmer B	230-342	224-339	226-314	213-353	240-316	247-387	283-372	240-311	208-340	219-354
Analyst/Programmer C	201-299	195-297	198-275	186-281	210-276	217-289	248-325	210-272	182-298	191-310
Systems Analysis										
Manager	379-507	465-655	395-618	474-636	472-606	452-647	454-649	nd	428-609	378-636
Lead Analyst	329-469	408-569	344-537	412-553	410-527	393-498	395-565	nd	372-530	329-554
Senior Analyst	284-380	348-491	296-463	355-477	354-454	339-485	340-487	nd	251-457	283-477
Analyst A	246-350	302-425	257-401	247-373	306-393	293-420	295-422	nd	278-396	246-413
Analyst B	212-302	260-366	221-346	265-356	264-339	253-362	254-363	nd	239-341	211-356
Analyst C	185-264	227-320	193-302	246-311	231-296	221-316	222-317	nd	209-298	184-311
Applications Programming										
Manager	354-529	383-560	342-555	347-555	359-599	415-539	490-609	438-502	335-522	328-523
Lead Programmer	308-460	333-487	297-483	301-483	312-521	374-469	427-530	381-436	291-454	285-455
Senior Programmer	265-397	287-420	256-416	260-416	269-449	311-404	367-457	328-376	251-391	246-392
Programmer A	230-344	249-364	222-361	225-361	233-389	269-350	318-396	284-326	217-339	213-339
Programmer B	198-296	214-313	191-311	194-311	200-335	232-302	274-341	245-281	187-292	183-292
Programmer C	173-259	187-274	167-271	170-272	175-257	203-264	240-298	214-245	164-255	160-256
Systems Programming										
Manager	396-581	394-620	428-591	435-572	nd	440-645	531-667	nd	352-584	392-589
Lead Programmer	345-506	394-539	372-514	378-498	nd	382-560	462-580	nd	306-508	341-512
Senior Programmer	297-436	295-465	321-443	326-429	nd	330-483	398-500	nd	264-438	294-441
Programmer A	257-378	256-403	278-384	283-372	nd	286-419	345-433	nd	229-379	254-382
Programmer B	221-325	220-347	239-331	243-320	nd	246-360	297-373	nd	197-327	219-329
Programmer C	194-285	192-303	209-289	213-280	nd	215-315	260-326	nd	172-286	192-288
Data Base Resources										
Manager	340-546	401-619	nd	400-575	nd	nd	nd	nd	423-557	358-586
Senior Data Base Analyst	296-475	349-619	nd	348-500	nd	nd	nd	nd	367-484	311-510
Data Base Analyst	238-382	281-433	nd	280-402	nd	nd	nd	nd	296-389	251-410
Data Base Analyst Trainee	204-327	228-371	nd	240-344	nd	nd	nd	nd	253-333	214-351
Auditing										
Manager	nd	420-622	nd	nd	nd	375-593	nd	nd	nd	345-551
Senior Auditor	nd	336-498	nd	nd	nd	299-474	nd	nd	nd	276-441
Auditor	nd	273-404	nd	nd	nd	243-385	nd	nd	nd	224-358
Auditor Trainee	nd	228-333	nd	nd	nd	194-308	nd	nd	nd	179-284
Telecommunications										
Manager	352-635	420-641	nd	395-765	nd	nd	nd	nd	477-593	371-615
Senior Analyst	285-514	353-519	nd	320-619	nd	nd	nd	nd	386-480	301-498
Analyst	261-436	315-480	nd	296-573	nd	nd	nd	nd	358-444	278-461
Analyst Trainee	197-355	235-358	nd	221-428	nd	nd	nd	nd	267-332	211-344
Network Coordinator	197-355	235-358	nd	221-428	nd	nd	nd	nd	267-332	211-344
Documentation										
Specialist	163-339	175-348	nd	nd	nd	nd	nd	nd	151-398	179-467
DP Operations										
Manager	258-571	373-618	360-598	265-629	445-554	457-667	398-698	478-638	315-630	358-598
Assistant Manager	206-455	298-494	288-478	212-503	355-443	365-533	319-558	382-439	252-500	286-478
Technical Assistant	193-427	280-463	269-449	198-472	333-416	339-500	299-523	358-478	236-469	268-448
Coordinator	154-343	223-370	215-359	159-368	266-332	274-400	239-419	286-383	189-375	214-358
Scheduler	144-318	209-346	201-335	148-352	249-310	255-391	223-391	267-357	176-350	200-334
Tape Librarian	92-205	134-222	129-215	95-226	159-199	164-240	143-251	171-229	113-225	128-215
Computer Operations										
Manager	273-426	288-450	306-498	268-477	307-485	310-542	370-516	378-502	299-471	252-450
Lead Computer Operator	205-320	216-337	230-373	201-357	230-364	232-406	278-376	283-376	224-353	189-337
Senior Computer Operator	177-277	187-292	199-324	174-357	199-315	201-352	240-326	246-326	194-306	164-292
Operator A	153-238	161-252	171-279	150-267	172-272	173-303	207-281	211-280	167-264	141-252
Operator B	134-209	141-220	150-244	131-233	150-237	151-265	181-246	185-246	146-231	123-220
Operator C	114-179	121-189	128-209	112-200	129-204	130-227	155-211	158-210	125-198	105-188
Data Control										
Supervisor	201-327	211-357	205-311	184-370	nd	274-394	223-392	315-403	193-299	180-314
Lead Clerk	162-265	171-289	166-251	149-300	nd	222-319	180-317	255-326	166-242	145-254
Senior Clerk	140-229	147-231	143-217	128-259	nd	192-276	172-274	220-282	135-209	125-220
Clerk	122-199	128-217	125-189	112-210	nd	167-240	135-239	192-245	118-182	109-191
Clerk Trainee	106-173	112-189	108-164	97-196	nd	145-209	118-207	173-213	102-158	95-166
Data Entry										
Supervisor	187-288	224-301	200-312	215-324	189-343	232-399	242-314	233-439	204-324	178-283
Lead Operator	151-234	181-240	162-252	173-262	153-278	188-323	187-254	189-356	165-245	144-229
Senior Operator	140-204	147-219	140-218	150-227	132-240	162-279	161-219	163-307	142-227	108-197
Operator	114-176	136-183	122-189	130-197	115-209	141-243	140-191	142-268	124-184	108-172
Operator Trainee	98-153	118-159	106-165	113-171	100-181	123-211	122-166	124-232	108-171	94-149

JOB TITLE	Atlanta	Balti-more	Boston	Chicago Area	Cleve-land	Colum-bus	Dallas-Ft. W.	Denver	Detroit	Hart-ford	Houston	Indian-apolis
	Average Weekly Salaries by City											
BLS Comparative Budget Index	92	102	111	103	100	—	91	97	98	106	95	98
Datamation Index	98	100	107	109	104	101	99	99	106	102	103	100
Management												
Corporate Mgr of DP	563	702	684	718	680	679	636	631	672	643	646	595
Assistant Manager	451	562	547	574	543	543	509	505	537	514	517	476
Division Manager	484	604	588	617	584	583	547	542	578	553	556	512
Manager Admin. & Planning	451	562	547	574	543	543	509	505	537	514	517	476
Technical Assistant	422	527	512	538	509	508	477	473	504	482	484	446
Coordinator	366	456	444	466	441	441	413	410	436	417	420	387
Systems/Programming Combined												
Manager	451	464	505	512	447	467	458	467	539	468	490	515
Lead Analyst/Programmer	392	404	439	445	388	405	398	406	469	407	427	448
Senior Analyst/Programmer	338	348	378	384	335	350	343	350	404	351	367	386
Analyst/Programmer A	293	301	328	333	290	303	297	303	350	304	319	335
Analyst/Programmer B	252	260	282	286	250	261	256	261	301	262	274	288
Analyst/Programmer C	220	227	247	250	218	228	224	228	264	229	240	252
Systems Analysis												
Manager	526	474	491	533	523	488	493	481	479	nd	501	453
Lead Analyst	457	412	427	463	455	424	429	418	417	nd	436	394
Senior Analyst	394	355	368	399	392	366	370	360	359	nd	375	340
Analyst A	341	308	319	346	340	317	320	312	311	nd	325	294
Analyst B	294	265	275	298	292	273	276	269	268	nd	280	254
Analyst C	257	232	240	261	256	239	241	235	234	nd	245	222
Applications Programming												
Manager	440	398	444	467	436	435	452	417	456	420	462	392
Lead Programmer	383	346	386	405	379	379	393	362	397	365	402	341
Senior Programmer	330	299	333	350	327	326	339	312	342	315	346	293
Programmer A	286	259	288	303	283	283	293	271	296	273	300	254
Programmer B	246	223	248	261	244	243	253	233	255	235	258	219
Programmer C	215	195	217	228	213	213	221	204	223	205	226	192
Systems Programming												
Manager	491	467	541	522	522	490	489	518	514	510	503	519
Lead Programmer	427	406	470	454	454	426	426	451	448	443	438	451
Senior Programmer	368	350	405	391	391	367	367	388	386	382	377	389
Programmer A	319	303	351	339	339	318	318	336	334	331	327	337
Programmer B	275	261	303	292	292	274	274	290	287	285	281	290
Programmer C	240	228	264	255	255	240	239	253	251	249	246	254
Data Base Resources												
Manager	435	467	517	490	432	447	451	423	424	nd	466	nd
Senior Data Base Analyst	378	406	450	426	376	388	392	368	368	nd	405	nd
Data Base Analyst	304	326	362	343	303	312	315	296	296	nd	326	nd
Data Base Analyst Trainee	261	280	310	294	259	268	270	253	254	nd	279	nd
Auditing												
Manager	463	419	nd	517	430	441	426	476	nd	nd	nd	409
Senior Auditor	370	335	nd	413	344	353	340	380	nd	nd	nd	327
Auditor	301	272	nd	336	279	286	277	309	nd	nd	nd	265
Auditor Trainee	240	218	nd	269	223	229	221	247	nd	nd	nd	212
Telecommunications												
Manager	399	nd	nd	492	482	527	385	nd	nd	nd	473	480
Senior Analyst	323	nd	nd	399	390	427	312	nd	nd	nd	383	388
Analyst	300	nd	nd	369	361	395	289	nd	nd	nd	354	360
Analyst Trainee	223	nd	nd	275	270	295	215	nd	nd	nd	265	268
Network Coordinator	223	nd	nd	275	270	295	215	nd	nd	nd	265	268
Documentation												
Specialist	204	177	279	282	235	264	nd	258	nd	424	229	225
DP Operations												
Manager	471	440	510	492	488	455	408	437	452	477	466	396
Assistant Manager	377	351	408	393	390	364	326	349	361	382	373	316
Technical Assistant	353	329	382	369	365	341	306	327	339	357	349	296
Coordinator	282	263	306	295	292	273	244	262	271	286	280	237
Scheduler	263	246	285	275	273	255	228	244	252	267	261	221
Tape Librarian	169	157	183	177	175	163	146	157	162	171	167	142
Computer Operations												
Manager	361	352	378	400	380	369	356	347	406	397	357	361
Lead Computer Operator	271	264	284	300	285	277	266	260	304	298	267	270
Senior Computer Operator	234	229	246	260	247	240	231	225	264	258	232	234
Operator A	202	197	212	224	212	206	199	194	227	222	200	202
Operator B	177	172	185	196	186	181	174	169	198	194	174	176
Operator C	151	147	159	167	159	155	149	145	170	166	149	151
Data Control												
Supervisor	273	264	267	279	259	245	265	234	253	262	276	318
Lead Clerk	220	214	216	226	210	198	215	189	205	212	223	258
Senior Clerk	191	185	187	196	181	171	185	163	177	183	193	222
Clerk	166	161	162	170	158	149	161	142	154	159	168	194
Clerk Trainee	144	140	141	148	137	129	140	123	134	138	146	168
Data Entry												
Supervisor	255	238	258	269	253	224	232	246	261	237	259	258
Lead Operator	206	193	209	218	205	181	187	199	211	192	210	209
Senior Operator	178	167	181	188	177	157	162	172	182	166	181	180
Operator	155	145	157	164	154	136	141	150	159	144	158	157
Operator Trainee	135	126	137	142	134	118	122	130	138	125	137	136

Average Weekly Salaries by City

Kansas City	L.A. Area	Miami Area	Milwaukee	Mpls.-St. Paul	New York	Omaha	Philadelphia	Phoenix	Portland	Raleigh Durham	Richmond	St. Louis	Salt Lake	San Fran. Area	Seattle	Tampa Area	Wash., D.C.
96	105	—	103	100	108	—	103	—	—	96	—	96	—	109	107	—	106
94	118	98	109	98	119	103	103	102	104	93	99	100	—	115	99	95	115
525	769	624	698	557	809	777	732	645	569	504	644	618	nd	792	540	581	710
420	615	499	558	445	647	622	586	516	455	403	515	494	nd	633	432	465	568
451	661	537	600	478	696	669	630	554	489	433	553	531	nd	680	464	499	611
420	615	499	558	445	647	622	586	516	455	403	515	494	nd	633	432	465	568
393	576	468	523	417	607	583	549	484	426	378	482	463	nd	593	405	435	533
341	499	406	453	361	526	505	476	419	369	327	418	401	nd	514	351	377	462
467	526	497	539	517	574	461	482	490	491	448	472	467	446	531	470	509	534
406	457	432	469	450	499	401	419	426	427	390	411	406	388	462	408	443	464
350	394	372	404	388	431	346	362	367	368	336	354	350	334	399	352	382	400
303	341	323	350	336	373	299	313	318	319	291	307	303	290	345	305	331	347
261	294	278	302	289	321	258	270	274	274	250	264	261	249	297	263	285	299
228	257	243	264	253	281	226	236	239	240	219	231	228	218	260	230	249	261
453	538	462	547	532	574	409	508	462	466	498	509	554	483	580	470	481	600
394	468	402	475	462	499	355	442	402	405	434	443	482	420	504	409	418	522
340	404	347	410	399	430	306	381	346	349	374	381	415	363	435	353	360	450
294	350	300	355	345	373	265	330	300	303	324	330	360	314	377	305	312	390
253	301	259	306	297	321	229	284	259	261	279	284	310	271	324	263	269	335
222	263	226	267	260	281	200	248	226	228	244	249	271	237	284	230	235	293
443	516	432	419	444	494	350	428	413	428	406	386	459	364	466	428	401	518
385	449	376	365	386	430	304	372	359	372	353	335	399	317	405	372	349	450
332	387	324	314	333	370	262	321	310	321	304	290	344	273	349	321	300	388
288	335	281	272	288	321	227	278	268	278	263	251	298	237	302	278	260	336
248	289	242	235	248	276	196	239	231	239	227	216	257	204	261	239	224	290
217	253	211	205	217	242	171	209	202	209	198	189	225	178	228	209	196	253
484	565	442	491	496	548	479	509	481	528	497	532	484	452	547	501	499	551
421	492	384	427	432	476	417	443	419	459	432	462	421	393	475	436	434	479
363	424	331	368	372	410	359	382	361	396	372	398	363	339	410	376	374	413
314	367	287	319	322	356	311	331	313	343	323	345	315	293	355	325	324	358
270	316	247	274	278	306	268	285	269	295	278	297	271	253	306	280	279	308
237	277	216	240	243	268	235	249	235	258	243	260	237	221	267	245	244	269
418	416	nd	475	444	541	506	535	418	420	nd	416	457	nd	567	388	nd	588
364	361	nd	413	386	470	440	465	364	365	nd	362	397	nd	493	337	nd	512
293	291	nd	332	311	378	354	374	292	293	nd	291	320	nd	397	271	nd	412
251	249	nd	284	266	324	304	321	250	252	nd	249	274	nd	340	232	nd	353
369	407	448	nd	488	517	nd	447	535	382	nd	288	436	nd	nd	444	nd	525
295	326	359	nd	394	413	nd	358	428	305	nd	390	349	nd	nd	355	nd	420
239	264	291	nd	317	336	nd	291	348	248	nd	317	283	nd	nd	288	nd	341
191	211	233	nd	253	268	nd	232	278	198	nd	253	227	nd	nd	231	nd	273
nd	559	385	557	443	578	602	489	407	447	nd	549	544	nd	529	503	444	566
nd	452	312	451	359	468	488	396	330	361	nd	444	440	nd	428	408	359	459
nd	419	288	418	332	433	451	367	305	335	nd	412	408	nd	397	377	333	424
nd	313	215	312	248	323	337	273	228	250	nd	307	304	nd	296	282	248	317
nd	313	215	312	248	323	337	273	228	250	nd	307	304	nd	296	282	248	317
263	304	nd	319	175	361	246	197	nd	244	nd	341	230	nd	269	228	204	317
411	601	457	515	440	545	486	469	528	513	467	466	428	455	505	485	375	521
329	481	365	412	352	436	389	375	422	410	374	373	343	364	403	388	300	417
308	450	342	386	330	409	364	352	396	384	350	349	321	341	378	363	282	390
246	360	273	308	264	327	291	281	316	307	280	279	257	273	302	291	225	312
230	336	255	288	246	305	271	262	295	287	261	261	240	254	282	271	210	291
147	216	164	185	158	196	174	168	189	184	168	167	154	163	181	174	135	187
341	411	334	398	362	422	403	336	372	419	356	320	368	353	427	375	343	434
255	308	250	298	271	316	302	251	279	314	266	240	276	265	320	281	257	325
221	267	217	258	235	274	262	218	241	272	231	208	239	229	277	244	223	282
190	230	187	222	202	236	225	187	208	234	199	179	206	197	238	210	192	243
167	201	163	195	177	206	197	164	182	205	174	156	180	173	208	184	168	212
143	172	140	167	151	177	169	141	156	175	149	134	154	148	178	157	144	182
254	304	260	319	250	301	201	247	245	309	214	275	275	313	300	279	270	300
206	246	210	258	202	244	163	200	199	250	173	223	223	253	243	226	219	243
178	213	182	223	175	210	141	173	172	216	149	192	193	218	210	195	189	210
155	185	158	194	152	183	123	150	150	188	130	168	168	190	182	170	164	183
134	161	137	168	132	159	106	130	130	163	113	145	145	165	158	147	142	159
227	267	236	260	235	272	266	229	235	267	218	226	245	239	293	265	215	275
184	216	191	210	190	220	216	185	190	216	176	182	199	193	237	215	174	223
159	187	165	182	164	190	186	160	164	187	152	157	171	167	205	185	150	192
138	163	144	158	143	166	162	139	143	162	133	137	149	146	178	161	131	167
120	141	125	137	124	144	141	121	124	141	115	119	130	126	155	140	113	145



New OMRON intelligent terminal is in a field by itself when its host crashes.

OMRON'S 8035 intelligent CRT terminal not only can operate alone if its host crashes—it operates in a field by itself.

The intelligent 8035 can, of course, talk directly to other terminals and is fully user programmable. It can also be used to develop microprocessor programs which are then converted to PROMs for use by the more economical, smart OMRON terminals—the 8038s.

This combination allows you to develop multiple terminal networks with customized programs at a hardware savings of 40 to 50 percent.

The 8035 can be equipped with up to a 28K memory and dual floppy disc storage. BAUD rates to 9600. Its software system, in addition to basic packages to control disc operations, includes a resident monitor, a symbolic assembler, editor, debugger and utilities for systems generation, communications and copy operations.

So, if you want your intelligent terminal to do more than stand alone when its host crashes—write or call Michael L. Squires, director of marketing, Information Products Division, Omron Electronics, Inc., 432 Toyama Drive, Sunnyvale, CA. 94086. (408) 734-8400.

OMRON

for a universe of exceptionally reliable CRT systems.

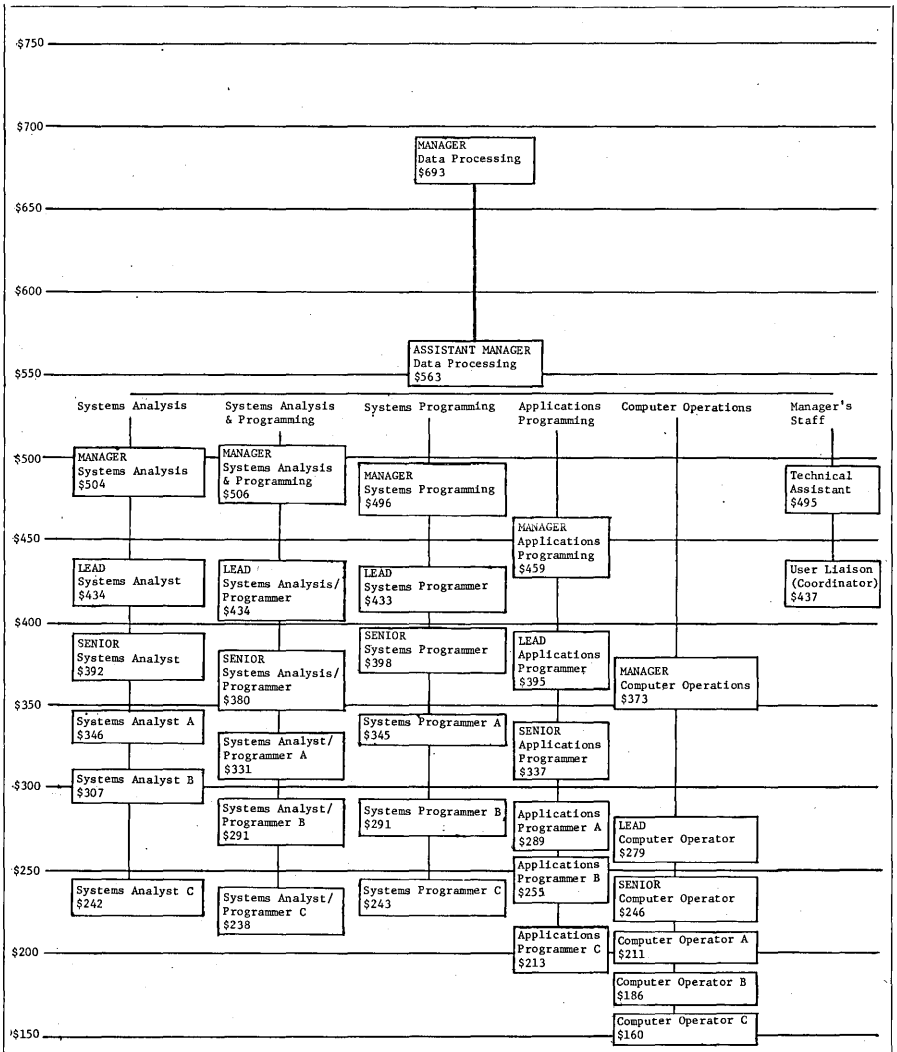
learned from the tables. We'll show just three positions for comparisons.

City Level	City	Avg. Sal Corp. DP Mgr.	Comp Ops. Mgr.	Appl. Pgmr Sr.
1	Boston	684	378	333
2	Los Angeles	769	411	387
3	Atlanta	563	361	330
4	Racine	719	428	314
5	Little Rock	617	278	241

What you should not infer from this table is that the dp shop manager in Boston should consider the advantages of Racine, Wisconsin. While Racine as a level 4 city comes out looking pretty attractive, one must remember that the sample size for that lovely little city is only 280 employees working in four companies. Boston's sample is 2,065 employees working in nine companies. Samples of less than 500 employees had to be used to generate information for Denver, Kansas City, Portland, and Salt Lake City.

And, you may ask, why is anybody even bothering to work in dp in Little Rock, Arkansas, Boise, and Des Moines, the only level 5 cities? In this case we have some inside information. There is a clear trend to establish dp shops in outlying cities. To borrow a Watergate phrase, they are "following the money," or more accurately, the possibility of not having to part with so much of it.

The latest Bureau of Labor Statistics information on urban family budgets and comparative indices dated April 27, 1977, was obtained and it shows that Boston and San Francisco have overtaken New York City with the dubious honor of being the most expensive places for a four-person family to live in the continental U.S. That schedule reflects a no-frills budget for a 38 year-old working husband, a nonworking wife, an 8 year-old girl, and a 13 year-old boy. The cities of Honolulu and Anchorage have ratings of 121 and 142, respectively. Unfortunately, we do not have any data on dp salaries in those locations.



Follow the money . . . So you're an applications programmer who thinks she might be able to take home more bucks if a job in systems came up. This chart of national averages for various positions shows you're right; in fact, systems programming or analysis positions are the highest paying in the computer center outside of top management. Note that a Systems Programmer "A" makes somewhat more than a Senior Applications Programmer. Note also that Systems Analysis/Programmers level C start somewhat lower than their analysis or programming counterparts, but rise to a slightly higher level if they can become manager.

Summing the salaries paid on average in the 30 cities we have chosen (the full Hansen report contains information on 45 *additional* cities), averaging it, and assigning the average city an index of 100 is a way of showing how well you can get along in that city doing dp. The rule is simple: if the DATAMATION index is higher than the city rating, you're in good shape. If it's lower, you're probably taking a beating. People in cities other than those listed might try to compare their rates with cities they know something about. If that fails, the Bureau of Labor Statistics does keep average salary data for a few positions for most cities; that information can help in comparing that city with the national average. People in nonmetropolitan areas will find it tougher to figure their positions. As a general rule, pay rates are better in bigger cities than smaller, and better in small cities than nonmetropolitan areas. Do not attempt to compare the indices on this year's charts to last year's. A different methodology was used to develop them.

The data used in this survey was supplied by A. S. Hansen, inc., publisher of the "Weber Salary Survey on Data Processing Positions in the United States." The survey includes an actual count of 88,166 employees in 66 positions in 1,157 companies. The 106 page annual report includes detailed information on positions in 75 cities and more detailed breakdowns of salary ranges within each city. **Further information on the report is available from A. S. Hansen, inc., at 1080 Green Bay Road, Lake Bluff, Illinois 60044.**

Installation size

The effects of installation size are straightforward; bigger shops put more load on managers and some other positions, so paychecks go up, though not for everyone. We report salaries for the five classifications of shop as a range. The numbers correspond to the 50% of survey respondents who fall right in the middle between the first quartile

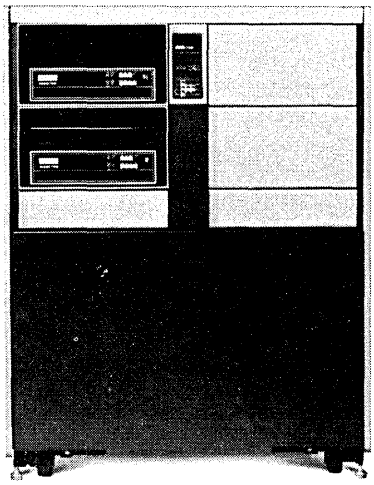
WITH THE PDP-11/60, A NEW GENERATION OF POWER COMES TO THE MID-RANGE MARKET.

The PDP-11/60.

The newest generation of PDP-11 power.

Positioned right between the PDP-11/34 and PDP-11/70.

And delivered in a complete package designed to combine this new level of performance with superior uptime.



We started with the performance. With its integral bipolar cache memory, the 11/60 gives you an effective cycle time of 532ns.

But it doesn't stop there. Its built-in floating point, offered as standard, allows you to run FORTRAN IV-PLUS, our fastest FORTRAN. And the optional high-speed floating-point processor can execute single- or double-precision add/subtract in 1.0 μsec, single-precision multiply in 1.5 μsec, and double-precision multiply in 3. 7 μsec.

In addition, you get a Writable Control Store (WCS) option that boosts the performance while allowing OEMs to expand the machine's capabilities into their own unique areas.

Then we maximized the uptime. The 11/60 was designed under our unique Reliability And Maintainability Program (R.A.M.P.) in order to maximize inherent reliability while minimizing repair time and the consequences of failure.

With innovations like Failsoft System Architecture, you get features like: an automatic bootstrap self-diagnostic that verifies the soundness of the system at start-up; error logging to spot potential hardware problems before they become critical; and the ability to run even when parts of the CPU are down. And if you do your own maintenance, the optional Diagnostic Control Store module can troubleshoot to the board level in seconds.

And we wrapped it all together in our new H9500 Series cabinet. The H9500 Series was developed to answer a host of reliability and serviceability problems inherent in other designs. Yet it still accepts existing 19" (48.26 cm) rack-mountable equipment.

The new cabinet incorporates: swing-out card cages and built-in cable troughs for better access and less signal noise; electrically isolated programmer and cabinet panels; quieter, more powerful fans; even modular power supplies. And it's available with single- and double-width expansion cabinets, in 5' (1.5 m) and 4' (1.3 m) versions, to fit your needs exactly.

The PDP-11/60. All things considered, the ultimate in mid-range OEM computers.

Digital Equipment Corporation, PK-3-M28, Maynard, MA 01754. (617) 897-5111, ext. 6253. In Europe: 12, av. des Morgines, 1213 Petit-Lancy/Geneva. Tel. 93 33 11. In Canada: Digital Equipment of Canada, Ltd.

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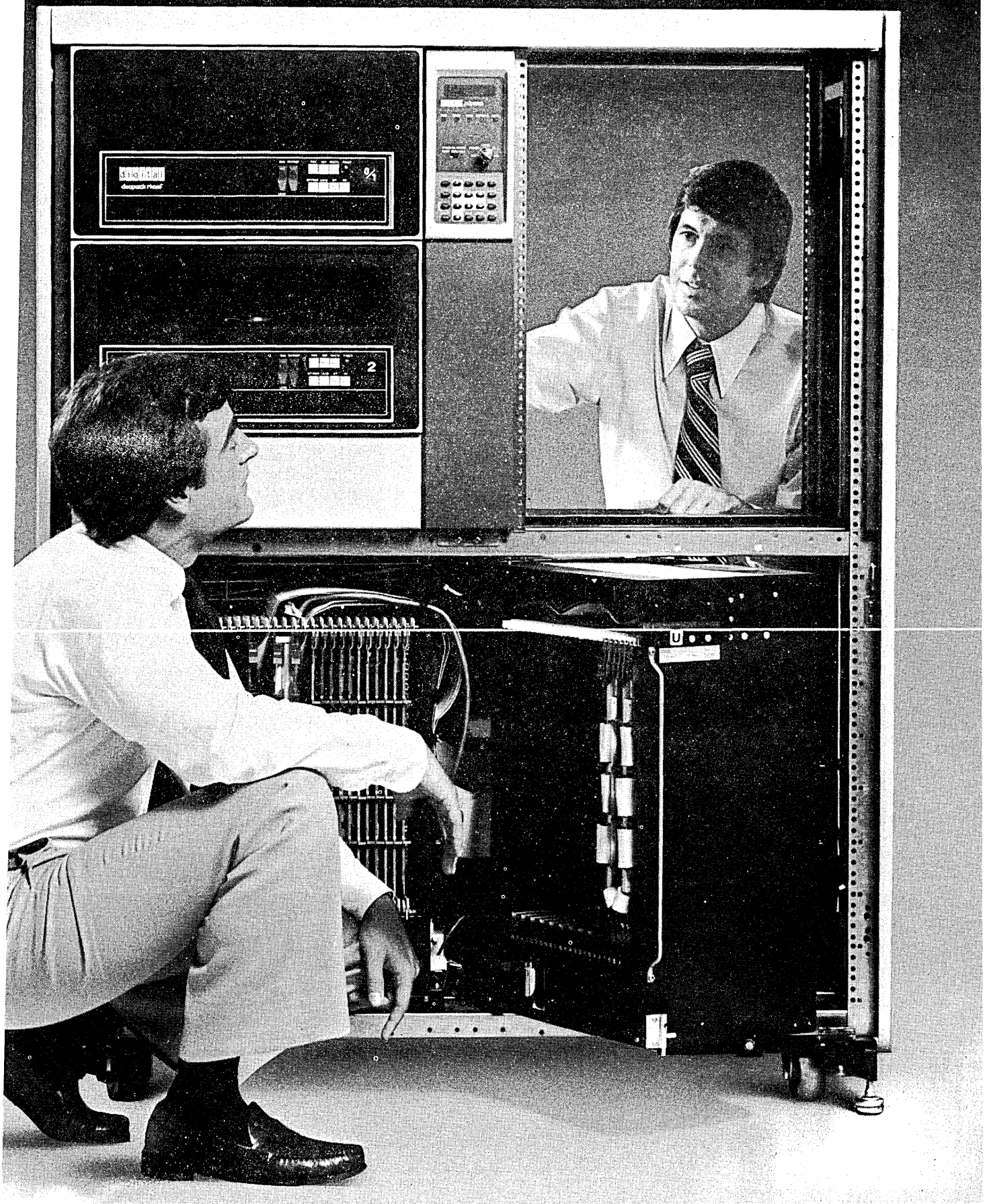
OEM PRODUCTS GROUP

AND HERE'S WHAT'S IN IT FOR THE OEM.



and the third quartile. So although the highest and lowest salaries are not reported, the numbers shown are reasonable salaries for that position.

The five installation size categories are split out by *monthly* hardware rental:

1. **to $12,000** (IBM System/3s, 370/125, NCR Century 200 Series, Univac 9700, etc.)
2. **to $25,000** (IBM 370/135, Burroughs 3700, Honeywell 66/20, etc.)
3. **to $50,000** (IBM 370/145, Univac 1100/20, CDC Cyber 73, etc.)
4. **to $150,000** (IBM 370/168, Burroughs 7750, CDC 6700, or multiple mainframes)
5. **over $150,000** (all the rest, usually multiple-cpu sites)

Conclusions

The salary increases given to data processing personnel apparently reflect a growing management attitude that their accomplishments are unsatisfactory. If this is the case, one could predict a growing disenchantment among the programming ranks, and perhaps unionization if the strong trend continues. But maybe not. Inflation is a tax on everybody's income and few are staying ahead of its grasp. In the end, we're all in this together.

JOB FAMILIES

The jobs have been grouped into a number of "families." The families range from "Manager" or "Supervisor" to "Trainee." There are two important things to know about the families. First, the levels in each category were *derived*, not arbitrarily set. A histogram was constructed for all people in "programming" by plotting "number of people" vs. "salary." If there were five "bumps" or clusters in the histogram, five levels of programmer were defined. These levels were worked back onto the questionnaire. Over a period of years, the listed classifications have evolved.

Second, the classifications have these general qualifying characteristics:

Manager (or Supervisor)	Usually in full charge of all activities of a section or department. May personally supervise the operations of his staff or direct the operation through subordinates.
Lead	Usually considered the assistant manager, or supervisor in families where an "assistant manager" title does not appear. Instead may be a line supervisor with full technical knowledge but added duties of assigning, instructing, and checking other section members.
Senior	Usually competent to work at the highest technical level of all phases of the activity. Works on his own most of the time. May give some direction to lower classifications.
A	Works under general supervision. Usually can work on his own in most phases of the activity. Requires only some general direction for the other phases.
B	Works under direct supervision. Usually fairly competent to work on several phases of the activities with only general directions, but needs some instruction and guidance for the other phases.
C	Works under immediate supervision, generally on only one activity. The work is carefully checked.
Trainee	Usually a probationary employee who has no previous experience. ❋

THE JOB DESCRIPTIONS

In addition to the "classical" staffing positions that have been used in data processing since its inception, new ones are emerging with the maturing of our industry and becoming ever more important.

For example, just as financial auditing is important in a corporation, dp auditing (and the dp auditor) is vital. Mismanagement, accidents (or "on purposes") here can severely restrain a firm's effectiveness. Similarly, data base management requires specialists who understand the intricacies of managing increasingly interdependent information banks. And data communications specialists will become even more important than they are today.

These positions have been included in the survey for the first time this year—not because they didn't previously exist, but because there is finally enough meaningful data on them to provide salary guidance.

A word of caution: don't fall into the trap of reading the various job descriptions and saying, "Hey, my Systems Programmer 'B' doesn't do that—her job is closer to an 'A' level." The only way the descriptions will make any sense is to equate your particular installation grades to our job descriptions to determine salaries for functionally equivalent positions.

Corporate (or Department) Manager of Data Processing

Maintains continuous control over policies and procedures, technical problems, priorities, and methods. Through subordinate supervision, is responsible for the overall direction of the various functions to ensure that activities assigned are completed in the most competent, effective, and efficient manner. Controls liaison between data processing and other functions in the company. Reports to management on dp plans, projects, performance, and related matters.

Assistant Manager of Corporate Data Processing

Usually has departmental line responsibility, but in certain instances may have only staff responsibility. Participates in research and procedural studies. Develops analyses of existing and newly developed equipment and techniques.

Divisional, Subsidiary, or Regional Manager of Data Processing

Similar to corporate dp manager, except that corporate dp policies may regulate his actions. May report to

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Corporate Manager of Data Processing, or may take functional guidance from the Corporate Manager and his staff while reporting to divisional, subsidiary, or regional general management.

Manager of Data Processing Administration and Planning

Directs activities relating to the preparation, review, and consolidation of corporate, regional, subsidiary, and/or divisional data processing budgets and business plans. Ensures adherence to budgets and business plans through periodic review of financial reports and capital appropriation requests. May oversee dp personnel administration, including selection and training. May be responsible for dp security.

Technical Assistant to the Manager

Analyzes proposed and actual projects in terms of dp feasibility. Usually has only departmental staff responsibility, but may provide technical guidance. Plans and recommends changes to the capacity of the operating system or its configuration. May apply knowledge of higher mathematics, operations research, statistical analysis, or numerical analysis techniques to solve business and technical problems.

User Liaison (Coordinator of Data Processing)

Coordinates activities of the dp operation with the company's other departments. Usually has only departmental staff responsibility. Assists in establishing systems analysis, programming, and computer operations priorities. Recommends standard policies and procedures.

Systems Analysis & Programming

Manager of Systems Analysis and Programming

Responsible for feasibility studies, systems design and programming. Assigns personnel to projects and directs their activities. Coordinates section activities with other sections and departments. Reports to the Corporate and Division Manager of Data Processing or to Corporate Management.

Lead Systems Analyst/ Programmer

Assists in planning, organizing, and controlling the activities of the section. Assists in scheduling and assigning personnel. May act as systems/programming project manager. May coordinate the activities of the section with other sections and departments.

Senior Systems Analyst/ Programmer

Confers with managers, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams. Analyzes existing system and program logic and makes revisions.

Systems Analyst/Programmer A

Confers with dp personnel to determine the problem and type of data to be processed. Defines the applications problem, determines system specifications, recommends equipment changes, designs dp procedures and block diagrams. May prepare flowcharts and codes. Devises data verification methods and standard systems procedures.

Systems Analyst/Programmer B

Assists in devising system and program specifications and record layouts. Prepares flowcharts and logic diagrams for existing and proposed operations. Codes. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. Analyzes existing office procedures as assigned.

Systems Analyst/Programmer C Trainee

Carries out analyses and programming of a less complex nature as assigned and instructed. Usually works only on one activity under very close direction with the work being closely checked. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details block diagrams to reflect specific procedures. May assist in the preparation of flowcharts.

Systems Analysis

Manager of Systems Analysis

Responsible for feasibility studies for new applications, and for systems design. Assigns and directs personnel. Consults with and advises other departments on systems and procedures.

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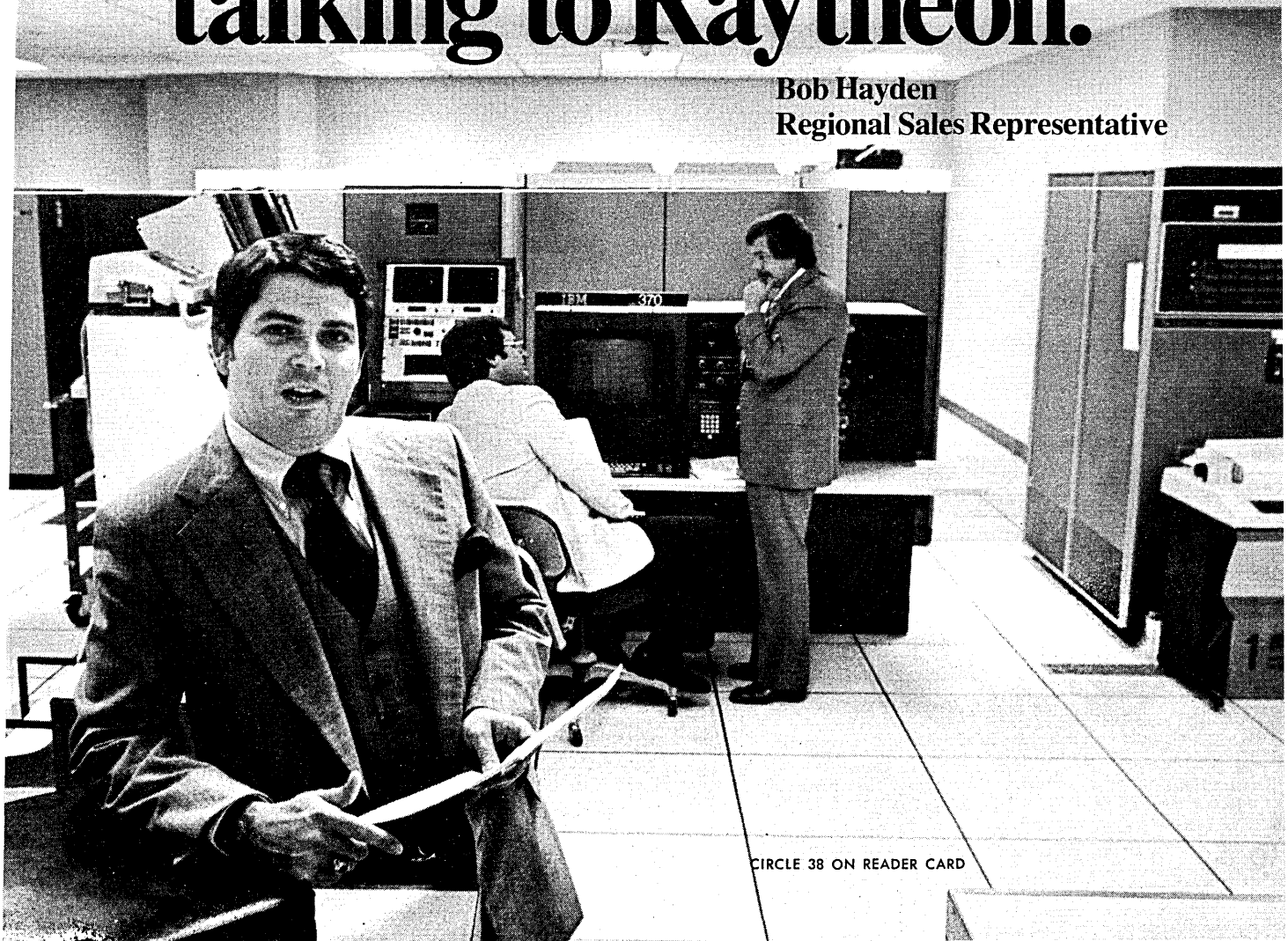

CIRCLE 38 ON READER CARD

O.K. Intertel, you're Number One in network control.

What's that do for me?

Good question. Simple answer:
AT INTERTEL, NETWORK CONTROL MEANS MORE THAN DIAGNOSTICS.

In short, it helps you do your job better. Intertel Network Control provides professional tools for professional communications managers to give you on-line management of your entire network. Diagnostics, restoral, and preventive maintenance are literally placed at your fingertips.

It helps your company's business run better. Customers are serviced, new orders are booked, reservations are made, money is transferred and inquiries are handled—all on an "on-time" basis.

It helps your network run better by increasing efficiency and eliminating downtime. In fact, many of our customers experience virtually 100% network uptime on a regular basis. Intertel has now installed more than 150 Network Control Systems in both multipoint and distributed processing networks. This gives us a distinct advantage. *Our customers.* They've taught us that to be totally effective, a Network Control System must help them solve real problems. Our System does this. At the same time, our System provides the best diagnostic capabilities available in the industry.

- It permits you to pinpoint network problems, across town or across the country, with the simple touch of a button.
- It lets you test a single component or the entire network without shutting down any part of the system.
- It identifies and disables streaming terminals and provides automatic network restoral, through proven automatic dial backup, in minutes or even seconds, instead of hours.
- It operates as well in sophisticated distributed processing networks, testing outbound from concentrators and multiplexers, as it does in multipoint networks.
- And it operates in networks of al speeds from 1200 to 9600 BPS withou any requirement for line conditioning

The Bottom Line

What does an Intertel Network Con trol System do for you? It goes fa beyond the diagnostic capabilities available from other companies. I gives you a complete system fo on-line management that solves prob lems that won't wait.

At Intertel we know a lot about wha makes data networks run better. We should. After all, we're:

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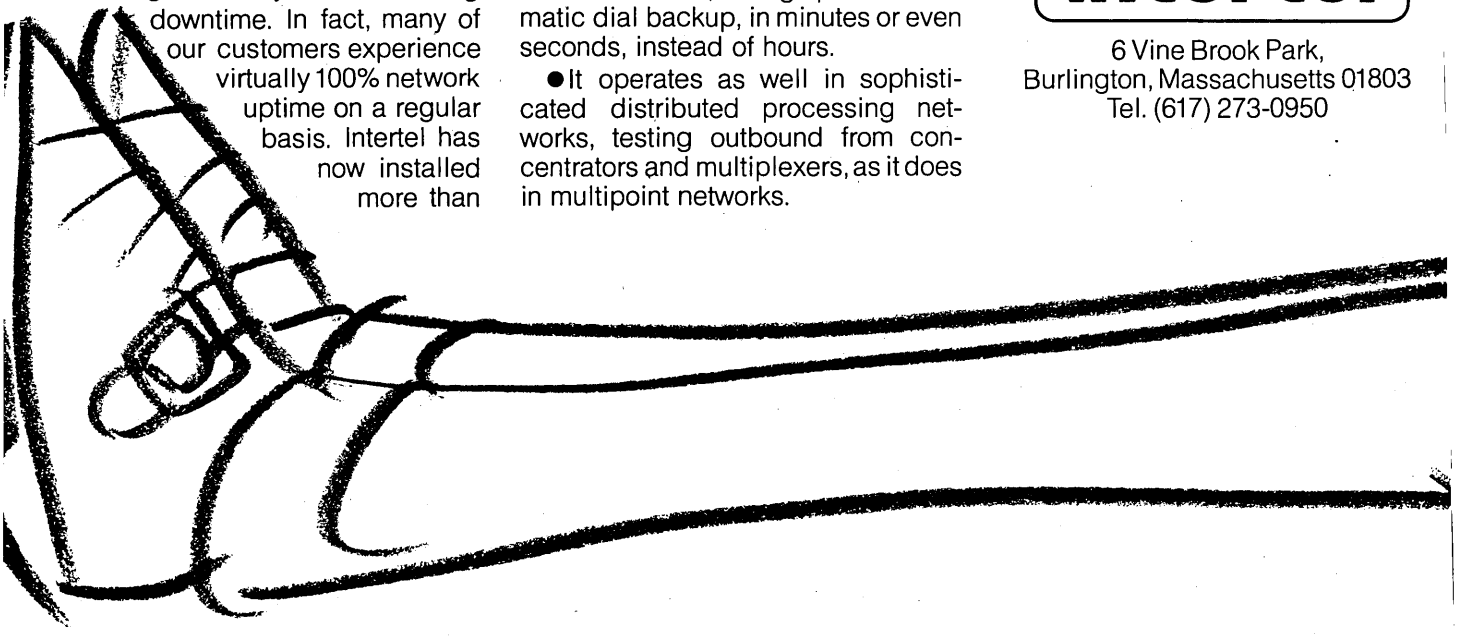


CIRCLE 51 ON READER CARD

Reports to the Corporate or Division Manager of Data Processing.

Lead Systems Analyst
Assists in planning, organizing, and controlling the activities of the section. Assists in scheduling the work of the section and assigning personnel to projects. May act as systems projects manager. May coordinate the activities of the section with other sections and departments.

Senior Systems Analyst
Confers with officials, scientists, and engineers to define business or scientific/engineering dp problems. Formulates statements of those problems and devises dp solutions. Prepares block diagrams illustrating the solutions and may assist in or supervise the preparation of flowcharts from those diagrams.

Systems Analyst A
Defines the applications problem, determines system specifications, recommends equipment changes, and designs dp procedures. Devises data verification methods. Prepares block diagrams and record layouts from which programming prepares flowcharts. May assist in or supervise the preparation of flowcharts.

Systems Analyst B
Assists in devising computer system specifications and record layouts. Prepares systems flowcharts to describe existing and proposed operations. Prepares comprehensive block diagrams in accordance with instructions from higher classifications. May assist in the preparation of flowcharts.

Systems Analyst C
Carries out analyses of a less complex nature. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details block diagrams to reflect specific computer procedures. May assist in the preparation of flowcharts.

Applications Programming

Manager of Applications Programming
Plans, organizes, and controls the preparation of application programs. Assigns, outlines and coordinates the work of the programming staff. Establishes standards for block diagramming, flowcharting, and coding. May write and debug complex programs. Collaborates with systems analysts and other technical personnel in scheduling equipment analyses, feasibility studies, and applications systems planning. Reports to the Corporate or Division Manager of Data Processing.

Lead Applications Programmer
Assists in scheduling programming projects. Coordinates the activities of the programming section with other sections of the computer department. May act as programming project manager.

Senior Applications Programmer
Analyzes problems outlined by systems analysts in terms of detailed equipment requirements. Designs detailed flowcharts. Verifies program logic by preparing test data for trial runs. Tests and debugs programs. Prepares run sheets for routine programs. May do coding from flowcharts. May assist in determining the causes of computer or program malfunctions. May confer with technical personnel in systems analysis and application planning.

Applications Programmer A
Conducts detailed analyses of defined systems specifications and develops all levels of block diagrams and flowcharts. Codes, prepares test data, tests and debugs programs; revises and refines programs and documents all procedures used in finished programs. Evaluates and modifies existing programs to take into account changes in system requirements or equipment configurations.

Applications Programmer B
Assists in coding and in analyzing previously defined system specifications. Assists in—and in some cases carries out on his own—the preparation of all levels of block diagrams and flowcharts. Codes. Assists in preparing test data and in testing and debugging programs. Assists in the documentation of all procedures used in the system.

Applications Programmer C Trainee
Assists in the analysis of system specifications and coding. Performs all work under close supervision.

Systems Programming

Manager of Systems Programming
Plans and directs all activities of the Systems and Programming Section. Projects software and hardware requirements in conjunction with other managers within the department and with corporate management. Develops standards for all systems software and works to design and implement systems required. Directs the interfacing of systems software with the hardware configuration and the application systems. Provides technical guidance relating to the operating system to all members of the dp staff. Reports to either the Corporate or Division Manager of Data Processing, the Manager of Systems Analysis, the Manager of Applications Programming, or to the Data Processing Operations Manager.

Lead Systems Programmer
Assists in scheduling systems programming projects and in assigning personnel to those projects. May act as a project manager for major systems applications and as the manager of the department in his absence. Usually assumes the responsibility for coordinating the activities of systems programming with the other dp sections.

Senior Systems Programmer
Develops specifications for extremely complex systems programming applications. May define the logic, perform the coding, testing, and debugging or may provide technical direction to lower classifications performing these operations. Usually is responsible for applications dealing with the overall operating system or with complex subsystems such as sophisticated file management routines, large telecommunications networks, or advanced mathematical/scientific software packages.

Systems Programmer A
Works from specifications to develop or modify programs to improve the efficiency of the operating system. Develops logic, codes, tests and debugs software defined by higher level categories. Modifies, tests, and debugs vendor-supplied utilities, application packages, and engineering releases. Assists in developing and modifying relatively complex software, such as routines supporting multiprogramming, telecommunications, and file management.

Systems Programmer B
Assists in defining and programming moderately complex software such as utilities, job control language, macros, and subroutines. May assist the coding of benchmarks, job accounting, and control modules developed internally by the firm. May assist with relatively complex software such as compilers, link editors, and assemblers.

Systems Programmer C
Assists in coding and maintaining utilities, job control language, and I/O programs, as well as other systems software of moderate complexity. May assist in maintaining the program libraries and technical manuals and in installing new vendor-supplied engineering releases. Assignments are gen-

erally under the technical direction of a higher level systems programmer.

Data Base Manager/ Administrator
Directs the activities related to the administration of computerized data bases, including their definition, organization, protection, efficiency, documentation, long-term requirements, and operational guidelines. Responsible for security and integrity controls, establishment and maintenance of data base support tools including data dictionaries, overall monitoring of standards and procedures, integration of systems through data base design, and interfacing with and training other dp sections and users.

Senior Data Base Analyst
May give some direction and guidance to other data base analysts. Responsible for the accuracy and completeness of master file data (though not necessarily for the physical or logical organization). May participate in the formulation of policy and procedures affecting data base management.

Data Base Analyst
Audits data base transactions and assists in maintaining the accuracy and completeness of master file data. Assists in the initial training of user groups with regard to procedures for supplying input and ensuring its accuracy and timeliness.

Data Base Analyst Trainee
Carries out less complex phases of data base management under immediate supervision. This level is usually staffed by beginners who have had sufficient background and/or experience to qualify them to start in data base management.

Manager of Data Processing Auditing
Develops data processing auditing programs and control guidelines. Consults with and advises other sections regarding systems and procedures. Normally reports to corporate or divisional manager of dp or to financial/general management.

Senior Data Processing Auditor
Audits new and existing dp applications at the highest level of all phases of dp auditing to ensure that appropriate controls exist, that processing is efficient and accurate, and that dp systems and procedures are in compliance with corporate standards.

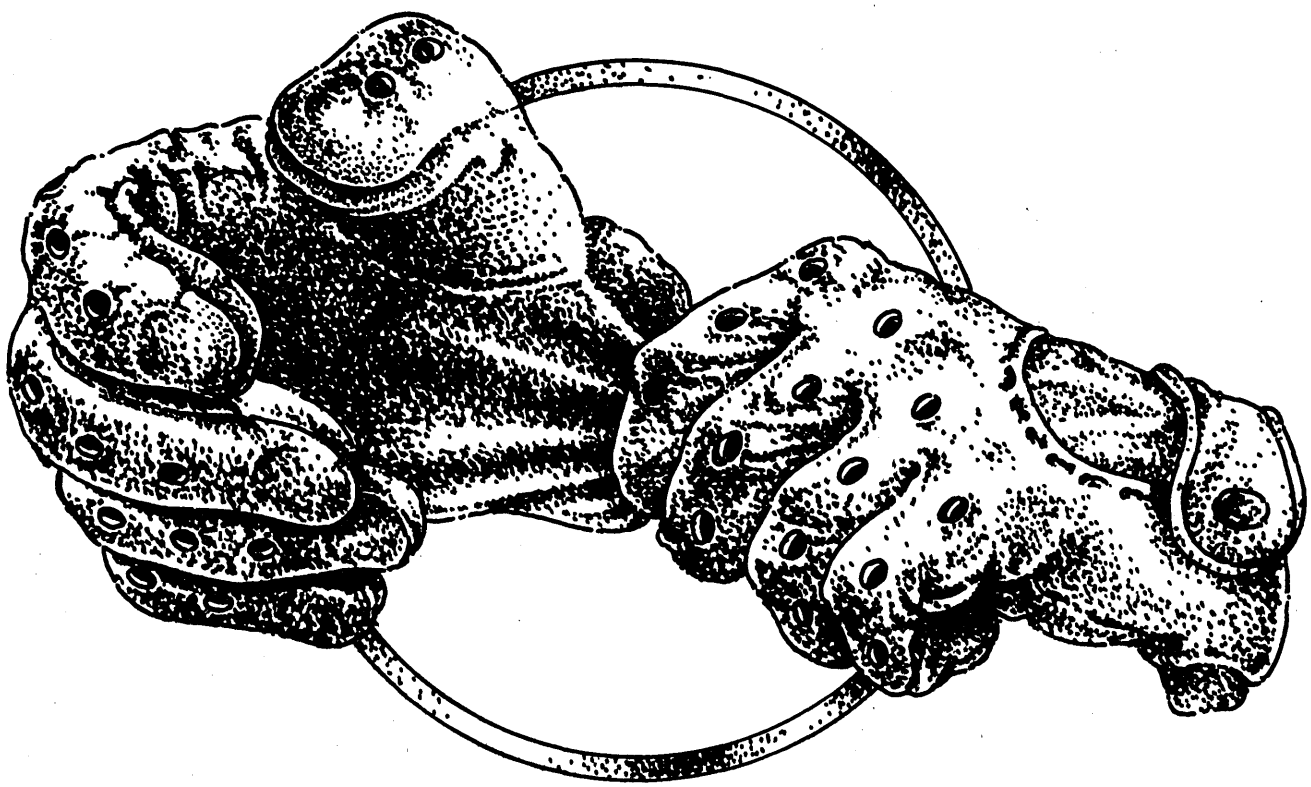
Data Processing Auditor
Audits new and existing dp applications to ensure that appropriate controls exist, that processing is efficient and accurate, and that dp systems and procedures are in compliance with corporate standards.

Data Processing Auditor Trainee
Carries out less complex phases of the dp audit function.

Telecommunications Manager
Directs activities of the telecommunications function, including planning, designing, installing, and maintaining networks in support of dp systems. Responsible for budgeting and long-range planning relating to telecom systems and projects. Interfaces with dp management staff to coordinate telecom software, hardware, and systems capabilities. Assigns personnel to various projects and directs their activities.

Senior Telecommunications Analyst
Participates in the design, implementation, and maintenance of telecommunications systems. May give some direction and guidance to other telecom analysts. Is fully capable in the use of programming language applicable to telecom. Provides technical guidance pertaining to front-end devices, communications simulation, and queuing analysis, and is responsible for evaluating and developing major telecom software systems.

Telecommunications Analyst
Participates in the design, implementation, and maintenance of telecom sys-



The Perfect Fit from Cincom Systems

"Data base and data communication software must go 'hand in glove' to realize their maximum contribution to an organization's information system plan."

This statement is heard over and over again from the *successful implementors of complex, on-line systems.* It certainly is logical! Yet... we still see the occasional disappointed user who has violated this principle and attempted to get by with the old interface approach.

Cincom's performance-oriented solution to this DB/DC requirement is to "perfectly fit" the strong "hand" of the *TOTAL Data Base Management System*... serving nearly 2000 customers worldwide ...with its fully integrated "glove," *the Environ/1 Data Communication System.* The on-line results of such meticulous tailoring include:

Optimum Performance and Efficiency

- Self-optimizing core management.
- Fully re-entrant COBOL-XT application code.
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- Multi-threaded operation.

Maximum Flexibility

- Operating system independence.
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Comprehensive Integrity and Security

- Automatic logging, backup and recovery capability.
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- Dynamic task sign-on and dispatching.

Ease of Use

- Batch to on-line programmers in hours.
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- On-line application program maintenance option.

These state of the art capabilities, coupled with Cincom's international support organization, have made TOTAL and ENVIRON/1 the modern DB/DC choice for many of the world's most progressive companies.

If you are evaluating data base, with immediate or future data communications requirements, Cincom would like the opportunity to show you the perfect DB/DC fit for your organization. We have 34 offices in major U.S. cities and worldwide.

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tems. May write and maintain operating manuals and assist in developing specifications, record and form layouts, and the like.

Telecommunications Analyst Trainee
Carries out less complex phases of telecommunications.

Telecommunications Network Coordinator
Responsible for equipment installation, troubleshooting, and hardware testing. Coordinates activities of equipment and line vendors, and maintains internal systems to assure that network components are operational. Maintains records of equipment failures and coordinates preventive maintenance and/or corrective programs with vendor service personnel.

Documentation Specialist
Responsible for preparing and/or maintaining systems, programming, and operations documentation, and for maintaining a current documentations library. May assist in establishing or recommending documentation standards. May instruct computer facility users on departmental documentation, operating procedures, and methods.

Operations

Manager of Data Processing Operations
Has many of the same responsibilities as the Corporate Manager of Data Processing, except that Systems Analysis and Applications Programming functions are not under his control. Systems Programming may report to him, and all other machine-oriented functions from data entry to report binding certainly would. Most likely reports to Corporate Management, but may sometimes report to Corporate or Division Manager of Data Processing.

Work Process Scheduler
Schedules operating time of the overall dp activities. Responsible for keeping idle time to a minimum. Schedules preventive maintenance.

Tape Librarian
Maintains library of magnetic and paper tape. Classifies, catalogs, and stores reels. Maintains charge-out records. Inspects tape for wear or damage.

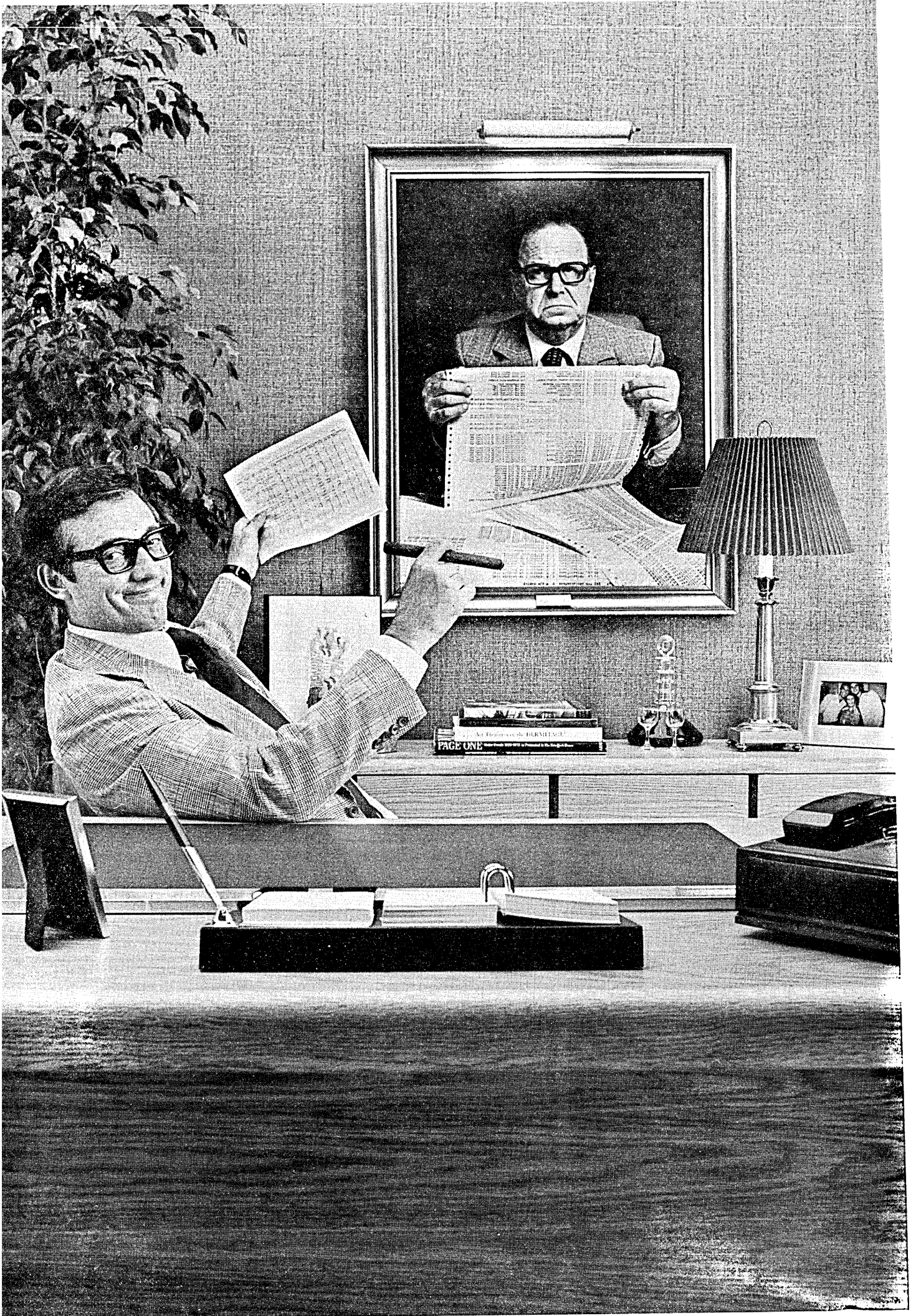
Manager of Computer Operations
Plans, organizes, and controls the Computer Operations Section. Establishes detailed schedules for the use of equipment. Assigns personnel and instructs them where necessary. Reviews equipment logs and reports on operating efficiency. Reports to the Corporate or Division Manager of Data Processing, or to the Data Processing Operations Manager.

Lead Computer Operator
Assists in scheduling the operations and in assigning personnel. Coordinates activities of the section with other sections in the data processing department. May act as shift supervisor.

Senior Computer Operator
Usually operates the central console. May give some direction to lower level classifications. Studies run sheets. Reruns job steps to recover from machine error or program error, consulting with technical staff where necessary. Maintains machine performance and production records.

Computer Operator A
Assists in running the machines and maintaining records. May assist in error recovery.

Computer Operator B
Assists in operating the computer and peripherals. May keep records regarding output units and use of supplies.


PAGE ONE

Computer Operator C
Carries out minor duties in accordance with detailed instructions. Usually works on only one activity under very close direction with the work being carefully checked.

Data Control

Data Control Supervisor
Plans, schedules, supervises, and directs preparation of records for data entry and distribution of reports. Maintains files and records, and supervises personnel. Reports to the Computer Operations Manager or to the Data Processing Operations Manager.

Lead Data Control Clerk
Assists in supervising group activities, in maintaining and revising lists, control records, and source data for recurring records and reports.

Senior Data Control Clerk
Maintains various control records and source data for recurring reports. May code source data and lists according to prescribed code designations. Performs related clerical and typing duties.

Data Control Clerk
Processes various lists and source data for recurring records and reports. Prepares and types lists. Performs related clerical and typing duties.

Data Control Clerk Trainee
In training to determine suitability for data control work.

Data Entry Supervisor
Assigns work to personnel and directs their activities. Reviews and evaluates work of own staff and prepares periodic performance reports. Normally reports to the Data Processing Operations Manager.

Lead Data Entry Operator
Assists in supervising a group engaged in operating data entry devices; assists in scheduling data entry functions; instructs operators on procedures; trains new employees.

Senior Data Entry Operator
Operates data entry devices in recording data; may instruct operators on procedures for routine assignments; may assist in training new employees.

Data Entry Operator
Operates data entry devices under direct supervision; verifies data entered; performs related clerical duties.

Data Entry Operator Trainee
In training to determine suitability for data entry work. ❋

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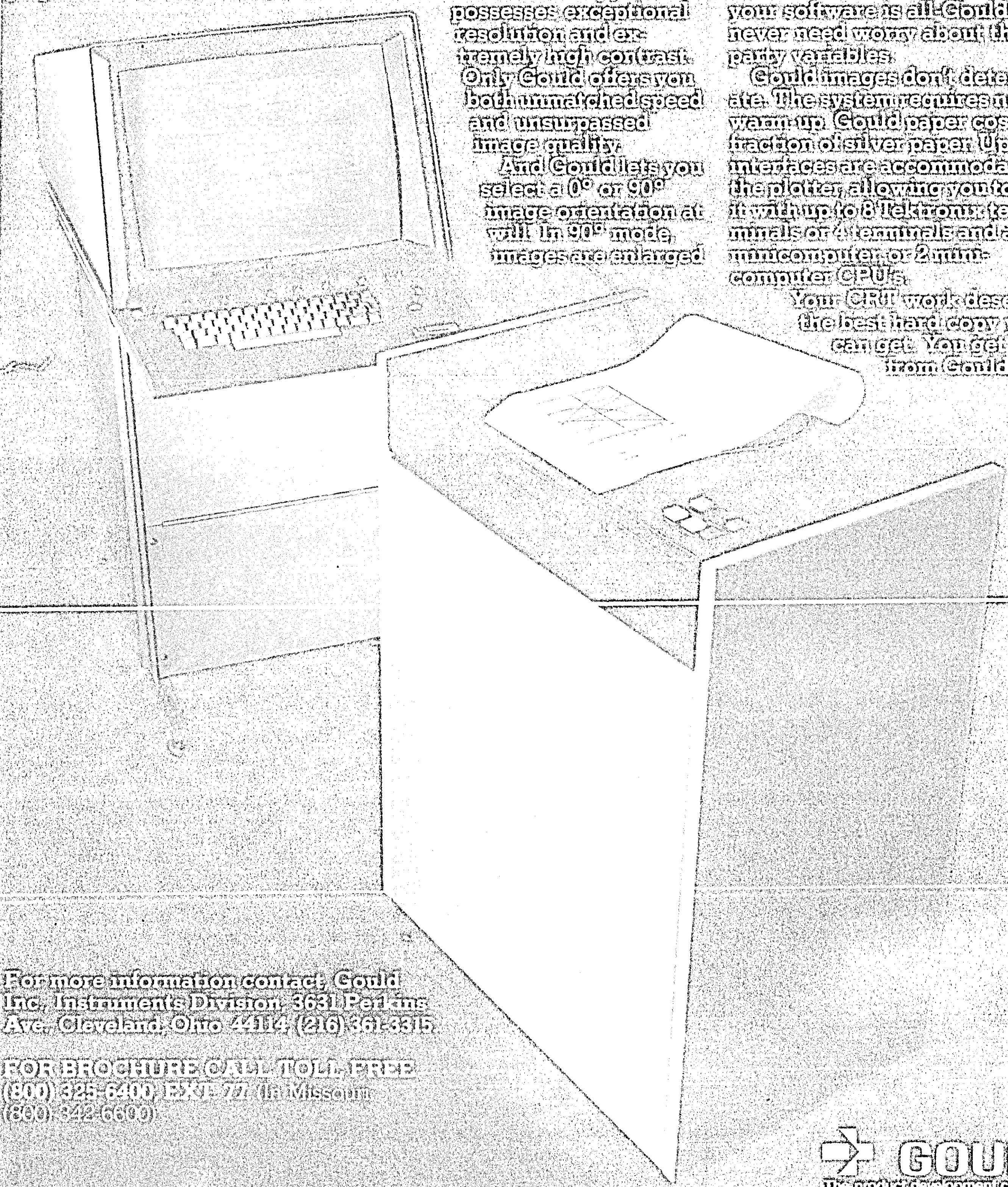

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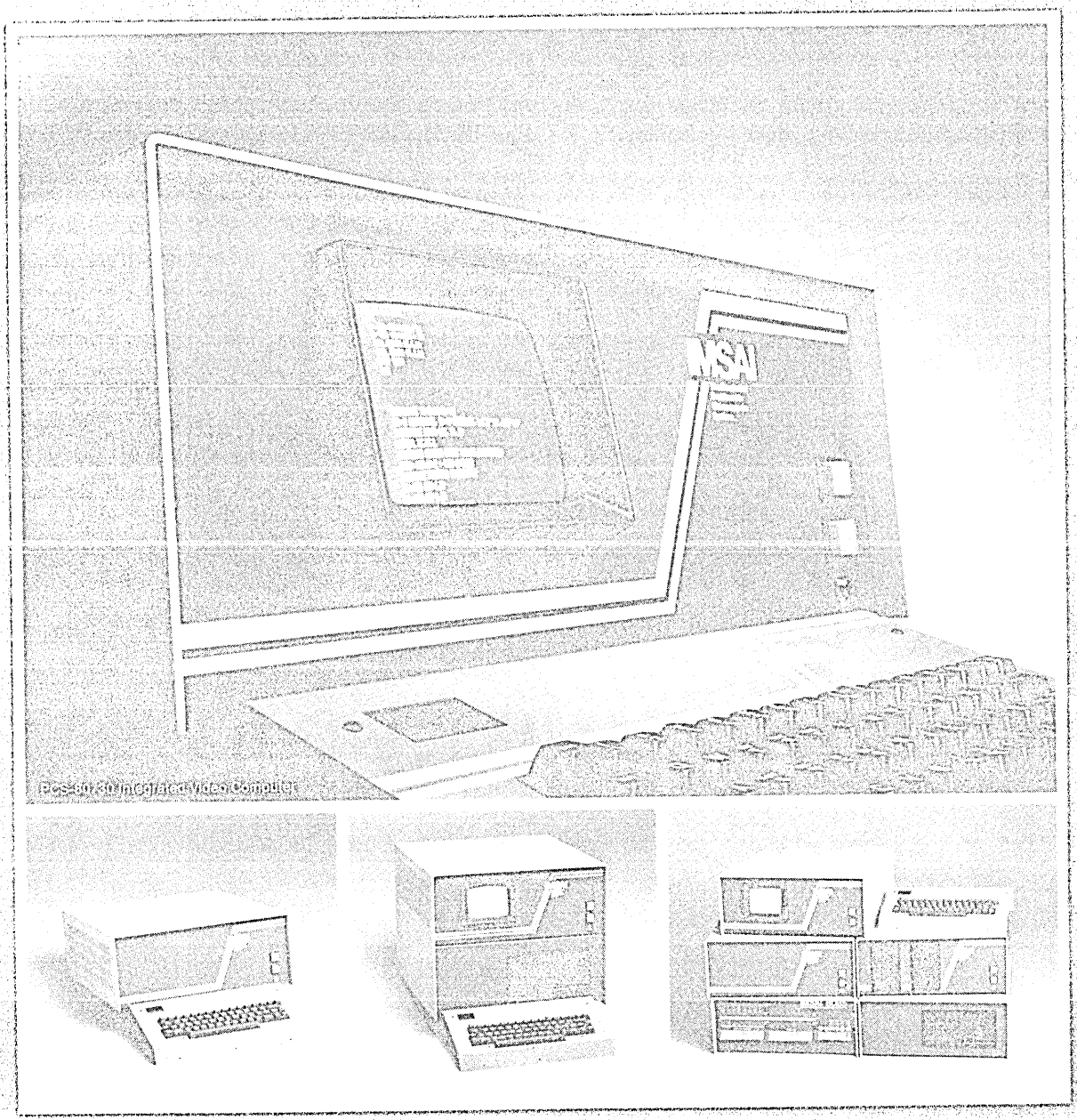

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is to take it apart piece by piece.

Compare the features of our S-100 bus system, the industry standard, to anyone else. After you've taken them apart piece by piece, you'll know why IMSAI is the system you can grow with. At a price you can live with.

IMSAI 80/30 Integrated Video Computer (with Intelligent Keyboard–IKB-1) Standard Features:

□ **Price assembled $1499.** IMSAI is the only S-100 bus manufacturer that offers a microprocessor driven keyboard with "N" key roll over, 2¼K of RAM, 8 expansion slots, choice of 4K, 16K, 32K and 64K RAM expansion boards, 3K ROM monitor, synch/asynch serial interfaces, parallel and serial ports, high resolution CRT monitor, 24 x 80 display with graphic editing and data entry features, and 28 amp power supply for the incredibly low price of $1499.

□ **mpu Speed.** IMSAI is the only S-100 bus manufacturer that offers true 8080 compatibility, operating at 3 mHz.

□ **RAM Included.** 2¼K.

□ **Expansion Slots.** Eight expansion slots are provided in a new terminated and regulated motherboard (10 slots total).

□ **RAM Board Sizes.** IMSAI is the only S-100 bus manufacturer to supply 4K, 16K, 32K, and 64K RAM memory expansion boards.

□ **ROM Monitor.** IMSAI is the only S-100 bus manufacturer to provide 3K of ROM.

□ **Asynch/Synch.** Only one other S-100 bus manufacturer provides both methods of data communication.

□ **PIO/SIO.** IMSAI is the only S-100 bus manufacturer that provides two serial ports and one fully implemented parallel port at no extra charge.

□ **Video I/O.** IMSAI is the only S-100 bus manufacturer to include a high resolution (14 mHz) monitor as an integrated part of the computer.

□ **CRT Format.** IMSAI is the only S-100 bus manufacturer to provide a full 24 x 80 screen, which is two times the capacity of the common 16 x 64 screen.

□ **Graphic/Edit.** IMSAI is the only S-100 bus manufacturer that provides graphics and text editing features with character and line insert/delete for your CRT display.

□ **Keyboard Included.** IMSAI is the only S-100 bus manufacturer to supply a microprocessor driven keyboard with "N" key roll over and tiered construction for a true typewriter keyboard touch.

□ **28 amp Power Supply.** The world famous IMSAI power supply assures stability and reliability of performance.

Options: IMSAI is the only S-100 bus manufacturer to provide a comprehensive array of fully integrated options including: line and character printers, CRT terminals, intelligent keyboard, ACR storage, standard and mini floppies, TTY BASIC with OS, 4K, 8K and 12K BASIC, audio cassette BASIC with OS, 8K disk operating system (DOS) based upon CP/M,* scientifically and commercially oriented disc BASIC and level 2 FORTRAN IV compiler.

□ **Printers.** Only one other S-100 bus manufacturer can supply both line and character printers.

□ **CRT/Keyboard.** IMSAI is the only S-100 bus manufacturer to provide both CRT terminal and intelligent keyboard as separate options.

□ **ACR Storage.** Available.

□ **Floppies.** IMSAI is one of the few S-100 bus manufacturers to provide both standard and mini floppies and the only S-100 bus manufacturer that supplies double density standard floppies.

□ **TTY BASIC.** IMSAI is one of the few S-100 bus manufacturers that provides self-contained operating systems with 4K, 8K and 12K BASIC.

□ **ACR BASIC.** IMSAI supports ACR BASIC with an 8K version.

□ **DOS.** IMSAI is the only S-100 bus manufacturer to provide an enhanced version of the control program monitor (CP/M*) that can support up to 18 disk drives.

□ **Disc BASIC.** IMSAI is the only S-100 bus manufacturer that provides both scientific and commercial versions of compiler oriented BASIC.

□ **FORTRAN IV.** IMSAI is the only S-100 bus manufacturer that offers a level 2 FORTRAN IV compiler that operates under an enhanced version of CP/M.*

Prices and specifications subject to change without notice.
*CP/M is a trademark of Digital Research Corporation.

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The automated Raster Scanner/Plotter can cut map line digitizing time from hours to minutes, compared to manual X-Y digitizers. But this advantage creates a problem—the massive amounts of data generated are too much for even large conventional computers to handle efficiently.

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STARAN combines content addressability with parallel array arithmetic to process hundreds, or even thousands, of data points simultaneously. This unique capability, plus parallel I/O and multidimensional memory access, produces significant throughput improvements over conventional computers. That's why the STARAN processing system is unsurpassed in ability to solve complex problems involving operations on many similar data streams or high-speed searches of many similar file records.

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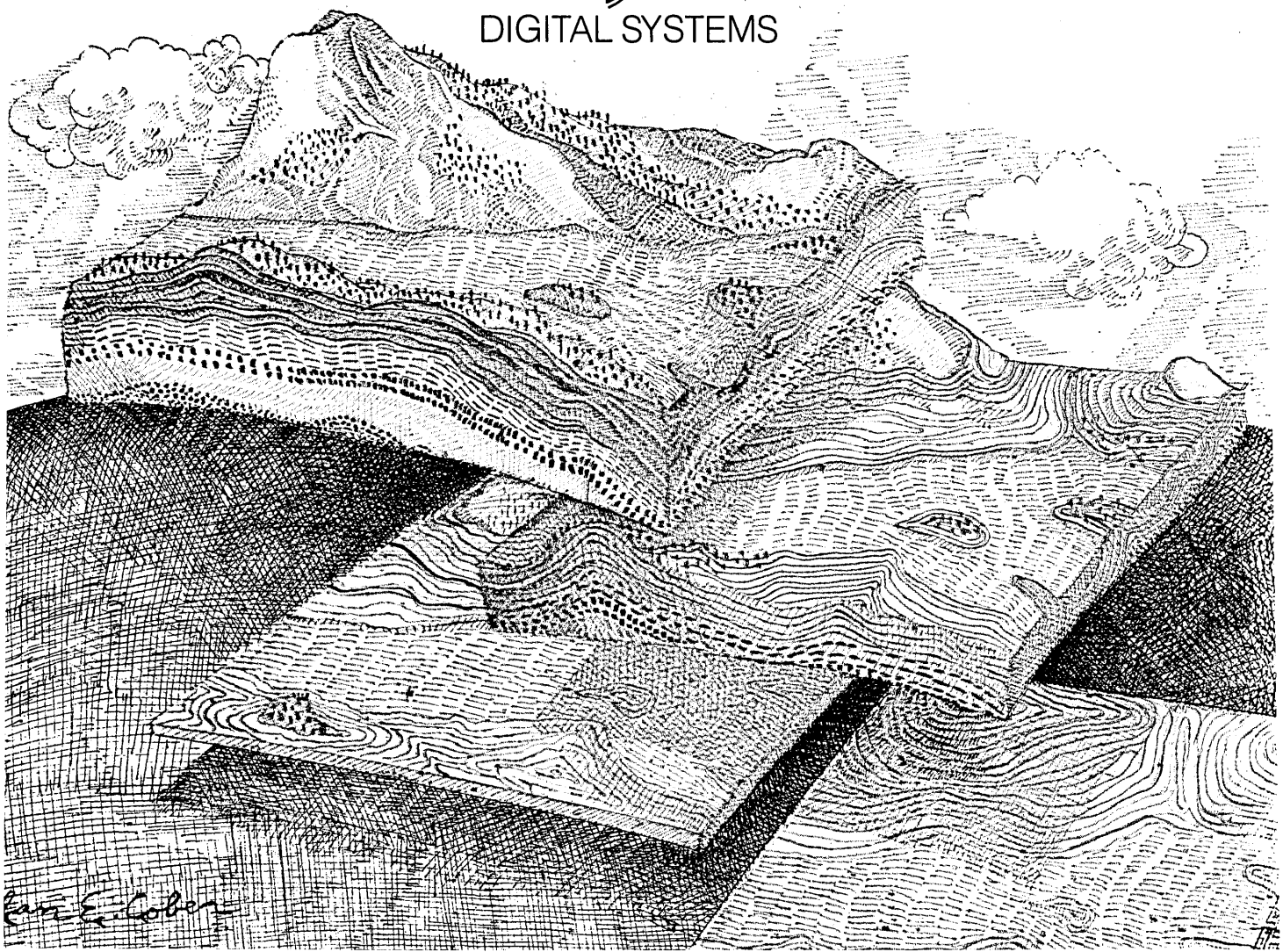


SBS's Celestial Version of "The System is the Solution"

by George M. Dick

By getting the jump on the competition, SBS probably will wind up with the biggest slice of the satellite pie in the sky. Here's their recipe.

One would think with all the commotion that Satellite Business Systems (SBS) is launching the first communications satellite ever. Of course it's not, as evidenced by Domsat, Intelsat, Westar, and others. Well then, perhaps SBS promises radical new technology. Not really: various "new" aspects of the SBS system have, in fact, been tried in previous experimental systems such as NASA's ATS-6 and CTS, as well as later operational Intelsat and military programs.

What is different about the SBS venture is the linking of many technological innovations into a single system, one that provides an integrated service for voice, data, video, and facsimile transfer. The aim is to provide large users with multiple locations in the 48 contiguous states with a total service from portal-to-portal, a one carrier service that handles all internal communications needs.

The all-encompassing nature of the system, coupled with the backing of SBS by IBM and two other corporate giants, Aetna Life Insurance and Comsat, has attracted the attention of practically every observer of the communications scene.

Large corporations and government agencies are interested in the progress of SBS because of potential cost savings and its convenience. Many of these large users now spend millions of dollars per year to lease communications facilities. Competing common carriers are understandably concerned about a telecommunications system that could

cut into revenues from these users. The computer industry is worried that SBS will give IBM more leverage in its domination of the computer field. The Justice Dept. also is concerned with this aspect of IBM's participation.

In the beginning

SBS began in September 1975, with an agreement in principle signed by IBM, Comsat General, and Aetna to carry on the business of CML Satellite Corp. (which was formed originally by Comsat General, MCI, and Lockheed). On Feb. 8, 1977, the FCC authorized SBS to enter the satellite business.

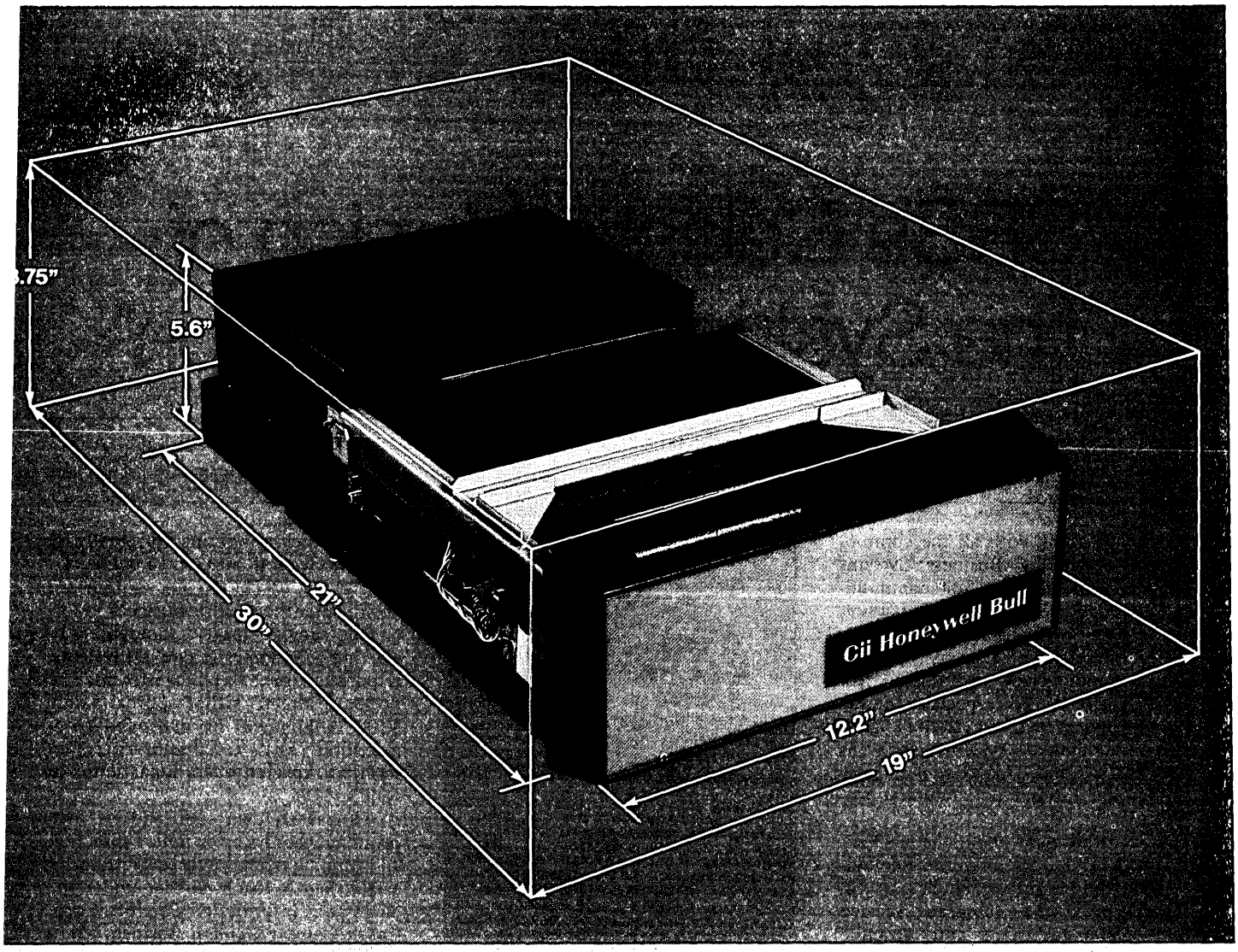
This satellite project, compared to existing U.S. domestic satellite systems, requires a large capital investment. The present estimate is that approximately $300 million will be expended from inception (as CML Satellite Corp.) in 1971 to expected operational status in January 1981.

SBS has its own staff and its own president, but receives policy direction and funding from the three subsidiaries established by each partner under the names of: Information Satellite Corp. (IBM); Comsat General Business Communications Inc.; and Aetna Satellite Communications Inc.

Each of these companies has a different strength to contribute to the SBS venture—one reason, perhaps, for the enthusiasm in the marketplace. Comsat has 15 years of broad and in-depth experience in communication satellite systems, research, and operations. The expertise of IBM in the computer field is well known by even the general public; since the proposed SBS market consists mostly of large corporations, IBM's experience in handling huge amounts of data traffic will be an asset. Aetna's participation should bring a strong business sense. The diversity and volume of communications in the insurance business are substantial; for this reason satellite system usage may prove worthwhile to Aetna in the long run. At present, however, it

This article is part of a report produced for the "Auerbach Data Communications Reports," a monthly updated, three-volume reference service covering hardware, software, services, and regulatory aspects of the data communications industry produced by Auerbach Publishers Inc., 6560 N. Park Drive, Pennsauken, NJ 08109.

New disk drive packs 10 Megabytes in unit one-third the size of conventional drives.



OEMs and systems builders will want to take a hard look at this new D120 MidiDisk drive (the first of a family) that combines large disk state-of-the-art technology in an unusually compact package.

Its performance advances include:

Operating Versatility. Three D120 units can be mounted vertically in a 19-inch rack. A table-top version is available also.

New Midi-Cartridge. The D120 uses a flat, ultra-thin midi cartridge which measures only 11" square, is less than one inch thick, and weighs only 2.8 pounds.

Speed. A fast 920 kilobytes per second. (Densities of 4,750 B.P.I., and 500 T.P.I.)

Accuracy. Data-imbedded, servo-tracking techniques for head positioning eliminate the need for a transducer, thermal compensation, or head alignment techniques. This simplified mechanism rules out any need for preventive maintenance.

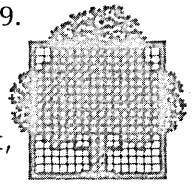
Power Savings. The midi cartridge is self-ventilated (operates at 3600 rpm). No air blower is required. (After startup, total power consumption is only 100 watts.)

Reliability. The spindle is an integral part of the brushless dc motor. There are no belts or pulleys, no electronic/mechanical adjustments to make. And head loading is controlled automatically to prevent damage in the event of a failure.

Available: Controllers for industry-standard microprocessors.

For price and delivery information, contact: **In North America**—Jean-Paul Garodel, Honeywell Information Systems, 200 Smith St. (MS 464), Waltham, Mass. 02154. 617/890-8400, x 2019.

In Europe—Alain Kiffer, Cii Honeywell Bull, 6 Avenue des Usines, 90001 Belfort, France. (84) 228200.



Cii Honeywell Bull

CELESTIAL VERSION

seems that Aetna's entry into the partnership is based primarily on the consideration that it is a good financial venture.

Phase one underway

SBS has begun phase one of its startup program with the leasing of a 4/6 gigahertz* Domsat transponder from RCA Americom for initial testing of a preoperational link between Earth stations on IBM property in Los Gatos, Calif., and Poughkeepsie, N.Y. The second phase will add five additional stations across the U.S. to provide service on a common carrier basis to IBM (for IBM internal usage). SBS will not have its own satellites launched until sometime in 1980. In early 1981 commercial operations will commence with approximately 30 installed Earth stations. It is anticipated that the new system will begin operation six months after completion of the startup program so that the full service would be available in 1981. SBS projects that 375 Earth stations will be installed by the end of 1983. At that point the satellite would be filled to allocated capacity (allowing for 100% redundancy).

Frequency bands

The frequency bands for the SBS satellite are different from those used in the U.S. Domsat and the international Intelsat system. These satellite systems, as well as Canada's present Telsat system, all operate in the four and six GHZ band. SBS has chosen the 11.7 to 12.2 frequency band for satellite to ground transmission and 14.0 to 14.5 GHZ for the ground to satellite transmission.

Some of the advantages of using the

REFLECTORS IN THE SKY

When satellites are used for ground-to-ground communications, it's convenient to visualize them as reflectors in the sky. Indeed, the Echo I satellite was nothing more than a large aluminum-covered balloon, and radio signals literally were bounced off the surface back toward the Earth.

Present day satellites produce the same effect as a bounce or reflection by utilizing transponders. A transponder is a combination receiver-transmitter that acts like a repeater in that it accepts a signal transmitted from the Earth, and then returns that same signal back to the Earth. It is common to utilize different transmission frequencies for the up and down directions to prevent interference between the two directions. This is a concern as the "reflected" signal will reach not only the intended receiver but also the original transmitting antenna (as well as all other antennae within an area of several million square miles).

Because it's easier to hit a stationary target than a moving one, it is desirable that our "reflector in the sky" be suspended by a skyhook. This is accomplished by carefully choosing the satellite orbit speed (which, incidentally, is related to orbit altitude) so that to an observer on the Earth, the satellite will *appear* stationary. That is, the angular orbit speed matches the Earth's rotation. This is known as a geostationary or synchronous orbit. Because of the nature of the Earth's rotation, such an orbit can be achieved only at a point over the equator. Also, for obvious reasons, a satellite with a geostationary orbit cannot be used to transmit information to the other side of the Earth. With an orbit altitude of 23,000 miles around an Earth with a 4,000 mile radius, the theoretical maximum coverage possible is approximately one-third of the Earth's surface. (As a practical matter, the coverage, or "footprint" is substantially less.) When information is to be transmitted beyond the footprint, a satellite "hop" is used: the signal bounced from the satellite is again bounced (by a ground station) to a second satellite which, in turn, sends the signal to a receiving station within the second satellite's foot/print. The ground station used between the two satellites must, of course, lie within an overlapped area of the two footprints.

Satellite antennae can be "omni" or "directional." An omni antenna radiates signals in all directions nearly equally. It is a power-waster in that power is sent to areas where there are no ground stations (such as the middle of oceans or, worse, outer space) and, consequently, a portion of the radiated power is unused. On the other hand, a directional antenna concentrates (or aims) its radiated power toward the geographical areas where it can be used. Because of the usage of the directional antennae, a satellite's footprint is generally *not* the perfect circle on Earth that one would expect. Indeed, the footprint typically does not even include the portion of the Earth directly below the satellite.

Regardless of whether satellites are involved or not, there is an inverse relationship between transmission frequency and antenna size. The mathematics involved in a detailed discussion of antenna theory are beyond the scope of this article. However, the reader may consider an automobile radio antenna. Commercial FM broadcasts are of a much higher frequency than AM broadcasts. FM radios usually are sold with the recommendation that antennae be kept at 30 inches. For a whip antenna, this is the best length for receiving the range of frequencies within commercial FM. An even multiple of 30 (e.g., 60, 120, etc.) would be the worst while an odd multiple (e.g. 90, 150, etc.) would result in the same reception as 30 inches. The important point is that if the length were reduced below 30 inches, reception would continually deteriorate down to zero. Frequencies used for commercial AM radio are about one-one hundredth of those for FM and, consequently, the shortest optimum length antenna would be over 200-feet long. Since very few automobiles have antennae capable of being raised to that height, it is safe to say that: "The higher, the better." (Some readers may recognize the preceding as a statement regarding "quarter-wave length.")

Similar discussion can be applied to dish antennae to determine minimum optimum size. However, dish antennae are designed to provide gain; that, is the antennae actually will enhance the signal power rather than simply "grab" as much as possible. Because of the gain characteristic, it is frequently advisable to utilize the dish equivalent of the "odd-multiple" whip lengths mentioned above. For example, the minimum optimum size may have been determined to be one meter in diameter. However, because of the weak signal strength reaching the antenna, it may be desirable to design an antenna with gain. In that case, we would want a diameter one optimum size larger than the minimum—or two sizes larger—or three sizes, etc. We might choose five meters, seven meters, 10 meters, or even 15 meters.

* 1,000 Hz = 1 KHZ (1 KiloHz)
1,000,000 Hz = 1 MHZ (1 MegaHz)
1,000,000,000 Hz = 1 GHZ (1 GigaHz)

higher frequency band are:

- There is very little use of these frequencies in the terrestrial microwave systems compared to the four and six GHz bands, thereby minimizing the possibility of interference and the problems of acquiring satisfactory Earth station sites.
- Higher antenna gain is achieved with the higher frequencies permitting much smaller antennae; furthermore, the antenna beam widths are narrower, allowing better utilization of the orbital arc. (This concerns itself with satellites operating in the same frequency and the orbital spacing in degrees between them to allow non-interfering operation. Directional antennae can be "focused" better with higher frequencies.)

The use of smaller antennae, for instance, diameters of five or seven meters, has given rise to the notion of rooftop or courtyard antennae placement.

There are disadvantages to higher frequency band operation too, such as: increased signal attenuation (power loss) during heavy rainfalls and, secondarily, the allocated frequency assignment of the same band to the direct broadcast satellite service, for homeowners tv, for instance. WARC (World Administrative Radio Conference) has recommended usage of those frequencies for commercial transmission in the western hemisphere. Present plans allow for satisfactory orbital spacing: however, increased traffic in the future may adversely affect the ability to maintain proper spacing inasmuch as there is a limited amount of room for satellites in the proper orbit for a geostationary satellite.

Redundant equipment will be provided as required and will be switched in automatically in case of failure. The Earth stations will use small diameter parabolic antennae which will be manually pointed at the time of installation. The cost of these small antennae Earth stations has been estimated by SBS at somewhat below $500K. While ground stations can be built for as little as $20,000, the estimate includes the extensive electronics in the satellite communications controller.

Fig. 1 shows the configuration of a typical Earth station which could be housed in a shelter adjacent to a user's building.

Earth station workhorse

The workhorse of the Earth station configuration is the satellite communication controller. The SCC will be implemented using a stored program computer. The principal functions of the SCC are: A/D voice conversion

- Forward error correction coding/ decoding
- Voice activity compression (improves efficiency of available power)
- Signaling and call processing
- Multiplexing
- Echo suppression
- Formatting, framing/synchronizing
- Multiple access control (satellite access determination)
- Demand assignment control (priority determination)

The total capacity allocated to a customer network will be divided among the Earth stations in that network in accordance with the demand assignment algorithm stored in the SCC. The division of capacity will be done automatically in response to real-time demand at each Earth station. Also available will be a pooled capacity feature to be used when the customer's traffic demand exceeds 448KB.

All transmissions via the SBS system will be in digital form. The digitizing of analog voice signals will be accomplished within the SBS Earth station so that the user need not concern himself with this aspect. The decision to use purely digital transmission is due in part to the use of time division multiple access, a technique allowing the Earth stations shared use of the satellite transponder. Each Earth station has a periodic window for transmitting a burst of bits to a receiving Earth station with a time-coincident window. That is, a transmitting station has predefined time intervals for access to the satellite. A receiving station must have the same access intervals (after accounting for propagation delay).

These burst periods occur so frequently that, as far as the user is concerned, information flows in a continuous stream from source to sink. Time division is currently the most favored multiplexing technique because of its superior noise and capacity performance over other techniques such as frequency division. SBS also has decided to use demand assignment, which varies transmission burst periods in accordance with user traffic flow and connectivity requirements. Either centralized or decentralized routing control centers are possible to achieve demand assignment. SBS has implied that the most likely approach will be for decentralized routing control (in the SCC's).

Tentative location for telemetry, tracking, and command Earth stations are Franklin Lakes, N.J., and Agoura, Calif. The satellite link from these stations will be extended terrestrially to a satellite control facility responsible for monitoring the status and health of the satellites.

(Continued on page 155)

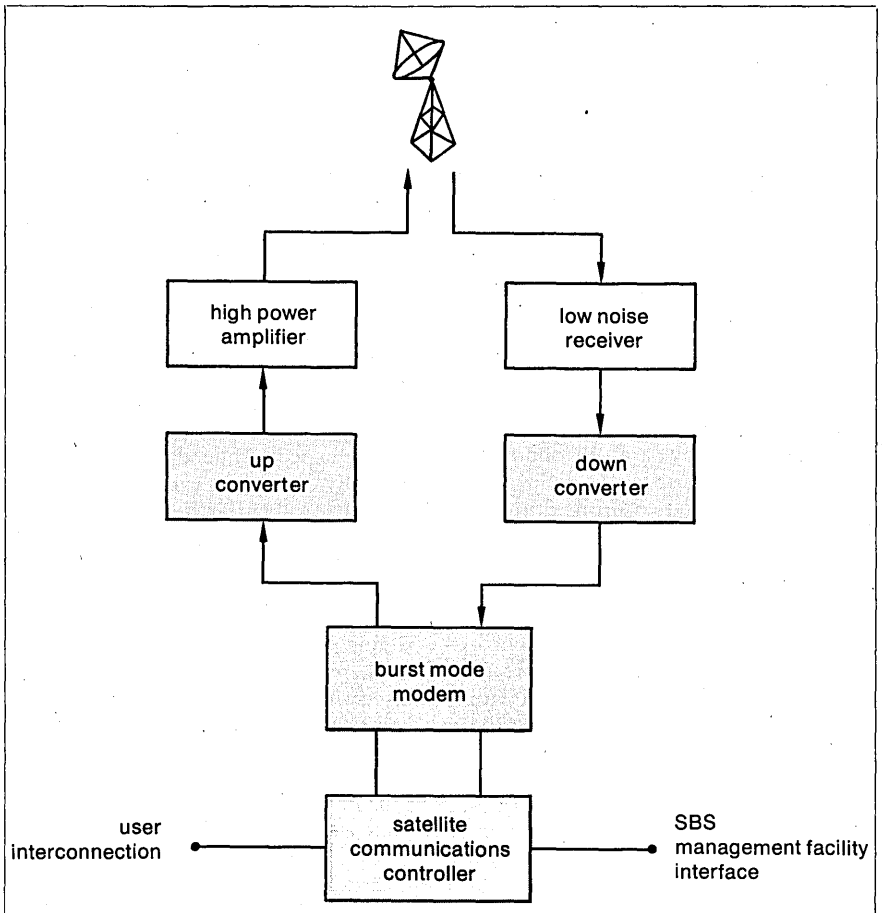


Fig. 1. Typical Earth station configuration

Hewlett-Packard
Computer Advances
Vol 2 No 4 November 1977

SOS-
are longer a
blue sky theory

HP 2240
a computer
conserver

Hard copy
made easy

The megabyte
comparator

SOS - a blue sky theory comes down to earth

Five years ago, Hewlett-Packard established its silicon-on-sapphire technology laboratory in Cupertino, California. This investment was prompted by a recognition of the customer benefits to be gained in our products from a CMOS/SOS (complementary Metal-Oxide Semiconductor, Silicon-On-Sapphire) process.

With sapphire, a non-conductive material, we can achieve superior dielectric isolation which enables high speeds and close packing of circuits. We are also able to eliminate parasitic capacitance.

For example, our Phi chip, with an area of 28mm^2, contains 8,000 transistors. Phi serves as a single chip interface between any microprocessor bus and the HP-IB;* and runs at speeds up to one megahertz while typically consuming only 300 milliwatts. Low power consumption is another SOS charactertistic.

Much of our effort during these years has been in establishing reliability and producibility. HP has recently introduced three new products that use several types of CMOS/SOS chips...

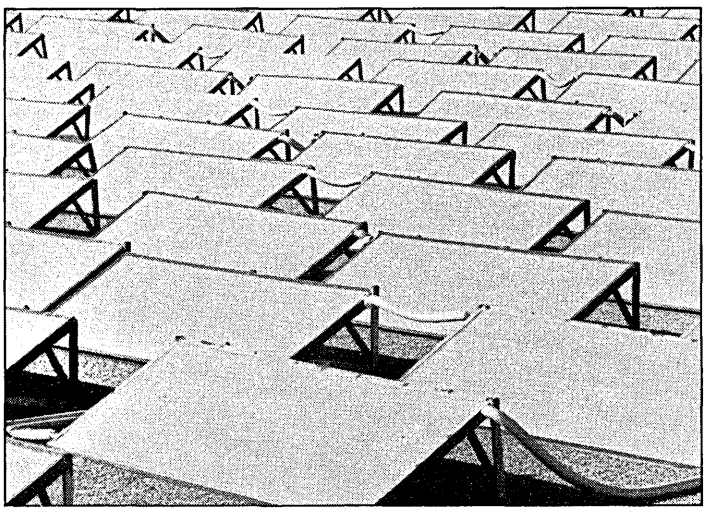
◀ *Cover*
There is an average of 200 dies on one of our three inch SOS wafers. The process of separating them into individual chips is similar to that of glass cutting, but as sapphire and diamonds are nearly neighbors on Mohs Hardness Scale, it is not possible to score the wafers with any diamond cutter. Only a laser scriber, whose power reaches far into the deep infra-red, can melt and evaporate the sapphire in preparation for mechanically breaking the chips apart.

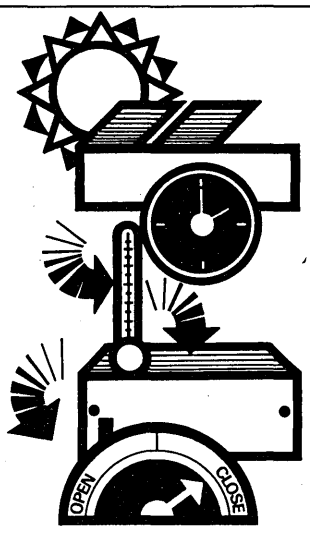
With SOS, the HP2240 is a computer conserver

The HP 2240 processor is HP's first measurement and control subsystem based on SOS technology. It simplifies product testing and real-time data acquisition, monitoring, and control; and can be used with 21MX-based systems, HP 1000 computer systems, or HP 9800 series desktop computers. The HP 2240 can also operate remotely with the HP 3070 data collection terminal or over telephone lines with HP's common carrier interface.

Built-in intelligence

Microprocessor-based intelligence makes testing easier and less expen-





One-line program
WU,600,000 AI,3,2,10, A0,4,3,1,50!

Time WU, 600,000
Wait until the 2240A elapsed time clock reaches 600 seconds, 0 milliseconds, which is ten minutes.

Measure AI,3,2,10
Input 10 sequential analog readings from the temperature sensor on channels 2 through 11 of card 3.

Control A0,4,3,1,50!
Output 1 analog voltage to to the hot air damper to close it 50%.

Solar heating is just one application that can be automated with HP's new measurement/control processor. For example the HP 2240 can **measure** room temperature at specified intervals—every ten minutes, for example—and **control** that temperature by regulating heat transfer from the system's solar panels. This is accomplished by three simple statements from the HP 2240's extensive set of high level commands. A similar solar panel-to-hot water heat transfer system was initiated by employees at HP's Sunnyvale, California site and has been running successfully for the past four years.

sive than with previous systems. With HP's Micro-CPU Chip as its heart, this processor executes critical real-time tasks that previously had to be handled by the computer. This frees the computer to do more appropriate tasks.

High speed, low power

SOS technology allows the HP 2240 to gather, store, and correct measurements at a fast 20,000-per-second rate. Yet this impressive performance is possible with a minimal amount of power — the HP 2240 draws no more current than a 150 watt lightbulb.

Easy as one, two, three

Microprocessor control couples with the Hewlett-Packard Interface Bus (HP-IB*) capability and can make an HP 2240 system operational within hours, in three easy steps.

First, you interface the HP 2240 to the computer via a single HP-IB cable; second, connect the HP 2240 to your sensors or controls via one of a large assortment of measurement/control cards; and third, instruct the HP 2240 to perform the real-time task with the aid of a simple, one-line program.

Two in one

The HP 2240 has the ability to measure and control both analog and digital signals, thus lowering automation costs in manufacturing and

Continued on page 5

*HP's implementation of IEEE Standard 488-1975 "Digital Interface for Programmable Instrumentation," and identical ANSI Standard MC 1.1.

Hard copy made easy with SOS-the HP 2631/2635

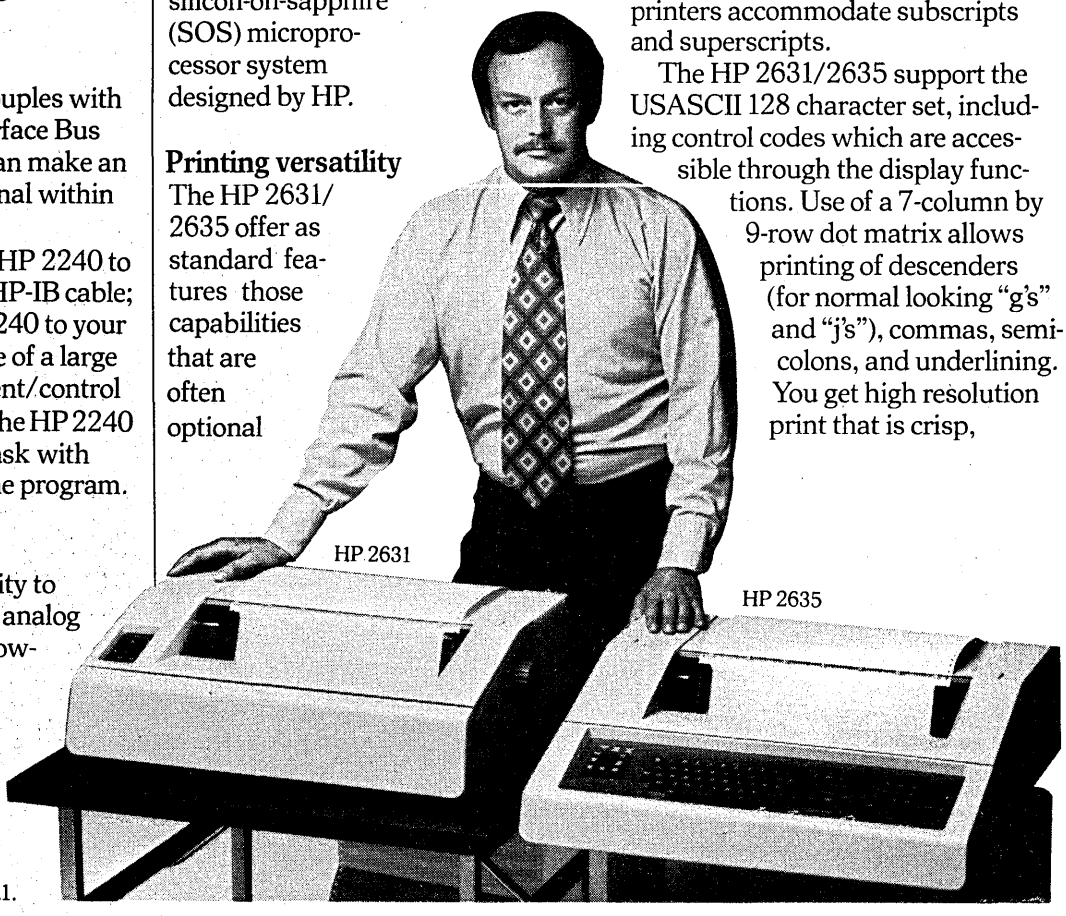
The new line of HP 2630 serial printers has just been announced. The HP 2631 is designed for environments requiring a low-cost, high performance printer. The HP 2635, the same high throughput printer with a keyboard, is suited to interactive environments. These printers operate at 180 characters per second (cps.)

Both printers are controlled by a silicon-on-sapphire (SOS) microprocessor system designed by HP.

Printing versatility

The HP 2631/2635 offer as standard features those capabilities that are often optional on other printers. For example, there are three print modes — normal (10 characters per inch), expanded (5 characters per inch) for titles and headings, and compressed (16.7 characters per inch). Compressed mode, an economical paper saver, allows you to generate reports in 8½ by 11 inch format with 132 characters per line, and to pack 227 characters per line on standard-sized computer paper. These three print modes can be intermixed on a single line. Lines can be spaced at vertical pitches of 1, 2, 3, 4, 6, 8, or 12 lines per inch, so the printers accommodate subscripts and superscripts.

The HP 2631/2635 support the USASCII 128 character set, including control codes which are accessible through the display functions. Use of a 7-column by 9-row dot matrix allows printing of descenders (for normal looking "g's" and "j's"), commas, semicolons, and underlining. You get high resolution print that is crisp,

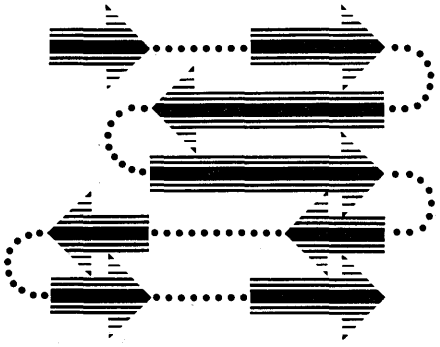


clear, and readable—even on the sixth sheet of a multiple-part form.

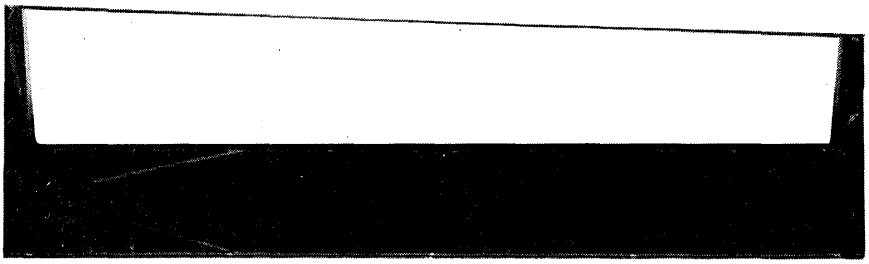
The HP 2631 is bilingual, supporting two full character sets (one standard, one optional), and can intermix the two on any one line. Alternate sets so far include Swedish/Finnish, Spanish, French, German, Norwegian/Danish, and British.

High throughput

Consider the path taken by the print head. It is bi-directional, fast, and determined by a "smart printing" algorithm that selects the optimal path and speed. By the time one line is printed, the next several lines have been processed and stored in a buffer. Leading and trailing spaces have been detected and ignored—the head moves directly to the first character of the next line to be printed. When ten or more adjacent spaces have been detected within a line, the head speeds to the next printable character at an accelerated rate of 450 cps, a major time-saver when printing tabular data.



The HP 2631/2635 choose the most efficient direction (left-to-right or right-to-left) for the print head to move. Smart, bi-directional printing can increase throughput as much as 50%.



A sixty yard, inky, mobius strip has been packed into this cartridge for quick, convenient, and clean insertion into the HP 2631/2635 printers.

Design and mechanical simplicity

The HP 2631/2635 are simple and modular in design, removing some of the hassle and cost often associated with printer ownership. The number of mechanical parts has been reduced to lessen the probability of breaking down and wearing out. One servo-motor, for example, drives both the print head and ribbon cartridge. To improve serviceability, boards plug in and pull out quickly. Loosen only six screws to ready the printer for repair.

Trouble-free ownership

Both printers are adjustment free. The chassis is factory-adjusted and "sealed" for life. The nine-wire, ballistic, print head is a simple, dynamic system which self-aligns and can be easily replaced.

The printers are clean—you'll never touch an oil can again since key moving surfaces are a teflon-based material. When changing the ribbon cartridge, you'll never touch the inky fabric.

The inexpensive, trouble-free cartridge ribbon also shows the designers' concern for mechanical reliability. The cartridge employs a mobius loop, which allows full surface use of the ribbon and ensures that printing is always on a fresh part of the ribbon. The ribbon normally needs changing only after 10 million characters. The print head is also conservatively rated at 100 million characters.

The HP 2630 family is designed with user convenience in mind. Additional features include a self-test capability that assures you the printer is operational. Pedestal and desk-top versions blend into office environments.

Mechanical simplicity, long-life parts, and no adjustment—all contribute to ease of use and low cost of ownership.

These printers are ideal output and/or input devices for HP and other computers, calculators and CRT terminals. Interfacing is via RS232 (CCITT V.24) and 20mA current loop options on the HP 2631/2635, plus differential I/O, 8-bit parallel TTL, and HP-IB* options on the HP 2631.

The U.S. price for the HP 2631 printer is $3150 and $3450 for the HP 2635 printing terminal. OEM discounts are available.

It is difficult to reproduce here the quality print produced by these printers. **Request a live demonstration or more information by checking "B" on the reply card.**

*The Hewlett-Packard Interface Bus (HP-IB) is Hewlett-Packard's implementation of IEEE Standard 488-1975, "Digital Interface for Programmable Instrumentation."

A million-in-one

Continued from page 2

engineering. Typical industrial applications range from monitoring offshore oil drilling to counting and routing wine bottles.

Decouple and delegate

The HP 2240 has the innovative ability to decouple automation tasks from the computer. Timing, scanning, event synchronization, formatting, and interrupt tasks can all be delegated to the HP 2240.

One-line programs

An extensive set of high-level measurement/control commands is another innovation. Users delegate tasks with one simple program statement. Requests to perform a task are generated by write or print statements in familiar BASIC, FORTRAN, HP Assembly, or HPL languages, as shown on page 2. The HP 2240 stores the instructions in memory and executes them in sequence, without further computer interaction.

Self-test

Part of the HP 2240 microprocessor design is self-test. Built-in ROMs and a separate self-test fixture allow users to run off-line diagnostics. This feature can lower repair costs and speed installation.

The HP 2240, with a typical mix of analog and digital I/O cards, costs about $6,000. High performance automated test systems based on the HP 2240 range from $10,000 to $27,600. Volume discounts are available. (U.S. prices only.) **Check A for details.**

A million bytes in one small box. That's how much memory Hewlett-Packard now packs in the "megabyte computer"—one million bytes of "fault control" memory in a 12¼ inch high HP 21MX package for only five cents a byte. Through the use of a memory extender, memory capacity for HP 21MX systems can be increased even further to a total of 1.8 megabytes.

Increased density was made possible by a new 128k byte memory module based on 16K-bit, N-Channel, MOS/RAM memory chips—the first in use by a major manufacturer of small computers.

Better throughput

The expanded memory system is especially suitable for real-time, multiprogramming applications where high throughput is critical; for example, high-speed data acquisition and process control. With a megabyte or more of programs resident in memory, the delays inherent in swapping to and from a disc are eliminated.

HP gives you a bit more

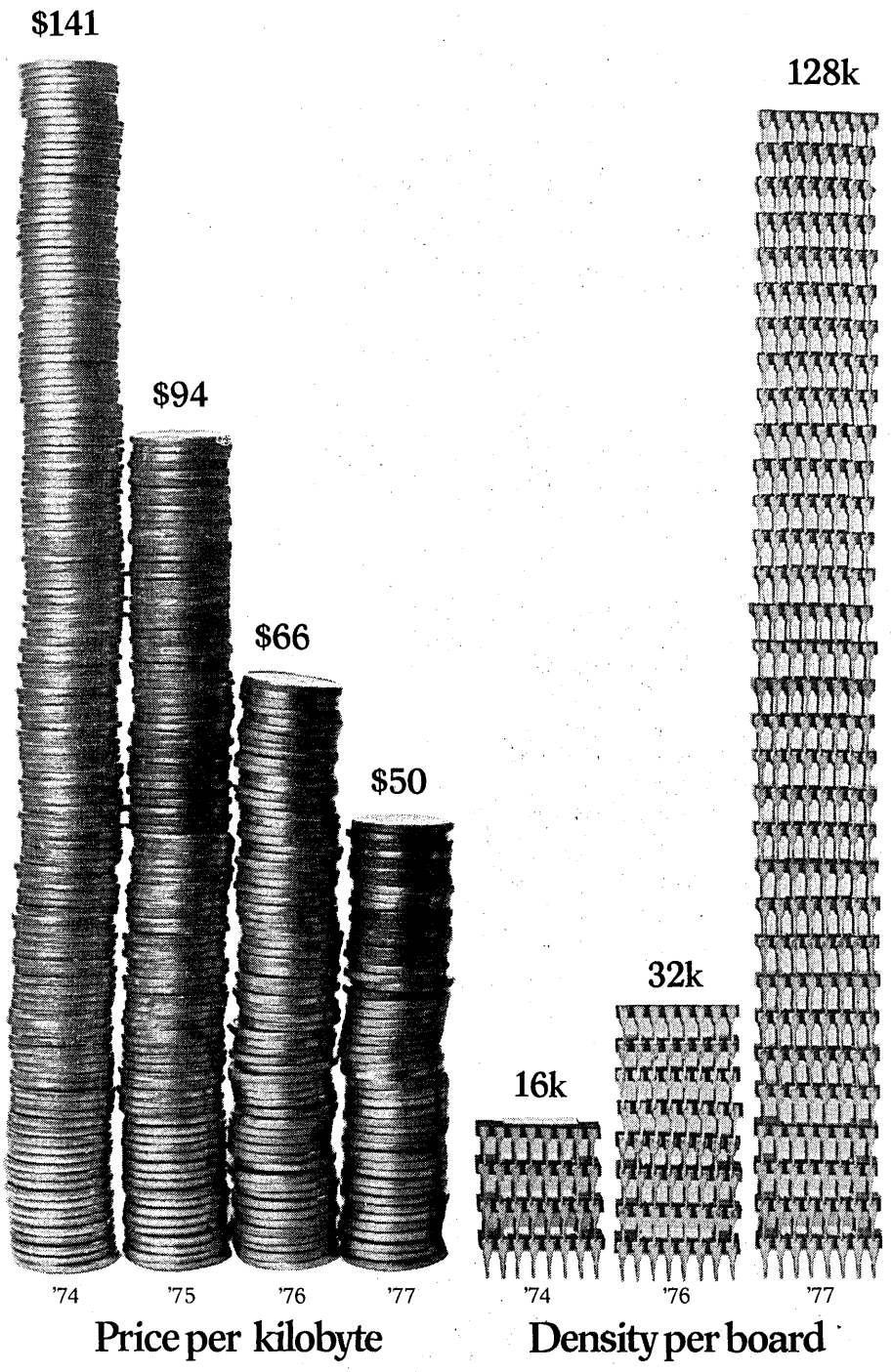
The increasing popularity of large memories in small computers makes

The "megabyte computer" and the 128k byte memory module—Hewlett-Packard's latest high-capacity memory packs one megabyte of "fault-control" memory in a compact 12¼ inch high HP 21MX mainframe—all for only 5 cents a byte.

memory reliability a major contributor to overall system reliability. Recognizing this, Hewlett-Packard also introduced a new "fault control" capability, which provides for detection and correction of all single bit memory errors. This is accomplished through use of a standard 21-bit Hamming code. But, HP goes one bit further.

There is always the remote chance of a double bit error. We added a 22nd parity bit to the Hamming code, enabling us to detect all double bit errors. Programs will continue running and data will be protected even if a memory chip malfunctions.

The new "fault control" system is expected to provide a significant improvement in Mean Time Between Failure (MTBF) of basic HP 21MX memory modules. This is especially important to large memory systems. For example, we would expect an MTBF of roughly one year, without the probability of a failure on the "megabyte computer." Memory stays operational so maintenance can be performed on a scheduled rather than emergency basis.



Since Hewlett Packard's early commitment to semiconductor memory, we have been able to bring customers memory price decreases at an average of 30% a year, and memory density that has gone up and up. The most recent HP 21MX memory system using 16k RAMs quadruples memory board capacity from 32k to 128k bytes.

When there's dirt in the air...
Memory-based systems, as you will read in the next article, can tolerate "unfriendly" environments. Such systems are excellent for remote, unattended locations where reliability is critical; for example, on offshore oil platforms, on shipboard, or in planes. The go anywhere, "megabyte computer" is ready to work without the need of air conditioning, elevated floor, or lots of space.

A nickle a byte
Density and reliability are not the only advantages of semiconductor memory. Cost savings is another. The new 128k byte memory module is priced at $6,400 (U.S. prices only)—just five cents a byte. "Fault control" memory is optional and available as a controller and associated check bit arrays. Existing HP 21MX customers can easily upgrade to larger memories.

More information on HP's large memory system is available. **Just respond to C on the reply card.**

Think big, even if you start small

With RTE-M, Hewlett-Packard's new real-time operating system, you can use big memories. RTE-M, software for HP 1000 and 21MX computers, can handle HP's memories up to 1.8 million bytes. But, you can start a system with as little as 32k bytes of memory.

M is for memory

RTE-M is memory-based, which ensures extremely rapid response time, within hundreds of microseconds. All system software and user programs are resident in main memory where they are instantaneously available for execution. There are no time delays caused by transferring programs in and out of main memory.

Good response time is further assured by a user-defined, flexible scheme for assigning priorities. Tasks are executed according to their specified priority as computer time becomes available. A time-critical program is guaranteed full and immediate computer attention and is run at optimum speed.

Flexibility further distinguishes RTE-M: it comes in three modular versions. Each customer chooses the tailored version that best matches his or her requirements. There's no hardware and software overhead.

The simplest system configuration supports a single terminal with 32k to 64k bytes of main memory. Intermediate systems support multiple terminals, 48 to 64k bytes of memory, and full real-time, multiprogramming. The high-capacity system offers all the features of the above two, can manage up to 1.8 megabytes of memory, and interacts concurrently in BASIC, HP Assembly, or FORTRAN. A dual density flexible disc is also available.

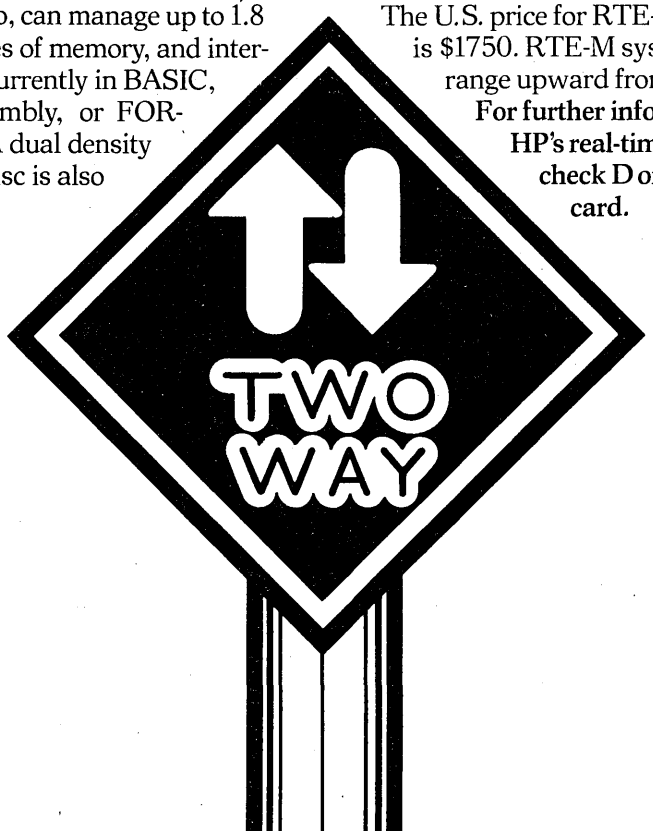
A two way street

All members of HP's RTE family—RTE-M, and disc-based RTE-II and III—are compatible. RTE designers went to great lengths to ensure that in terms of the programmers' and operators' interface-system prompts, operator commands, programmatic calls, and error messages are identical for all versions of RTE.

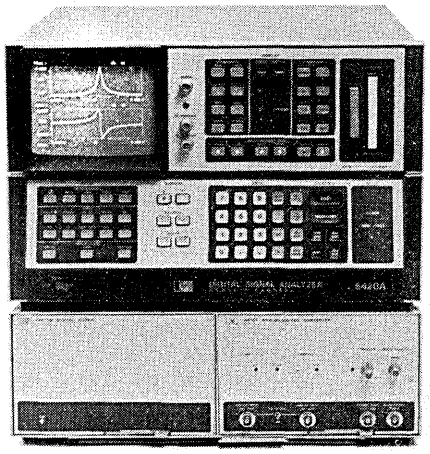
Program statements of the operating system and the file manager are alike; program transportability is assured within the three RTE-M versions. Transporting programs, in either direction, between RTE-M, RTE II, or III requires only minor, if any, changes. It is like a two way street. Upgrading is simple, as is adding multiple small systems supported by a larger program development system.

The U.S. price for RTE-M software is $1750. RTE-M systems range upward from $21,000.

For further information on HP's real-time systems, check D on the reply card.



New & Noteworthy



Can you find the computer in this photograph?

21MX K-Series computer components are being "buried" alive at HP

The Santa Clara, California instrument division integrates the K-Series into its own products because the "K" offers the high processing power and microprogramming capability of 21MX computers in component form, on a single, low-cost board.

The K-Series is at the heart of the HP 5420 digital signal analyzer, which accurately measures signals associated with noise and vibration. HP 5420 applications include analyzing the dynamics of structures from bridges to automobile frames, measuring spacecraft noise levels, and studying aircraft wing vibrations.

With K-Series intelligence, the HP 5420 is totally interactive, allowing users to set up, display, and control all measurements from a clearly defined set of front panel keys. During measurement set up, for example, operators press a key and a menu appears on the screen, listing all possible measurement functions. This assists even inexperienced operators in making the correct measurement selection. Operators spend less time setting up a measurement, and more time analyzing results.

The HP 5420 performs three basic tasks in every measurement application, as described below. Embedded in the HP 5420, the "K" provides the speed, power, and flexibility necessary to accomplish them.

Task one

Sample one or more analog signals and convert them to digital signals.

High direct memory access rates are essential in performing these analog-to-digital conversions. The K-Series is a high-performance, 16 bit minicomputer with a 650 nanosecond cycle time—many times faster than traditional microprocessors. Also, the "K" board's flexibility makes it easy for OEM's to add an extended arithmetic processor board for even faster data manipulation.

Task two

Compute the desired measurements on the signals and store them in memory.

The advanced algorithms critical to these measurements require speed, memory, and computational capability well beyond a simple microprocessor... or even most minicomputers. The "K" board contains a full 24 bit microprocessor with which OEM designers can easily microcode specialized routines into read-only memory, where they can be permanently stored.

Task three

Display results on the CRT screen, plot, or process them further.

Because of the computational capability of the "K," measurement results are shown simultaneously, while the analyzer is still performing fast data acquisition. Further analysis is provided using preprogrammed post-measurement operation, and results can be stored on a removable tape cartridge.

The HP 5420 digital signal analyzer is priced at $29,900. The 21MX K-Series board costs $1475 and can be volume-discounted. (U.S. prices only). **Check E and F on the card if you wish more information.**

Get your HP1000 off to a fast start with RPL

Finally, it's as easy to turn your computer on in the morning and off at night as it is to flip the light switch in your office.

HP 1000 computer systems now have a standard remote program load (RPL) capability which lets users automatically "boot-up" their systems by simply pressing "power-on."

RPL/Auto Boot-Up loads and starts the operating system, and allows complete reloading of user software from disc, magnetic tape, or over a communication line into memory—without once touching the computer's front panel.

With RPL, customers can also develop their own applications for start-up of remote, unattended systems, valuable in distributed processing. **Check G on the reply card for more information.**

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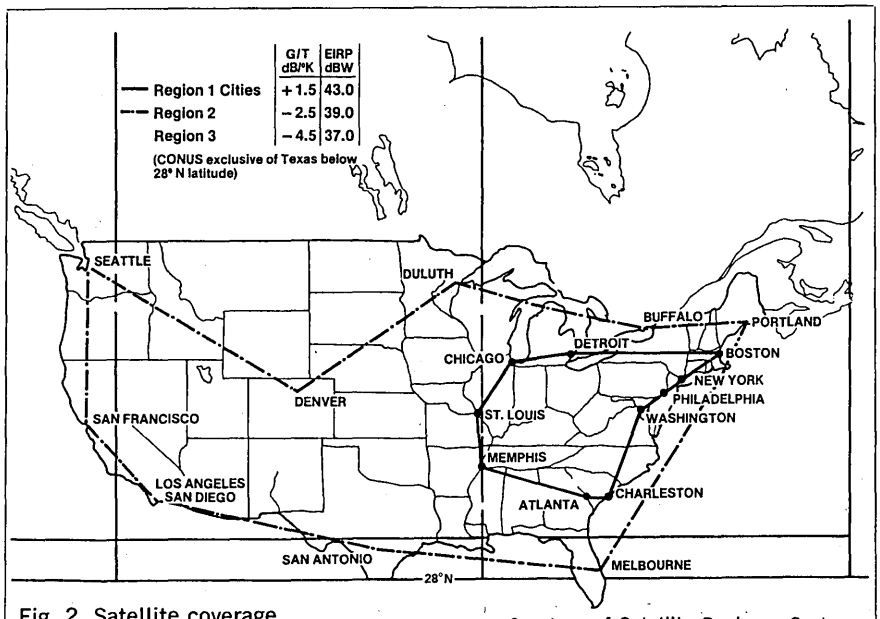

Fig. 2. Satellite coverage

Courtesy of Satellite Business Systems

Monitor and control

The System Management Facility, with a dual processing system as its central element, will monitor and control system performance of the overall SBS system operation. The management facility will be able to communicate with all Earth stations via a satellite link. Management facility functions will include collection of system performance and traffic data, allocation of satellite capacity pool, and changes in system configuration and billing for various services, and will be located on SBS property.

The two SBS satellites will have geostationary orbits. (Geostationary orbit is when the satellite appears to be at a fixed position relative to a point on the earth.) Each satellite will carry ten transponder channels. The power output of each transponder will be 20 watts and will have usable bandwidth of 43MHz. The data carrying capacity of each transponder is 41 Mbps for a total capacity of 410 Mbps per satellite. (It is important to note that these are one-way capacity capabilities.) The two satellites will provide coverage of the contiguous 48 states (See Fig. 2) from the requested SBS orbital locations at 122° west longitude and 110° west longitude. (Over the Pacific Ocean, 2,000 miles and 1,500 miles due west of Ecuador, respectively.) SBS is taking a very conservative approach by assigning only half of each satellite capacity; if one satellite fails all traffic can be carried by the other satellite.

The Earth stations, designed to operate unattended, are to be owned and operated by SBS. A user will communicate through his network by connecting to access ports on the Satellite Communication Controller through a phone system. A customer will be able to interface various end devices to the SCC such as PABX's, low speed data modems, synchronous digital data sets, and various analog sources including facsimile and video. Table 1 lists the typical interfaces for data proposed by SBS. It should be noted that SBS service can be extended by the users to remote locations by acquiring terrestrial circuits from other common carriers. The coverage pattern of the satellite favors the Mid-Atlantic states, the Southeast as far south as Florida, and the Midwest as far west as Kansas City. (See Fig. 3.) In this area, called region one, Earth stations typically will be equipped with five-meter parabolic antennae. Most of the rest of the

TYPES	RATES	SBS Interface
Low Speed	600, 1200, 2400 bps	Voice grade modem line signal into voice port
Low Speed	2.4, 4.8, 9.6, 19.2 Kbps	EIA RS232C or CCITT X4
Medium Speed	56, 122, 224, 448, 996 Kbps	CCITT V35 or X21
High Speed	1.344, 1.536, 1.544, 6.312 Mbps	CCITT V35 or X21

Table 1. SBS data channel interfaces

United States is in regions two and three and will require seven or 10 meter parabolic antennas. The division of the country into regions is based on the fact that signal strength is not uniform throughout the satellites' footprints combined with varying weather patterns. The five or seven meter selection in region two and the seven or 10 meter selection in region three will be based on local weather conditions and service requirements.

The link performance objective is stated in terms of bit error rate and corresponding availability at that rate. Accordingly, a channel bit error rate of one error or less in a million bits will be achieved 95% of the time, and one error or less in ten thousand bits will be achieved 99.5% of the time. For customers who require superior error performance, SBS will apply forward error correction so that one error or less in ten million bits will be achieved 99.5% of the time.

Heavenly problems

Satellite communications present problems not found on Earth. We now must become concerned with such exotic-sounding terms as solar noise activity and eclipses. SBS customers can minimize the effects of solar noise activity by securing optional dual antennae. These can be two co-located antennae for two-satellite accessibility or two antennae several miles apart accessing the same satellite. SBS engineering indicated that such a solution would be cost-effective only for the most critical operations inasmuch as solar activity becomes a severe problem only when the sun, the satellite, and the ground station are in line with each other. These occurrences are predictable, infrequent, and of short duration. All satellites depend on a minimum percentage of time in sunlight in order to keep the batteries properly charged (through solar cells). These percentages will, of course, vary depending on the application and orbit of each individual satellite. An eclipse, therefore, causes a satellite to be temporarily under-powered. The SBS satellites orginally were designed to provide sufficient power to one-half the transponders during an eclipse. Customers ordering priorities would have been routed through these transponders; SBS now claims that the satellites have been redesigned so that all transponders will function during an eclipse.

Potential competition

It looks like SBS has a jump on the other carriers with on-premises small aperture Earth stations, but it would be very surprising if AT&T doesn't have a counter-strategy. The AT&T/GT&E Comstar will be allowed to carry private network traffic by 1979. It also is quite possible that Western Union and RCA Americom will provide competitive and equally innovative satellite systems in the early 1980s.

It can be gathered from the SBS press releases that the intended strength of the system is the provision of transmission channels that are as transparent as possible to the user, and the assurance that acceptable interfaces will be in conformity with national and international standards. These features will no doubt be put to the test as the competition heats up between satellite systems vendors and terrestrial carriers. They will be vying for large users such as the *Fortune* 500 corporations and government agencies who spend millions of

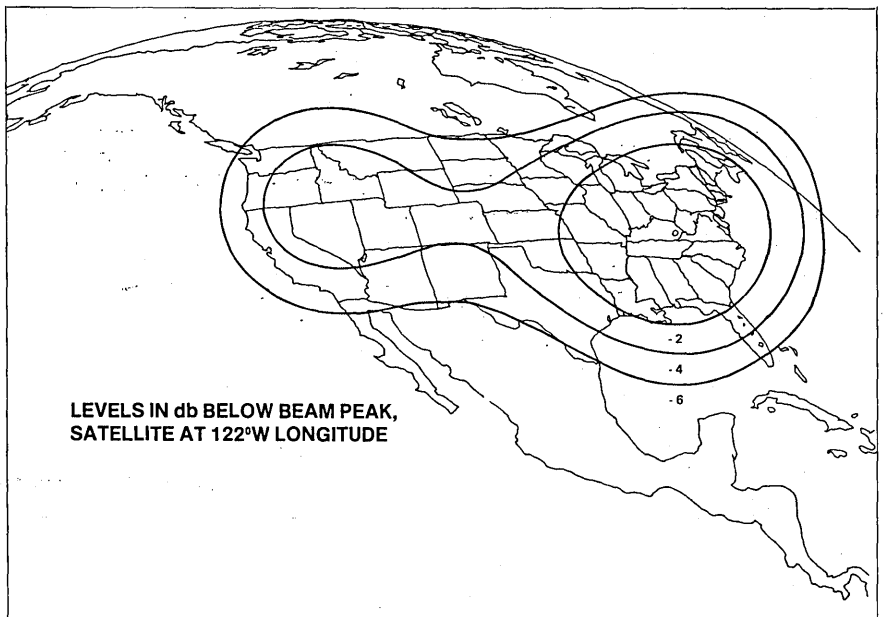

Fig. 3. Representative coverage pattern Courtesy of Satellite Business Systems

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With Comprehensive Software

There's much more than just hardware, too. You get a comprehensive Diskette Operating System with a utility library including sort, index and index sequential access method (ISAM), a data entry language (DATAFORM®), a data processing language (DATABUS®). Like all Datapoint systems there's a common, dynamic file structure. No time consuming file format conversion necessary. You start writing application programs immediately.

Easy Concurrent Communications or Printing

The 1500 will communicate in IBM 3780 discipline, or DATAPOLL® for Datapoint-to-Datapoint communications. Auto-answer is standard. You needn't halt an ongoing data entry operation to communicate — with the 1500 you can communicate while an operator continues to enter or process data. Or, you can elect to do concurrent printing on an optional Freedom Printer™.

More Features — And a Growth Path

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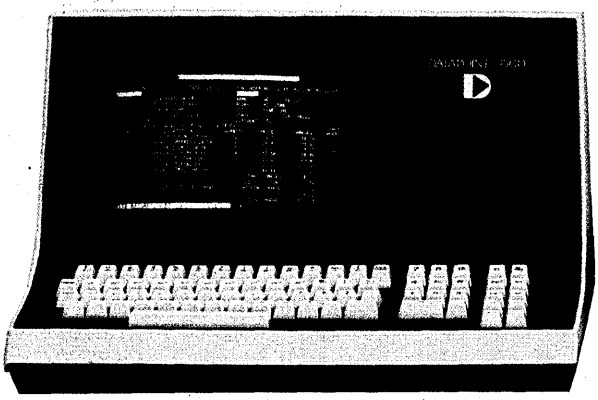

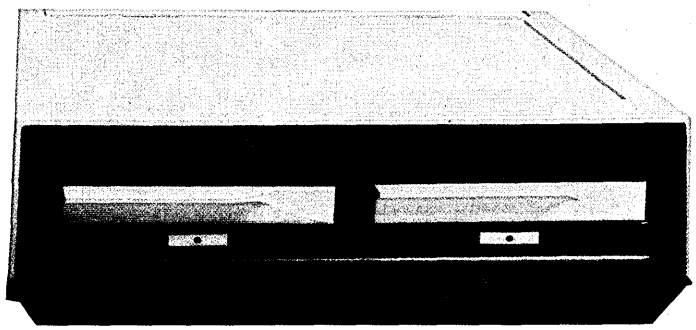

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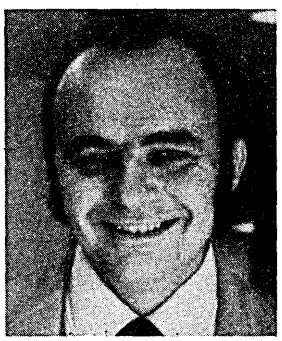
Clouds in the sky

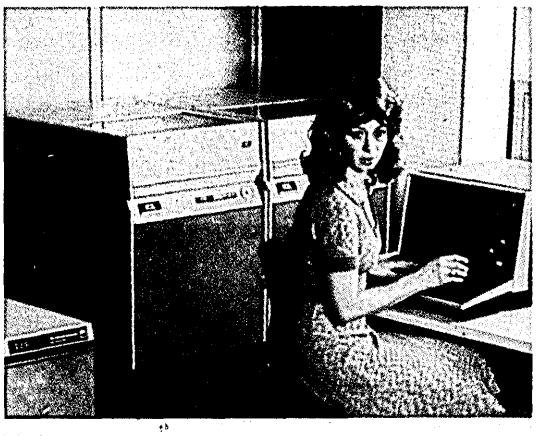
The SBS game plan certainly sounds impressive, and, considering the triumvirate behind SBS, appears formidable. But we may have an irresistible force meeting an immovable object. The United States government (Justice Dept.) has filed a brief attacking the FCC's favorable SBS decisions. The Federal Trade Commission has supported the Justice position as a friend of the court. Not surprisingly, American Satellite Corp. (and its parent firm, Fairchild Industries, Inc.), Western Union Telegraph Co., and American Telephone and Telegraph Co., also have joined the court action in opposition to SBS. An earlier brief was filed by the Computer and Communications Industry Assn. Other organizations, such as the United States Independent Telephone Assn., while not having a formal position regarding SBS per se, do, in general, oppose all specialized carriers. The outcome could range from a total victory for SBS, a total defeat, or some middle ground, such as a watered-down version of the present SBS intentions.

One thing is certain: resolution of the conflict will take time—valuable time. This lost time will certainly hurt SBS. Even if a total victory is achieved in the courts, other carriers (both existing carriers and newcomers) will have had an opportunity to steal some of SBS's thunder. ❋



Now employed by Auerbach Publishers Inc., Mr. Dick is responsible for preparing reports on communications testing and for developing plans for seminars on that subject for Auerbach subscribers. Prior to joining the company, he was employed by Datran, where he was responsible for providing technical support to field engineers in six states.

His earlier experience was with INA Corp., where he was responsible for maintaining a large network, and in the aerospace industry (RCA, Boeing, and NASA) where he worked in hardware evaluation.



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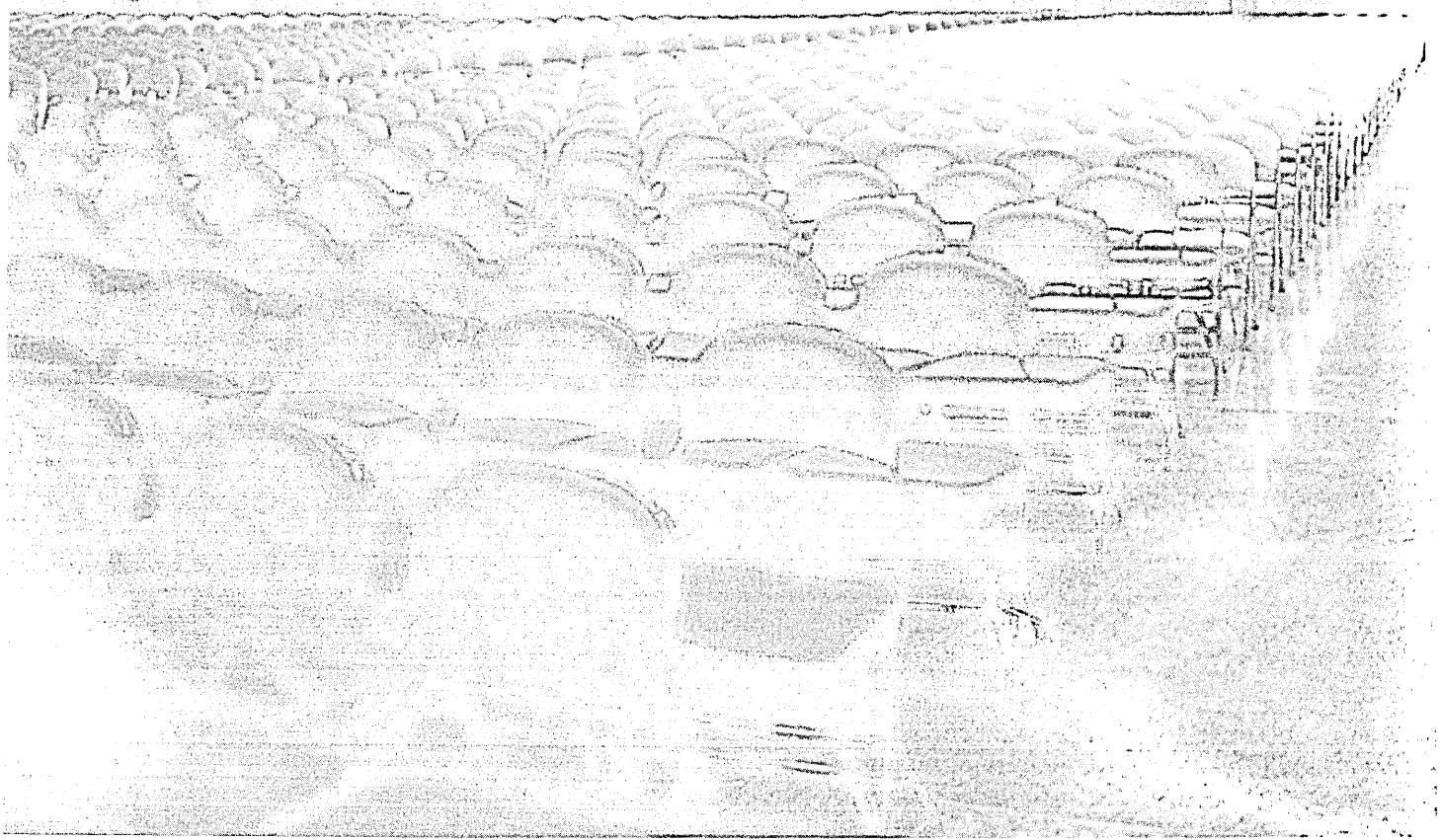

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CIRCLE 10 ON INQUIRY CARD

Horace Builds a Cycle

by Joseph L. Podolsky

The problem with the classical development cycle is that it assumes things will be built only once, and that is in conflict with the real world.

"That blasted development cycle is wrong! That's the problem!" shouted Horace Heuristic, MIS manager for the Potent Toy Manufacturing Co. as he leaped from his chair.

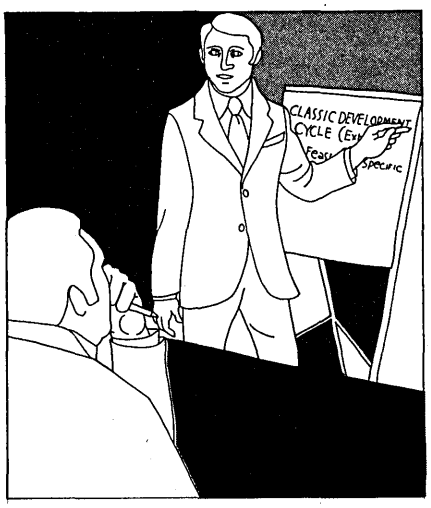
Ina Interface, the department secretary, technical assistant, and programmer trainee, peered into the doorway of Horace's office and smiled tolerantly at her boss. "You look like you were hit by a real flash," she observed sarcastically.

Horace was rummaging wildly among papers and books on the table behind his desk. "It's all right here," he exclaimed. "It's here in Brooks' book and Ross' article, and Weinberg had the idea way back in 1972. Yet, for all of that, I just plain missed the point. . . Ina, please ask the systems managers to meet with me at 10 o'clock tomorrow in the conference room. Maybe we can figure out what a reasonable development cycle should look like."

Ina shrugged and went about setting up the meeting. "It should be a fun meeting," she thought. "Horace really seems worked up over something."

At five after ten the next morning, Bartholomew Byte, the marketing systems manager, Portia Partition, finance and administration systems manager, and Aloysius Access, manufacturing systems manager were all at the coffee pot, filling their cups. "Horace should know better than to call a meeting at coffee break time," muttered Bartholomew. "Nah, he doesn't care," said Portia. "Ever since he gave up coffee for spiced tea, he's been impossible."

They finally made their way to the



conference room where they found Horace furiously writing on the omnipresent flip chart pad. "Look," he said as they sat down, "here is the system development cycle we're using now. What do you think of it?"

CLASSIC DEVELOPMENT (Exhibit 1)
1. Feasibility Study
2. External System Specifications
3. Internal Program/Procedure Specifications
4. System Construction
   (Program Code, Procedure Writing, Testing)
5. Implementation
6. Operation
7. Maintenance

Silence filled the room. After about twenty seconds Aloysius cautiously remarked, "Well, we sure use it a lot. It's the basis of our estimates for both schedule and cost, we use it to set project milestones and management reviews, we orient our documentation around it, and we assign people to projects depending on what phase it's in."

"Good comment," responded Horace. (Aloysius' face flushed with relief.) "The system development cycle is basic to the very way we function around here. But like anything that is so basic, we often take it for granted and assume that it's the only way of doing things."

Horace paused. "Let's ask ourselves a question. Is there anything wrong with our development cycle? And, if so, how can it be improved?"

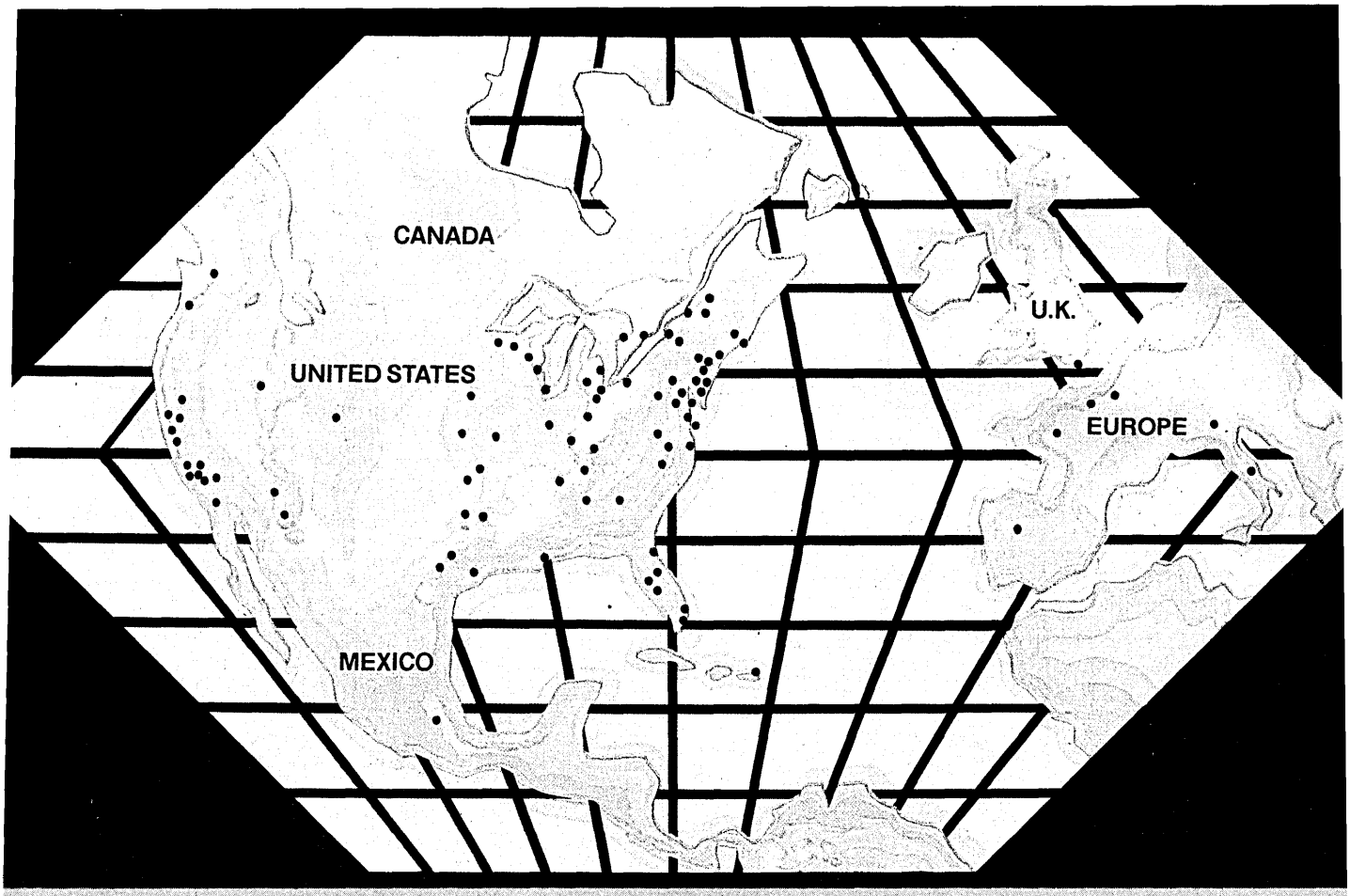
More silence. Finally, Portia said, "Well, it's like the girl with the curl; when it's good it's very, very good, but when it's bad, it's horrid."

"What do you mean?" asked Bartholomew.

"Well, continued Portia, "take, for example, that payroll system we did for the Stuffed Teddy Bear Div. (STBD) last year. They had been doing their own payroll on ledger cards for five years. Because of that, it was pretty easy to get a handle on the problem. STBD accountants knew what they wanted, so it was a straightforward task to define the system specifications. Nobody changed his mind too much, and the system was implemented just about as we had planned. Even so, it took us nine months to give birth to the computer system."

"Yes, but there's been a lot of maintenance," commented Aloysius.

"True," answered Portia, "but it has been just that, *maintenance*. The basic functions of the system have not changed. For example, we had to change the FICA rate and the state tax



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CIRCLE 12 ON READER CARD

table at the beginning of the year, but the system is still writing the same checks and generating the same registers."

"Those were easy," interrupted Aloysius. "What happened when they merged the Swinging Monkey product line into STBD?"

"That caused more of a problem," admitted Portia, "but it was really all technical. We had to expand the data base to handle more employees, and we had to add a piecework computation to the payroll because some of the people are paid on a monkey-per hour basis, but still, the development cycle worked well. We just treated that change as though it were a new project, and everything went fine."

"Okay, okay," Aloysius interrupted again. "When has it been horrid?"

"That's easy," said Bartholomew. "Let's talk about that order entry system we installed in the Wind-up Space Toy Div. (WUSTD). That was a bloody disaster. We defined the external specifications, and everyone signed off. Things went well throughout the system construction phase until Martha Marketplace, the order entry manager, got promoted to Corporate Stuffed Animal Coordinator. Her replacement, hired from our competitor, Wind-up Walk-abouts, Inc., had all sorts of new ideas that weren't in the system. We went back and tried to respecify the system, but every time we came to some agreement, he would change his mind."

"Well, you can't really blame him," Aloysius said, "he was just learning the ropes. After all, space wind-ups are a lot different from walk-abouts. And he had a right to have the system his way. After all, it is his department."

"I guess," said Bartholomew grudgingly "but things really fell apart when we finally installed the system. When the order entry clerks began filling out the input form they found the work flow didn't work right, especially when they tried to have the forms batch controlled. And when we cut off the old manual system we found there were a few transactions no one had told us about."

"But the marketing managers were happy," interjected Portia. "The system allowed all orders to be entered within twenty-four hours. And the sales people were ecstatic."

"You bet," Bartholomew continued, "but once those managers saw what the system was doing, they wanted all sorts of things that no one had mentioned before: new reports, new transactions, new ways of measuring the performance of their clerks. They even started to want on-line inquiry into order status, something we specifically excluded from the original design because everyone said it wasn't needed. And to make matters even worse, Mathilda and Marcus, the two programmer/analysts who really knew all about the project, already had been reassigned to the Marketing Forecast System—and you know the pressure we were under to get that done. So, we had to use the maintenance staff to cope with changes. It was awful."

"That's a good example of when the development cycle seems to breakdown," said Portia. "We had the same sort of problems when we developed the Standard Cost System. Our users kept changing their minds during the development process, so the project was way over schedule and budget. And once the system was installed no one seemed to like it; everyone had ideas as to how it should be changed . . nobody thought about those things during the design process when we were *looking for* that input."

At this point, Horace, who had been sitting quietly during the conversation, carefully selected a watercolor marking pen (the permanent color ones bleed through flip chart paper), stood up, and turned to a fresh sheet of flip chart paper.

"Your examples are right-on," he exclaimed. "Sometimes our traditional development cycle works, but often it does not, and for some very good reasons."

Horace turned to the flip chart and wrote:

PEER'S LAW:
The solution to a problem changes the problem.

"I see." mused Bartholomew. "That's what happened in our order processing system. It wasn't that we did a poor job of systems analysis, but when the system was installed it changed the work environment so much that new problems ("call them 'opportunities,'" interjected Aloysius) became critical."

"Right," answered Horace. "Doug Ross made a more general observation which speaks to the same point. He said (Horace wrote on the flip chart):

Development cost is only a small part of the life cycle cost.

"In fact, "Horace continued, "Ross felt that what normally is called 'maintenance and enchancement' costs two to four times as much as 'development.'"

"Wow," interrupted Aloysius. "Managers already complain about dp development costs. If they saw numbers like that, they would really be upset."

"Ah, but they pay them even without seeing them," said Portia thoughtfully. "They're just buried in users' operating accounts and in our ever increasing maintenance costs."

"And managers become frustrated with data processing in general," added Bartholomew, "because they think costs are out of line but can't find a way to control them."

"Exactly," said Horace. "And I think that part of the solution to this problem lies in the development cycle itself."

He turned to a clean page on the flip chart and wrote:

Hypothesis: The system development cycle should be constructed so that it recognizes that a system will probably require substantial continuing changes after the user begins live use of the system.

"How does that fit with Brooks' 'Throw one away' concept?"

"It's right in line, Portia," answered Horace. "In fact, I have the key quote from Brooks right here."

Horace turned back a page and under Peer's Law he wrote:

Plan to throw one away; you will, anyhow.

"Weinberg actually proposed the basic change in the development cycle in an article he wrote in 1972," continued Horace. "He was studying how teams of programmers performed when given qualitative objectives such as minimum core, output clarity, program clarity, minimum program statements, or minimum development hours. He discovered that each team ranked first on its primary objective. He also suggested that the traditional analysis-coding-debugging strategy be replaced by:"

Analysis-coding-debugging-improving

Horace paused a moment, flipped the chart back to the page on which he had written his hypothesis and said, "Last night I sketched what I call a 'Recursive Development Cycle.' Let me write it up here."

RECURSIVE DEVELOPMENT CYCLE (Exhibit 2)

Next iteration

1. Feasibility Study—also "impact" study; what changes in the basic functioning of the department should be (can be) made via the system.
2. External specification—first cut.
3. Internal specification — key factors — ease of change, promptness.
4. System construction — key factors — ease of change, promptness.
5. Implementation — training, begin wish book, plan for enhancement.
6. Familiarization period-settle-in, continue wish book.
7. External specs for next version — requires priority setting with users.

"That doesn't look all that different from our old cycle," complained Aloysius. "What are the implications of this new cycle?"

"I can see a whole bunch," answered Portia. "Let me list them, Horace, and you can write them down."

"Okay," replied Horace. He flipped to a clean page, wrote the heading and listed the points as Portia spoke:

IMPLICATIONS OF RECURSIVE DEVELOPMENT CYCLE (Exhibit 3)

1. Project planning does not end at installation. The plan assumes that modifications will be made after the system is operational. These factors must be considered:
   a. Development cost—must include personnel and computer costs associated with several development iterations.
   b. Development schedule—the system can be installed after the first iteration, but everyone will plan for several more development cycles.
   c. Personnel—all the people involved with the initial development assume they will live with the system after it is installed and will help implement the modifications and enhancements. The people cannot be assigned to other projects right after the initial installation. The project is not turned over to a maintenance staff until it has stabilized through several iterations.
2. The system must be constructed assuming that it will be modified. Techniques such as these must be used:
   a. Use high level programming language.
   b. Comment programs extensively, so it is clear what the program is doing.
   c. Structure programs following approved standards with careful use of modules and carefully defined interfaces.
   d. Use tables and files rather than imbedded code.
   e. Carefully document changes.
3. Getting the system operational and in the hands of the users is second in importance only to system maintainability. The sooner the system is in use the sooner subsequent iterations can begin to meet user needs.

"There is one other important point," said Bartholomew as Portia finished. "We always talk about the need to involve the user, but with our present cycle it never works out that way. The users are busy and don't really think through the system specifications, so we have to use our own best judgment in many areas. With this recursive cycle, we might have the same problem during the initial development, but once the system has been installed I bet we *will* get their full attention."

"I think you're right," answered Horace. "The user managers will be able to actually see how the system is working in their area. Then when they come up with suggestions, we will be expecting them and be ready and eager to put their ideas into the next iteration —instead of getting mad because they didn't suggest them during the design process. The users will feel better, too, because, when their ideas are implemented, the system will become *theirs*, not ours."

"Okay," grumbled Aloysius. "I know I'm the pessimist in this crowd, but there are lots of problems with this approach."

Horace turned his flip chart to a clean page and said, "You list them, and I'll write."

PROBLEMS (Exhibit 4)

1. Problems from users' viewpoint
   a. Users may be even less involved than they are now in the initial design because they will know that they will have opportunities later on to modify the system.
   b. Each time the system is modified user operating people must be retrained. This is not only expensive and time consuming, but may confuse people as they use the system.
   c. Users may ask for changes just because they haven't given the new system a chance. They may ask that things be done that conflict with goals set by the managers who had the system built.
2. Problems from systems department's viewpoint.
   a. Resource planning will be difficult, since it will not be easy to forecast when an analyst/programmer will be finished with one project and ready for assignment to a new one.
   b. At some point, there will be an "enhance-old-system vs. build-new-system" decision. While this exists now, if there is a policy which strongly leans toward enhancing existing systems we may not recognize the point at which it would be better to develop a new system.
   c. Analyst/programmers may become bored after working with the same system through several iterations. This can result in lower quality work or an increased turnover.
   d. Cross-training in systems development will decrease. There will be only a small group who knows any one system.
   e. Testing will become more of a problem, since each system iteration will require not only testing of new and modified system features, but also testing of previous system functions to see that they still work.

When Aloysius finished his comments, Horace quietly sat down and carefully snapped the cover back on his marking pen. The group stared at Aloysius' list of problems for several moments in silence.

"You know," Bartholomew finally said thoughtfully, "that list of problems is valid considering our current development techniques, but if we sharpen up our methods, as we probably should anyway, some of these problems become less significant.

"For example," he continued, "if we are careful about documenting the changes and communicating that a change has occurred, we should avoid user confusion.

"Furthermore, Aloysius' comment about testing is valid now, too, because we do not have up-to-date test data bases and transactions. And since the analyst/programmers who are doing the modifications usually are not the original developers of the system, they don't know all the potential traps,

so regressive errors occur. Under this Recursive Development Cycle, the original developers will be making changes and will be more likely to develop and use good test data."

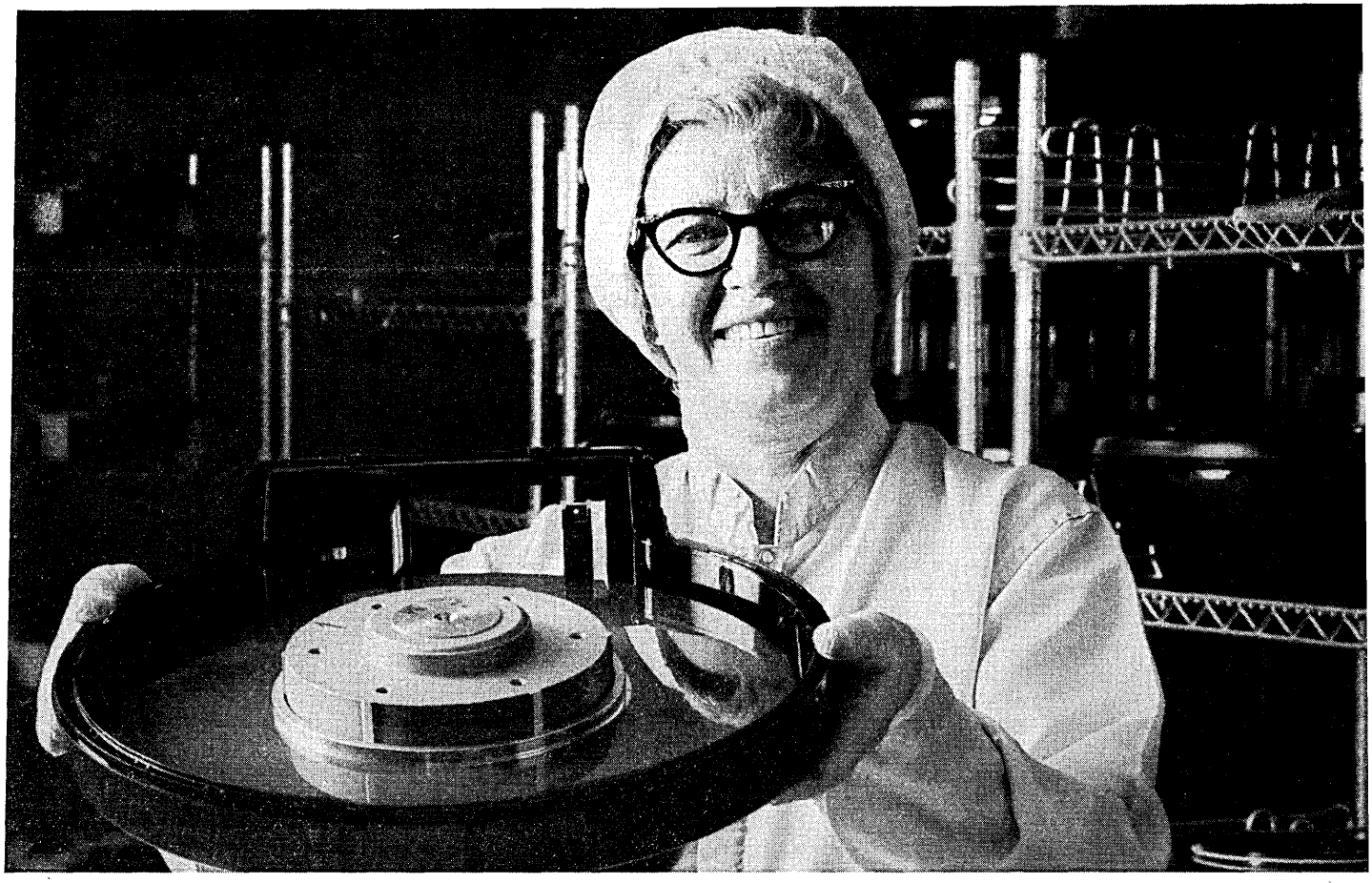
Warming to his subject, Bartholomew continued, "I think that a lot of problems could be avoided if we followed the practice followed by many software vendors and maintained 'version control' over each iteration of the system. We could label each enhanced iteration of the system a new 'version' and label any bug fixes within a version a 'release.' Then all code, documentation, and training material could be cross-referenced by version and release numbers. That would decrease user confusion."

"Excellent comments," said Horace. "What about the point Aloysius brought up about the planning and personnel problems this will cause for our systems department?"

"Well," answered Portia, "I think that our planning problems will actually diminish under the Recursive Development Cycle. Now all post-installation problems are handled on an interrupt basis. If the maintenance analyst/programmer has questions, he must go to the original developers and distract them from their current tasks. Those interruptions have caused several projects to be finished late. Under the Recursive Development Cycle the 'developers' and the 'maintainers' will be the same people, at least for a while. By carefully thinking through what our analyst/programmers have to do both before and after initial installation, I think we can come up with schedules that are quite realistic.

"The enhance vs. rebuild decision doesn't bother me either," continued Portia. "We have those same concerns now and have even less on which to base a decision. Under this cycle we will at least have an idea of the number of enhancements made and the complexity of the requested modifications. We'll know a lot more about the old system so that our decision to rebuild will truly be to achieve something better, not merely to scrap something we don't understand any more."

"This business of 'boring' our analyst/programmers by asking them to work through several iterations amuses me," interrupted Bartholomew. "We always talk about how we want the user to become involved with us, but we are usually very reluctant to become involved with the user. We often treat our development work like it was some ivory tower R&D project, and we expect the users to simply smile, to be grateful, to grab whatever we lay be-



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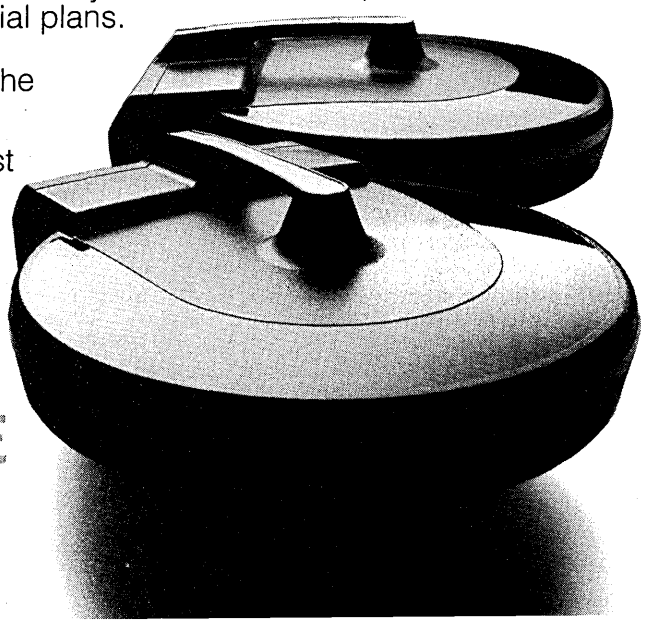

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fore them, and to change their ways to accommodate our brilliant ideas. That's nonsense! This approach will force our people to recognize that they are building tools for routine operation in the user's environment. Since our analyst/programmers will have to live with the system after it's installed, perhaps they will do a better ongoing job of working with the user to determine how well the system really does day in and day out."

"Aloysius' point on cross-training is well taken," continued Portia, "but I see two possible answers to that problem. First, since the systems are to be built for change to begin with, new people will have an easier time learning what the system does and how to change it. Second, since most of our projects have more than two people on them, we can rotate new people into the project for specific iterations and put some of the old people on other projects, always leaving enough old people to form a cadre to help the new people learn. That, of course, also is another answer to the boredom problem.

"I see one other advantage to the recursive cycle: modifications to the system after the initial installation will be made more rapidly and more economically since they will be made by the original developers."

"All right," grumbled Aloysius. "Those are all good comments, but what about those 'thoughtless changes' I mentioned?" (See item 1.C in Exhibit 4.)

"That's a good point, Aloysius. Brooks called that the 'second system effect.' " Horace got up and flipped back to the page on which the recursive cycle was listed (Exhibit 2). "That's exactly why I put in this 'familiarization period' as point six. We will delay making a change until we feel that the users have given the new system a chance. As with many other things, this will require some judgment on your part and on the part of the user managers."

Horace looked at his watch (an old analog device with a circular face and hands) and said, "It's almost lunch time." (If he had a digital watch he would probably have said something meaningless like, "It's eleven forty-seven.") "We've discussed this enough, I think. I'll have Ina type the flip charts, and I'll dictate some of the comments you all made and distribute that to you. We can think about this more and discuss it again at next week's meeting.

"In the meantime, I would like to try the Recursive Cycle. We have a user steering committee meeting next week. I'll review this concept with the committee, and recommend to the user managers that we try this cycle on one of our new projects.

"Portia, you're just getting started on that system to calculate customs duties on our intracorporate shipments with our stuffed snake facility in Korea. I think that I'll recommend to the Steering Committee that we try the Recursive Development Cycle on this project.

"I think we'll find it works well because it recognizes and considers what to some extent we are already doing, it will give us the tools to become involved with the users, and it will allow us to control costs and to provide high quality service over the entire life of the system, not just the short piece we arbitrarily called the 'development cycle.'

"Let's get to the cafeteria before the lines get too long." ❋

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Presently the facility information systems manager for the Components Group of Hewlett Packard Co., Joe Podolsky has been president of Life/Equity Information, Inc. (a small computer services company), a systems manager and computer operations manager at Fairchild Semiconductor, and a systems engineer with IBM.

He also teaches in the Golden Gate Univ. MBA Program on the Stanford Industrial Television Network and is on the Board of Directors of a small financial services company.

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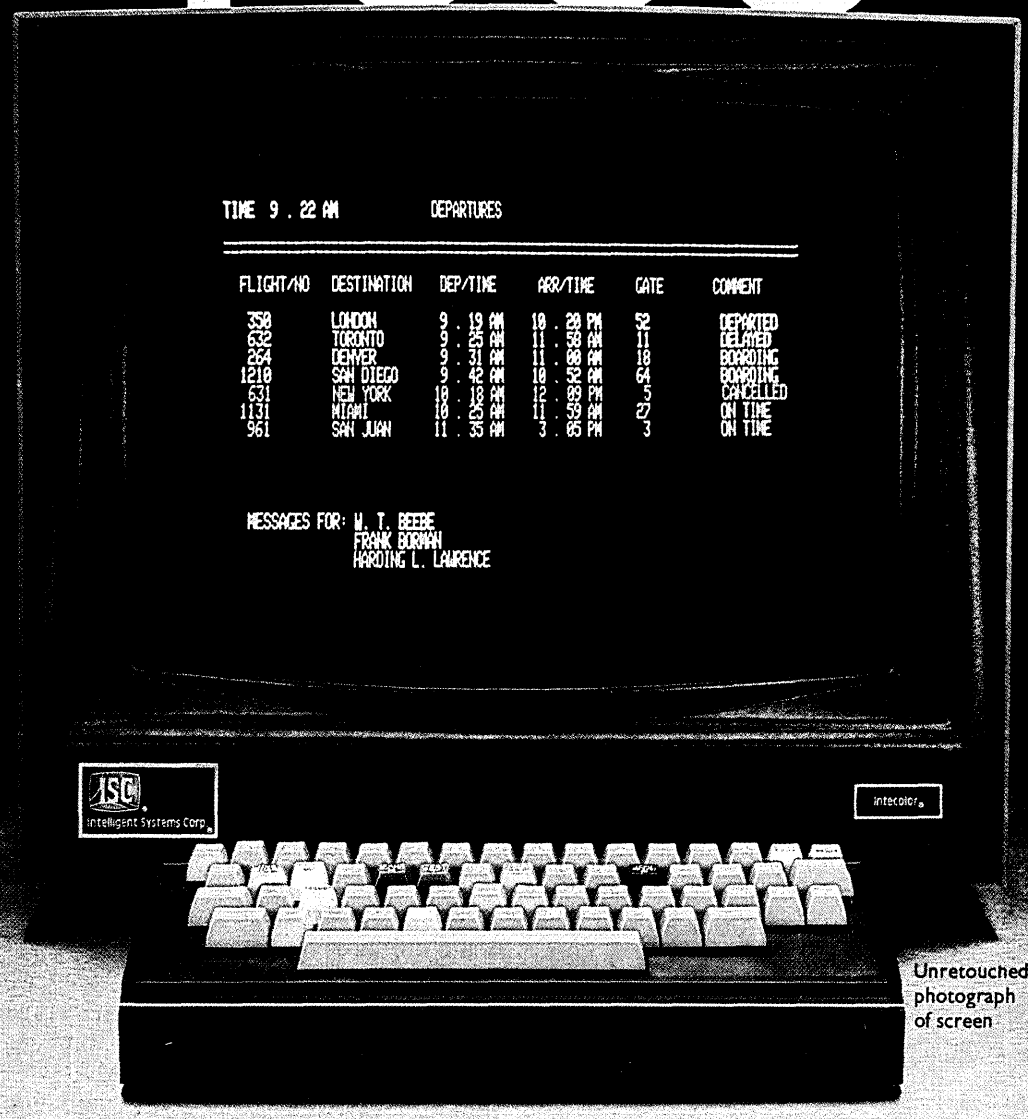

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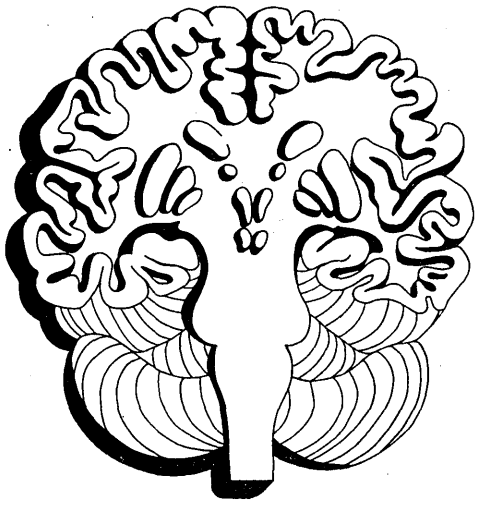

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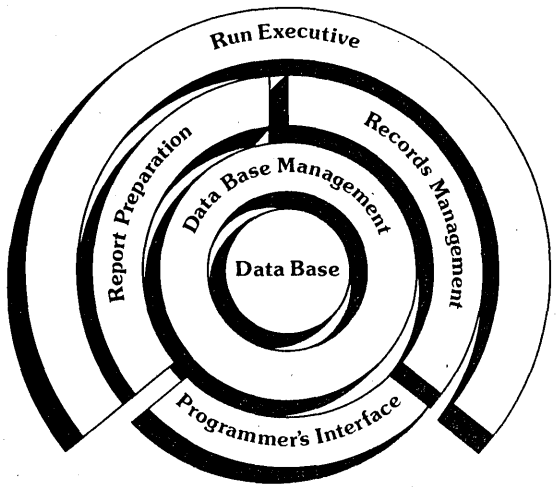

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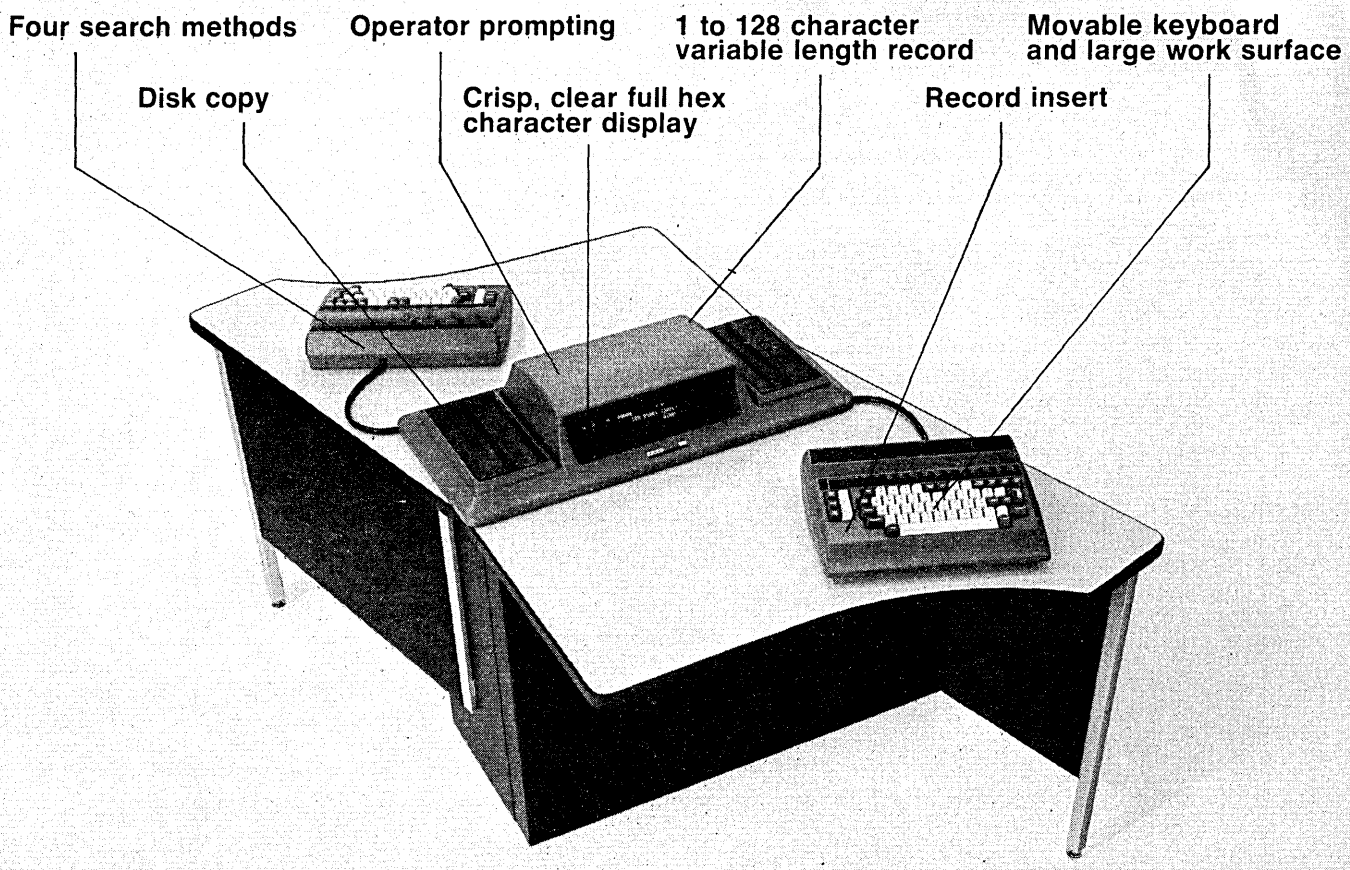

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IBM Does It Again

Giant's offerings now seen by industry sources as nothing more than warmed-over 158s and 168s

"Put away the books on advanced technology and bring out the calculators again," the industry yawned as IBM this fall announced the much-rumored 3031 and 3032 central processors.

Touted as having an "internal operating speed" of two to two and one-half times that of a 370/148, the 3031 seems to be on a par with the 158. The 3032, with its stated two and one-half to three-fold improvement over the 158-3, falls in the performance range of the 168. Many industry sources have gone so far as to say the new processors are nothing more than warmed-over 158s and 168s with the addition of more bundled facilities and significantly reduced price tags. Oh, and in smaller packages.

The 3032 pricing took some competitors and observers by surprise because it offered a deeper cut than expected. It is about 45% less than the 168-3 in purchase price, and in some cases, can be rented or leased for less than half the 168-3. "IBM decimated the price lists of vendors which had held off announcing their own competitive systems until IBM showed its hand," said one research firm. The 3031 runs about 30% to 38% less than the 158-3 selling tag, about 35% to 45% less in rental and lease charges. Maintenance, however, is a few hundred dollars more per month, signifying a higher percentage of the rental price and more pay to IBM from the purchase customer.

IBM apparently has learned to live with and love the purchase content of its portfolio.

The purchase/rental (not lease) ratio continues along the same lines set by the 138 and 148–about 35 to 38:1, a shorter payoff period than the 3033. Leasing companies see a purchase opportunity, although the life expectancy of these systems is "just a few years," pending new IBM announcements.

One analyst, Harry Edelson of Drexel Burnham, dissected IBM nomenclature on the system and noted that without the U designation, meaning uniprocessor, IBM may be telling the user there will not be attached or multiprocessor versions of these models–again indicating short life. Arthur D. Little's Frederic Withington doesn't claim to have a crystal ball for predicting IBM's plans, but he does say the sophisticated memory access controller of the 3031 and 3032 seems to indicate multiprocessing would be a rather straightforward undertaking.

IBM apparently has learned to live with and love the purchase content of its portfolio. It has piled up several record quarters for purchased equipment, and in the recent third quarter report called these three months the biggest ever for purchases–signifying more than $1 billion, according to Edelson. "This is good for the industry, because the emphasis on purchase means a less capital-intensive industry." In other words, IBM may be leading its competition out of the jungle of rentals.

The very quick delivery times (first quarter 1978) indicate that the 3031 and 3032 are taking over 158 and 168 production lines with ease. The short lead times also will serve to keep the plug-compatible mainframes (PCM's) off balance. While IBM expected to produce only a few hundred 3033s in 1978, it is expected to pump out more than 500 of the smaller

IBM's 3032: Publicity photo released by IBM with announcement of its new 3032 processor.

3031 and 3032s next year. This would jibe with inside reports that IBM has been producing about 20 168s per month until recently.

The question is, what will the average delivery time to any customer be? The leasing industry is guessing about 18 months, which means that the demand for 158s and 168s will still remain high for several months to come.

The 148 market

Will these new models heavily impact the 148 market? Over the short term, perhaps not. A research firm indicated that most 148 users are I/O-bound rather than cpu-bound. Since the 148 is priced about 20% less than the 3031 at the two megabyte level, these users would be hard put to justify buying a processor that gives them two to two and one-half times the power they already have and can't fully utilize.

There are widespread rumors of a price cut on the 148—one PCM termed it "almost a necessity"—and some think that IBM will encourage more buying of 148s before long by just such a price cut. Unlike the older 158 and 168 models, the 138 and 148, when announced, were already somewhat molded to the new pricing scheme IBM established firmly with the 3033. Hence, any price cuts for the 148 "should not be more than 12%," said one user, and the 138 "couldn't stand more than 5%." Those cuts, he maintains, should bring them solidly into line with the three new models. Another observer speculates the cuts might go as deep as 20% to 30%.

What happens to the competition when they see IBM lopping 30%, 40%, and 50% off the price of their own machines? They have to do some fancy footwork to keep their list prices and/or discounting practices attractively below IBM. "The name of the game is not to down-price. That would be a disaster in a high fixed-cost, low variable-cost industry," said one research expert. A lot more performance for a little more money, he insisted, is the way to go.

Rapid response

Itel certainly gets the bouquet for most rapid response to IBM's announcement. The same day IBM announced the 3031 and 3032, Itel let loose with the AS/6, said to have 1.1 to 1.25 times the internal performance of the 3032 for a price a shade over 3% higher than the 3032's. A price/performance estimate ($ millions purchase for typical system/millions of instructions per second), prepared by Arthur D. Little, gives the AS/6 a rating of 0.74, compared to the 3032's 0.86. Itel believes that IBM announcements stimulate the market: users will jump on the bandwagon and order IBM's latest offering, then Itel can come around and change minds by offering more computing for the user's dollar. Of course it wasn't luck that timed Itel's announcement, it was IBM: the AS/6 has been in the wings at least since spring, when Itel's advertising department "mistakenly" sent an AS/6 ad to a newspaper, which subsequently printed it.

Univac also tried to go the "lots more for a little more" route, with its recent announcement of three new models in the word-oriented 1100/80 series and two new models in the byte-oriented 90/80 family.

Additions to the 1100/80 family are said to span the 3031, 3032, and 3033 product line. An entry level central processor complex sells for about $1,230,000, and is said to offer about 30% more kick than a 3031. The 1100/83 and 1100/84 are three and four processor systems that are said to surpass the 3032 and 3033 in performance. A typical 84 central processor configuration will be priced at $4.7 million. The 90/80-2 and 90/80-3, for which a firmware 370 emulator is available, are said to have nearly 50% and 100% more "central processing power" than IBM's 370/148, respectively. The model 2 leases for essentially the same as a 148. Central processor complex prices for a 90/80-2 range from $720,000 to $878,000. For a 90/80-3 the range is $900,000 to $1.2 million.

Univac's Frank Holst, v.p. for program management, says that the 90/80-2 is aimed at the 148 user who can't afford to make the jump to the 3031 but needs more power. Deliveries for all five machines will begin in the second quarter of next year. Univac says its bundled software and support make its systems prices look even better.

Answer from Honeywell

Honeywell, at writing, was readying some announcements for its big Level 66 and 68 product lines. Due in mid-November, one of the announcements is expected to center on an enhanced Level 68 Multics system. The firm also stated that it would enhance the 66/85's performance, but "you (the users) will hear more about this product next year," v.p. Stephen G. Jerritts told a meeting of its large systems users.

Sources expect that Honeywell will announce this month and over time a series of new Level 66 and 68 models that will answer the IBM challenge. Each announcement will be marked by much improved performance (twist those wires, turn that screw, and paint the box blue) for a little more money. In 1978, these sources say, Honeywell will announce a super version of the original 85 and a bunch of multi-multiprocessor versions that will be due out in 1979. While there were some circuitry problems with the 85, the sources continue, the delay in delivery from 1978 to 1979 was done for marketing reasons.

And, before year's end, NCR will cap off its 8000 line of processors with a unit to compete in the 3031-level market. The unit will offer performance comparable to the 3031, but, of course, the price will be lower.

Two PCM's responded with statements, not new products. Both felt the new processors from IBM missed their respective market. Control Data felt that the 3031 represents a $1 million machine in the 158 class, while its Omega 480-II is roughly a half-million dollar machine in the 148 market. Amdahl Corp. is at the other end of the spectrum, manufacturing processors above the 3032. Its most recent announcement, the 470 V7 came hot on the heels of IBM's 3033, which had eclipsed Amdahl's then top-of-the-line 470 V6-11.

—Bill Musgrave & Angeline Pantages

Univac, Honeywell, and NCR have similar offerings and PCM's respond with statements, not new products.

PRICING COMPARISONS ON IBM'S NEW PRODUCTS

Model	Purchase	Rental	Lease	Maintenance
370/148				
1 MB	689,000	19,000	17,280	2,235
2 MB	799,000	22,800	20,740	2,405
3031				
2 MB	1,000,000	27,497	25,000	3,070
6 MB	1,455,000	43,207	39,310	3,690
370/158-3				
2 MB	1,597,865	18,805	45,290	2,604
6 MB	2,052,865	65,525	59,600	3,234
3032				
2 MB	1,900,000	48,110	43,740	6,500
6 MB	2,360,000	64,290	58,470	7,110
370/168-3				
2 MB	3,381,350	102,557	93,265	5,516
6 MB	3,838,350	118,347	107,635	7,970

note:
All models (except 370/148) include six channels, extended facility, console, and power unit. The 370/148 differs in that it has five channels and no extended facility.

A Hornet's Nest for the PCM's

"This may be another 'one wire change.'" "They're warmed over 158s and 168s." "Looks deceivingly simple, like a 158 with a new nameplate." "The 'new' cpu's seem to be 158s and 168s, although there are some changes." "The 3031 instruction execution unit is too similar to a 158's to be anything else." These were comments from a number of PCM's and industry watchers, concerning IBM's 3031 and 3032 announcement last month. One industry observer went so far as to suggest that instead of quoting first quarter 1978 deliveries, IBM might have said, "We'll ship as soon as we get enough returned 158s and 168s."

The guts of the new processors bear a striking resemblance to the existing 158 and 168 processors (see table), though the channels and memory have been upgraded to improve performance.

One PCM feels that we've seen IBM reaffirm the 370 architecture over the past year and a half through the announcements of the 138, 148, and 303X-series.

In the 303X, IBM seems to be moving much of the work outside of the cpu. The I/O controller in the new family seems to lead to a "new microcoded architecture," according to one observer, while the family's sophisticated memory access controller makes the 303X architecture "memory centered." Pointing to the 3036 console, common across the 303X line, sources note the new series is getting modular.

Should increase migration

"The large storage sizes should increase migration to data base, communication, MVS, and SNA systems," according to Gideon Gartner, a computer industry analyst with Oppenheimer and Co. "The low price per unit of performance should encourage easier justification of all of the above, plus the exotic peripherals: 3850 mass storage systems and 3800 laser printers. The 3360 Direct Access Storage Device (DASD) is coming."

Gartner's opinions, coupled with the modular approach and evolution outside the cpu, fit well with the conjecture that IBM's "new direction" is upon us, being released in bits and pieces that will all come together several years on. Modular systems, based on the 303X and exotic peripherals, will evolve over the next few years, then IBM's new processing engine for the '80s will slip in, displacing a minimal amount of hardware and making a smooth transition.

A large market

The 303X line provides highly attractive price/performance ratios, which should create a large market. "Based on 3033 precedence, we expect 6,000 initial orders for the 3032, and 10,000 for the 3031, worldwide," Gartner says. At the same time, he expects the 3033 backlog to drop by at least 500 units. Of course, many of these orders never will be filled. As a dp manager from Kansas told us, "I always order IBM's latest offering on announcement day; by the time they can deliver it I'll have decided whether or not we really need it."

These recent announcements stir up a hornet's nest for the PCM's. IBM's price/performance ratio, defined as typical system price divided by instructions per second, has invaded the realm of the PCM. Figures developed by Arthur D. Little indicate the ratios for the 3031, 3032, and 3033 are 1.1, 0.86, and 0.85, respectively. In contrast, the 148 and 158-3 both come in at 2.0, and the 168-3 at 1.7. Among the PCM's, Amdahl remains attractive with its top-of-the-line V7 (which is more powerful than the 3033) getting a 0.55 ratio. Its V6-2 gets 0.75 and the V5 is 0.9. Itel's new offering, the AS/6, also is attractive, with a ratio of 0.74. Its other two models don't fare as well: the AS/4 rates a 1.6 and the AS/5 looks like IBM's old line with a 2.0. Seems to be time for some repricing in the PCM business.

Repricing may not be enough: there's a rumor making the rounds that IBM is putting "electronic serial numbers" in the firmware of the 303X-family. Thus software will be able to verify that its host is a real "IBM machine" and not some ersatz unit from a PCM interloper. With the PCM's reliant on IBM for operating software, this threat is of the highest order. But, since this is only a rumor, it remains to be seen if 1) it really is so, and 2) whether this is a leak from within IBM to scare potential buyers of PCM equipment or if IBM is planning to change its software relationship with its competition. Unfortunately, very often the rumor is as damaging to planning as the fact.❋

HARDWARE CHARACTERISTICS OF IBM'S NEW PRODUCTS VS. THE 148, 158, AND 168

Processor	370/148	3031	370/158-3	3032	370/168-3
processor cycle	180 nsec-270 nsec	115 nsec	115 nsec	80 nsec	80 nsec
data path	4 bytes	4 bytes	4 bytes	8 bytes	8 bytes
buffered inst. prefetch	no	128 words	128 words	'several'	n/a
preprocessing during execution	no	no	no	up to 4 inst.	up to 4 inst.
main memory size	1 MB—2MB	2 MB—6 MB	1/2 MB—6 MB	2 MB—6MB	1 MB—8 MB
memory cycle time (minimum for read)	405 nsec/4 bytes	345 nsec/8 bytes	1,035 nsec/16 bytes	320 nsec/8 bytes	320 nsec/8 bytes
memory interleaving	no	4-way, doubleword	no	4-way, doubleword	4-way, doubleword
cache	no	32K	16K	32K	32K
channels:					
byte multiplexor	1 std	1 std	1 std, 2 opt[1]	1 std, 2 opt	2 max[1]
data rate/channel	50 KB/s	40–75 KB/s	n/a	n/a	110KB/s
multiplexor channel	4 std	5 std	2 std, 5 max[1]	5 std, 10 opt	11 max[1]
data rate/channel	1.85 MB/s	1.5 MB/s[2]	1.5 MB/s	1.5 MB/s[2]	n/a
selector channel	std mode on mux	std mode on mux	std mode on mux	std mode on mux	6 max[1]
price/performance[3]	2.0	1.1	2.0	0.86	1.7

1 maximum of six channels, total on 158-3, 12 on 168-3
2 with two-byte interface the rate goes to 3 MB/s
3 source: Arthur D. Little

"INFO '77: Close to 15,000 turnout for exhibit and conference held for first time under one roof at New York's Coliseum.

Conferences

Info '77 Gets Mixed Reviews

If a sampling of the visitors and exhibitors at Info 77 is any indication, the fourth annual Information Management Conference and Exposition was both a whopping success and a flop.

On the exposition floor of the New York Coliseum where the show was held last month, Clapp & Poliak, Inc., which sponsors Info, had delivered as promised, many of the vendors showcasing their wares said. Not only was the attendance at record levels—14,800 for four days—but the show attracted a healthy share of end users and systems administrators as billed.

On the floors above, however, a number of those 2,500 visitors who'd signed up for the conference sessions grumbled angrily about persistent technical problems that plagued many of the sessions. Info visitors, who spent anywhere from $30 for a half-day session to $150 for the full four days, didn't get their money's worth in many instances—but through no fault of the speakers, who generally were well-prepared and topical.

The sponsor's first try in New York City at placing both the show and the conference under the same roof (previously, the conferences had been held at nearby hotels) bombed. Speakers were supplied with microphones that didn't work, and inadequate or nonexistent visual aids. The conference rooms themselves frequently were overheated and vastly overcrowded—so much so that, for example, an opening day session on strategic planning for information resources had to be repeated.

Who is this?

Worst of all, though, speakers using a microphone in one room often found their talks being broadcasted into an adjoining conference room, and vice versa. In one session, as an example, the initial speaker was drowned out by a concurrent talk in a nearby room on word processing over the P.A. system. Once the wp talk was turned off, another address on minis came over loud and clear. By the time the system ultimately was repaired, the audience appeared ready to walk out.

Despite these problems, many of which were the result of Coliseum union policies rather than the sponsor's oversight, a number of sessions provided useful exchanges of user policies and approaches. Speaking in a session focusing on disaster planning, William M. Sullivan, manager, computer operations/programming for the Nordberg Machinery Group in Milwaukee, detailed how his firm and a number of other Milwaukee area concerns established a remote computer site that could be used if any of their systems were knocked out.

"The site is fully equipped with ample telephone lines, power, and air conditioning capacity to support the majority of companies we've signed up," Sullivan explained. "And the vendors involved (IBM, Burroughs, and Honeywell) can have their equipment up and running in five to ten days."

Inexpensive means

With an alternate, mutually shared and maintained site, the Milwaukee group believes they've found an inexpensive—the lease with telephone lines included runs to only $100 a month per company—reliable means around the backup problem. Admittedly, though, only one system outage can be taken care of at a time, and if two or more go out concurrently, the system is to be utilized on a first come basis.

Milwaukee area firms established a remote computer site for use in cases where disasters knock their systems out.

Another speaker at the same dp security session, Morton B. Comer, a.v.p. with Provident National Bank, Phila-

SHOW AND CONFERENCE: Record attendance at show drew plenty of end users and systems administrators. But densely packed and overheated rooms at conference sessions where microphones malfunctioned caused many to grumble.

delphia, outlined a more ambitious backup arrangement. Comer's bank plus some twenty other companies in the Philadelphia area, all of whom are major IBM users, are establishing a shared site which ultimately will house two IBM 3033s and be operated by a service concern which may sell off excess time to users outside the group. If a disaster hits, however, and Comer defines disaster as "the inability to deliver critical applications," the member company's processing will be transferred immediately over to the remote site.

Different approaches

Distributed processing and data base management were two topics that got special emphasis at the show, and speakers often differed markedly in their approach to the distributed and d.b. question. For example, Charles Siegel, dp staff consultant with United States Fidelity and Guaranty asserted that distributive data bases and processors should be centrally managed to ensure commonality of data, standardization in the way programs are performed, and a reduction of the company payroll.

"The most important aspect of centralized control is the ability to reduce the need for personnel," Siegel argued. "The trend in personnel costs is continually upwards in almost a geometric progression. Conversely, new technologies make storage, processing, and, most important, transmission costs relatively cheaper. If an enterprise opted for remote management of the data and processing, it would require at least two technical people at all locations. It is obvious that the people required to support a large scale distributive network will be substantially less if they were all at the central location."

> "We gave them authority to buy all the minis and micros they wanted, but God help them if they hired a clerk."

Citibank's disciple of distributed data processing Jon S. Gould took another tack, disagreeing with the theory that information gathered at remote processing sites must eventually be stored on a huge central computer.

In a session entitled "Using Minis to Replace Mainframes," Gould, who is v.p. of the New York bank's Securities Processing System Development operation, traced his bank's well-publicized campaign to throw out huge mainframes in favor of placing minis and micros at the department and branch level.

Gould says soaring labor costs and the availability of "super minis" in 1974 were the key factors in the bank's decision to distribute processing. Until that time minis had been used primarily in process control applications and their operating systems were consequently more suited to on-line, real-time applications.

"We gave them (the remote user organizations) authority to buy all the minis and micros they wanted, but God help them if they hired a clerk," Gould maintained in a debate on pure distributed processing versus distributed processing in which minis are linked to huge central computers.

The latter approach was advocated by C. Alan Conover, v.p. of systems planning and programs with Honeywell, Inc. Citing several existing examples of this approach, Conover advocated that such systems are designed for users, not programmers, and thereby should have the support of a central site. "The horror stories we hear today of interruptions in computer systems are mild compared to the real horror stories that haven't surfaced yet," Conover said.

Gould differed, arguing it was the bank's experience that only from 10% to 15% of the information generated at distributed sites actually was needed at the corporate level, and that data was "aggregated up" (collected) through minis.

In addition, he said there was no huge, central data base at the bank, and that even Citibank's teleprocessing networks (ARPAnet-like packet switching systems soon to be supported by Honeywell Level 6 minicomputers) were being distributed also.

New identities

On the exposition floor, meanwhile, a number of companies which recently had gone through mergers and acquisitions like ICH with its Singer line, Nixdorf/Entrex, and Racal-Milgo ("We're not ICC anymore, folks," the company announced) used the show as a forum for updating the audience on their new corporate identities and capabilities.

And a host of new products were in evidence as well. Some samples: Applied Data Communications announced ADVENT 1000, a small business system priced at under $10,000; Software Inter-

national displayed new on-line general ledger and financial reporting packages; General Automation introduced the 440 Data Series, a 128 byte mini with large scale data base handling technology; Monchik-Webber's DATAPAD computer-controlled data entry system, permitting ordinary handwriting to be input directly into the computer, made its debut.

Others touting new products included Qume with a new printer for the oem market where the company already counts IBM as a customer; Graphic Sciences with a new automatic facsimile receiver; Vydec with a distributed word processing system; and Microdata with a business system dubbed Royale—a successor to Reality, the firm's present system in the business field, Microdata's president and chairman Donald W. Fuller, explained.

Apparently, pleased with the floor response at Info, a number of vendors have signed up for increased space at next year's show in Chicago, Info sponsors claimed. Honeywell, for example, which had about 1,000 square feet this year has reportedly requested 3,500 in 1978. And ten new exhibitors, among them Texas Instruments and DEC, also have reserved space at Chicago. All told close to 54,000 square feet of the roughly 64,000 square feet available next year is spoken for, Clapp & Poliak maintains. Now if Info can just find a P.A. system and a couple of slide projectors that work, they'll really be in business.

—Laton McCartney

Fourth of July on June 30?

A subsidiary of Management Assistance, Inc. (MAI) hired three actors to write the Declaration of Independence on a word processing system that the company had just acquired during the Info '77 conference in New York last month.

Wordstream, the name of the product, was developed by privately owned Avionic• Products Engineering Corp., Denville, N.J., which MAI acquired for $5 million in cash and will operate as Wordstream Corp. Its subsidiary Genesis One will market the system nationally, and maintenance will be provided by Sorbus, Inc., MAI's maintenance subsidiary.

It is a clustered, shared logic system, whose minicomputer, built by Avionics engineers, supports 12 display terminals, three printers, and 10 diskette storage modules. Some 20 systems have been installed in the New York and New Jersey area.

At a meeting for press and consultants in New York, the three actors portrayed John Adams (at the keyboard) making changes in the Declaration at Benjamin Franklin's direction, while Thomas Jefferson contemplated adding some new paragraphs. Their changes, additions, and deletions—plus many references to the system's 30,000 word dictionary—were displayed on a large video screen. Said a Wordstream spokesman: "If Thomas Jefferson had used the Wordstream system for drafting the Declaration of Independence, the Fourth of July might have been June 30." ✲

User Groups

Among Xerox Users: A Different Mood

Even though Xerox has been out of the general purpose computer business for more than two years, users of Xerox remain a dedicated group—dedicated to their hardware and software and the perpetuation of both, but not necessarily to Honeywell, which took over the Xerox customer base in February 1976.

This was painfully evident at a meeting in Palm Springs, Calif., last month of Exchange, the Xerox Data Systems equipment users group; painful to Honeywell, at least. The vendor's representatives at the meeting seemed well aware of the deterioration of confidence among Exchange members and they did their best to allay this.

Exchange has earned a reputation through the years as a user group which leans hard on its vendor, usually getting what it wanted in terms of support and technical advances. "Honeywell doesn't know what to make of a user group like Exchange," said one Palm Springs attendee, a former XDS and later Honeywell employee.

At an Exchange meeting last February in Atlanta, at which Honeywell announced a range of new products for Xerox users including Control Processor 6 (CP 6), an operating system to succeed CP V, much beloved by the Xerox base, users seemed convinced that Honeywell was meeting their needs. "Honeywell is proceeding down the honorable path," said Randy Best, then chairman.

Stronger statements came out of an earlier meeting in Phoenix in June 1976, when one user went so far as to say "Xerox' decision to withdraw from the computer business could turn out to be the best thing that ever happened to us." Honeywell gave the first hints of CP 6 at this meeting.

Letter applauded

The mood was different last month in Palm Springs. Best, currently chairman of Exchange's Planning Committee, was loudly applauded when he read a letter written during the summer to Honeywell's Richard Douglas, v.p. and general manager, Marketing and Services, Information Systems Div.

The letter said users continued to be impressed by CP 6 and Honeywell's financial commitment to it. But, it noted, "Field engineering support is continuing to deteriorate . . . spare parts are hard to get . . . field engineering expertise seems to be going down . . . software support is the lowest we've ever experienced . . . Field Engineering Div. morale among former Xerox employees is very low." Best said he found "the quality and quantity of shipments from the Metro Center (a spare parts and refurbishment center established by Honeywell in Phoenix last year for the Xerox base) very disappointing."

The letter concluded: "There is a growing and serious level of distrust toward Honeywell . . . it is hard to justify increased business with Honeywell. We are concerned that a management and people commitment be made and made now or it will be a tragedy for all concerned."

Douglas, quarterbacking the Honeywell delegation, handled this kick-off well, especially considering that some-

one played a recording of the theme from *Star Wars* as he walked to the podium. "I feel it should be Charlton Heston up here, not me," he quipped.

He made some concessions. "We realize that Honeywell is one of many suppliers competing for your business . . . We know quality of support is a problem . . . We are behind in our schedule at the refurbishment center."

Solutions promised

And he promised some solutions. In the support area, he noted "Xerox product knowledge is a scarce commodity." He said Honeywell is trying to correct this with a company-wide Xerox training program. For software support, he said, Honeywell is establishing a new organization at the Los Angeles development center," he said, having completed arrangements for the second major inventory relocation (of spare parts from Xerox) in the fourth quarter of '77.

Douglas said the Metro Center has completed development of a front-end communications subsystem for CP v users and that, "Randy Best has offered to be the beta test site (Motorola in Phoenix). He promised that CP 6, when it comes, "will be price performance competitive. Performance and timing tests will be conducted in early 1978. We expect to earn your business."

Owen Keith, Honeywell's v.p., field operations, had some answers to the expressed concerns over field engineering.

He pointed out that because of cross-training, Xerox users who could be serviced from only 12 field locations last spring, will have from 50 to 60 service centers available to them by the end of this year. He said he feels the parts needs and parts problems are being taken care of with the addition of inventory to the Metro Center.

"We know the Xerox field people are uneasy," Keith said. "In August we surveyed these people about their major concerns. These turned out to be the big company syndrome, a difference in benefits, and a perception of a lack of opportunity within Honeywell."

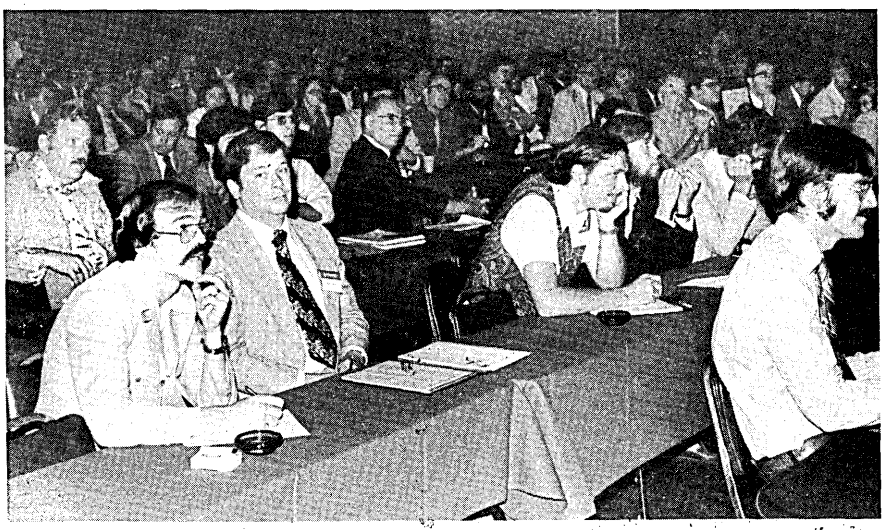
For the FED force

He said Honeywell is attempting to offset the "big company syndrome" by increased internal communications. As for the benefits issue, he said, "We have made significant enhancements including a dental plan for field engineering forces." And on the opportunity perception problem, "We are demonstrating that there is opportunity by promoting their peers."

Keith said part of the software support problem arose from the fact that "a large number of analysts (from XDS) never accepted employment with Honeywell."

"There is still some doubt as to your importance among our people," admitted Keith. "Within the Field Engineering Div., in the next several months, we will conduct a program under which local FED management will visit every Xerox site. We will monitor standards against targets. That is my personal commitment to you."

Shel Klee, head of the Los Angeles Development Center which is responsible, among other things, for development of CP 6, told Exchange members that this project is on target. "This has been a busy year for us, a year of continued growth." The center has grown from 65 people in July '76 and 103 last February to 117, and "we're still actively recruiting." He said the center now has two large Honeywell level 66 systems, a number of level 6 minicomputers, and five Xerox systems, and is into three shift and weekend operations.



XEROX USERS: They had few accolades for Honeywell and left a Palm Springs conference in a "we'll wait and see" mood.

That the Xerox users are still vitally interested in CP 6 was evidenced by the crowds that attended an afternoon-long CP 6 workshop conducted by LADC personnel. Although many users had to stand throughout the long presentation, they stayed.

Will it make it?

In the halls, however, some were wondering if CP 6 will really make its schedule of benchmarks in 1978 and availability in 1979. Opinions ran the gamut from strong confidence through could be to an outright "no way" expressed by one user.

There was a workshop for 16 bit users

JOHN ESCHINGER
"a good turnout"

too, but the paths offered to these users by Honeywell were less clear-cut than is CP 6 for the users of CP v. "We feel that only 30% to 35% of these (16 bit) users are upgrade candidates and real-time and general purpose migration requirements are different," these users were told. The workshop amounted to a tutorial on the capabilities of the level 6 family of minicomputers, although Paul Eastman of Honeywell noted that while "Sigma 3 and the XDS 530 were aimed at a limited marketplace, Level 6 covers a very broad spectrum."

There were grumbles at the meeting that had nothing to do with Honeywell support. Due to personnel changes on the Exchange staff, copies of user-delivered papers were not available as in the past, only poorly printed, hard to read abstracts. One speaker apologized prior to his presentation, saying he didn't know until several days before the meeting that his paper had been accepted.

For William Bearley of Citrus College in Los Angeles, it was worse. He didn't find out until he arrived in Palm Springs and saw his name on the program. He hurried back to Los Angeles to put his presentation, including slides, together and did a creditable job with the theme, "Generalized Information Systems: Fact or Fiction."

He described how a generalized information system his college had implemented had cut programming costs, reduced maintenance problems, and cut the need for applications programs. He typified the Xerox user's fondness for his Xerox hardware. "We didn't have a Xerox machine when we started implementation of the system," he said. "We were with a company called I Believe in Money. Half of our programs were running in 1400 emulation on a 360. We had more than 600 programs to maintain and we couldn't integrate data from different files."

The vehicle for leaving

He said the generalized information system will link files from different applications for reporting and has made it possible to respond to most requests in a matter of minutes if the required data is on file. "And it was the vehicle that allowed us to leave Company A and get off emulation." Citrus now has a Xerox 560. Bearley said conversion to the Xerox machine completely cut out the need for applications programs, whereas this need was only reduced by 80% to 85% with the IBM equipment.

He urged his audience to "put pressure on companies like Honeywell to create powerful applications languages for us."

Honeywell responded to other pressures during a closing question and answer session with some concessions and some promises. Users concerned with what they deemed the poor quality of quality assurance tests of supersonic transport tapes were assured, "there has been no real consistency and we will fix that." Another concern was that analysts' alerts (warnings from Honeywell of a potential software problem) were not followed up when the problem was fixed. "Yes, the fix and alert often happened simultaneously. The timing has been bad. This is a goof on our part and we accept the criticism," said Honeywell's Bob Nix.

Attendance at the Palm Springs meeting was 192 users and 88 Honeywell representatives, down from 242 users and 109 Honeywell reps at the Atlanta meeting, but "a good turnout" in the estimation of Exchange chairman, John Eschinger, Bucknell Univ. Many users said they were unhappy with the "overwhelming" nature of the Honeywell delegation in Atlanta and were glad to see this cut down.

Most users seemed to be leaving the conference with a wait-and-see attitude. The wait will be until next May 23 to 25 when Exchange meets again, in Toronto.

Douglas, again preceded by the martial strains of the *Star Wars* theme, sounded the closing note. "We're getting to know each other. The problems of the past are behind us. We are, in fact, listening to you and trying to respond. The Xerox community is very important to Honeywell." **—Edith Myers**

Networks

Finning's Network Is Easy to Expand

"Anybody tends to be a gambler if the payoffs are pretty good." And so far for "anybody," C.A. (Tony) Harris, the soft-spoken dp manager at Finning Tractor & Equipment Co. Ltd., those predicted payoffs have been more than pretty good. So good that other commercial sector companies from as far away as Scotland are trying to get some dp tips from the innovative Vancouver, Canada, Caterpillar tractor distributor which has set up a sophisticated multiprocessor minicomputer-based network—the largest of its kind in Canada.

"Our approach is different from the traditional network approach taken by such manufacturers as DEC and Hewlett-Packard."

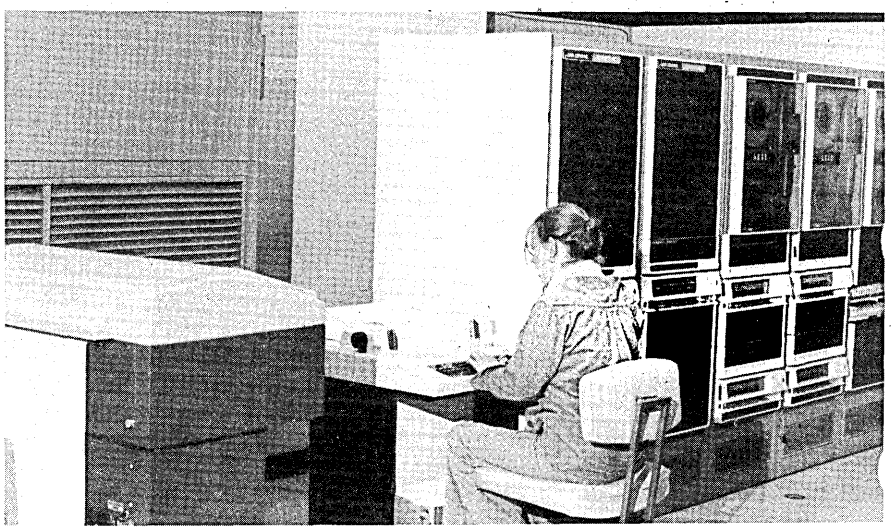
This network (FINNET) and the software products that are an outgrowth of this network development represent a success story—one that Finning likes to recount and Data General, the primary project vendor, likes to tout. Originally brainstormed in the spring of 1974, the company's network concept was a natural for minicomputers. But even so, two big mainframers, Honeywell and IBM, tried to woo the Canadian company with big number crunchers. However Finning, which already had a Honeywell 2040A operating in a batch mode, had pretty well made up its mind from the start to exploit mini might in its fledgling network.

Competing head-on for the resulting contract were the mini maker rivals Digital Equipment Corp. and Data General. DEC, bidding two PDP-11/70s, finally lost out to DG which Finning insiders point out had two sales advantages with its fast Infos file access system and its Multiprocessor Communications Adaptor (MCA). This latter device was particularly important to the company, since its central site processors have to have near instantaneous communication with each other.

Speedy order processing was also a must for the heavy equipment distributor which processes 3,300 orders a day through its 24 remote locations. The firm also maintains inventories for 600,000 parts worth $15 million. So order processing and inventory control, formerly handled in a batch environment on the workhorse Honeywell mainframe, are the main computer chores now being tackled by the new setup. The Honeywell system, still unretired although some associated gear has been returned, is being used for such functions as payroll processing.

Network components

Finning's real-time interactive network is centered around two Data General Eclipse C/300 commercial systems installed at the firm's home office in Vancouver. Connected to these main minis is a network of DG Nova 2 and Nova 3 minicomputers which are spread throughout Finning's remote branches. Operating off the field Novas are crt terminals and serial printers, DEC's LA 180.



FINNING'S NETWORK is centered around two Eclipse C/300 commercial systems installed at firm's home office in Vancouver.

Each remote site hook-up can support up to 14 crt's and any number of line printers. The terminal net is tied to the central Eclipse in Vancouver by dedicated synchronous lines. Currently there are between 30 and 40 remote terminals communicating with the central site. By the end of next year, the company expects 75 terminal link-ups. Right now, that terminal cache of 30 to 40 represents the 10 to 15 Finning branches or "remotes" which are currently on-line. (The dozen or so real remotes in this mix are coupled with pseudo remotes which are being used as internal test stations.) Finning's top dpers predict that all the rest of the branches will be on-line by the end of next year.

But of course that's if the Caterpillar equipment czar can decide how to tailor its expansion to accommodate recent developments, the most notable being the new $11 billion joint U.S.-Canada Alcan pipeline project. Finning computer systems manager Doug Dyment admits the pipeline plan "has certainly put a kink in our thinking.

"Right now," he says, the company is "trying to decide exactly how the pipeline is going to affect our growth. It's caused us a bit of a delay," he laments, "but in the long run it's going to mean more remotes for us."

Formerly with DG

Dyment and senior systems programmer Mike Haines are both happy Data General defectors. While Dyment was v.p. and co-founder of Data General Canada Ltd., Haines originally joined Datagen's Canadian subsidiary as a sales and technical engineer. Both are software research experts.

And it was Finning, not DG, that gave them both the chance to practice their combined software know-how. In on the ground floor of FINNET development, Dyment was in charge of network design. Haines was brought onboard about six months after Dyment when the company realized it would need some more system programming talent. Both know the in's and out's of the innovative network backwards and forwards.

Not traditional

Dyment explains Finning's network concept that he helped develop: "Our approach is different from the traditional network approach taken by such manufacturers as DEC and Hewlett Packard. Those nets are processor-based and their whole concept doesn't really tie everything together . . . They just allow a bunch of disparate processors to communicate with one another . . . So really, they're just communications capabilities that don't do that much toward helping the user solve his problem."

So what exactly is Finning's version of a network? Computer systems boss Dyment describes it this way: "Our system is a process-based system. And the concept is that the number and location of processors is largely irrelevent as far as the solution to the problem is concerned. We don't see," he explains, "our network as a way of tieing together a bunch of processors so that they can talk to one another."

The homogeneous FINNET, he says, is "a viable alternative to the big single processor. It provides a way to use a lot of little processors, operating similarly to a big processor." This approach, he claims, provides "a lot of flexibility" compared to going the big mainframe route which forces the implicit purchase of things other than raw processing power—i.e. disc processing muscle, memory access, and channel times.

No artificial barrier

But one of the biggest boons in this strategy, Dyment contends, is its growth potential. There's no artifical barrier, he insists, to stifle system expansion. "To us, adding another processor to the system is trivial . . . And because of the way we can move processes around in the system if we find one machine that's getting overloaded we can split the processes up and juggle them around however we see fit."

Another clever Finning strategy also is beginning to pay off. From the very beginning of the mini switchover, the company's computer crew has tried to separate systems programming from applications programming. Since applications such as the personnel and parts systems are of limited, if any, use to outsiders, Finning's dpers have concentrated on systems applications which can be used universally.

> Next year, the company anticipates shelling out close to $200,000 for additional hardware.

"Whenever a decision is made about how we should do something," Dyment points out, "we always try not to build anything into the system software about Finning." And that's done, he candidly admits, "because of marketability."

Formed subsidiary

And marketability is a big driving force behind much of what this $250 million company is doing today. Two months ago, with the blessing of Finning's top management, Finning Computer Services Ltd. was formed as a wholly owned company subsidiary. It's now projecting first year sales of $500,000 for the new venture.

Headed by David Langley, Finning's new computer software marketing manager, the enterprise will market on a license fee basis its in-house developed network (FINNET) and the associated communications protocol (NETCOM), as well as several home-grown software packages such as the M-5 virtual memory system which expands program execution space from 64KB to 2MB for FORTRAN 5 users. Finning's fledgling offshoot will also offer, as a result of in-house FORTRAN modifications, two languages—CFOR, a business programming language for Eclipse users, and BCPL, a high level language for Nova and Eclipse users.

Potential customers targeted by Langley include distributor-type businesses, companies with inventory hang-ups, or firms with discrete location problems that want to transfer data back and forth. Other businesses with close-in branches could also benefit from Finning's mini net approach, the company claims.

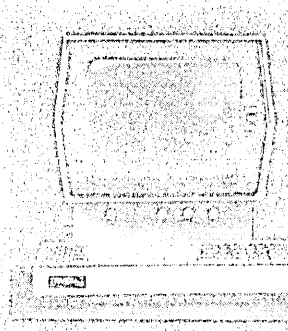
Ironically, Finning hadn't originally planned a marketing campaign. But it became clear early on that there was considerable interest, which has continued to grow, in the company's unique network scheme. Declares one top Finning dper: "The (marketing) idea was always in the back of our minds. But we weren't really thinking about it as a separate business. We were just thinking of recouping some of the network development costs by selling it to other Caterpillar dealers."

Now that the decision has been made to make the marketing move, former DGer Langley has his hands full gearing up for promotion, documentation, and encouraging user standardization of the various products. His "biggest tool," he acknowledges, is the Data General sales force. And this is obviously true since Finning's products give the DG peddlers an "extra tool to sell their wares," says senior programmer Haines.

Problem of distribution

But one major problem still has to be solved before Finning Computer Services can really get off the ground. And that's distribution. To solve this problem Langley is looking into several alternatives. Distribution, he explains, could be through an established software house or an independent oem software concern.

There's also a third option, one which Langley feels is unlikely. And that's to let Data General, the mighty mini maker itself, take over the whole operation—an opportunity that DG seems increasingly anxious to exploit. However, Finning insiders seem to believe that the Southboro, Mass., company, even if it was interested, wouldn't offer anywhere near



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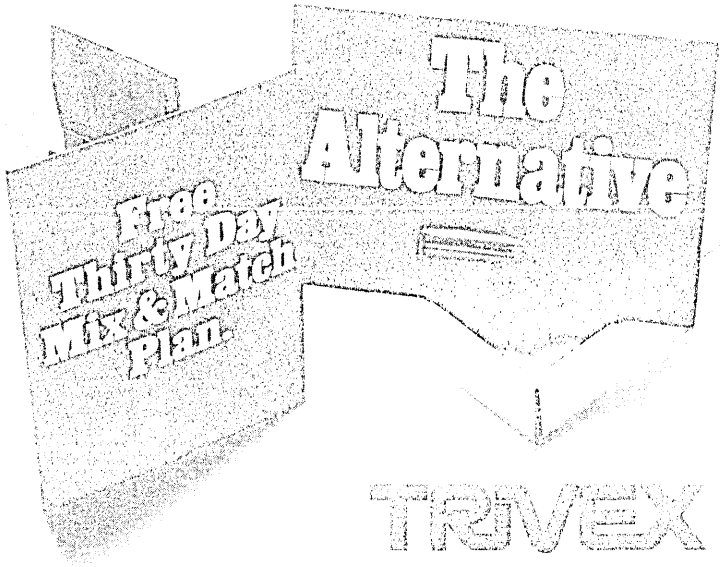

enough money for the business.

"A lot of DG's response to this thing," Langley maintains, "depends on how much pressure their product marketing people feel they're under to produce a homegrown network capability. One of the realities of this situation is that DEC's DECNET has not been a smashing success . . . But if it were to become a better product very quickly, then I think DG might be even more interested in looking into us."

Whatever the outcome of the temporary distributor dilemma, Finning's top dpers are committed to following through on their network plans. For next year, the company anticipates shelling out close to $200,000 for additional hardware. Included in those hardware buys will be another Eclipse, one or two Novas, and an undetermined number of discs. The new Eclipse, says Haines, will be used to boost the horsepower for the data base and application-type software.

Some of this new equipment will also be needed for new systems that Finning is anxious to start up. One of these is an internal communications setup using the crt terminals which will enable the company to offload its TWX and Telex gear (except in the main office) for a bottomline savings of $12,000 a month. This system is to be operational by January.

By the end of next year, the tractor distributor hopes to hook up through a specially dedicated and interfaced Nova to the Caterpillar Tractor Co.'s worldwide inquiry network which uses IBM 3270 terminals. With access to this Cat net, Finning offices will be able to track down equipment faster and keep closer tabs on shipments, order rates, and other vital distributor data.

Finning is also looking into other system-type applications for future network implementation. Although still an uncommitted project, a word processing system may be set up, tieing the computers to typewriters. The company already has a wp-type arrangement which is used internally by programmers to produce project reports, specifications, and documentation. Other extra systems may also be added for such applications as perimeter control and fire security at remote branches, and a data collection for job costing applications.

New commercial applications, expected to be ready to roll early next year also are in the works. While the firm's accounts receivable system is already up, the accounts payable system isn't targeted to be ready until the first quarter of next year.

The parts inventory set-up, which Haines describes as the operation's "bread and butter system," has gone through first phase development. The second phase, he explains, is "the backwater portion" of the total parts inventory system which is being coded now and should be up by February. In addition to these systems, dp manager Harris says another important system to keep track of equipment inventories is also being worked on.

After three and one-half years of intensive work, Finning's dp pioneers feel their network has met all the original design goals. And they've taken very little flack from Data General. In fact, they claim the big mini maker has been very cooperative. "We've had extremely good response from Data General all along," confides Haines.

However, to ensure this good treatment from Data General, Finning was savvy enough to "hedge our bet in a couple of ways," admits Harris. Anxious to protect itself, the company spent six months drawing up the voluminous contract which spells out the unusual lease/purchase arrangement on the $1 million deal. (These costs, to be written off over a five-year period, amount to monthly payments of $27,000 which includes maintenance.) The company also carefully put together a list of spare parts to be checked out and on hand from DG, and made sure that a DG service technician would be permanently on-site in case of trouble.

But even with all these "insurance policies," Harris readily concedes that he was scared by the big mini move. And this was also despite the fact, which was readily evident, that the firm would save one-third of the systems cost by going the mini instead of mainframe route.

"You bet I was (scared)," he confides. Former top Canadian DGer Doug Dyment seems to know just how scared Harris was. Dyment says of Harris: "He's only now beginning to come out of shock."

—Linda Flato

Printers

Thinking Small, Slow, and Big

"Vertical integration" is a naughty word at Dataproducts Corp., the Woodland Hills, Calif., firm that last year sold 10,503 line printers worth $86 million to 373 original equipment manufacturers and systems houses.

The term, as defined by the company, applies to computer manufacturers who find it more profitable to make their own printers rather than buy them from independents such as Dataproducts. The company claims it is the leading independent with about a third of the $300 million a year worldwide printer market. When measured in terms of what end users pay for them, it's a market that reaches close to the $750 million figure.

"We've reversed vertical integration among customers for higher speed products," says Graham Tyson, the company's president and chief executive officer. "Now, we're trying to do the same thing at the lower end."

And Tyson admits, "We'll run into a lot of competition there."

The company's printers up to now have ranged in speeds from 300 lines per minute (lpm) to 1,800 lpm. Last May it announced an attack on the lower end with four products that it thinks are needed in a computer environment where small business machines and dispersed or distributed systems are becoming prevalent:

—The B-180 and B-300, using a steel band font carrier for stress relief, will be priced at $3,000 and $3,300 respectively in oem quantities.

DATAPRODUCTS CHIEFS: Erwin Tomash, left, and Graham Tyson in front of Woodland Hills plant.

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CIRCLE 27 ON READER CARD

—The M-200, the company's first dot matrix printer, has an average speed of 200 lines per minute, but its logic-seeking lookahead feature which determines whether a line should be printed left to right or in reverse, can raise the speeds to as much as 300 lpm. Its price will be about $2,000 in oem quantities.

—The T-80, its first thermal matrix printer, is a desktop device that prints at speeds of 80 characters per second. The company aims it at those needing single hard copies from crt terminals, as well as use with small interactive terminals. The price is about $1,000 in oem quantities.

Ready in second quarter

All of these products will be in production and ready for shipment in the second quarter of next year, which is the first quarter of the company's fiscal year that ends in March. Whether they'll sell—or whether their potential customers decide to opt for vertical integration and make them themselves or go to other suppliers—depends on Dataproducts' ability to deliver the reliability, ease of use, and, most critical, price. "Price of peripherals," says chairman Erwin Tomash, is at the point that when compared to low priced mini and microcomputers, it is almost embarrassing.

But Dataproducts has done well in shaving prices. A 300 lpm printer it introduced 14 years ago at a price of $18,000 has dropped continually to within the $3,000 range today. "And without any degradation in performance," he notes.

"In fact," adds Tyson, "we're told by an IBM printer source that the price we're asking for our B-300 is about equal to IBM's cost in making a similar product."

The markets

Tomash, 56, and Tyson, 54, co-founders of the company in 1962, talked recently about Dataproducts' goals, progress, and markets.

First and foremost, Tomash, Tyson, and other company officers, notably Irving Weiselman, also a founder and now its v.p. for product programs, and Robert G. Bartizal, plucked two years ago from Control Data's peripherals company, think that the future in the printer industry still is in the impact printer market. That's where all of its business has been so far.

About 26% of Dataproducts' printers are used with large scale computers, 31% with minicomputers (its biggest customer is Digital Equipment Corp.), and the rest (43%) with terminal systems. In five years, though, it expects that mini-based small business and terminal systems will account for more than 70% of its shipments. However, big-dollar, higher-speed devices will be in demand too.

So no wonder the company's R&D budget has been soaring year by year—from a paltry $4.7 million two years ago to $9 million this year. "Today, you can't forget anything," says Tomash. "To keep costs down we have to work on all of the components of a printer—the mechanism, the paper feeding, the basic controls."

A 300 lpm printer introduced 14 years ago now sells for about $3,000.

The company's new B-80, for instance, now is electronically controlled through integrated circuits, instead of discrete power transistors, and the power needed is down from 650 watts to 200 watts. "That means a smaller heat absorbing sink, a smaller power supply, a smaller box, fewer components," said Tomash. And, of course, a smaller price.

Reliability is critical. When you sell someone a $10,000 a month printer you can afford to send a maintenance man around, Tomash said. "At $500 a month, however, you can't. So it had better be reliable. Prices have tumbled." And, they point out, today's printers aren't going to sophisticated users, but to the guy on a factory floor, so they must be easy to use.

Good track record

Happy talk about their products? Maybe. But Dataproducts has a good track record.

Formed with founders' seed money and some $1 million in small business investment corporation money, its plan was to reach $25 million a year in five years. It made it in six. It tried for a growth rate of 15% to 20% a year and recently succeeded. Last year it became a $100 million company (1977 revenues reached $115,298,000) and this year's six-month revenues in September had passed the $61,830,000 mark.

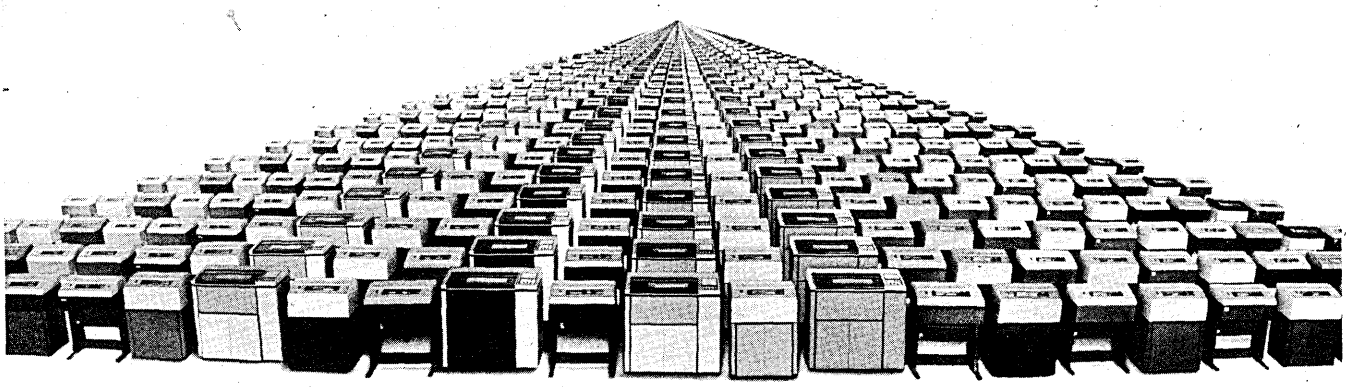
And although printers accounted for three-quarters of its revenue, it wasn't doing badly in other ventures.

Its core memory activity last year continued to soar despite continuing price cuts on semiconductors. (Revenues rose 33% to $17,963,000 and income was $3.5 million, a rise of 194%. Tyson said the company will reach another record in core memories this year.)

Its Stelma Telecommunications subsidiary in Wallingford, Conn., primarily a supplier of military communications systems, last month was integrated with Dataproducts' military (ruggedized) printer manufacturing. Eventually, says Tyson, the result could be a line of communicating teleprinters, although the reason for the integration was to consolidate the company's marketing efforts to the government.

No dumping

While it foresees an eventual lessening in the demand for core products, Dataproducts won't dump its employees when that time comes. In Dublin, Ireland, where it makes core products with some 300 employees, the company recently opened a printer facility as it is doing in Hong Kong where some 800



PRINTERS, PRINTERS: Datproducts Corp. shipped 10,000 of them last year, getting about $86 million from a $300 million market.

persons are involved in making core and printer components. The same for a core facility in Santa Clara, Calif., where the core making work-force of 300 is being trained to make the matrix printers. The company last month had some 4,000 employees and was adding on all the time.

"It probably would be cheaper for us to say 'thank you and goodbye' when the time came to phase out our core activity," says Tomash, "but that isn't the way we work." (Although Tomash admits he once was "despondent" at the quality and attitudes of new people coming into the company in the late '60s. "Nobody seemed to want to work or to stay," he said.)

Ink-jet acquisition

As for the future in printer products, Tyson said Dataproducts is studying ink-jet printer technology, but doesn't have a product under development and probably couldn't have one for shipment for four to five years. He said IBM's recently introduced model 46/40 ink-jet device does not have the "broad gauge use" that a product from Dataproducts must have. However, he doesn't rule out an acquisition should the technology prove useful to Dataproducts strategy. The same, he said, goes for electrostatic printers, along the lines of IBM's model 3800 printer, whose print speeds range from 10,900 to 13,880 lpm.

Income from core memories rose 194% last year and the company will set another record this year.

Tyson and Tomash are convinced that customers respond to market pull, not necessarily to "the technology you have in the lab," although Dataproducts does have some 350 persons working in the lab. "IBM had two tries with a printer before it came up with its model 1403," said Tomash of the famed IBM printer introduced in the mid-'60s with its 360 line and which still is in wide use and demand today. "One was a matrix printer and the other a stick printer. Both were in production before being replaced by the 1403."

Which is their way of saying that Dataproducts isn't an IBM with all of the giant's resources. But with its 4,000 employees in six locations, its national and international marketing force, its distributors in nine countries, and its nine major printer models going to some 400 customers, plus all that is in the near future, Dataproducts could at least qualify as the IBM of the independent printer industry.

—Tom McCusker

EFTS

NCEFT Final Report: Not Much Difference

Competitive marketplace endorsed with two exceptions

In a long overdue final report, the National Commission on Electronic Funds Transfer endorsed a totally competitive marketplace for EFT services with two key exceptions.

One concerned AT&T and the other operation by the Federal Reserve System of automated clearing houses (ACH's). In general, the final report didn't expand much on an interim report made public last January.

The commission (NCEFT) had an uphill fight even to get going. Established by Congress in August of 1974 to recommend action and legislation in connection with the development of public or private electronic funds transfer systems, it didn't get staffed until October of 1975 with a two-year charter to accomplish its mission.

Its preliminary report early this year was generally considered lacking in many respects, and was called by some (February, p. 16) a ho-hum report. The final report, issued in late October, doesn't differ much from the interim version.

The commission's most significant recommendation in the final report was that "only the underlying communications transmission and distribution facilities used with EFT systems should continue to be regulated . . . and only to the extent they are provided by . . . common carriers." Those (common carriers) providing EFT transmission/distribution *services* (as distinct from *facilities)* should be unregulated, the commission added. It also said the carriers should be allowed to offer services (a departure from the interim report). The question of how to do this was referred to the Federal Communications Commission (FCC), although the report recommends, as a possibility, that the carriers be allowed to set up arm's-length EFT services subsidiaries.

No need

Government regulation of EFT delivery services would be unnecessary (because there's plenty of competition) and counter-productive (because it would discourage needed technological innovation), said the commission. These considerations outweigh the fact that "EFT systems may . . . include components such as concentrators, multiplexors, modems, switches, and other equipment" which traditionally have been considered parts of a regulated communications service.

If that formulation is accepted by Congress, it will have far-reaching implications for all users and suppliers of on-line computer services.

For, implicit in the commission's recommendation is a completely new criterion for deciding which communications-related services should be offered exclusively by the carriers, and which should be offered competitively. Whether a particular service is "communications" or "data processing"—the issue the FCC currently is agonizing over in its Computer Inquiry—becomes academic. Instead, regulation hinges on whether the service is a natural monopoly and is characterized by rapid technological change.

That shift in policy could open a lot of new markets for unregulated vendors of on-line information services—for example, electronic mail and electronic mail box services, teleconferencing, interactive services based on the shared use of a central switch, and packet communications. Another possibility is that users of a commercial "data processing service" could send messages back and forth to each other without restriction, instead of being limited to communication with a central computer as they are now.

Although the EFT commission said the carriers should be allowed to offer EFT services on an unregulated basis, it added that "AT&T presents a special case" because of the 1956 consent decree. "Unless and until that decree is modified, an issue on which this commission takes no position," AT&T should provide only those EFT services permitted by the FCC. (It may be significant that the original wording of this recommendation said "legislation should be adopted which would permit AT&T to establish . . . a separate subsidiary, notwithstanding the . . . 1956 consent decree or current FCC rules.")

The commissibn endorsed operation of automated clearing houses by the Federal Reserve System largely because of economics. Using a single system to process government and private sector transactions is far cheaper than separate systems, the report explained, and "the commission believes, although this is not critical . . . , that Federal Reserve banks are the proper processors of government . . . automated payments." Many commercial banks and some vendors of computerized EFT systems and services disagree with this reasoning: the vendors are looking for additional business, while at least some of the banks want to gain control of ACH operations so they can deny access to savings and loan associations, credit unions, and other competitors.

Dominance controls

The EFT commission's report acknowledges that the U.S. standards-writing process leaves much to be desired. It mentions that dominant firms are allowed to control the market through de facto standards, and says industry-wide efforts could be more "responsive"—i.e. speeded up so that the final product reflected newer technology. But, despite these shortcomings, and despite "the concerns voiced by many vendors" that "the current process (of developing standards within ANSI) will unnecessarily delay the development of needed standards," the commission recommended no drastic remedies.

> Regulation now hinges on whether the service is a natural monopoly and is characterized by rapid technological change.

It believes a supplier should be required to make public its communications protocol and interface standards if these are at variance with ANSI standards." Also, if the standards are changed, the modifications should be publicized "at the time they are certified for use" rather than after systems incorporating modifications are delivered to customers. This will assure "maximum lead time for other manufacturers." In addition, representatives of federal and state financial regulatory agencies should become "principal members" of the ANSI groups developing EFT standards, and ANSI should "expedite" development of standards for numbering systems, message formats, and standardized invoice and billing systems.

These recommendations follow in the wake of much stronger statements by a number of industry groups, including the Computer and Communications Industry Assn. (CCIA), which argued that voluntary disclosure of proprietary standards is "not effective or enforceable." CCIA advocated a federally chartered organization to administer EFT standards. NBS would provide technical support, and membership fees would be modest so smaller participants wouldn't be disadvantaged. If the board failed to begin work on a particular standard, a participant could seek court review. Standards promulgated by the board would be mandatory for the federal government and for federally insured financial institutions.

Regarding EFT system security, the commission's most significant recommendation was that credit card users who write their personal identification numbers (PIN's) on the card and then lose it "should be considered negligent and therefore liable for any . . . loss."

The report adds that several countermeasures, including the new encryption algorithm standardized by the government, have been developed but "none has gained widespread acceptance because of (its) cost and/or reliability." The commission, however, decided to be "deliberately cautious in making recommendations that might be . . . restrictive in the constantly evolving EFT security environment."

Security threat

Referring to "considerable study" of the security threat, the report says the experts "generally agree" that technical and procedural solutions to "vitually all" of the problems are "currently available." Whether this availability provides an adequate answer to the problem, though, is questionable, particularly if the solutions are too costly and/or unreliable.

Another possible inconsistency in this section of the commission's report is the statement that EFT may be "significantly more secure" from fraud than paper-based systems because a crook needs "a higher level of technical skill." Soon after making this assertion, however, the commission points out that "interconnected EFT systems introduce a new dimension in security risks—that of large and complex communications networks with switching facilities used by many financial institutions and merchants. The possibility that a breach in security at one point may compromise security at many financial institutions thus becomes both real and important."

The report contains a long list of recommendations aimed at assuring the privacy of EFT files, but largely they are reiterations of proposals developed by others, and are no longer very controversial and repeat the interim report. Briefly, the commission says: EFT systems should not be used for surveillance of individuals; the government should be required to obtain a subpoena before gaining access to an individual's EFT record; disclosure to other third parties should be restricted, and in many cases forbidden, unless the individual agrees to disclosure beforehand; he should be able

to challenge and correct his EFT record; and if denied EFT service because of an unfavorable report by a credit authorization agency, he should be given the agency's name and address.

The commission stood by its support, stated in its interim report, of ACH operations by the Federal Reserve Board until such support can be taken over by the private sector. Last July, the Privacy Protection Study Commission opposed the idea, saying "no governmental entity" should be allowed to own, operate, or manage any part of an "electronic payments mechanism" involving private transactions because it would encourage government snooping. The EFT commission indicated it shares this concern up to a point, but believes another privacy commission recommendation addresses the real problem. This one says "individually identifiable" EFT account information should be retained by the parties to EFT transactions—i.e. both by an ACH or other service provider—"except to the extent, and for the limited period of time that such information is essential to fulfill the operational requirements of the service provider."

EFT may be "significantly more secure" because a crook needs a higher level of technical skill.

Minicomputers

Wang Takes A Giant Step

The commercial on CBS' Sunday afternoon NFL football game depicts Wang Laboratories as the David of the dp industry, ready to do battle with the Goliath of Armonk.

Wang Labs a giant killer? The prospect may not exactly have IBM quaking in its boots, but with the recent announcement of two new virtual memory-based minicomputer systems and a current growth rate that is second only to that of Amdahl Corp. within the industry, the Lowell, Mass., small computer and word processing equipment manufacturer appears ready to give IBM and some of its other competitors a real run for the money.

Indeed, as the numbers point up, Wang has already come a long way towards moving into the corporate big leagues. In the five years since Dr. An Wang, the firm's 57 year old president, chairman of the board of directors, and guiding genius, abandoned the calculator business and moved into computers, Wang's sales have shot up from roughly $47 million to $134 million—a compounded annual growth rate of close to 30%. And the firm projects its revenues will be about ten times their present level in the 1980s. "Our goal . . . is to position the company to become a billion dollar equipment supplier within the next decade," notes Wang's Sr. v.p. John F. Cunningham.

WANG'S NED CHANG
V.P. of marketing explains
"We've reached a milestone."

Moreover, profits have burgeoned—last year they reached $9 million and the company now boasts a 25% share of the small computer market it serves.

Further, with Wang's introduction of crt-based word processing systems (WPS 10, 20, and 30) in mid-1976, the firm's word processing business has also taken off. Today, in fact, Wang claims to be booking more word processing equipment based on crt technology than any other supplier. Combined, the word processing and computer worldwide customer base now exceeds 30,000 users, Wang asserts, and is strong enough to provide the company with a springboard into new ventures.

A milestone

"We've reached a milestone," explains Ned Chang, the company's sr. v.p. of marketing. "We've developed a strong market position and with this customer base, we're ready to launch a more complex, ambitious product line."

Specifically, Chang is speaking of the recently introduced 2200vs virtual memory processor and two interactive computer systems dubbed the 32-bit WCS/60 and the WCS/80.

Both machines offer a virtual memory capacity through the 2200vs processor and move Wang squarely into the large scale minicomputer market in head-to-head competition against IBM's System/34, DEC's PDP 11/34 and 11/70, and Data General's Eclipse line.

Wang's principal target, however, ap-

pears to be System/34, and the introduction of its new computers was carefully timed to have a maximum impact on the 34 market. "We feel we timed the product very well," says Chang. "We could have introduced it last spring, but we wanted to make the announcement before IBM started delivery (on System/34) and after they'd opened up the market."

One customer likes it

With considerably more throughput than the 34, Wang's new computers have proven more appealing than IBM's offering to at least one customer, a major national retail chain which is employing a WCS/80 in a distributed mode tied to its big IBM host machines. "We're using it in a warehouse where we needed a low cost interactive machine that was easy to use and had a very large file capacity," an executive with the firm, who asked that neither he nor his company be identified, explained.

Because of its virtual memory capacity and instruction format, registers, and addressing that are the same as those in the 360 and 370 lines, Wang believes the new machines are a natural for the IBM distributed marketplace. "We feel that because of our architecture, it's much easier for an IBM user to bring us into the host environment than it would be to use a foreign technology like that of Datapoint or DEC," says Chang.

Wang also is shooting at the first time user market and hopes to triple its span of overall computer market coverage with the 60-80 product. "We now serve about 25% of the total market by unit," Cunningham explained. "Our new products will expand that coverage to 80%."

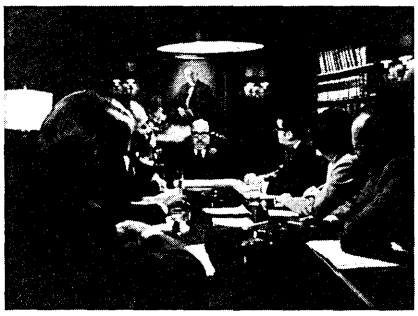
Image problems

Maybe so, but Wang has something of an image problem as it attempts to giant step into a large scale mini market. "We're still thought of by some people as a calculator company, and that works against us in trying to sell big systems," one Wang sales executive confides privately.

To overcome this image problem, Wang is blitzing the home screen with an ad campaign and setting up a sales force to deal with big national accounts. Small may be beautiful, as the Wang people have so often said in the past, but when it comes down to the numbers on the corporate balance sheet or future growth aspirations, bigger is better.

—L.M.

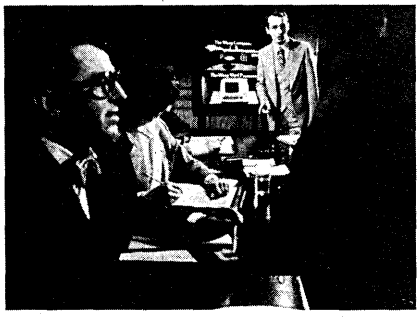
Wang's David Defeats Goliath on Television



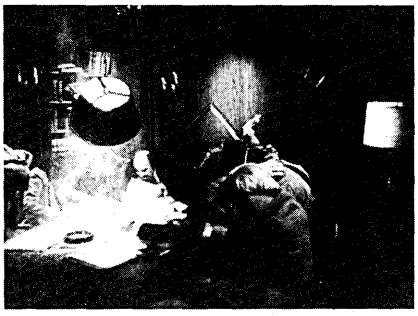
Board Chairman: Let's buy our small computer from the giant computer company. You can't beat Goliath.

Board Chairman: Right, David?

David: Sir, let's go with Wang.

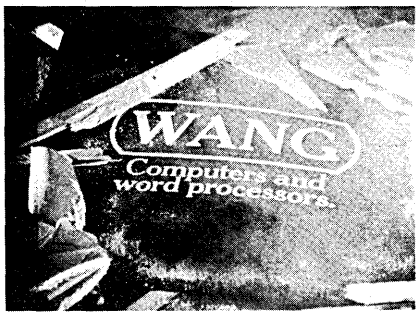


David: Nobody makes a better small computer or word processor. They're giant killers.



Sound of sling whistling in background. Crashing noises.

Board Chairman: He's right.



Announcer in background: It happened before, it can happen again, because nobody's hungrier than Wang.

Software

Personal Project In The Business World

When Unix, a time-sharing operating system for Digital Equipment Corp. PDP 11s, was under development at Bell Laboratories in the early 1970s, it was as a personal project with no predefined objectives.

Its designers see this as a key factor in its subsequent success. One of them, Ken Thompson, wrote the first version when, dissatisfied with available computer facilities, he discovered a little-used PDP-7 at Bell Labs and set out to create a more

hospitable environment. His work excited the interest of Unix' other designer, Dennis Ritchie, and it grew and grew, first to an 11/20 and later to an 11/45.

Word of Unix' simplicity and ease of use got beyond the walls of Bell Labs. Others wanted it, particularly universities. Bell said it would make Unix available at no charge for educational use but others would have to pay a $20,000 license fee for an unsupported tape.

"Few people thought there would be many people willing to pay that price when DEC was offering a supported timesharing operating system for considerably less," said Peter Weiner who became the first person to do exactly that.

It was in 1973 when Weiner was preparing to leave Yale Univ., where he had established and directed its computer sciences department, for Rand Corp. where he was to head up the Information Sciences Dept. "I completed the papers to get Unix for Yale just before leaving for Rand," he recalls. One of the conditions under which Weiner went to Rand was acquisition by the company of a PDP 11/45. A second was payment of the $20,000 for Unix.

Since that time, Weiner estimates that some 60 companies have paid the price for an unsupported Unix. He believes the operating system is running on 360 cpu's outside of Bell Labs.

A very active Unix user group grew up fast, Weiner said, and that group was the only source of support and enhancement. At least it was until last June. Last April Weiner was asked by a friend what new ideas he felt would make a good basis for a new business. He began to think about the numbers of companies which had been willing to part with $20,000 for Unix unsupported, about the enhancements he had created for Unix while at Rand, and about his own long-standing interest in interactive personal computing.

Formed a company

By June he had formed Interactive Systems Corp. in Santa Monica, Calif., and had a license from Bell Labs to market Unix-based systems. He offers systems with or without hardware and he offers support. By late October, Interactive had its own PDP 11/45 up and running, supporting terminals not only on the desk of each of the firm's 12 employees but in each employee's home as well. "Among other things we use the system as electronic mail," Weiner said. The company also had one customer installation in, at ITT in San Diego. "We're working with ITT to develop a real-time capability, something in which Unix does not excel now," Weiner said. "We're going to add real-time support."

One thing he already has added is INGRES (Interactive Graphics and Retrieval System), a relational data base for which Interactive holds a license from the Univ. of California at Berkeley where it was 10 man-years in development.

Another is INed, an interactive text editor which is crt-oriented and can perform corrections, insertions, deletions, and other reformatting operations, usually by pressing a single labeled function key.

Interactive Systems was founded, said Weiner, "on the premise that society is about to experience major changes through the introduction of highly interactive and effective computer systems. Our goal is to develop and market systems that make integral use of advanced computer technologies. These computer-based systems will change human interaction with computers in fundamental ways. We are geared to participate in and give shape to this revolution."

License from Bell

The company calls its enhanced Unix systems Interactive System/One. Interactive System/Two is coming along. It too is based on a Bell Labs development. This one, called Programmers Workbench (PWB), uses Unix and makes it possible to develop software for large scale computers using minis. Interactive has a license from Bell for PWB, similar to the one it holds for Unix.

The company took delivery late last month on an IBM Office System 6 which it hopes to use in getting Unix into word processing. On order is a phototypesetter which it plans as a vehicle to get the company into photocomposition. "We want to be into all aspects of the automation of the office," said Weiner.

The staff

In addition to Weiner as president, other officers of Interactive include: Howard Lee Morgan, an associate professor of decision sciences and computer sciences at the Wharton School, v.p.; Margaret Gallegos, formerly with Rand, corporate secretary and chief financial officer; Walter Bilofsky, from Bold, Baranek & Newman, director of research and development; Keith Davis, most recently minicomputer supervisor of a double mainframe PDP-11 facility, director of services; James Gillogly, from Rand, director of programming; Beatrice Yormark, from Rand, director of systems analysis; J. Steven Zucker, Rand, director of system development; and Ev Conger, a former consultant, publications director.

Offers of directorships in mid-October had been made to and were being considered by: Ed David, a former presidential science advisor now head of Exxon Research and Engineering and the person who signed off the Unix project while still at Bell Labs; Guy Dobbs, Xerox Corp.; and Larry Roberts, president of Telenet.

—E. M.

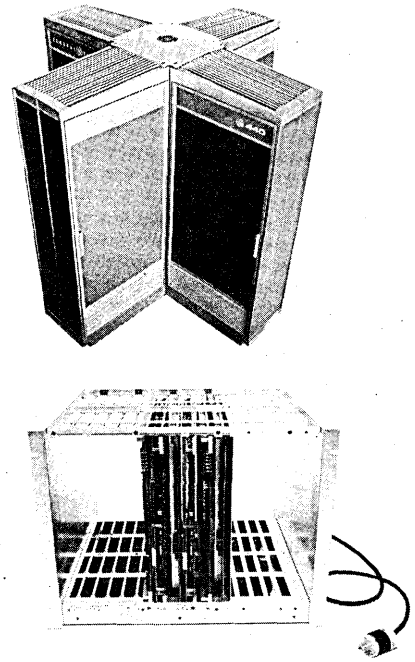
Mainframes

Telefile to Debut Yesterday's Cpu's

Telefile Computer Corp., Irvine, Calif., bills itself as a computer enhancement company, dedicated to prolonging the useful life of older cpu's whose speed and efficiency never were fully tapped before they were effectively obsoleted by their manufacturers in one way or another.

The firm never made computers, although a computer bears its name. The rights to the name Telefile were purchased from Bunker-Ramo which once produced a computer by that name. A few of these are still in existence and operating.

Now the Orange County company is going to live up to the "Computer" in its company name. It will announce late this year or early next, three families of computers it will produce, but they are not new in the true sense of the word. They are Telefile's enhanced versions of three computer families that have been around for a while: the Lockheed MAC-16; the General Electric 400; and the Xerox Data Systems Sigma systems.



SIX FEET PLUS tall GE 440's (above) transparent and more powerful successor is Telefile Computer Corp.'s shopping cart size TCP-24.

Telefile will call its MAC-like 16-bit family, TCP-16s. The 24-bit GE-400 compatible computers will be TCP-24s, and the 32-bit Sigma look-alikes will be called TCP-32s.

The aim of the new computer families like that of Telefile's main product lines—accessories and peripherals for the oldies but goodies of computerdom—is keeping intact users' investments in useful software.

Datacomm uses

Lockheed's MAC-16 (now the LEC-16) didn't sell all that well, said a company spokesman, but "those that bought them, bought lots and they're ideal for process control applications." Telefile itself used many in its data communications products.

Telefile said its TCP-16, some models of which are available now, does more than emulate the MAC-16. One currently available model, Model 1, the company said, is a single board, a microprocessor chip set which does everything the MAC does but does it a little slower and "a whole lot cheaper." Model 2, also available now, is a straight board-for-board emulation of the MAC.

Coming, beginning with Model 5, Telefile said, is microprogramming of the MAC and extension of its instruction and register sets. "Where the MAC-16 addresses only 4K to 65K words, upper TCP-16 models will go from 32K to one million words," a spokesman said.

Computer size will be cut down, he added, and only three boards are required in some TCP-16 models where MAC has eight.

Shrunken GE device

Of the GE-compatible TCP-24, he said: "In a basket of six printed circuit cards no bigger than a shopping cart, will be a computer fully transparent to the six-and-a half foot tall GE-400 mainframe." This family should be available in early 1979. Telefile said the TCP-24 family will have four times the performance at a fraction of the cost of its GE predecessor.

In memory, the firm said, cycle time will be cut from 2.8 microseconds (fastest GE time) down to 700 nanoseconds, and memory will be expanded all the way to two million addressable words in 16K word increments.

Again, Telefile's aim was at a market of GE users desiring to protect a major investment in hardware and software by giving them a place to grow. Although the TCP-24 was developed and ready to go by mid-October, the company was waiting for reaction at a late October meeting of GE users in Ft. Wayne, Ind., before really going ahead with the project.

Sigma is a favorite

The firm's favorite among the new families is the Sigma-like TCP-32s. Since before Xerox got out of the general purpose computer business, the Xerox customer base has been a big market for Telefile. Now it's a computer market as well as a peripherals and accessories market.

The new Sigma 9-like computers from Telefile are scheduled for delivery in late 1978 and will, the firm said, "run all that great Xerox software plus any other programs users have developed."

As with the 24-bit machines, the 32 bit units will use LSI, MSI, and microprogramming techniques that the company claims will reduce size, increase reliability, and boost overall performance.

Telefile claims the TCP-32s will outperform Sigma 9s by four to one.

It's a rare company that can make a go of introductions of old computers, but Telefile has a good track record based on enhancing the obsolete so maybe it can do it.

—Edith Myers

Companies

NCR: A Sheik in Oil Rich Arabia

Salesmen There Say IBM Is Just Another Company

(Editor's Note: Vin McLellan, of our Boston bureau, has been traveling in the Middle East. This report was filed last month from Beirut, Lebanon.)

In the sandy, wealthy lands of the Middle East— among the petro kingdoms—NCR, the old cash register company from Dayton, is a familiar and respected courtier. It was a presence in Arabia for more than 20 years before it began selling computers here three years ago—which is perhaps why NCR is something of a Sheik among the U.S. and European firms now queuing to barter their bytes for buckets of oil.

Only here, among all the international markets, NCR claims more than 50% market share "in most of the region." The U.S. Dept. of Commerce describes the Mideast as an export market of almost

unparalleled and explosive potential for U.S. technology. Although only a sliver of NCR international, it is the company's fastest growing overseas market, and the competition had been worrying about NCR even before the recent product line expansions made it so much more of a formidable competitor. Computers are so new here that the U.S. status hierarchy doesn't apply. Salesmen say IBM is just another company.

Even in Saudi Arabia, the mother-lode for any U.S. salesman in this part of the world, NCR maintains the claim of majority market-share. (Although in deference to IBM's huge ARAMCO installation at Dhahran, they concede the measure by value and claim only the number count.) But while virtually every computer firm still is desperately trying to establish a commercial beachhead in the Holy Land of Islam, NCR this year expects to pump out $10 million in Saudi sales. And although NCR executives refuse to separate computer sales, they concede that they rely largely on dp for a continuation of their 40% annual growth.

Hard to grasp

With all the press devoted to the oily billions being poured into Saudi development—with a population of less than six million, the 1977 Saudi budget is more than $32 billion—both the harsh difficulties and the unique potential of the market have been widely heralded. Yet it remains difficult to grasp. Current spending blinds you to the take-off curve.

Using the common, and contagious, liquid metaphor of which the Arabs are so fond, Khalil Abboud, NCR general manager for *LEJOSA* (Lebanon, Jordan, and Saudi Arabia) describes the Saudi market as "bubbling, absolutely bubbling!"

Jordan is "small but steady." Lebanon is still politically and commercially unstable, but nothing has replaced it as the financial center of the Mideast, and a post-war resurgence is beginning. "But the Saudi market," he said, "the Saudi market is so big. So unbelievably big!" Just yesterday, it was essentially closed. "It had nothing. Then suddenly, whoomp!"

NCR and IBM still are the only "established" vendors, said Abboud, but ICL, CII-Honeywell Bull, Data General, DEC, and Wang all are beginning to appear. Many of them are strutting in like chickens, he laughed. "And they're going to lose a lot of feathers."

"We have found that an annual 40% increase in sales is about as much as we can really digest," he explained. Even that keeps his staff in a constant cycle of recruitment and training. Within the last three months, he said, he has hired 15 new field engineers to add to the 35-man NCR technical staff already on duty in Saudi. And even with that addition, he can only cover orders already on the books.

They know what they want

NCR, said Abboud, picks up 60% to 70% of its Saudi computer sales—"perhaps more"—without competitive challenge; and while that may change quickly, even now it's not a walk-in sale. "It's not a showplace market," he insisted. "They know what they want. These units get functionally applied and well used. They want the best; they want it yesterday; they want it to work; and they want results to go with it. And they're

Baksheesh: "Better Not to Mention It"

"Better not to mention it; better not to mention it at all," cautions Khalil Abboud, NCR's general manager for Lebanon, Jordan, and Saudi Arabia. He refers to *baksheesh*—the unregistered commission, the bribe, the traditional expediter.

NCR runs its Mideast business directly through its own employees rather than through foreign national agents. So it does not have the option of simply overpaying its agents and leaving the necessary "local arrangements" to them, thus establishing "undeniability." But from private talks with U. S. salesmen in the computer industry and

KHALIL Y. ABBOUD
The Saudi market is bubbling

others, this is common current practice. And within the Saudi context, many argue that it is the only way they can work. Even the Saudi requirement that a foreign company have a well-paid figurehead "sponsor" (for NCR: the brother of a former prime minister) argues that the practice of paying for connections, or just for a name, is institutionalized.

Mr. Abboud, put on the spot, disagreed. "If some people are using their foreign agents for blind drops," he said, "and if they are Americans, I think they are shortsighted."

Others do what they want

"If they are not Americans, they don't have the IRS, they don't have the SEC, they don't have all of this," he pointed out. "They don't have the same problems; they can do what they want. But we are an American firm, so for us, it's out . . . But we've had offers and we've had to say, 'Sorry, for us it's not worth it. For one order, how many people might have to go to jail?' "

(NCR, in March of 1976, said it voluntarily reported to the Securities and Exchange Commission that it paid between $300,000 and $500,000 between 1971 and 1975 to obtain foreign business. But it said none of its senior officers or directors authorized or knew of the payments, and that it had circulated a written policy to key company officials that prescribed a code of conduct.)

But where does this put a company like NCR when it must bid against CII-Honeywell Bull or ICL in Saudi? "Well," temporized Abboud, "they've just come, you know, they're just comers . . . But when others come, especially, let's say, smaller and less scrupulous firms, well . . . the place is a temptation.

"It is for anyone selling anything! Minicomputers. Big computers. Anyone selling anything.

"They say, 'If everyone is doing it, and if I'm just here to make money, why don't I join the bandwagon!' "

And how does NCR guard itself against temptation and sin?

"Well, as far as our own people, the individuals, it's mostly not worth it," explained Abboud. "And as a company, we're 100%. For the simple reason, forgetting about ethics and everything else, we are not prepared—for any order, regardless of the size—to have our chairman, his assistant, his vice-chairman, our vice-presidents, and me also (although they can't force me to testify; they might catch me someday) to go to jail!

"Short of committing perjury . . . I mean, unless you're willing to say, 'No, it wasn't me, I haven't done it' . . . Okay, so nobody can prove anything. But unless you're willing to perjure yourself, you'd better stop. You'd better stop. Otherwise they'll catch up with you." **—V.M.**

often *very* ticklish about deliveries."

In May, NCR closed a deal for the rental of a Century 151 at the Saudi Ministry of Finance. It had been a competitive bid; the Century against an IBM 370/115, both the type of small mainframes that are still the heart of the market in this region. "Delivery was one of the prerequisites: immediate delivery," said Abboud. NCR gambled and preordered; IBM apparently couldn't. And delivery, said the Saudis, finally became the "only factor" in the choice. "They want all their equipment within three months. Offer them something with delivery in a year, with another half year needed for set-up, and they'll say, 'Thank you very much. We don't need it.' "

War Is War, But . . .

An executive of New York's Citibank, recently based in Saudi Arabia, tells a rather impressive tale of Lebanese initiative and NCR finesse.

During the height of the civil war in Lebanon, one of the NCR units—probably a terminal—failed at the Rhiat Citibank office. It had to be replaced. From NCR in Greece, Citibank learned that the only similar unit in the area was in the boarded-up office in Beirut. So late one night, NCR Moslem employees in West Beirut went to the office, picked up the machine, and trucked it to a rendezvous along the bitterly contested battlefront where they passed it over to Lebanese Christian NCR employees who smuggled it to Greece, then shipped it to Saudi.

Said the Citibank executive: "A perfect example of the Lebanese character: war is war, but business is business. . . ." ❋

No local talent

The harsh climate and the unrelentingly constricted Islamic culture are obvious problems for Western (or Westernized Arab) staff. Spiralling costs are the biggest trap for newcomers. But from NCR's point of view, the shortage of manpower is almost a constant haunting crisis. "It's a country where you simply can't hire local talent," said Abboud. Everyone is understaffed; both vendors and users (one major reason for the competition-free sales). "It's the same for all of us—NCR, IBM, even the Saudi government. The people who sell, service, program, and use these machines are all foreigners. We at NCR have reached the stage where as long as a person has the qualifications, any nationality is good—as long as the man is willing to go to Saudi Arabia!" And Abboud himself has no illusions as to why anyone binds himself into a three-year contract in Saudi. "For the money," he said, with a flat certainty. "It's the *only* reason."

Khalil Abboud is Lebanese; a 25-year NCR veteran; one of those cosmopolitan Levant businessmen who are about equally respected and feared throughout the Arab world. *LEJOSA* is one of the three NCR regional sales districts in the Mideast, and Abboud governs it now from the battered city of Beirut. After 18 months in Amman, Jordan, where NCR had evacuated during the height of the civil war, Abboud returned in July to set up the office again on notorious Phoenicia Street, in the shell-pocked center of Beirut's nightclub district.

Most natural crossroads

With all its problems, Beirut is still the most natural crossroads for East and West—and NCR, like so many American companies, still finds the Lebanese businessman, with his ability to walk comfortably in both worlds, the indispensable middleman. "By strange coincidence," he said smiling, the other two Mideast NCR districts (North Africa and the Gulf States) also are managed by Lebanese.

Nearly half of NCR's 100-man staff in Saudi is Lebanese, but the rest, said Abboud, look like a composite UN force: "Indians, Pakistanis, Syrians, Germans, Jordanians, Americans, Maltesians, and British. Recent rumors that the Saudis are refusing visas to Lebanese Moslems—who broadly speaking supported the leftists in the civil war—might impact NCR's Saudi staff.

"To do business in Saudi Arabia is difficult," sighed Abboud, "and it's expensive. So very expensive. More than four or five times the cost of Lebanon and Jordan. If you just consider the fact that everyone is expatriate. To get a visa, if you have all the papers ready, will take a month. For a visit. If it is a work visa, it could take two or three months. That's time lost. And you have to offer employees attractive conditions to make them stay, because as far as fun there is *nothing!* Housing? There is no doubt that you have to give it free. No doubt. No employee could bear the cost. The cost of everything . . . it's just unbelievable!"

Though deeply mired in the past, the Saudis are determined to buy a way directly into the future for their children.

Saudi Arabia is a hardship post even for the Saudis, apparently, but it's difficult to feel sympathy for NCR: $10 million in sales; 40% growth; 70% of sales no-bid? "I know, I know! It is a pipe dream," Abboud squealed with a laugh. "It *is* a pipe dream! But I tell you, you leave all your feathers behind when you get out. That's the trouble with the place. . . ." Both hands raise in wordless exasperation.

"Unexpected costs, yes, that's part of it. That's one to start with," he explained patiently. "I mean, if you take rents, for example. In the past three years rents in Saudi have gone up 1,000%!" Less easy to categorize, or even describe, apparently, are the myriad of petty details—consuming time, energy, and money—that have to do with trying to operate a modern business in a preindustrial feudal country with a strangling bureaucracy. The problems reflect the very situation that gives rise to this enormous potential. The Saudis are a people deeply mired in the past, but determined to buy a way directly into the future for their children. "If you take a country that has nothing," said Abboud, "nothing. And that was going along at a very slow quiet pace—and then, suddenly, they have a budget of 110 billion rials and it has to be spent!"

Computer is a must

No culture in the world could withstand such drastic changes without severe dislocation and distortions—and the market for computers is in the center of the whirlwind, providing the logistical and financial control for this massive spending. "In every field, financial and otherwise, the Saudis feel that a computer is a must," said Abboud. "Otherwise, there is no way to cope." Even the consumer economy seems over-scale: "When you have car dealers, for example, that sell anywhere between 5,000 and 10,000 cars a month! When you have just sales to control, forget everything else, you need a computer. And when you want to control your spare parts," added the unquenchable Lebanese salesman, "one computer is not enough!"

In this part of the world, where history is still largely biography, business is "who you know." It seems a cliche among American salesmen in the Middle East that business here is 80% politics and 100% connections. Abboud agreed: "Definitely."

—Vin McLellan

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Infoton's new generation of low price terminals does it all. The incredibly versatile 200 and 400 give you a choice of options unmatched in the industry.

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News in Perspective
BENCHMARKS . . .

Retail Naked Minis: Computer Automation's Naked Mini computers made their first appearance in retail stores last month. The Irvine, Calif., minicomputer manufacturer entered into an agreement with Tandy Corp., Ft. Worth, Texas, operators of the national Radio Shack chain, whereby Tandy will sell the Naked Minis directly to the public through new retail outlets of its recently organized Tandy Computer Div. The first Computer Automation minis were offered in the first Tandy Computer Store opened last month in Ft. Worth. Tandy expects this to be the forerunner of a chain of separate (from Radio Shack) stores it will build to offer a full line of data processing products. The minis will be sold over the counter in small business systems packaged by Tandy or as standalone units that professionals and hobbyists can incorporate into their own systems.

Acquisitions and Mergers: Honeywell Inc. has agreed to acquire Incoterm Corp., Wellesley Hills, Mass., producer of applications-oriented intelligent terminals. The exchange of stock transaction proposed is valued at approximately $38 million . . . Xerox Corp. privately purchased $500,000 worth of stock in Threshold Technology Inc., Delran, N.J. producer of voice recognition systems, and received an option to buy an additional $500,000 worth if TTI achieves a net profit of $275,000 in its current fiscal year ending next June 30 . . . Tymshare, Inc., Cupertino, Calif., completed acquisition of the credit card processing operations of Western States Bankcard Assn. whose processing revenues approximate $20 million annually . . . DBA Systems, Inc., Melbourne, Fla., and Scientific Systems Services, Inc., Satellite Beach, Fla., have agreed to merge. The preliminary agreement calls for DBA to exchange 100,000 shares of common stock plus cash and notes totaling approximately $250,000 for all outstanding SSS stock.

A Loss for Telex: Judgments following three and one-half years of litigation between Telex Corp. and Transamerica Computer Co. will cost Telex $1.9 million if there's no appeal, and Telex in late October hadn't decided whether or not it would appeal. Transamerica had alleged that Telex failed to abide by agreements relating to the sale of tape drives and similar equipment. Telex charged that Transamerica didn't fulfill its obligations in a joint venture between the two companies. Both firms were awarded some damages but the net effect would put Telex out the $1.9 million.

DEC Cuts Prices: Digital Equipment Corp. cut prices on eight of its PDP-11 systems by up to 21%. The company said productivity gains, lower raw material costs, and build-up of its high volume manufacturing capacity over the past 18 months made the price cut possible. The cuts affect the PDP-11/03, PDP-11/34, PDP-11/60, and PDP-11/70 systems. A PDP-11/03 (LSI 11) with dual RX-01 floppy disc, 32KB of MOS memory, RT-11 operating system, and a choice of either the VT-52 crt terminal or LA-36 printer is now $10,000, down from $12,200. A PDP-11/34 with 64KB of MOS memory, an RK 05F double-density 5.9 megabyte disc drive, an RK 05J 2.6 megabyte disc system, and an RT-11 operating system is now $27,500, down from $35,040. Both oem and end user prices are covered by the reductions.

IBM in the Mini Market: IBM's Series/1 will capture more than 16% of the general purpose minicomputer market by 1981, according to a forecast by Input, the Menlo Park, Calif., research firm. The company said shipments of minicomputer-related products will grow from approximately $1.9 billion in 1976 to $7.4 billion in 1981. IBM's market share is expected to grow from 2% today (an estimated 200 units installed outside IBM) to more than 16% (an estimated 90,000 units installed). The Input study indicates current Series/1 users are "extremely happy" with their systems. It also indicated that "many competitors have lost some substantial business to Series/1 and are totally unaware of it."

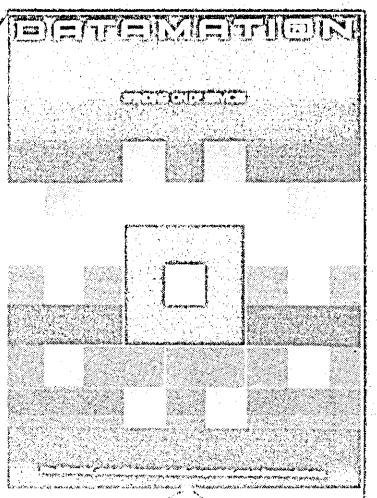
Amdahl Ups Production: Amdahl Corp. increased its production capacity by 25% during the third quarter ended Sept. 30. John C. Lewis, president, said the firm's shipment capability increased to five systems per month during the quarter, up from four systems per month in the second quarter. "Further increases in production capacity will be implemented during the fourth quarter, and still another incremental capacity increase is planned during the first half of 1978 to meet continuing strong demand for the company's products," Lewis said.

Software Packages Lead: How will the computer services industry grow? Rapidly, according to the eleventh annual Assn. of Data Processing Service Organizations (ADAPSO) industry survey. The numbers: $5.3 billion in annual sales today, $12 billion by 1981—a compounded yearly growth rate of 18%. Hottest segment of the industry: software packages which now account for annual sales of roughly $530 million. That figure should jump to $2 billion in four years, the study says. And consolidation is on the upswing as well. Two and one-half percent of all the companies in the industry now account for 51% of industry sales.

Crt's and Teleprinters: Creative Strategies Inc., San Jose, Calif., market research and consulting firm, said crt terminal and teleprinter sales will top $1.3 million by 1981, reflecting a compound annual growth rate of 16%. The firm said the growth will be spurred by a "worldwide distributed processing and telecommunications explosion." Current figures peg crt terminal and teleprinter installations at slightly less than 1.5 billion units. By 1981, CSI forecasts installed units exceeding 3.5 billion, a 19% compound annual growth rate. The cost/performance ratio will decrease as microprocessors become the industry standard, the firm said, further blurring the distinction between smart and non-intelligent terminals. CSI expects half of the total installed crt display terminals will feature microprocessor controls by 1981.

Historic Certificate: George W. Abbott (left), recipient of the first Certificate in Data Processing (CDP), presented it to the National Museum of History and Technology in Washington. Abbott's CDP was accepted by Uta Merzbach (center), curator of the museum's section on Science

and Mathematics, and Brooke Hindle, museum director. Abbott received his certificate when the test first was offered in 1962. He has been systems project director for Central States Health and Life Co. of Omaha since 1970. Earlier he worked in data processing for United of Omaha, Mutual of Omaha, and Fairmont Foods Co. Abbott said he was unaware his was the very first CDP until he was approached by the Institute for Certification of Computer Professionals (ICCP) about donating it. *



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LOOK AHEAD

(Continued from page 16)

CALIFORNIA BANK MOVING TO TOTAL ON-LINE TELLER SERVICE

Security Pacific National Bank was well on its way late last month to a goal of getting tellers in all of its 520 California branches on-line by the end of the year. More than 400 branches had terminals and the Incoterm units were being installed in more. And phase B, which would add capabilities to the terminals which now are limited to account balance look-up, is on the way. New capabilities being considered include establishing accounts and calculation capability for such things as currency conversion. And the bank is growing in the point-of-sale field, too, with more than 500 Southern California supermarkets now using the bank's check/charge card verification terminals to the tune of 750,000 transactions per week.

THE FABULOUSLY SUCCESSFUL SERIES/1

Peripherals manufacturers Datum and California Computer Products have joined Control Data Corp. (October, p. 15) in arrangements with IBM to provide peripherals for the fantastically successful Series/1 minicomputer. IBM originally estimated the U.S. market for Series/1 this year at 600 to 900 units, but that's soared to from 4,000 to 6,000 units. So IBM is making deals with these and other leading peripherals manufacturers to tide the giant over until it can begin to provide its own peripherals.

One view is that IBM has deliberately stayed out of the booming Series/1 peripherals market. The company apparently has never seemed comfortable spewing out mass volume, except on discs and some of the other add-ons offered with the Series/1.

RUMORS AND RAW RANDOM DATA

Sources at the Federal Reserve Board say IBM was naturally upset when the Fed installed an Amdahl V6 last July in Washington. But what really worries IBM, the source says, is that a good experience in Washington might lead to the placement of Amdahls in the 12 regional reserve banks and that the Fed's action might start a domino reaction in the large commercial banking sector...Spokesmen at Burroughs say a rumor reported in this column (October, p. 176) that its Master Control Program (MCP) can't fit into the B-80 memory and the memory can't be stretched because there's no space in the cabinet is just that, a rumor. Burroughs says the basic section of MCP does fit into the main memory; a new version soon is to be released with 96K of memory; and still another B-80 version is contemplated with a smaller cabinet and even more memory...A spokesman for Exxon Corp. denies that the huge oil company will acquire Xerox' Office Products Div., as reported in this column last month. He said reports of the acquisition first circulated in Europe and recently reached the U.S., but there isn't a "scintilla of truth" and "we've never spoken to Xerox"...A rider to a bill now before a Senate postal committee would give the U.S. Postal Service $300 million to let contracts for automation. A wag said he's glad the money is for automation--not storage facilities.

Introducing a true heavy-duty 120 cps teleprinter.

Our new EDT 1232 is equipped with a 1,024 character buffer which permits an effective throughput of 120 characters per second.

Our built-in buffering capability virtually eliminates the need for carriage return and line feed "fill" characters.

The EDT 1232 gives you fully formed, upper and lowercase characters instead of a series of dots. So you get high print quality, time after time. Even with multiple-part forms.

Expanded carriage.

It also offers versatile form handling. Multiple-part forms can be vertically front-loaded. Or, forms can be loaded from the rear.

With its expanded carriage, the EDT 1232 has 132 print positions per line, which makes it ideal for your computer-generated reports.

The EDT 1232 was designed to operate on a continuous 12-hour-per-day duty cycle to meet your data communication needs.

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To meet your systems needs, we're offering the EDT 1232 in a variety of configurations. It is available as a keyboard send/receive (KSR) teleprinter, shown above, as a KSR with magnetic tape cassette buffer or as a Receive-Only with our Video 100.

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CIRCLE 69 ON READER CARD

hardware

Off-line

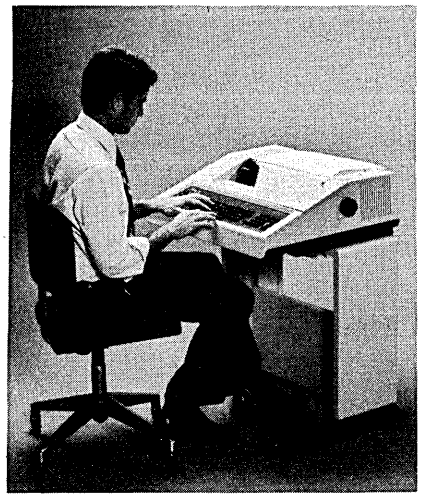
Hoechst-Roussel Pharmaceuticals Inc.'s Toxicology/Pathology section uses an in-house-developed information storage and retrieval system to store the results from animal studies involving new drugs. A researcher in the lab can enter his observations at a terminal. Then, upon request, the computer can generate a report of all observations made during a given experiment. Hoechst-Roussel says this data collection system will become even more important if the U.S. government's proposed Good Laboratory Practices legislation regarding the conduct of drug safety experiments goes into effect later this year.

Imagine a 12-inch disc with the capacity to store 900MB. Drexler Technology, of Palo Alto, Calif., says it has the capacity to do just that. The technology is photographic, not magnetic. The photodisc stores data as one-micron dots; being photographic, the discs are of the read-only variety, making them suitable for distribution of large programs, such as operating systems. A reason cited for the limited application of the technology is that recording errors could not be detected until the discs had been developed. This firm's technical staff has proposed a method that is said to permit the instant detection of errors so they can be corrected before development. Units to read the discs will use a laser read-head on a mechanism that is similar to a cross between a conventional disc drive and the video disc units under development by Philips and MCA for the consumer market.

IBM has knocked purchase prices down, and kicked lease, rental, and maintenance charges up on some of its products. The purchase price on most key entry products is down 25%. Lease and rental prices on some printers, and "a limited number of other products," have gone up as much as 10%. Some maintenance charges are up as much as 18% (even more for "some minor features"), while some monthly maintenance agreements may reflect decreases of as much as 20%.

Printer, Terminal

A proprietary sos (silicon on sapphire) microprocessor provides control for this family of 180 cps dot matrix serial printer products. Standard features include three different ways to print (normal, expanded, and compressed), automatic underlining, and smart bidirectional printing. Multiple character sets are optional. The first members of the family are the model 2631A, a printer, and the model 2635A, a printing terminal. The smart bidirectional printing algorithm strips leading and trailing blanks, moving directly to the next position where data is to be printed. Imbedded blank fields of 10 or more spaces are skipped over at an accelerated rate. In normal print mode (10 cpi), 136 columns may be printed across 14-inch paper. Expanded mode prints 5 cpi for boldface and highlighting. Compressed



mode fits 136 characters across 8½ inch paper; 227 columns can be printed on 14 inch paper. Vertical line spacing may be varied under program control; the choices are 1, 2, 3, 4, 6, 8, or 12 lines per inch. Twelve lines per inch is used for sub- and superscripts. On the 2631A printer, a switch selects 6 or 8 lpi on the 2635A terminal any of the choices may be selected from the keyboard. The USASCII 128-character set is standard; both units can handle one additional 128-character set. The 2631A has an 8-bit interface, compatible with other printers from this vendor. The 2635A terminal has an RS232C interface as standard equipment, with other interfaces available as options. The 2631A sells for $3,150; the 2635A for $3,450. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR DATA CIRCLE 311 ON READER CARD

Drum Plotters

Two plotter lines, said to represent a "new generation of drum plotters," have joined this vendor's selection of graphics products. Both lines are said

to show increased throughput over older models, with the same axial plotting speeds, due to the use of drive motors and pen actuators that provide faster acceleration and reduced pen up/down times. The 103X family comprises three drum plotters with one or three pens and axial plotting speeds ranging from 2 ips to 4½ ips. The tabletop units have 34-inch wide drafting areas (standard); a 15.4-inch drafting area is available as an option. Prices range from $8,220 to $11,960, including one year's maintenance. The model 1051 can, under program control, select any of four pens. The standalone 1051 has a plotting area of 34 inches, with 39 inches available as an option. Its axial plotting speed is 10 ips. The basic model 1051 sells for $19,200.

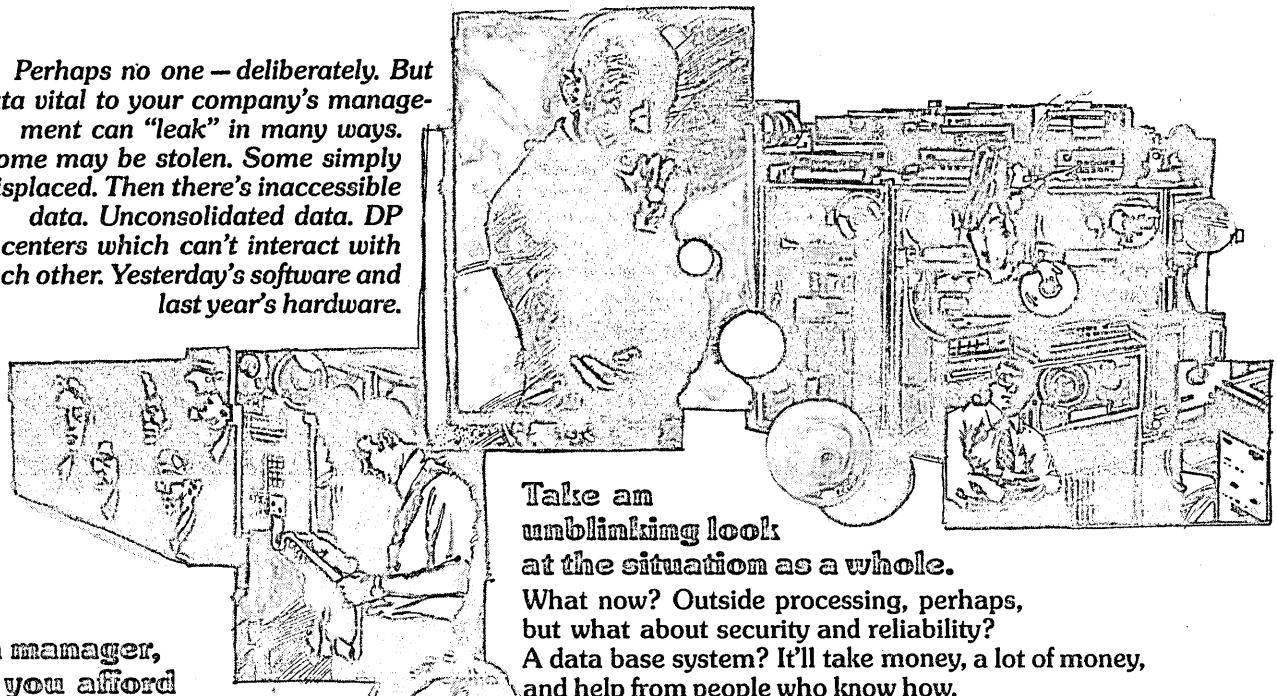
All of the new plotters have y-axis limit switches, paper supply monitor, paper cutter bar, plot time meter, and plot speed control. All four are software compatible with other plotters in the vendor's product line, and all come with hardware interfaces for most mainframes and minicomputers. Deliveries on all units are quoted at 90 days. CALIFORNIA COMPUTER PRODUCTS, Anaheim, Calif.

FOR DATA CIRCLE 310 ON READER CARD

Data Concentrator

The Micro800 uses statistical multiplexing techniques and allows four or eight asynchronous channels to share a single communications link. Between concentrators, communications may be synchronous or asynchronous at speeds of up to 9600 bps. All interfaces

Perhaps no one — deliberately. But data vital to your company's management can "leak" in many ways. Some may be stolen. Some simply misplaced. Then there's inaccessible data. Unconsolidated data. DP centers which can't interact with each other. Yesterday's software and last year's hardware.

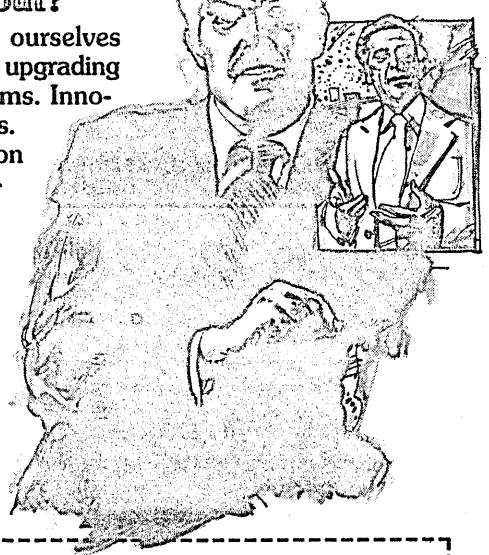


Take an unblinking look at the situation as a whole.

What now? Outside processing, perhaps, but what about security and reliability? A data base system? It'll take money, a lot of money, and help from people who know how.

As a manager, can you afford not to check us out?

We've already proven ourselves to others. With sensible upgrading of management systems. Innovative DP conversions. Workable consolidation plans. And a 99% uptime record at our Dallas Center. Send us your request for a proposal. Or ask for a Sun Seminar...a working session on subjects you choose. In your conference room. For the time you allot.



But your options are limited.

Computer problems are multi-dimensional and interrelated. You need a big single source, not a series of specialists. But in all the world, only a half-dozen companies have the depth, size and experience to accept the really big assignments. Now there's one more.

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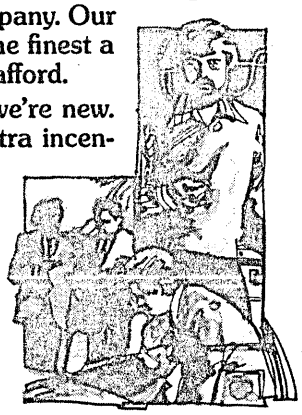
For twenty years we developed and ran the computer services for America's 27th largest industrial — The Sun Company. Our capabilities, frankly, are the finest a large oil company could afford.

But to the marketplace, we're new. Which means we have extra incentive to prove we deserve your business. You'll find us more flexible. And far more inclined to develop new answers than apply old systems.



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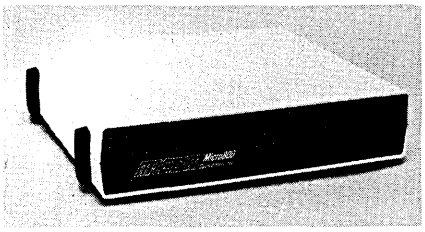
CIRCLE 40 ON READER CARD

hardware

are RS232. The aggregate data rate of the multiplexed channels may typically be twice that of the actual communications link. The Micro800 has automatic retransmission-on-error between concentrators. The microprocessor-



controlled unit can handle 5, 7, and 8 level character codes. The unit also has self-test features. A four-channel system sells for $1,870; an eight-channel system sells for $2,630. MICOM SYSTEMS, INC., Chatsworth, Calif.
FOR DATA CIRCLE 313 ON READER CARD

Computers

Designed as both entry level systems and nodes in distributed processing networks, this vendor's I-8100 family of small systems uses several microprocessors, each dedicated to a specific function such as processing or disc I/O. The family will conform to the vendor's Distributed Network Architecture (DNA), and will offer DLC (Data Link Communications) and binary synchronous communications. Consisting of two interactive systems, the I-8130 and I-8150, the family offers compatibility with larger members of

the vendor's interactive 8000-series of systems, meaning that programs written for the I-8100 family will run on I-8200 and I-8430 systems. COBOL is the primary programming language for the I-8100 series.

The I-8130 consists of multiple processors, a nine-inch visual display, keyboard, 48KB (expandable to 64KB) of memory, two floppy disc drives, and a 50 lpm matrix printer. This basic configuration sells for $19,970 and rents for $656 per month on a three-year plan. Options include additional floppies, cassette tape units, and a selection of printers.

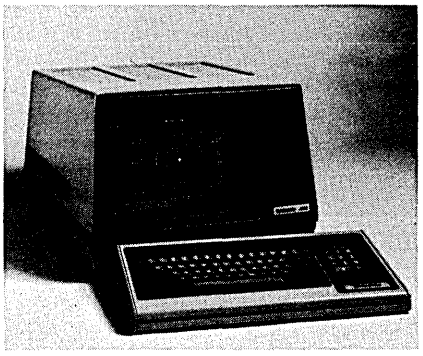
The basic I-8150 consists of multiple processors, 48KB (expandable to 64KB) of memory, a nine-inch display, and a keyboard. It also has a 5MB fixed disc, a data cartridge drive, and a 50 lpm printer. Its selling price is $29,200 and it rents for $831 per month on a three-year plan. Options include additional terminals, more disc (up to 40MB), cassette tape, and additional printers.

Operating software for the I-8130 goes for $60 per month; for the I-8150 it's $70 per month. COBOL carries a charge of $30 per month. The vendor also offers applications programs, with fees ranging from $25 to $90 per month. NCR CORP., Dayton, Ohio.
FOR DATA CIRCLE 301 ON READER CARD

3270 Alternative

The 290 series of on-line display systems are compatible with IBM 3270s, but may be leased for as much as 25% less than IBM equipment, according to the vendor. Purchase prices are said to be even more competitive. The 290 can replace any 3270 with a 1,920 character display without requiring reprogramming of the host computer or retraining operators. Three versions are offered for either remote or local channel use. The 291 and 296 remote configurations can communicate at speeds ranging from 1200 bps to 9600 bps using either bisync (BSC) or Synchronous Data Link Control (SDLC) line protocols. The 291 remote cluster control unit handles a combination of as many as 16 display stations and printers; the 296 control station is a display and controller which can support up to eight displays and printers. A local cluster control unit, the 292, attaches directly to a 370 channel, and can support 16 devices. The display station of the 290 systems has a 15-inch screen (1,920 character capacity) and a ca-

product spotlight



Crt Graphics Terminal

With its name already well established in the high-resolution graphics terminal market, this vendor is trying to make an equally big name for itself in the terminal market populated by users who want occasional graphics from terminals that will be used predominantly for alphanumeric I/O. The 4025 provides just that, plus a growth path into the full-blown graphics world.

The 4025 can display up to 34 lines of 80 ASCII characters on its 12 inch diagonal crt screen. For graphing, the display is organized as 640 by 480 addressable points. Graphics and alphanumerics may be mixed on the screen; they scroll in unison, so an alphanumeric message won't be written over the user's graphics. With up to 32KB of alphanumeric memory, and another 32KB of graphics memory, the user can scroll through a fair amount of data without losing any data. An optional hardcopy unit can make copies from the terminal's memory, allowing the user to print up to 53 lines or a full-page graph on 8½ x 11-inch pages. Multiple pages may be printed. The terminal makes efficient use of graphics memory by dividing the screen into 8 x 14-point cells and only storing detailed information for cells that contain graphics.

The microprocessor-based 4025 has features expected of data entry terminals, such as forms (which can be scrolled through if they take more than a page), editing, and various field attributes. The micro handles the terminal's operating characteristics (such as data rates), editing, and graphics, but it does not support standalone processing.

Options include a variety of peripherals, interfacing options (RS232 is standard), extra character sets, and a 3270-like controller which handles as many as eight terminals providing polling and EBCDIC-to-ASCII conversion. Software support for graphing (pie charts, histograms, etc.) also is available. A 4025 with 8KB of display memory and 8KB of graphics memory sells for $4,745. Without graphics memory, the same terminal sells for $3,845 The vendor also offers an alphanumerics-only version, the 4024, with a slightly limited list of options. The 4024 sells for $2,995. TEKTRONIX, INC., Beaverton, Ore.
FOR DATA CIRCLE 315 ON READER CARD

EMM BEATS THEM ALL WITH THE FIRST WORKING 370/148 ADD-ON MEMORY

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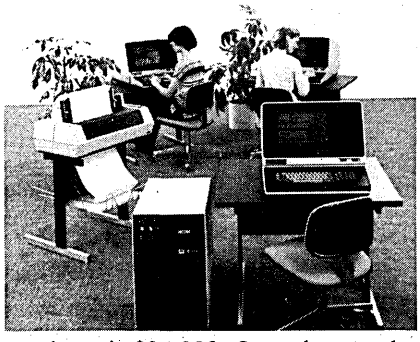
hardware

ble-connected keyboard. Options include light pens, numeric keypads, badge readers, and key locks. Printers rated at 66, 120, and 180 cps also are offered for use with the 290 series. Purchase price of a typical 290 configuration with six display stations and



a printer is $34,980. On a three and a half year lease (including maintenance) the same configuration would go for $639 per month. One and two year leases also are offered. SYCOR INC., Ann Arbor, Mich.
FOR DATA CIRCLE 303 ON READER CARD

Minicomputer

Capable of addressing up to 256KB of mainframe memory, the model 8/16E is a general purpose mini aimed at the scientific, business, and oem markets. Memory management hardware is built into the 8/16E. Memory comes in 32KB increments, with a 275 nsec access time and 750 nsec cycle time. The processor's instruction set resembles that of IBM mainframes, and features list processing instructions, hardware multiply/divide, and single and double precision floating point arithmetic. The processor has 16 general purpose registers, dual I/O bus architecture, and 255 automatic I/O channels. Compatibility is maintained between this processor and the other 16-bit processors in the vendor's product line. A single processor with 128KB of memory sells for $16,000, with quantity discounts ranging up to 38%. A recently revised real-time, multitasking operating system, OS/16 MT2, is available for $1,700. INTERDATA, INC., Oceanport, N.J.
FOR DATA CIRCLE 304 ON READER CARD

Position Sensor

The E270 might be called a digitizer although its descriptive title, Transparent Pressure-Sensitive Position Sensor, is more appropriate for its intended applications: telling the computer where a user is pointing (with finger or stylus) on a crt screen, photograph, or diagram. One of the applications the vendor suggests for the E270 is selection of an item from a menu displayed on a crt. Measuring approximately 8½ x 11 inches, the unit provides 12-bit coordinates for the selected point. Resolution is roughly 0.003 inches. The Position Sensor comes in other sizes, and resolution will vary with size.

Prices start at $3,990. A serial interface, for 20mA or RS232 devices, sells for $950. ELOGRAPHICS, INC., Oak Ridge, Tenn.
FOR DATA CIRCLE 309 ON READER CARD

Dot Matrix Printer

The 120 cps serial dot matrix model 702 printer is said to be well suited for use with small systems. The latest addition to the vendor's 700 series of printers, the 702 can print up to 132 columns on six-part forms. The unit prints 10 characters per inch horizontally and allows the operator to select either six or eight lines per vertical inch. Microprocessor electronics pro-

hardware

vide logic seeking bidirectional printing. First deliveries are expected by the end of this year. Single unit end user price of the 702 is $2,145. CENTRONICS DATA COMPUTER CORP., Hudson, N.Y.
FOR DATA CIRCLE 305 ON READER CARD

Multiplexor

The TDM-2 allows transmission of two channels of asynchronous data over a single synchronous line. Two terminals plug into the multiplexor which is connected to a synchronous modem. Transmission rates of 2400bps, 4800bps, and 9600bps (between modems) are accommodated. Connections to the TDM-2 are made through RS232C interfaces. The multiplexor sells for $995. SYNTECH CORP., Rockville, Md.
FOR DATA CIRCLE 307 ON READER CARD

Digitizer

The Pagitron/COM Scanner can scan drawings as large as 17 x 22-inches and produce a nine-track, 800 bpi mag tape for use with graphic com systems. Since the scanner converts art into digital form, the digitized image can be manipulated by a computer. Scanning time for a 17 x 22-inch image ranges from roughly six minutes for an engineering line drawing to about 10 minutes for a more dense and complex image, such as a topographical map. Several small pieces of art may be "ganged" to increase system throughput. The scanner also has a "thresholding" circuit that can produce high contrast output from faded or low-contrast originals. Delivery is six months ARO. Pricing starts at $120,000. OPTRONICS INTERNATIONAL, Chelmsford, Mass.
FOR DATA CIRCLE 312 ON READER CARD

Communications Management

Already active in distributed dp, this vendor now supports the geographical distribution of its Infoswitch long distance telephone management system. Corporate managers can maintain control over the long distance calling network and telecommunications facilities in the field. The manager can control accounting records, line performance, and traffic engineering of the network. Known as SHARE, the system lets one of this vendor's centrally located computers control as many as six remote switching subsystems. The remote switches share the host computer's peripherals; communications between central and remote sites occur in full duplex mode over 1200 bps lines. Remote switches can operate independently of the host if it becomes unavailable. In its largest configuration, a SHARE system can comprise 250 trunk lines. A second processor can be used to back up the host. Capable of working with any standard PBX or Centrex facility, an Infoswitch SHARE system incorporating one central computer and two six-trunk switching subsystems sells for $86,200. A three-year lease (including maintenance) has a monthly fee of $2,877. DATAPOINT CORP., Communications Management Products, San Antonio, Texas.
FOR DATA CIRCLE 308 ON READER CARD

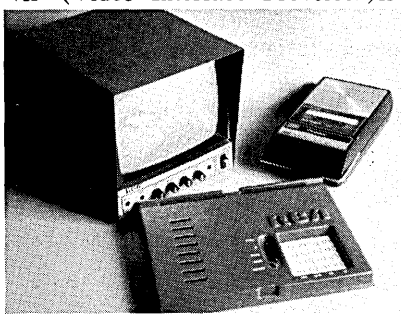
IEEE 488 Interface

Occupying one I/O slot in a Data General cpu, the model 417 provides IEEE 488 standard interface functions of talker, listener, and controller. Diagnostic software and drivers are supplied for all three modes. The hardware communicates with the cpu using busy/done logic. It allows parallel and

serial polling. In addition to diagnostics and mode drivers, the software handles service requests from devices generating unsolicited interrupts. The software is written in assembler and comes as both source and object paper tapes with documentation. The model 417 sells for $2,100. RAY BUSHNELL, INC., Wheaton, Md.
FOR DATA CIRCLE 314 ON READER CARD

Hobby Computer Kit

Add another major company to the growing list of hobby and personal computer manufacturers. The COSMAC VIP (Video Interface Processor) is a



$275 computer on a card with an eight-bit microprocessor, operating system in 512 bytes of ROM, 2KB of RAM, graphic video display interface, hex keyboard, audio cassette interface, and regulated power supply. The unit's output may be fed directly into a crt display or, through an FCC-approved modulator, into a television receiver. An interpretive programming language, CHIP-8, has 31 two-byte hexadecimal instructions. The COSMAC VIP can be expanded, both on the printed circuit card and via connectors. Two more KB of RAM may be added on the card, and the total memory may be expanded to 32KB. I/O also may be expanded to 19 parallel lines on the pc card. The manual includes assembly and operating instructions, programming information, logic descriptions, and diagnostic and video game listings. RCA/SOLID STATE DIV., Somerville, N.J.
FOR DATA CIRCLE 302 ON READER CARD

Microcomputer

R2E (réalisations études électroniques) has begun marketing its Micral microcomputer system through a U.S. subsidiary. The Micral C, introduced this past June at the NCC, is designed for small business applications such as accounting, word processing, and inventory management. The 8080-based system comes with 24K of RAM (expandable to 64K), an upper/lower case 1,920 character crt, keyboard, and dual Shugart minifloppy disc drives

(on-line capacity 160KB). Synchronous and asynchronous communications are optional. A standard parallel printer interface allows connection of a hardcopy device, such as printers from Centronix and Diablo. Software includes an assembler, business BASIC, and a FORTRAN IV compiler. End user pricing for the basic Micral C is $8,995; oem prices start at $7,995. R2E OF AMERICA, Minneapolis, Minn.
FOR DATA CIRCLE 306 ON READER CARD

COM

The on-line Autocom microfiche recorder/processor automatically converts data from 360s (Model 25 and up) and 370s into 4 x 6-inch film cards, each of which can contain up to

270 pages. After the recording command is issued by the cpu, the Autocom automatically accepts data and produces cut, dry microfiche. The unit has a 16KB buffer memory, which helps to keep channel connect and contention time low. The unit offers 42X or 48X reduction, standard or full-reversal film processing, up to 12,000 lpm recording, and an optional 1,600/6,250 bpi tape drive for on-line/off-line operation. Deliveries are scheduled to begin in February. The unit sells for $61,000. DATAGRAPHIX, INC., San Diego, Calif.
FOR DATA CIRCLE 316 ON READER CARD

Digital Signal Processor

The SPS-61 should find applications in real-time signal processing applications, such as demodulation of digital communication signals, picture enhancement, pattern recognition, and speech synthesis. The unit is said to combine the most popular features of array processors and hardwired signal processors. User-microprogrammable, the unit has a 167 nsec instruction time and a 6MHz 32-bit I/O bus. It can be programmed to operate under control of a host computer or to operate autonomously. The SPS-61 will interface to any general purpose computer, according to its manufacturer. The unit may be programmed for real-time or batch operation using FORTRAN, Macro assembler, or microcode assembler. It is also software compatible with the vendor's higher-performance SPS-81. Options include up to 128K words of 32-bit memory, high speed scratch pad memory, expandable program memory, additional A-D and D-A converters, and high speed multiply option. With 16K words of bulk memory, the SPS-61 sells for $34,100. SIGNAL PROCESSING SYSTEMS, INC., Waltham, Mass.
FOR DATA CIRCLE 317 ON READER CARD

Key Entry/Remote Batch

The Key-Edit 80 is a modular data entry system that combines remote batch terminal and key entry standalone processing. It enables users to prepare, edit, sort, merge, reformat, and check key-to-disc data input prior to transmission to the mainframe. A system can accommodate from two to eight terminals. A straightforward English-like programming language is used to define input formats and edit and validate data or previously entered background material. The system includes a 32K cpu and a 1.4MB disc unit. Communications occur at speeds ranging from 2000 bps to 9600 bps using IBM HASP, 2780, 3780, or 3740 protocols. The basic control unit has a supervisor's console permitting in-progress status reports and audit trails in summarized or detailed form. A 300 cpm card reader and a 300 lpm line printer are also included. The basic system leases for $1,350/month. CONSOLIDATED COMPUTER INTERNATIONAL, INC., Waltham, Mass.
FOR DATA CIRCLE 318 ON READER CARD

Printer Controller

The Universal Printer Controller, Model CY 480, controls and interfaces any standard 5 x 7-dot matrix printer having a print speed of up to 200 cps. The CY 480, a 40-pin LSI chip, works with impact, thermal, and electrostatic printers, including those from Victor, LRC, Practical Automation, and Amperex. Operating from a five volt power supply, the CY 480 will interface a printer to any mini or microcomputer through standard 8-bit ports. The controller accepts either RS232C (serial) or parallel ASCII input. The unit has an upper and lower case character generator, 48 character internal line buffer, and a two-color print command. In small quantities (1 to 49), the CY 480 sells for $92. In quantities of 5,000 and up, the price drops to $30. CYBERNETIC MICRO SYSTEMS, Palo Alto, Calif.
FOR DATA CIRCLE 319 ON READER CARD ❄

A robot complained to the staff
that whether he'd sorrow or laugh,
whatever the shade
of emotion displayed
it came out in the form of a graph.
—Gloria Maxson

software & services

Updates

A standard specification for MUMPS (the Massachusetts General Hospital Utility Multiprogramming System) has been approved by ANSI. FORTRAN and COBOL are the only other languages so approved. Designed for interactive data management applications, the general purpose interpreted programming language was in use by more than 600 institutions as of mid-1977. Currently available on six major computer lines, MUMPS' user base remains medically oriented, although it is gaining popularity in business and commercial applications.

In what is said to be the first time a group of competitive banks have banded together to offer a Pay-by-Phone service, 18 Massachusetts savings banks now are offering a service that enables customers to pay monthly bills by phone. The service became available on the last day of October. Each customer is assigned a secret personal identification number; for additional security, each account the customer wants to pay is given a unique (to the customer) identification number. The 24 hours a day, seven days a week service uses software developed by Telephone Computing Services of Seattle, Wash., and hardware from Digital Equipment Corp.

If you've been getting more mail from your congressman recently, it may be due to the Republican National Committee's use of Easytrieve. The committee uses Easytrieve to format data from county organizations, organize the information, and generate weekly reports and mailing labels for candidates across the country. Last year 80 million lines of address listings were produced for candidates running for federal or state offices. The demand is expected to be greater this year.

After polling 325 of its subscribers, Auerbach Publishers says the prognosis for the commercial software market "shows a healthy demand" for both purchasing and leasing packages. The free report was intended to determine trends in projected software spending and to evaluate the types of software service the respondents had received in the past.

Distributed Processing

Late last month, this vendor made a long range policy statement on distributed processing, stressing its commitment to the concept and its intention to adhere to various standards such as Recommendation X.25 of CCITT, the Advanced Communication Control Procedure (ACCV) of the American National Standards Institute and IBM's SDLC protocol. The statement was partially foreshadowed by the June announcement of Distributed System/3000, the hardware/software combination for forming networks of the vendor's 3000 series II computers. Now distributed processing support has been announced for the vendor's 1000 series of small computer systems and its 2026 data entry systems.

The 2026, which formerly could communicate only with another 2026 or as an RJE station with larger computers, can now function interactively connected to a 3000 processor via Distributed System/2026. Under DS/2026, it can exchange data with the larger system or function as a virtual terminal to the 3000. DS/2026 software will be supplied with all 2026s delivered in the future; systems in the field will be routinely updated.

Software and firmware combine to make up Distributed System/1000, allowing 1000 series computer systems to communicate with each other and with 3000 systems. Using a nodal addressing scheme and store-and-forward capabilities at each node, any 1000 can address any other 1000 in the network. Nodal addressing allows users to define networks as stars, rings, strings, or combinations of these. Nodes may be reconfigured without impact on previously written programs because node addresses remain fixed. While networked to a 3000 a 1000 can simultaneously support connection with other 1000s in a DS/1000 network. Only two 1000s can concurrently communicate with a 3000.

The 1000 also can function as a virtual terminal on the 3000. The previous limit of two concurrently active communications lines on a 1000 has been removed by the introduction of a high-speed microcoded communications driver. With a hardwired serial interface, DS/1000 links operate at 60 Kbps at up to 600 feet and at 3 Kbps at 10,000 feet. Asynchronous modem links operate at up to 1800 bps. Synchronous operation is to 19.2 Kbps. Hardwired links between 1000s and 3000s run at up to 250 Kbps for links up to 1,000 feet; at 2,000 feet the link can run at up to 125 Kbps. Software and firmware to form one network link between 1000s sells for $6,200. Additional links are $3,700. The enhancement to link a 1000 to a 3000 is $500. Deliveries will begin next month. HEWLETT-PACKARD CO., Palo Alto, Calif.
FOR DATA CIRCLE 326 ON READER CARD

Micro Software

This microcomputer manufacturer now offers FORTRAN IV, a CODASYL-type Data Base Management System (DBMS), and a text editing language for its Z80-based microcomputers. Although it has yet to be tried, the software should run on any Z80-based system under CP/M.

The FORTRAN IV compiler, written by Small Systems Services, Inc., is said to be a complete implementation of ANSI Standard FORTRAN IV, with extensions, such as named common, full type conversion, a library of scientific and string functions, and sequential and direct access I/O. It runs in less than 24K with DOS; both FDOS IV and CP/M versions are offered. Available on a floppy diskette, the compiler sells for $349.
FOR DATA CIRCLE 328 ON READER CARD

Micro-SEED is a version of International Data Base Systems, Inc.'s SEED DBMS (August, p. 162). Both hierarchical and network data structures are supported. Micro-SEED consists of a Data Definition Language (DDL), Data Manipulation Language (DML), and Database Initialization Program (DBINIT). Micro-SEED requires the vendor's Z80 Disc System configuration with an additional 48K of memory. The package is priced at $1,250, and will be available by year's end.
FOR DATA CIRCLE 329 ON READER CARD

Z-TEL is a utility for editing and manipulating text files. As many as 10 "macro expressions," strings of commands, may be defined to avoid retyping repetitive editing sequences. Nested iteration, backwards searching, and conditional branching within a command string are all supported. Z-TEL requires less than 7K of memory, and is available on paper tape for $50, on cassette tape for $40, and will be available on diskette. TECHNICAL DESIGN LABS, Princeton, N.J.
FOR DATA CIRCLE 330 ON READER CARD

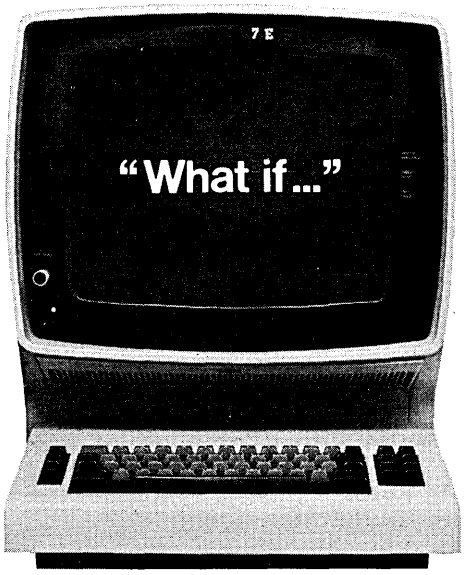
Data Base Report Generator

General Information System/vs operates over OS/VS data files and DL/1

asi/inquiry

The IMS DB/DC QUERY LANGUAGE

USED BY MORE IMS INSTALLATIONS THAN ANY COMPETING PRODUCT



ASI/INQUIRY is an IMS DB/DC query language that operates completely as an interactive Message Processing Program. The design of ASI/INQUIRY is such that the *structure of the data base is transparent to the user*. Moreover, one need not have familiarity with DL/1 segment logic or the complexities of multi-pathing. Extremely rapid response time is assured.

MAJOR HIGHLIGHTS

- ☐ End-user oriented
  - —Easy-to-use language
  - —Requires no knowledge of IMS
  - —Comprehensive diagnostic messages
- ☐ Rapid response time for even the most complex queries
- ☐ Dynamic priority scheduling to maximize system performance
- ☐ Availability of default as well as user-defined screen formatting

Recently delivered, Release 2 of ASI/INQUIRY contained a number of major enhancements, including:

- Development of a TSO-supported version
- Full support of IMS/VS secondary indexing
- Open-ended computational facilities
- Ability to SORT display output

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS DB/DC or TSO-supported IMS environment. It is the only system combining an easy to use language, complete user flexibility, and rapid response time in a single package. If you want to start answering "What if . . . . " immediately, call or write today for further information.

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data bases, providing processing, reporting, and inquiry facilities. A high-level retrieval tool, GIS/VS can produce reports with automatically aligned decimal points, and date and time formatted for formal reports. The package has algebraic arithmetic capabilities, so the data may be processed, instead of simply selected and formatted for a report. Additionally, GIS/VS can link to programs written in PL/1 and COBOL. The package also supports the 3800 printing subsystem, and, through IMS/VS, 3790s and 3770s. GIS/VS runs under OS/VS1, OS/VS2 (SVS or MVS), or with OS/VS1 or OS/VS2 under VM/370, as well as TSO. The GIS/VS Basic Query System has a monthly license fee of $907. The Advanced Query Feature has a monthly license of $283. An Update/Create feature carries a monthly license fee of $595; a Modify feature is licensed at $141 monthly. INTERNATIONAL BUSINESS MACHINES CORP., White Plains, N.Y.

FOR DATA CIRCLE 327 ON READER CARD

System/3 Utility

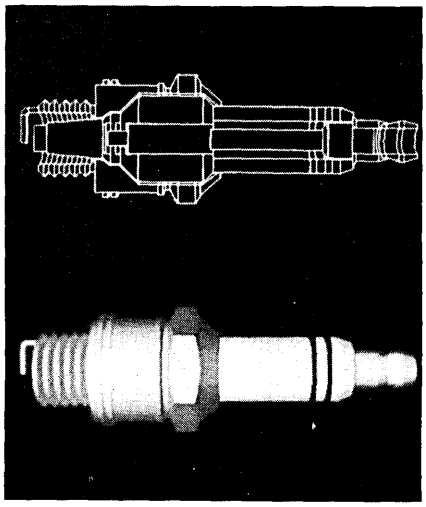
On-line System/3 users of CCP will find the DFF hardcopy utility useful

software spotlight

Design Aid

A set of FORTRAN programs, SynthaVision, can create and analyze models of solid objects. Computer-aided design and computer-aided manufacturing users can use the package to prepare mathematical models of three dimensional objects and then produce line drawings of any cross-section desired. Once an engineer has created a model, he can use it to help determine mass properties such as center of gravity, volume, and weight. The model also may be used as input for stress analysis. Manufacturers using numerically controlled machinery can use the three dimensional model of an assembly in interference calculations. The package can even generate shaded pictures said to have the appearance of photos.

In SynthaVision, the first step is modeling the object of interest. Models are composed of geometric "primitives," such as spheres, cones, and boxes. Eleven primitives are currently available; others are expected. The model can then be cross-sectioned at any angle and presented as a line drawing or shaded picture, or it can be used for analysis.



The first user of the package will be Boeing Corp.'s Computer Services Co., which will use SynthaVision to model aircraft parts. Boeing will use the models for mass calculations, interference analysis, and graphics.

SynthaVision requires about 220KB of main memory and carries a perpetual license fee of $150,000. Rental plans will be offered. MATHEMATICAL APPLICATIONS GROUP, INC., Elmsford, N.Y.

FOR DATA CIRCLE 320 ON READER CARD

during system development and documentation phases. The utility can print screens or print formats on the system printer. The formats, generated through DFF from source library, cards, or diskettes, will be printed in the same format they appear in when displayed on the crt or terminals printer. In addition to displaying fixed format fields, the utility identifies all execution time data fields with asterisks showing their positions and lengths. Source code for the utility is available for a one time, one location fee of $100. REAL-TIME COMPUTER SYSTEMS, INC., Bridgeport, Conn.
FOR DATA CIRCLE 325 ON READER CARD

DOS/VS Enhancement

By increasing block sizes for tape and sequential disc files, Speedy decreases file I/O overhead and reduces program run times. For tapes, block size is increased to 6KB, 8KB, 12KB, or 16KB; disc files are blocked for full- or half-tracks. The vendor says this takes advantage of the larger partition sizes in DOS/VS systems. The vendor warns that in the worst case, paging may increase, but claims that overall performance will still improve. Available for a 30-day free trial, Speedy has a perpetual license fee of $3,150 (through the end of this year), increasing to $5,000 in January. It's also available on a rental basis. DATACHRON CORP., New York, N.Y.
FOR DATA CIRCLE 332 ON READER CARD

Utilities

Two secondary storage utilities, one for OS/MVS users, the other for DOS users, are being offered by this firm. DASTUTE, for OS, MVS systems, is said to both combine and enhance seven IBM utility programs (IDCAMS, IEBPTPCH, IEPROGM, IEBGENER, IEBUPDTE, IEBISAM, and IEHLIST). Aside from combining these functions into one program, DASTUTE is said to offer these benefits: it uses macro-type control statements, it reduces the use of DD cards, it provides a VTOC listing macro for both disc and tape data sets, it gives intelligent error messages, and it is TSO-compatible. Its selling price is $3,750.

For DOS users, DMCVTOC produces a graphic display of specified cylinders, showing data file names and track utilization. The program generates two reports, one in data file name sequence, the other in physical track sequence. The program is said to be compatible with all physical disc drives and file organization techniques. This program sells for $395. Both of these utility programs are offered on a 30-day free trial basis. DMC INFORMATION SYSTEMS LTD., Calgary, Alberta, Canada.
FOR DATA CIRCLE 323 ON READER CARD

Statistics Package

SCSS (SPSS Conversational Statistical System) runs on IBM 360s and 370s under OS-TSO or VM/370-CMS. A DECsystem-20 version is due early next year. The conversational statistical and tabulation system is designed for use with files containing up to several thousand records of many variables. It comprises six major procedures: multiple linear regression with forward, backward, true stepwise, and direct solution methods; correlation and partial correlation; frequency tabulations; n-way cross tabulations; and descriptions of subpopulations, including means, sums, standard deviations, and variances. The user may create new variables from existing ones using FORTRAN-like statements. The SPSS batch statistical system can generate data in SCSS format if desired. SCSS carries a $4,000 annual license fee, with discounts offered to tax-exempt and academic organizations. The fee covers one year of SCSS use on a single computer system, and entitles the licensee to maintenance, consultation, new documentation, and new statistical procedures implemented during that period. SPSS INC., Chicago, Ill.
FOR DATA CIRCLE 324 ON READER CARD

Text Editing

PAGE, which is described as "a full-screen video terminal text editing program," runs on PDP-11/34s through 11/70 processors under RSTS/E. The

software & services

program displays a page of text on the crt screen, and the user can position the cursor to the point where editing is desired. Instead of using "blind" commands to search, position, and edit text, the user sees the text in the context of a page. Global searching also is available under PAGE. The BASIC PLUS program will run on any RSTS/E system that has a video terminal with direct cursor addressing, cursor control, and "delete line" and "clear screen" functions. The program carries a one-time license fee of $750. The vendor also offers two-week demonstrations on customer systems. INTERACTIVE INFORMATION SYSTEMS, INC., Cincinnati, Ohio.
FOR DATA CIRCLE 321 ON READER CARD

Fortran Aid

The FORTRAN Termination Monitor prints the name (and subscripts for arrays) of variables along with their values if the FORTRAN program ABENDS. At the beginning of the FORTRAN program, a call to the termination monitor provides a list of variables to be dumped if the program terminates abnormally. Since the variables are identified by name, and their values are printed in the proper type, the programmer doesn't have to pore over a hex dump for this information. The package is said to work on any IBM MFT, MVT, MVS, SVS, or VSI system. The vendor charges $50 for the package. PILKERTON INTERNATIONAL, Anaheim, Calif.
FOR DATA CIRCLE 334 ON READER CARD

IMS Utility

This data base space utilization program, UCC-41, helps determine the effective space utilization in IMS data bases. The package is said to help the data base administrator decide when the data base needs reorganizing, when to add additional direct access extents and volumes, and when DBDGEN parameters need changing. The status of free and occupied space is also detailed. The package requires no additional JCL or changes to IMS. It's available on a 30-day free trial. UCC-41 sells for $3,200 including one year of maintenance. Subsequent yearly maintenance charges are 15% of the current selling price. UNIVERSITY COMPUTING CO., Dallas, Texas.
FOR DATA CIRCLE 335 ON READER CARD

Calculator Programs

Owners of Texas Instruments' models 58 and 59 programmable calculators can now get a software package for use during their *leisure* time. This "solid state software" package contains 20 different programs that are useful to golfers, bowlers, chess players, football fans, bridge players, and photographers. A golfer can calculate USGA handicaps. Football fans can forecast scores; a second program, which requires an optional printer, lets two players simulate a game. Another program can maintain bowling scores for as many as 90 bowlers at a given time. U.S. Chess Federation ratings can be calculated using another program. Bridge players can tally the score in each deal in duplicate or tournament play. Photographers can calculate exposures for enlarging, and another program adjusts f-stops in flash pictures. The package also includes games, such as blackjack, craps, and Nim. The Leisure Library sells for $35. TEXAS INSTRUMENTS INC., Dallas, Texas.
FOR DATA CIRCLE 336 ON READER CARD

Documentation Aid

LogicChain is intended to replace automatic COBOL-flowcharting programs. It accepts COBOL programs and produces a source listing, procedure index listing, data use analyzer index listing, logic diagnostic listing, and linked indexed logic chain chart. The procedure index is an alphabetized directory of procedures, showing where

each is located. The data use analyzer listing is an elaborate cross-reference map that indicates not only where an identifier is referenced, but what type of reference is made (access, result, subscript, etc.). The linked indexed logic chainchart uses non-ANSI standard symbols to show the logical interrelations of the various statements in a program. Diagnostic messages identify syntax errors, and some logic errors (such as no path to the given statement). LogicChain is an upgrade of this vendor's earlier Dynachart. LogicChain has a license fee of $7,800 for the first year, and $900 per year thereafter. The package runs on mainframes from Burroughs, Honeywell, IBM, and Univac. APPLICATIONS PROGRAMMING CO., Cherry Hill, N.J.
FOR DATA CIRCLE 337 ON READER CARD

System/34 Applications

Availability of these programs is still at least a year off, but users of IBM's System/34 can look forward to financial applications for distributors and a Manufacturing Accounting and Product Information Control System (MAPICS) for small to medium sized manufacturing firms.

The Distribution Financial Accounting System II (DFAS II) handles general ledger, accounts payable, and payroll, complementing the previously announced Distribution Management Accounting System II (DMAS II). DFAS II consists of three modules which may be installed in any combination. The programs can handle multiple company accounting for as many as 20 companies.

The general ledger application implements double entry bookkeeping. Upon request the program can produce a year-to-date income statement and balance sheet. The program accepts automatic entries from payroll and accounts payable. The monthly license fee for this module is $35.

Accounts payable can handle check writing and reconciliation, invoice distribution, and invoice payment selection. The program distributes expenses by account number for automatic detail posting to the general ledger. Reports include an aged payables listing, vendor performance report, and a cash requirements report. Accounts payable carries a monthly license fee of $35.

The payroll system produces weekly, biweekly, semi-monthly, and monthly payroll checks. It calculates gross-to-net pay for hourly and salaried employees and handles varying pay rates, shift differentials, taxes, voluntary deductions, and exceptions. The program also distributes labor costs by department. The monthly license fee for this module is $47. All three DFAS II modules are slated for November 1978 availability.

MAPICS comprises programs for order entry and invoicing ($50 per month license), inventory management ($45 per month license), accounts receivable ($35 per month license), sales analysis ($45 per month license), general ledger ($35 per month license), accounts payable ($35 per month license), payroll ($47 per month license), product data management (handles bills of material, manufacturing routings, and cost records; $75 per month license; available December 1978), material requirements planning ($90 per month license; available January 1979), and production control and costing ($90 per month license; available February 1979).

Additionally, MAPICS includes support for IBM's 5230 data and time entry stations in a program called, appropriately enough, data collection system support ($53 per month license).

Most of these modules can stand by themselves, although a few require the presence of one or more other modules. Unless otherwise noted, all of these programs will become available in November 1978. INTERNATIONAL BUSINESS MACHINES CORP., General Systems Div., Atlanta, Ga.
FOR DATA CIRCLE 322 ON READER CARD

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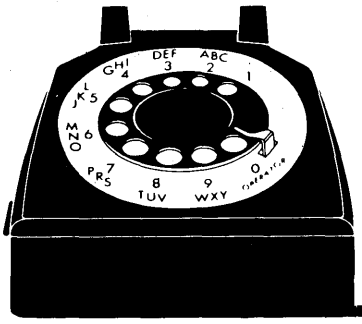

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personal computing

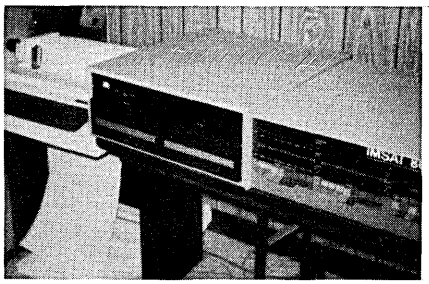
Portia Isaacson, Contributing Editor

Low cost personal computers are being widely used for business applications, mostly by small businesses. Computer stores commonly estimate that 20% to 50% of their dollar volume sales are of computers to be used for business purposes. Industrial process control, education, and hobby sales make up the remainder. This month's column will explore hardware and software configurations typical of low cost computers used in business applications. An exhaustive survey isn't intended, but rather a discussion of products typical of those available.

Typically, the small business application requires a central processing unit, memory, dual disc drives, a hardcopy printer, a BASIC interpreter, and a disc operating system. The central processing unit and memory form the nucleus of the processing system. A disc is required for random access or rapid sequential access needed in most applications. Dual discs are necessary for reasonable copying operations. A hardcopy printer generates reports, keeps permanent records, and prints forms. The BASIC interpreter and disc operating system allow development of applications in a reasonable higher-level language rather than assembly language. The photo above shows a personal computer system typical of those used in business applications. Table 1 lists the major components of the system with their approximate costs.

Central processing unit

The cpu in this configuration is a microprocessor. The 8080, with seven central registers, eight-bit wide data paths, eight-bit integer arithmetic, and an instruction execution time range of two to nine microseconds is the most common. The 8080 can address a maximum memory space of 64KB. The 8080 cpu is roughly comparable to the S/360 Mod 30 in terms of the data path widths, number of registers, instruction execution time, and maximum memory size. Several manufacturers of personal computers use the 8080, including MITS, IMSAI, Vector



Graphic, Processor Technology, Poly-Morphic Systems, and the Digital Group. Recently a number of Z-80 systems have become available, offering improved execution time, extended addressing modes, additional registers, and block instructions. One company, Alpha Microsystems, now offers a 16-bit cpu in the AM-100 which is based on the Western Digital microprocessor and offers a substantial increase over the eight-bit cpu's.

Memory

A memory size of 32KB is sufficient for many business applications. In fact, the typical memory size found on a S/360 Mod 30 in a dp installation is 32KB. In personal computing systems, BASIC typically occupies 12 to 20KB of memory, depending on the BASIC, leaving the rest for the application program. Expansion to 64KB is possible if the application requires it. Although it is physically possible to place more memory in the card cage, only 64KB can be addressed at any one time. Memory management software to support the use of memories larger than 64KB is not available. The memory speed is typically 500 nsec access time, five times the speed of the S/360 Mod 30.

Memory is commonly available in 8K, 16K, and 32K byte boards. The respective costs are approximately $230, $400, and $800 for assembled and tested boards. Memory is available from all cpu manufacturers and also from many other companies. This very competitive environment guarantees the lowest possible price.

System Component*	Approximate cost
Card cage, cpu, and power supply	$1,000
Memory (32KB)	900
Hardcopy terminal and serial interface (30 cps)	1,650
Dual floppy discs and interface (256 bytes per drive)	3,000
BASIC	100
Disc Operating System	100
TOTAL	$6,750

*All components are assembled and tested.

Table 1. Typical small-business application configuration

Discs

For most data processing applications, the most important decision will be the choice of a disc. As shown in Table 1, the disc is half the cost of the entire system. The performance ground rules are the same in low-cost computing as they have been for years. Data processing applications tend to be limited by the disc, which not only determines the amount of data that can be accessible at one time, but also determines the speed at which it can be accessed. Since the disc is largely mechanical, it will also be one of the least reliable components of the system. Another reason for caution in the selection of a disc is that in mixed vendor systems the system software comes from the disc manufacturer.

Floppy discs of the eight-inch and 5¼-inch variety are being widely used. Dual eight-inch floppy disc drives, which store 500 to 600KB total have an average access time of 35 milliseconds and a transfer rate of 30KB/second, cost about $3,000 including the controller. The eight-inch floppies are offered by numerous companies including MITS, IMSAI, and ICOM. Dual 5¼-inch floppy disc drives which store about 150KB, have an average access time of 30 milliseconds, and a transfer rate of 30KB/second, cost about $1,800 including the controller. Several companies offer the 5¼-inch floppies including ICOM, North Star, Polymorphic Systems, Processor Technology, and Southwest Technical Products. We can expect to see some significant increases in storage per dollar in the near future. In fact, Micropolis is already delivering 5¼-inch dual floppy disc drives which store 630KB total for $1,900 including controller. We also can expect to see hard discs for low

personal computing

cost computers. MITS presently offers a 10-million byte disc for $7,995. Alpha Microsystems offers the Calcomp Trident disc which stores 25 to 300 million bytes.

Printer and/or terminal

Most business applications need a hardcopy or crt terminal and a printer. For the most part printers or terminals have not been developed especially for the personal computing market; time-sharing terminals and low end minicomputer printers are being used. The computers use the serial RS232C standard interface for a terminal or printer. This is the same interface used by time-sharing terminals, minicomputer terminals, and some printers. Since any terminal or printer using the RS232C standard interface can be used with personal computers, a wide selection is available. The ones mentioned below typify the range of equipment available.

At the low end of printers useful in a business environment is an impact printer that prints on roll paper at 120 characters/second for approximately $750. The Digital Equipment Corp. DECWriter LA36 terminal accepts continuous forms, prints at 30 characters/second, and costs about $1,500. The Texas Instruments 810 impact printer prints 150 characters/second and costs $2,100. For word processing applications the Diablo terminal plots and prints at 30 characters/second and costs $3,000. If a printer is chosen, a crt terminal such as the Lear Siegler ADM-3A costing $900 also is needed. It's clear that the terminal and/or printer can be nearly the most costly component in the system. Since the printer is largely mechanical it may also be a source of maintenance problems.

Software

When comparing the capability of personal computers to larger computers and time-sharing services, the most obvious shortcoming of the personal computer is in the software area. There is a minimum amount of system software available and nearly no application software.

BASIC is the language of personal computers. Fortunately, many of the available BASICs have been extended especially for business applications. The added features include formatted input/output and disc file manipulation including random access, decimal arithmetic, string processing, subrou-

tine parameter passing, and chaining of programs. The typical cost of a BASIC interpreter is about $100.

Macro assemblers also are available, but due to the very low level of the machine language these would generally not be useful for business applications. Should it be necessary, the BASIC interpreters usually will allow the execution of assembly language subroutines. FORTRAN recently has become available for about $700, but would probably not be the language of choice for business applications over business-extended BASIC.

Disc operating systems are available from the disc system supplier. These are typically a single user system featuring a minimal set of file maintenance commands such as copy, delete, build, and edit files. They also offer a text editor and usually an assembler and linker. At the high end, Alpha Microsystems offers a multitasking, multiuser, time-sharing operating system.

A few application packages are available. These include general ledger, payroll, inventory control, word processing, accounts payable, and accounts receivable. The prices vary greatly but $1,000 to $2,000 is a typical price for an application program. Application software packages are available from the personal computing manufacturers in some cases, but, for the most part they are offered by individual computer stores. Significant additional offerings may be expected soon—primarily packages for particular types of small businesses such as medical clinics, personnel agencies, real estate firms, lawyers, motorcycle shops, and astrologers.

Maintenance

Most businesses are very concerned about the maintenance service available with personal computing equipment. From the manufacturers the only available service is through the mail. If it breaks, you send it in, the manufacturer will fix it either under warranty or for a fee. Warranty coverage varies greatly, with three months to one year common on assembled products. This type of service will not be immediately acceptable to most businesses, but in some cases it may be satisfactory.

The answer to the maintenance service problem for most businesses is the computer store. Most offer maintenance service on the systems they sell, and most require that the equipment be brought to them for service. However, an increasing number of stores are willing to offer on-site service for businesses.

Computer stores may be expected to provide better maintenance service as the market becomes more competitive.

Buying a system

If you want to buy a large mainframe computer or a minicomputer, you call the manufacturer who sends out a salesperson. This same procedure is not applicable in the personal computing area. Low cost computers require a new method of marketing and servicing in order to keep the price of these services in line with the price of the equipment. The retail computer store has emerged to fill this need.

It is not necessary to buy all parts of a personal computing system from the same manufacturer. In fact, mixed vendor systems are the rule rather than the exception. It's quite common to buy the card-cage, power supply, and cpu from one manufacturer, the memory from another, the disc from a third, and the terminal from still yet another. With the obvious potential compatibility problems, it is clear that most businesses will need some knowledgeable assistance in planning the proper configuration for a particular application. The retail computer store offers this service for a very small charge or, in many cases, no charge.

Increasing business usage of personal computers

Several factors will contribute to the increasing business usage of personal computers. First, the new, much lower cost threshold for the feasibility of application will open many new application areas. Packages including hardware, software, maintenance, and training will be developed, primarily by computer stores, for particular types of businesses and business applications.

Next, the misconception, primarily by large business dpers, that personal computers are very small will be dispelled. Personal computers are not small; they are low cost. As noted previously, today's personal computer compares quite closely to the S/360 Mod 30, the dp workhorse computer of the late 1960s.

Another important factor will be the declining cost of disc storage. When disc storage capacity doubles for the same cost, as it has done recently in floppy discs, many new business applications become feasible.

The other major factor is maintenance and support. As computer stores provide better service, more businesses will be willing to computerize their applications. National service organizations specializing in personal computing equipment maintenance will probably emerge.

We can look forward to the rapidly increasing use of personal computers by businesses large and small. ❁

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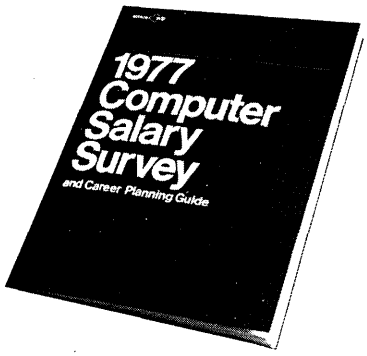

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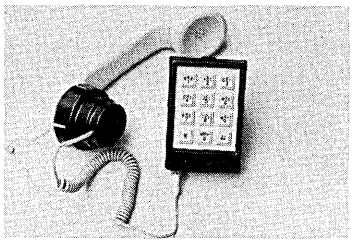

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Does your company now have an IBM 7080 available or have information concerning availability of IBM 7080? Do they have dual channels? Are they serviceable/reparable? Latest Engineering change? Can they be acquired to provide spare parts for future maintenance use? Do you have IBM 7080 spare parts?

Does your company now have an IBM-7080 simulator or have information concerning an existing system that is using such a simulator? If so, provide the names and model numbers of the computers that will operate with such a simulator. What is its performance? Is 7080 data conversion required to use it? What are the maintenance requirements?

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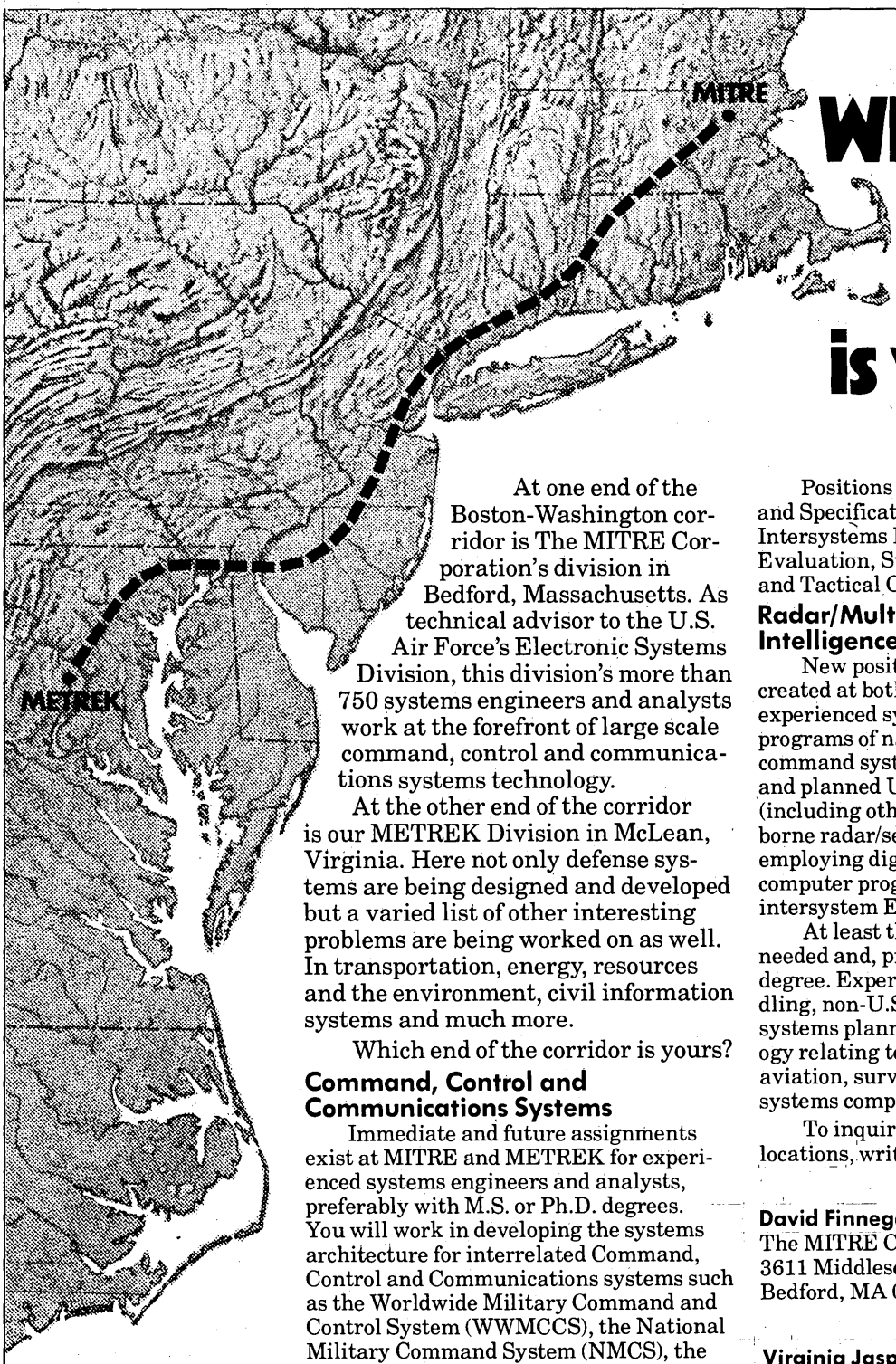

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Copyrighting Programs is Unwise

As a part of the Copyright Act of 1976, Congress established a National Commission on New Technological Uses of Copyrighted Works (CONTU). The purpose of that commission is to recommend periodic revisions of the new law, which goes into effect Jan. 1, 1978.

The commission since has made certain recommendations to Congress, including the recommendations that computer programs be protected by copyrighting in a manner similar to that used for books. Here are two reactions to that recommendation, both of which suggest that copyrighting computer programs will not work.

The Copyright Act of 1976 is the first significant change in the copyright laws since 1909. The new law inevitably must involve software, programs, and data bases—but in ways which are thus far undefined. Sharing the uncertainty prevalent in the computer industry over software protection, Congress delayed facing these aspects by establishing the National Commission on New Technological Uses of Copyrighted Works (CONTU) to study the proper treatment of software programs and data bases under the new law and to make recommendations.

CONTU, in turn, recently issued preliminary reports on how the new law should apply to software programs and data bases. As might be expected in view of a commission membership drawn largely from areas oriented to traditional copyright, its recommendations tend to favor the use of statutory copyright to protect proprietary interests in software programs.

In light of the realities of the marketplace, however, trade secrets' protection, rather than statutory copyrighting of published works, is the way to protect software programs from unauthorized use. Among these realities are the ways commercialized software programs are distributed and used, including pricing arrangements, the means of furnishing code to customers, and the means by which code is introduced into cpu's. Other realities to be considered involve legal considerations of software program suppliers, such as tax exposures, freedom to impose restrictions on uses by customers, and possibly even the obligations to qualify to do business in all states where licensees are located.

I persist in using the term "*software* program" in order to distinguish that type from a *hardwired* program. The manners in which each type is protected are different. Also, as should be obvious to data processing practitioners, I use that term to mean not computer media but rather the series of steps taken in computer processing (a user might not have *any* computer media for a software program when using it). It might even be better to speak of "practicing" a software program or information processing process rather than using a program, at least in speaking to a lawyer, because it is more precise and understandable in terms of prevailing experience outside the computer industry. It certainly should be more readily understandable to judges.

Copyrighting protects copies, not uses

Under the old law, a statutory copyright normally would be secured only for published works and it was secured by publishing a work with a particular form of notice. Starting Jan. 1, 1978, all "works of authorship" will enjoy statutory copyright upon creation. Hence, two classes of statutory copyright will exist, one for published works and the other for unpublished works. Also, under the old law, a kind of copyright referred to as "common-law copyright" arose under the laws of the various states and applied until the work was published. This too is being superseded by the new federal copyright law.

Traditionally, owners of statutory copyrights have used statutory copyrighting to: (1) enable themselves, as authors, to license others, such as publishers, to make copies of copyrighted works; or (2) as publishers or motion picture distributors, to enjoy the exclusive right to market copies of those works as such by sale or lease. Compare those activities to what software program marketers do in distributing rights to use information processing *processes*. In performing that function they frequently, but not always, inform their customers of the natures of those processes or programs they are licensing by furnishing computer media and documentation. Sometimes, however, they accomplish that step by sending streams of electronic impulses directly to the customer's computer. In essence, suppliers of the use of software programs do not deal in copies. Instead, they have the same role licensors of industrial processes—like refining petroleum, producing chemicals, or operating a blast furnace or galvanizing plant—have had for a long time. Licensors of processes merely furnished manuals when, in the past, the "information processing" for them was performed by people. Such licensors still normally rely on trade secrets' protection except in the relatively few cases where they can secure patents and choose to do so.

Wise software distributors usually protect themselves in other ways. Their carefully designed legal arrangements are dictated by the pricing methods common in the industry. Those pricing methods provide that the customer-licensee pays a fee either for each central processing unit with which the licensed program is used, or, much less often, for company-wide use. In contrast to publishing, the pricing is not related to the extent of copying of computer media or documentation. If there is any copying by licensees, it is for details such as backup copies for availability in the event of a mishap, or for use in correcting errors or accomplishing updates or enhancements.

The marketing arrangements usually forbid customers to transfer information and related computer media to others so that the supplier can preserve the size of the market available to it. Hence, suppliers of software programs must have a legally enforceable power, not only to prevent customers from delivering copies of computer media for their programs to others and from giving others detailed information about the natures of the programs, but also to bar

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running those programs on cpu's for which license fees are not paid. Those restrictions are appropriate for trade secrets but not for copyrighted works. Copyright law does not provide a legally enforceable basis for that type of licensing arrangement for published works. Software program suppliers relying on it are jeopardizing their valuable proprietary rights.

Computer specialists must be aware of subtleties of copyright law in order to form sound judgments on the propriety of relying on it. For example, there is a big difference between ownership of a statutory copyright and ownership of a copyrighted work. In this regard, it is classical copyright law that the owner of a statutory copyright on a published work may not, by virtue of that ownership alone, control any use another person may make of that work except copying. This means that a copyright owner may not bar transfer, or use for particular purposes, of *physical copies* of copyrighted works it does not own.

Recognizing this, distributors of copyrighted motion pictures normally own the prints for the pictures they market, and lease them to exhibitors. Retention of ownership of copies of a published copyrighted work and distribution of them by leasing is essential if restrictions on use or transfer of the copies are to be enforceable. That continued ownership of all copies of the copyrighted works, even if it were practical where customers continually make copies of computer media for software programs, exposes suppliers and users to adverse tax consequences and corporate law burdens.

Copyrights don't protect contents

An owner of a statutory copyright on a published work does not have the legal power to bar dissemination of the informational contents of the work. The real price for whatever "monopoly" a statutory copyright bestows is the contribution of the information contained in the work for free use. In general, that type of copyright merely covers the *form* in which the contents are expressed. Once a work is published, trade secrets' protections on disclosure of its contents ceases to be available.

Most suppliers of software programs and their customers act as if they are unaware of these fundamental considerations. They run great risks that their comfortable worlds will disintegrate. They might be astonished if, relying on the foregoing rationale, a trustee in bankruptcy of a program "licensee" successfully asserts ownership of computer media and the right to transfer them freely.

It is interesting to conjure up the legal arguments a software program supplier would make when confronted with such a challenge to its proprietary rights under statutory copyright. The supplier would insist that mere ownership of the computer media will not permit the practicing (running) of the program because doing so entails a copying of the media into the memory of the cpu, for which a license is required. He also would contend that magnetic tapes eventually need reproduction simply because of wear, and even this is barred without a license to copy.

IBM bases its software program licensing scheme on this rationale of "copying" into the memory of the cpu. But is that approach legally supportable? People have been reading copyrighted books into the memories of their own human cpu's ever since copyright originated without the need for licenses. Should the analogous activity with computers be treated differently? I doubt that it should.

Further, computer media are relatively fragile as recording means and often require refreshing by reproduction. That reproduction would seem to be so-called "fair use," for

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which no license is required, because it does not involve any undercutting of the economic interests of the software program licensor.

Hence, a license well might not be required for the act of copying. The owner of a copy of the copyrighted work probably is authorized to make those copies, if copies they be, as a normal attribute of that ownership, because of the nature of the works involved.

Incidentally, the agreement forms of software program suppliers that ostensibly rely on statutory copyright rarely are drafted with the legal elegance that is appropriate in light of the considerations outlined above. Not really confident in relying solely on the power to bar infringement represented by unauthorized copying, most suppliers forbid the transfer of the computer media (even though they do not assert, or at least do not establish, a basis for their ownership of all copies of those media made by each licensee). They also forbid the disclosure of the informational content of those media (even though that restriction has no legal authority, particularly because the protection they claim implies publication and publication in turn negates the existence of secrecy and hence also negates the basis for nondisclosure commitments). Licensees of software programs are authorized routinely to make substantial numbers of copies of computer media. It would be unseemly for suppliers to assert seriously a claim to own all those copies.

Trade secrets, protection will work

In sharp contrast to the power of the owner of a statutory copyright on a published work, the owner either of trade secrets, or of a common-law copyright, or of a statutory copyright on an unpublished work may impose legally enforceable restrictions on *use* of the physical works involved, which include the forbidding of their transfer. Remember that owners of extremely valuable industrial processes have been relying completely on trade secrets' protection for decades.

There are other good reasons, apart from legalities of statutory copyright on published works, that favor reliance on trade secrets' protection for software programs. These involve the impact of taxation, corporate law, and antitrust law.

If statutory copyright on published works is relied upon, attention tends to be focused again on the copies of computer media as items with intrinsic value and legal status, much like printed books. Suppliers speak as if they are furnishing those items as such, rather than as being merely incidental to another type of transaction, as is a license to practice a trade secret process. This creates gratuitous exposure to state and local taxes based either on the ownership of tangible personal property or on transfers of that property, the latter being sales and use taxes. Wise customers might resist transaction arrangements that result in such gratuitous exposure, because they end up paying those taxes.

Then too, software program suppliers sometimes expose themselves needlessly to the burden of qualifying to do business in the states in which they have customers when they take the route of statutory copyright on published works. This is so because they create the notion that they own tangible property located in those states.

Because the new copyright law introduces a novel concept of statutory copyright on unpublished works (superseding common-law copyright), suppliers of software programs that rely upon trade secrets' protection must be particularly alert to legal niceties starting Jan. 1, 1978. Although Congress asked for CONTU's recommendations, it can be ex-

pected that eventually computer media will be copyrighted automatically upon creation under the Copyright Act of 1976. If a supplier takes any action that would be deemed to constitute publication of the media, statutory copyright for a published work would attach at that time and other modes of protection would be excluded.

Hence, to enjoy trade secrets' benefits, it is necessary to structure software program transactions very carefully. Restrictions on distribution of the computer media must be set forth explicitly and with some degree of legal elegance. Carelessness in handling contractual formalities suddenly becomes even more harmful than it was before the effective date of the new law.

It is important to recognize that the legal weaknesses of statutory copyright on computer media are not present with the trade secrets' approach, regardless of who owns the media. The scope of trade secrets' protection is comparable to that of common-law copyright and, after the Copyright Act of 1976 becomes effective, of statutory copyright on unpublished works.

Finally, in many situations, suppliers want to make their software programs available with various limitations in order to maximize their return. Suppliers that rely on statutory copyright of published works risk running afoul of the antitrust laws in doing so. This seems to stem from the "monopolistic" nature of that type of copyright. Not having monopolistic qualities, trade secrets' protection is believed to skirt that exposure and hence validate various types of restrictions.

In summary, then, it appears that selection of the proper measures for protecting proprietary interests in software programs requires an integrated approach to all the legal aspects of that type of property, including taxation, corporate law, and antitrust, and not merely selection among patents, copyrights, and trade secrets. It also involves the careful identification of the marketing arrangements that are used so that the legal approach adopted gives the supplier some assurance that it will stand up under attack.

—Roy N. Freed

Mr. Freed is a lawyer in Boston who devotes much of his professional attention to the wide variety of legal matters involved in the acquisition and use of computer/communications technology. He is also the author and publisher of "Computers & Law," now in its fifth edition.

Programs Are Not Books

Book publishing, an ancient and honorable profession, has a history of thousands of years. For roughly 500 years, the law has dealt with problems involving the copying of published materials. While the law was not always 100% clear, it served well enough to protect the rights of both authors and publishers.

More recently, certain questions have arisen regarding these rights when dealing with mechanical copying devices. This is characteristic of the impact of technology on the law. It is indeed fortunate that the law as we know it is a living body and able to change and adapt itself.

The point is that, historically, the law has learned to change itself to adapt. Rather than cram new technology into old law, it has been a customary practice to create new law from the base of older rulings, statutes, and precedents.

In its reports, CONTU seems to me to have fallen into the convenient trap of attempting to forcibly insert this new technology, data processing, into old law, copyright. New law is needed. Some could contend that if left alone, new

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law will evolve naturally.

The often cited analogy, programming to book publishing, is not a valid one. There are perhaps six major points of difference between the programming world and the book world. These points tend to overlap somewhat, but I believe that a truer picture will emerge from considering them all at one time.

1. Definition

A book can be defined easily. It has covers, a starting point, and an ending point. One can hold it up, touch it, feel it. It is a complete entity.

On the other hand, no satisfactory definition of what a program is, nor what its included sub-elements are, exists. A program has multiple forms. It has no pre-defined limits except in the case of its smallest, most trivial member. In a vast majority of cases, a "program" in and of itself is useless without a wide variety of other programs being available. Programs as we know them these days are almost always fragments of much larger entities.

2. Degree of completion

A book is published as a totality. A table of contents often exists stating which chapters are included and what materials are covered. It would be rare to find a book with some blank pages inserted marked, "to be defined later."

A program, conversely, commonly is released to the outside world with missing features, elements to be included later. Consider a program whose essential purpose, sending out invoices, was *not* addressed at the first date of "publication." Indeed all that was released at the first date was a series of subprograms to build and update files. From the first, our menu or table of contents permitted the user to ask for "billing"; however, it wasn't there.

3. Authorship

Books are the work of an author or group of authors sitting down to do the total job from blank paper to finished product. In a majority of cases, it is one author working from personal creativity. Programs, on the other hand, tend to be the work of teams which rely on other work done by other teams.

4. Creativity

This argument may be felt by many to be highly contentious. However, the appearance of such terms as "software engineering" or "the software factory" is a clue to the programming process. Books are examples of creativity. Programs are engineered.

One can well argue this at great length, the arguments are real and the differences of opinion considerable. However, most commercially oriented practitioners of data processing would suggest that creativity is not really a *necessary* attribute of a programmer. What is desired is the ability to understand a problem posed by a user and to dredge from experience to package a solution from known subsolutions, components. This is engineering, developing new solutions from old ones and taking advantage of packaged work whenever possible.

As an example, consider the 1960s development team at General Motors' Research Laboratories doing highly original state of the art work in graphics technology. The experiment was highly successful. However, the true creativity was shown by those who came up with the ideas, defined the problem, worked out the approaches. There was nothing

very creative about writing the program; that was merely slogging to ensure that the ideas would work.

5. Impact of errors

When errors are discovered after book is published, the publisher will either issue an errata sheet or correct the errors in a later edition. Rarely is a book withdrawn due to errata. No attempt is made to get the corrections disseminated to earlier buyers.

Conversely, when program errors are discovered, a major and expensive effort is undertaken to correct them as soon as possible and to insert the changes into the existing program. It is common practice to distribute changes to old buyers as well as to new users. Unlike book errata, program failures may be so serious that the program will not function until corrected. Few book errors would be of this serious a nature.

6. Standalone nature

A book is complete in and of itself. While the use of a dictionary may be helpful, the vast majority of books are readable "as is" by their intended audience.

A program, on the other hand, is nearly unreadable without the immediate presence of supporting documentation. Indeed, the best program ever written (whatever that may be) could not be read (translation: run on a computer) without the availability of certain key documents. These documents may include such prosaic sounding manuals as "Operators Guide," "User's Manual," or "Program Logic Manual." However, without them, virtually all use of the program will cease.

It is for these reasons that the analogy between books and computer programs fails badly. These are different entities and must be treated differently within the law.

Programmers aren't authors, either

The other major discrepancy is the assumption throughout the CONTU Software Subcommittee Report that programs are created by individuals who desire widespread publication/dissemination.

This notion is utterly wrong. It reflects a purely academic concept of programming and data processing. Even without having any numbers to back up these remarks, it is clear that the vast majority of all programs are written by individuals employed by profit-making corporations.

The work of individuals employed by corporations, large and small, is the natural property of those corporations. It has been "bought and paid for" and falls well within the traditional employee-employer relationship.

The programs have been written to solve specific needs within a specific problem setting. Dissemination of the efforts of the individuals is not, therefore, a factor. In a corporation, one does not write programs to gain professional recognition or attain honors in the academic community—aside from research work, of which there is precious little. It is done, hopefully, to meet corporate objectives.

Dissemination is not a goal, and indeed, if the program makes a significant profit contribution, *non*-dissemination may be the goal.

Those corporations which produce programs for profit, the software houses, are in a special situation. Since their "product" is a program, they need to protect their efforts at three stages: (1) upon coming up with the ideas, (2) during the development, and (3) during the sales process.

Few would be foolish enough to contend that an idea can be protected. The realm of the mind is not protectable in law, nor should it be.

During the development stage, the idea which has been embellished and developed is turned into a program. Since it is difficult to consider protection of half-developed notions —a copyright of an author's outline seeming rather an odd idea—a corporation developing a program relies on standard and traditional methods such as trade secrets, employee contracts, and the like.

It is only in the selling stage, after (hopefully) the program is complete, that we wonder about protection. It would seem to many of us that current contractual and precontractual agreements are more than sufficient. The buyer and seller agree, using a contract form that has been with us for a long time, that the property (program) is for the use of the buyer only and that other use will bring consequent penalties. There is not a thing here that is new, novel, or unusual.

Discussions of the need for publication, dissemination of ideas if you will, deal with a world that does not exist except in the minds of certain academicians. The originality of thought, the hallmark of a patent process, does not exist here. While there are many ways to write a payroll program or to solve Bessel functions, in reality the programming is merely the mechanical slogging through of ideas that come from elsewhere.

What one wishes to protect in fact, is the effort rather than the thought—effort measurable in man-months or dollars or any terms one cares to use.

The minority—those who desire to publish their programs —need some sort of protection. A certain few programs are published in magazines that are themselves copyrighted. Perhaps that affords some protection. However, it is clear that the litigation necessary to protect one's claim could be both expensive and time-consuming. It is also clear that the solution developed for protecting those few programs thus published may not be applicable to the majority of programs.

I would sum up these remarks with the following thoughts:

(1) Protection of an idea is impossible and probably even undesirable.

(2) Protection during the development of an idea into a program can be done using conventional legal mechanisms.

(3) Seller protection under traditional contract law appears reasonably capable of protecting developmental rights.

(4) Eventually, and probably sooner than most believe, it will be possible to protect a program by taking advantage of the computer hardware. Use of execute-only, read-only PROM, EPROM, or ROM would appear to be a very near-term development.

(5) CONTU believes that trade secret protection is expensive. However, it is the cost of enforcing the protection that is really expensive, especially when traditional "reasonable" precautions are not taken. Further, cost does not always bear the relationship to price that is stated in the CONTU Software Subcommittee Report. Mere elimination of trade secret costs may or may not have any effect on program price.

(6) Publication/dissemination is an academic rite and bears little resemblance to the commercial world of data processing. Laws designed to protect this small minority may interfere with the rights of the majority who develop programs for a living.

(7) The analogy between book and program is an extremely weak one that falls apart under even cursory examination. The analogy should no longer be used. Therefore, the law regarding copyright as applied to literary works need not be extended to programs.

—Philip H. Dorn

Mr. Dorn is an industry consultant and a Datamation contributing editor. His remarks here are taken from his testimony before CONTU.

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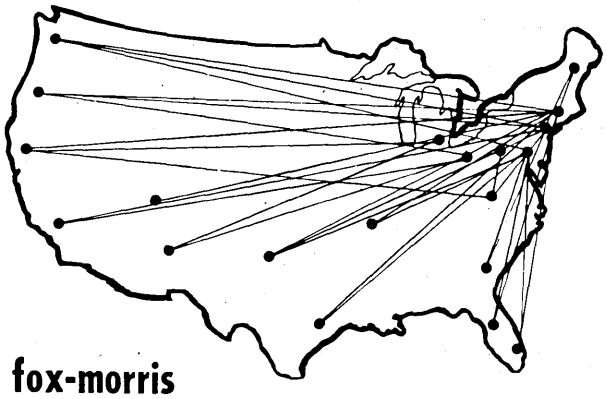

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