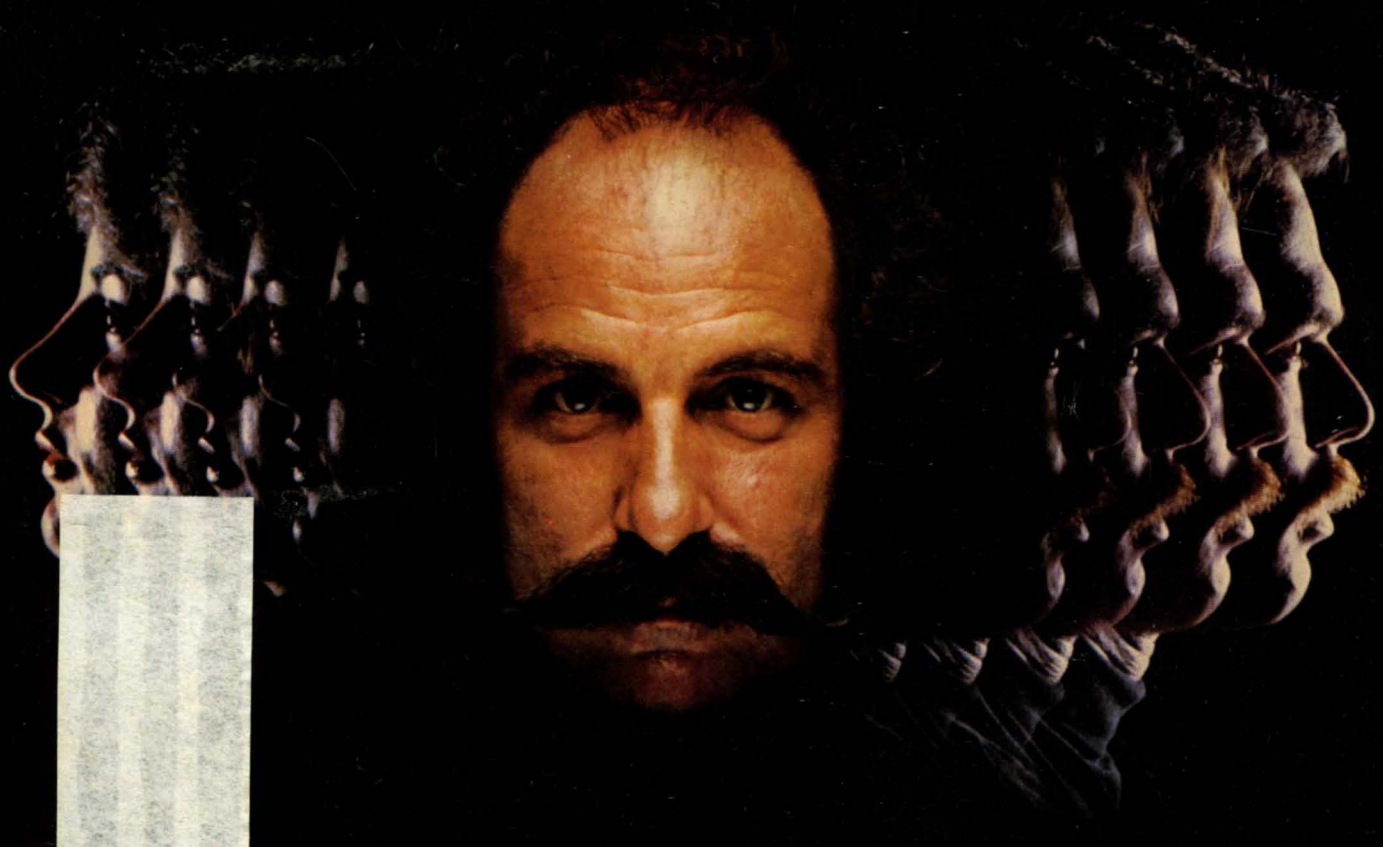


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ALSO:

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INFO 78 PREVIEW

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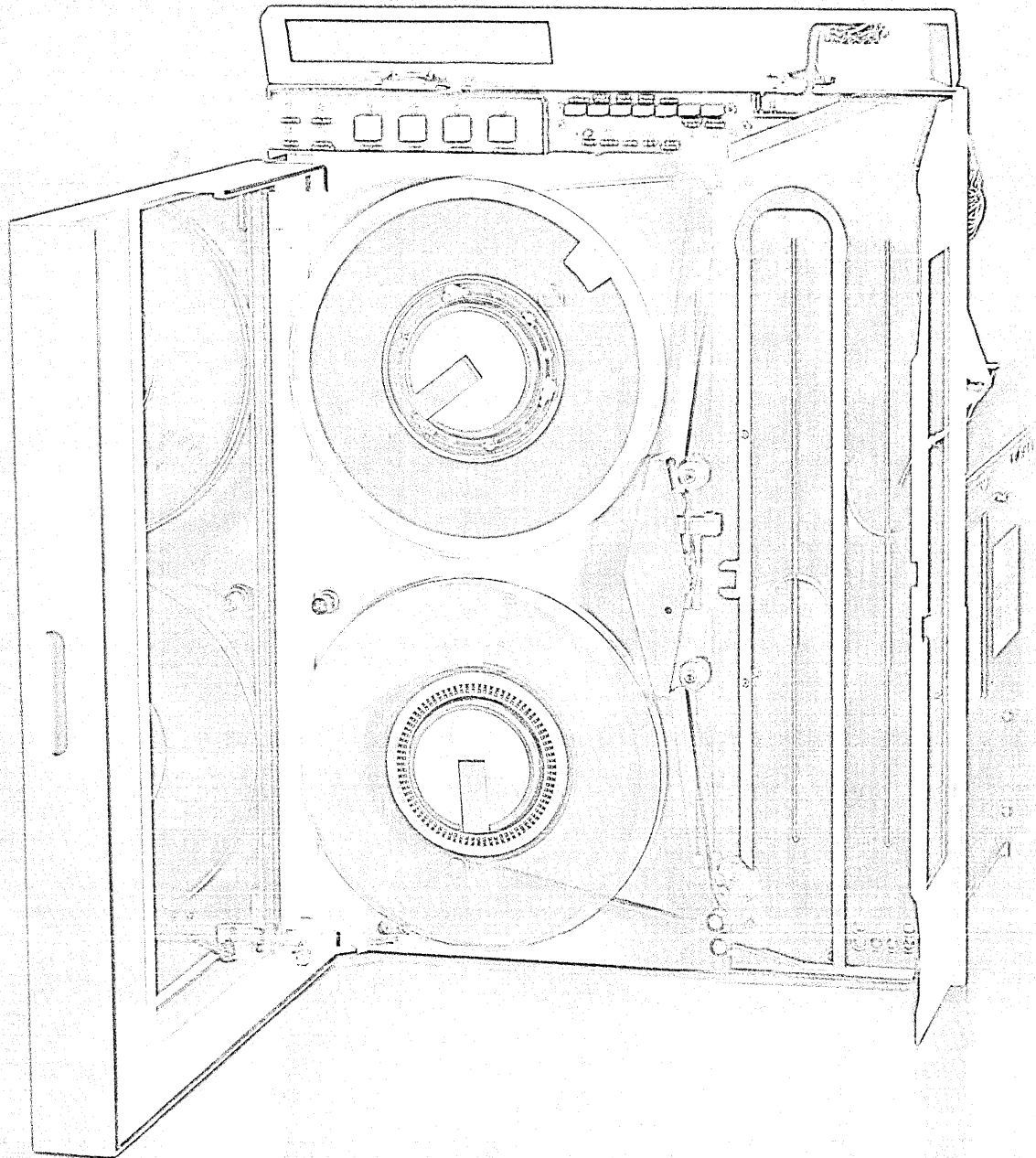
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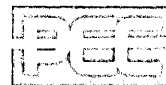
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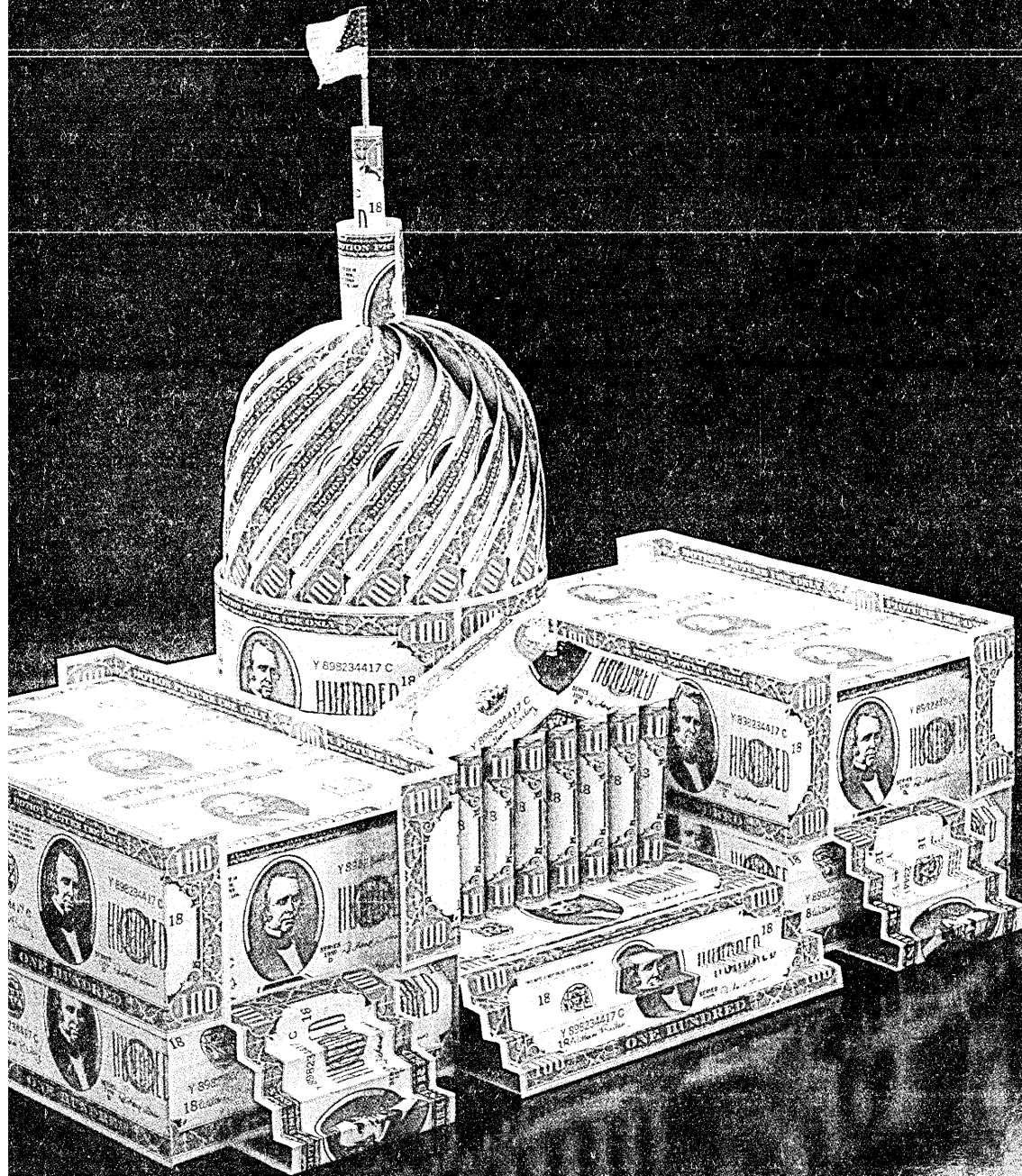
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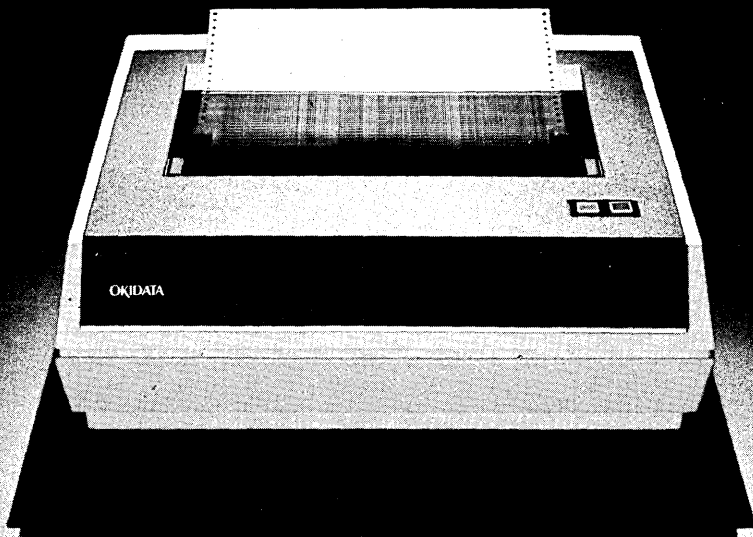
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ADR's MetaCOBOL® Makes Structured Programming Work for Sweden's KF

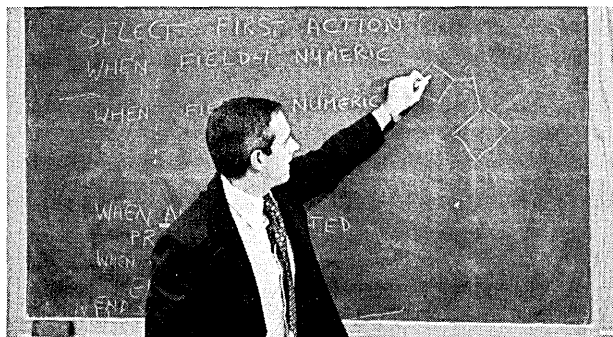
Four years ago when Sweden's \$2.8 billion/year Kooperativa Forbundet (KF) adopted structured programming, they chose ADR's MetaCOBOL as the tool to make it work.

"If we had implemented structured programming without using MetaCOBOL, the COBOL code we produced would not be clear," explained KF's Mike Evans. "We could get the original code to look tidy if we put a lot of comments around it. But we knew there was a great risk that the person who maintained that program would not be as tidy as the one who wrote it.

"With MetaCOBOL, the structure is in the code. Our programmers know immediately what is happening without superfluous comments. And, when the programmers maintain their programs, they

With MetaCOBOL, the structure is in the code.

have automatically documented the changes because the documentation is all right there as part of the code.



"Our programmers can pick up a MetaCOBOL structured listing they have never seen before and can follow what happens. MetaCOBOL supports structures with one entry and one exit so that they

Today our programmers make fewer mistakes and spend less time on maintenance.

can be regarded as black boxes. Programmers do not need to be concerned about what happened inside because they know that a given structure always yields a certain result.

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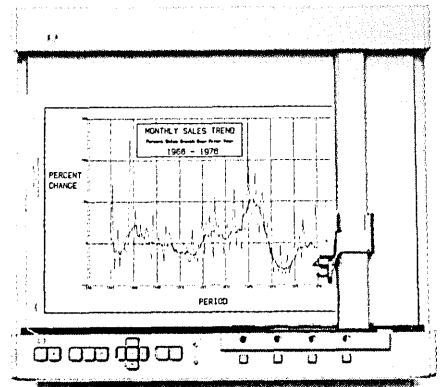
A special scientific instruction set, standard in the system, also helps to improve execution speed, performing trig and log functions in less than 48 microseconds. And a fast FORTRAN processor, which

handles commonly used FORTRAN operations in hardware, also gets things done in a hurry.

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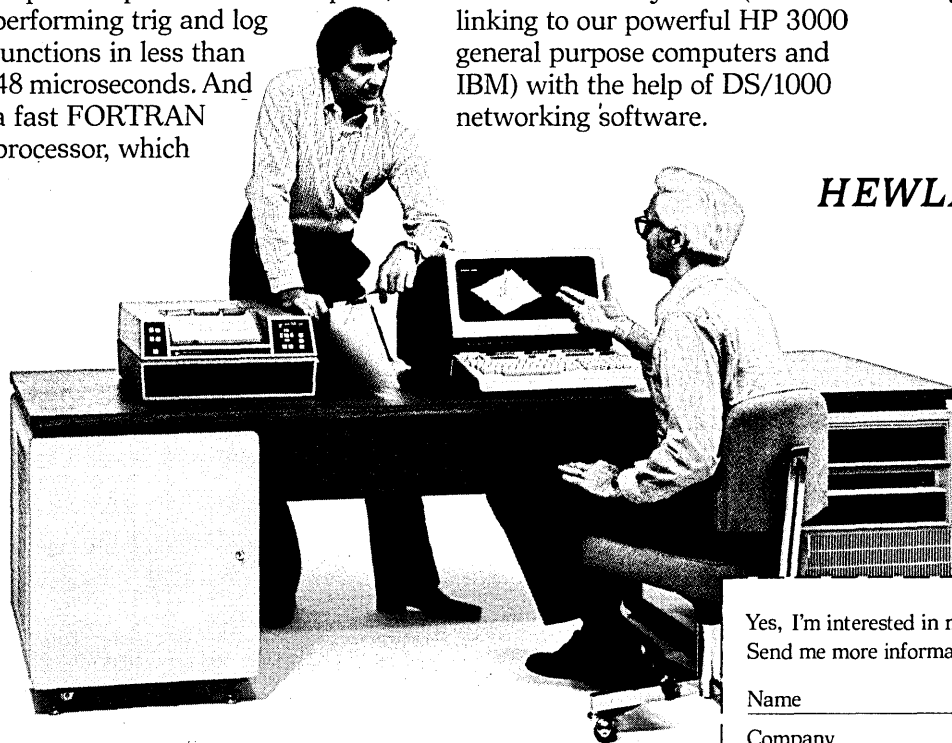
The HP 1000 Model 45 comes with a fast (25 msec seek time) 20M byte disc drive and an HP 2648A Graphics Terminal, as well as our new Graphics/1000 support software to help you write graphics programs. You can also team it up with other HP products like the HP 9872A four-color plotter and the HP 7245A printer/plotter.

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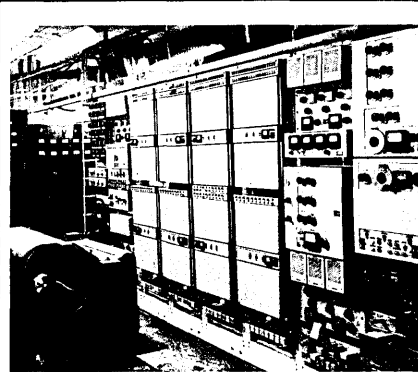
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TWENTY YEARS AGO/TEN YEARS AGO

LOOKING BACK



The Musasino 1 computer.

September/October 1958 YEAR OF THE PARAMETRON

It seems that 1958 was a great year for unique computers. In last month's Looking Back we reported on the perceptron, a system that promised not only to think thoughts but to think original thoughts at that. Alas, the perceptron became one of evolution's drop-outs.

In the very next issue of DATAMATION, a Japanese computer utilizing devices called "parametrons" made its debut.

Saburo Muroga, a senior research engineer from Nippon Telegraph and Telephone, explained in obfuscated engineerese the principle of the parametron. Said Muroga, "A small signal which takes one of two possible phases has been amplified into one with much larger amplitude which retains the original phase. And it is interesting to note that these two possible phases are different from each other by pi radiation; that is, the voltage of one oscillation is equal to the minus of the other."

Interesting indeed. E. Goto of Tokyo Univ. decided to apply the parametron principle to switching circuits and, by devising a three beat excitation and a majority decision logical operation, he developed a sort of shift register. A computer was aborning.

5,356 parametrons found their way into the Musasino I large scale digital computer, a 256 word machine used to calculate tables of elementary functions. The arithmetic unit used 2,800 parametrons, the control unit contained 1,600, and 1,456 were in the magnetic

memory; 519 vacuum tubes helped matters along.

Parametrons, it seemed, had an amazing MTBF for those days; at the time the article was written they had been running for 4,000 hours with the only failures occurring because of easily repaired soldering defects.

The M-1 was sure but it was slow. Its speed was somewhat less than that of existing vacuum tube computers. We'd be interested in learning whatever became of the M-1.

Also in this issue was a feature article focused on the problems of dealing with "the presently unmanageable mass of technical information . . ." Charles P. Bourne and Douglas C. Englebart, both of the Stanford Research Institute, posed six pages worth of pertinent questions which they felt must be answered before an effective information system could be designed. At the same time Congress was studying an SRI draft program for a National Technical Information Service.

September 1968 COMPUTER AIDED INSTRUCTION

All the problems that have kept CAI from gaining a toehold in the schools today were being talked about ten years ago in this issue's opening series of articles.

Cost was a major problem. LSI was just being discussed at an IEEE Computer Group conference in Los Angeles and microprocessors were the stuff of visions.

Work on higher level languages had not progressed to any satisfactory point, instructional material was deficient in quality, and serious linguistic ambiguities involving student natural language response to computer-generated quotations had yet to be worked out. The promise of CAI seemed a long way off.

In the news was the announcement that Computer Sciences Corporation and Western Union had broken off merger talks when AT&T said it would halt negotiations on the sale of TWX to WU. AT&T was also gathering lineage by wresting a stay from the FCC on its decision to allow foreign attachments on common dial-up lines. *

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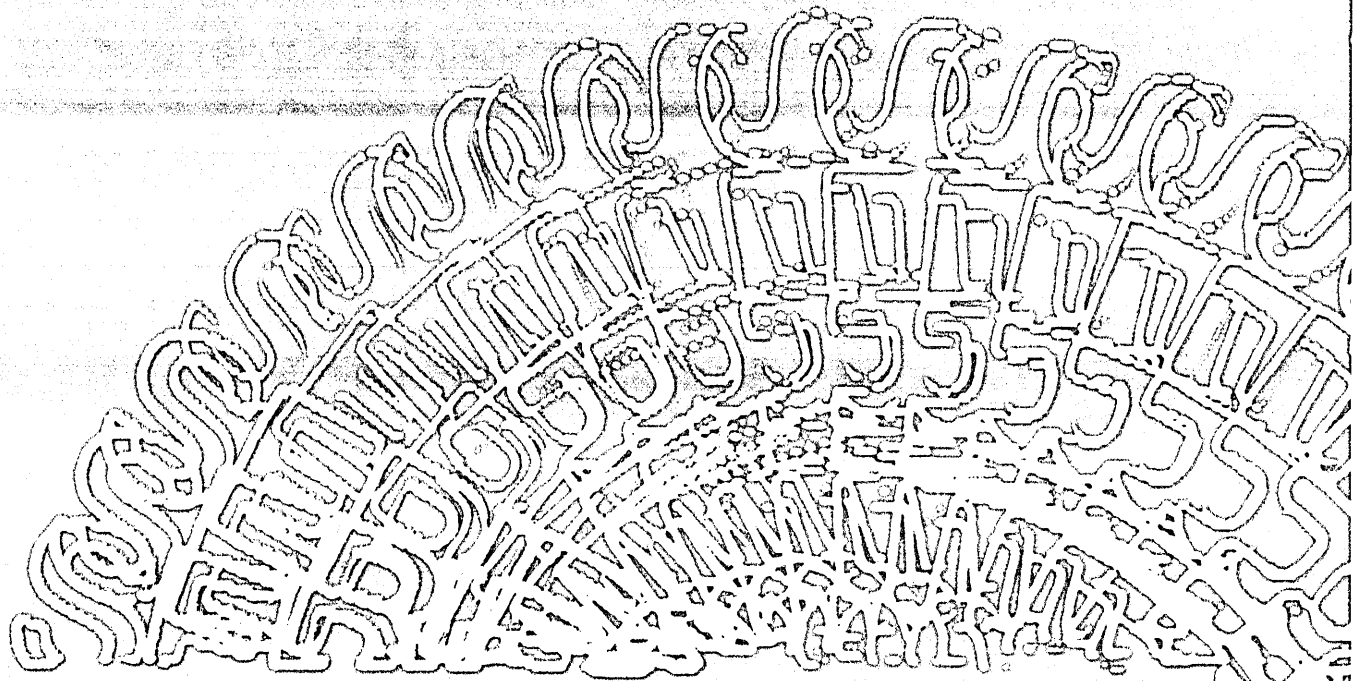
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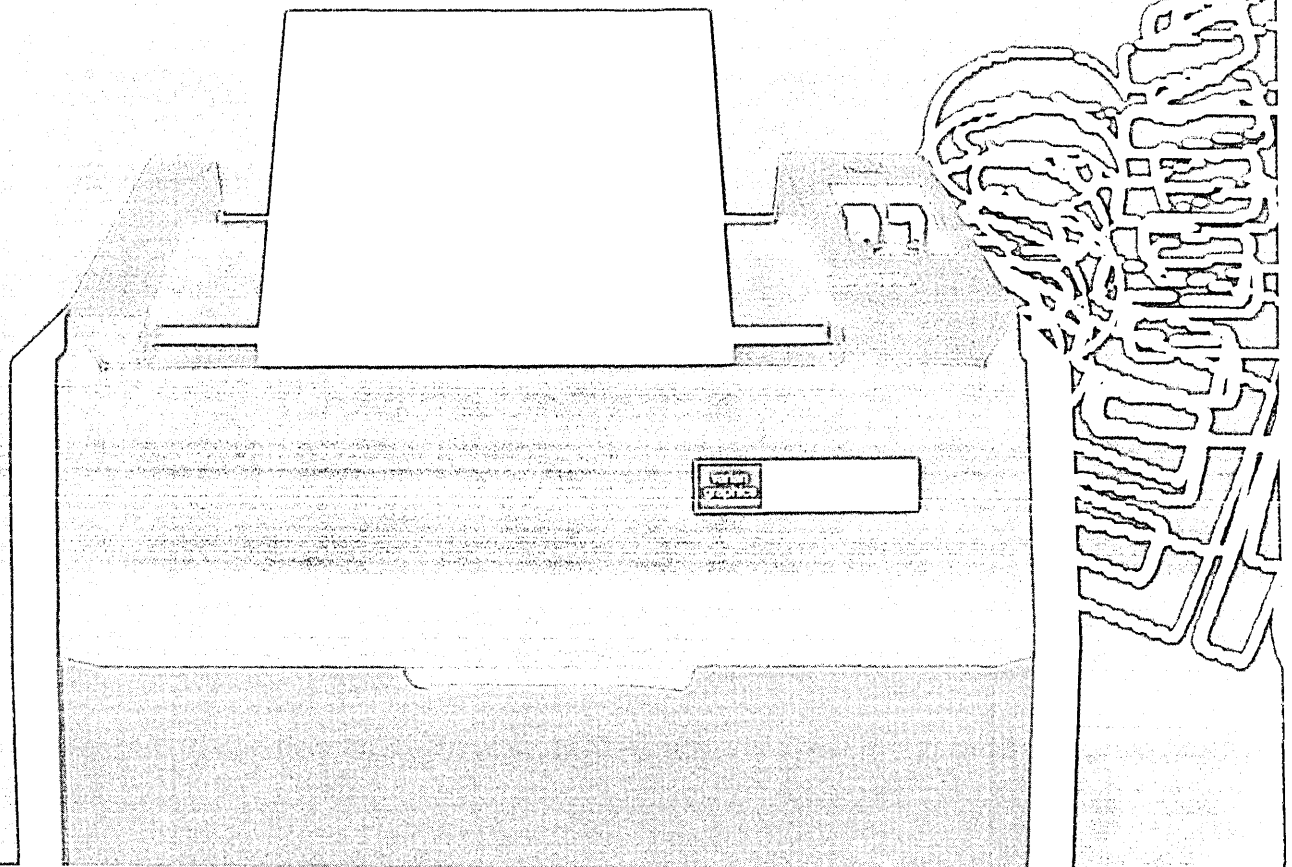
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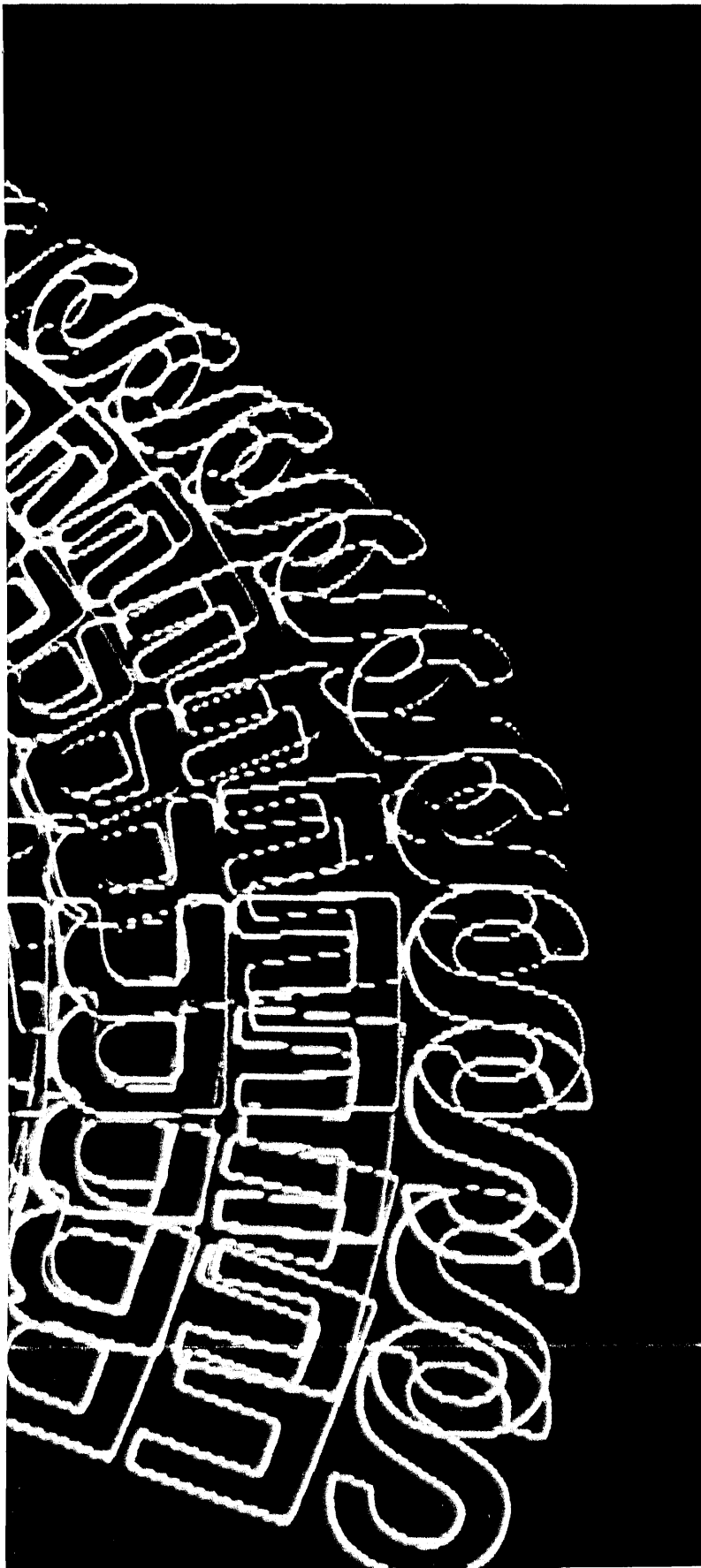
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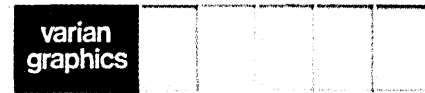


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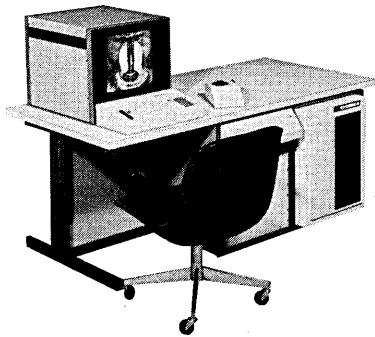
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Comtal is image processing.

By definition, an *image* is the digitally stored representation of the shape and shadings of objects, people or scenes. And, *processing* is the enhancement of brightness, color and definition of the image.

Printed reproductions cannot do justice to the quality of Vision One Image Processing Systems. To see what you're missing, send to Comtal for samples of Vision One image quality and standard interactive processing features.



Vision One is delivered ready to operate on digitized imagery without a host system/software development or time-consuming software installation or integration.

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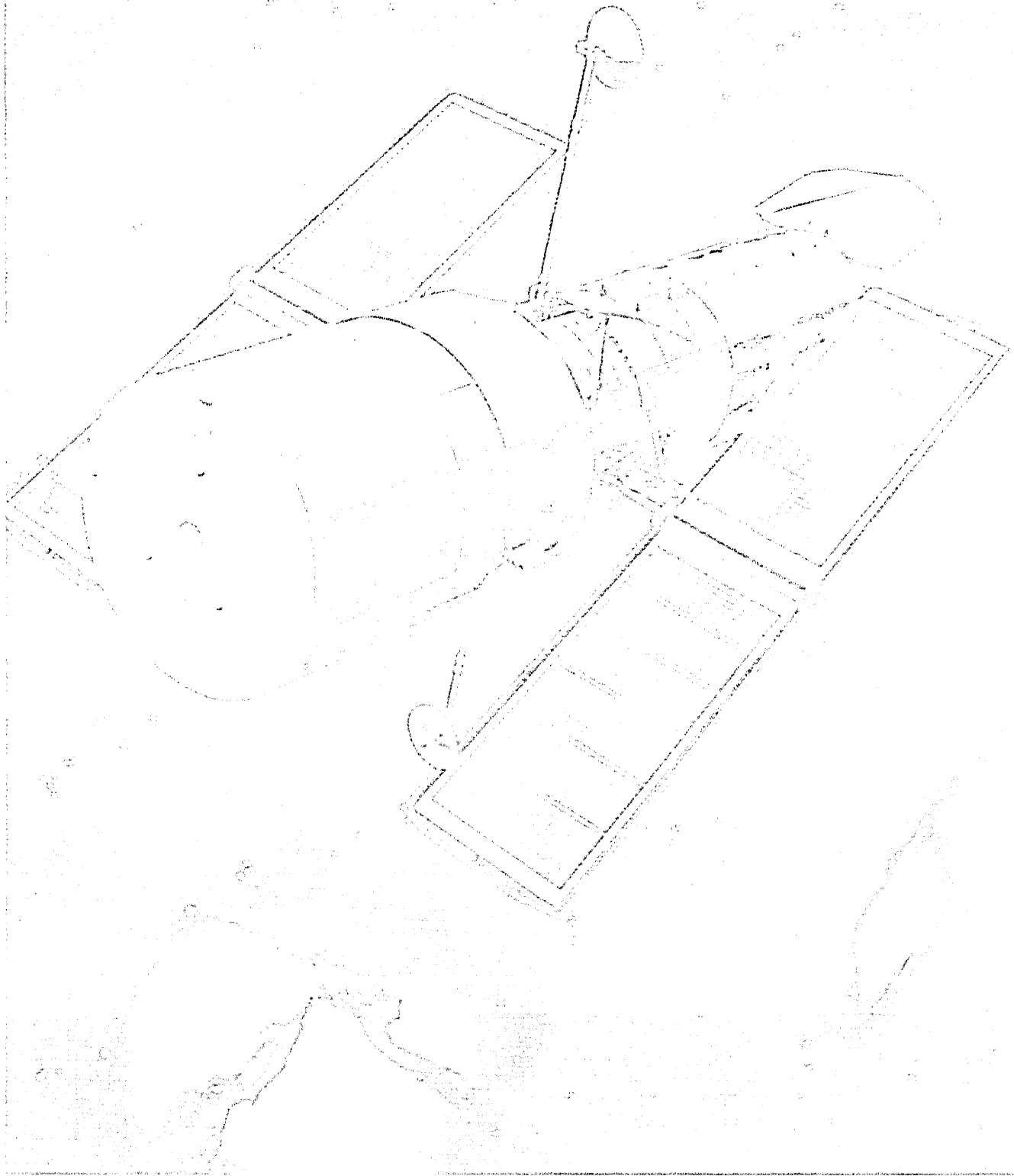
Vision One is an intelligent image processing system featuring real-time, completely operator interactive image processing for black and white or full 24-bit color (8 bits each of red, green and blue). Image resolution is 256x256, 512x512, or 1024x1024 pixels with internal solid state memory for up to fifteen 512x512 images (8-bit) and sixteen 512x512 graphic (1-bit) overlays.

Comtal is the acknowledged leader in digital image processing and offers the first commercial system with these features:

Real-time roam of multiple displays in very large data base memories (1977), stand-alone image processing systems, real-time small area independent color correction, and real-time convolution processing (1975). Also, 1024x1024, 256 shade soft-copy display image processing system (1974), full 24-bit color and digital image function and pseudo-color image processing (1973), with single standard digital interface for all features and options (1972).

Comtal has the only commercial systems with real-time operator interactive image processing and hardware generated display of image processing test patterns.

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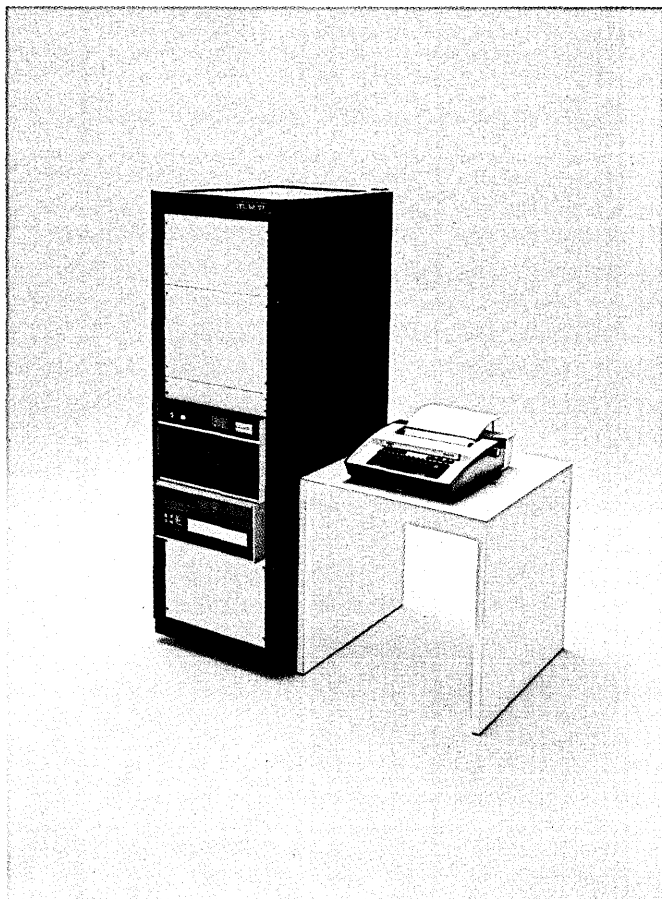
of users are turning to IBM's Model 224. Clip your business card to this ad and send to Computer Corporation of America, 575 Technology Square, Cambridge, MA 02139. 617-451-3571.

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Circle 11 on Reader Card

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SEL 32/5730

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SEL 32/5740



SEL 32/5750

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You don't have to trade reliability to get Classic's performance.

The best thing about the Classic isn't its performance. It's the fact that its state-of-the-art performance isn't achieved at the expense of reliability.

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LOOK AHEAD

PROBLEMS WITH 3033 REPORTED BY USERS

Problems with the IBM 3033 continue to surface. One large user, Martin Marietta, Baltimore, Md., has reportedly had trouble keeping its 3033 system up since its mean time between failures (MTBF) has been less than 100 hours. One night late last month, the system went down eight times, reports an industry insider. Although IBM maintains a strict "mums the word" policy on quoting mean time between failure on any of its systems, the normal MTBF is usually clocked at between 400 and 500 hours on most systems. Other 3033 users are also rumored to have had problems getting their systems operational. While the Central Intelligence Agency's 3033 finally is not failing as frequently as it had several months ago, ITEL's 3033, installed in late May, was still not operational as of late in August.

IBM SEEN SLASHING MEMORY PRICES

Look for IBM by next January to slash the price of main memory well below that offered by the most aggressive add-on memory suppliers. Oppenheimer & Co., the New York brokerage firm, says the company will use new high density storage to offer memory at under \$35,000 per megabyte, a major slash from its present price of around \$110,000 and considerably below the \$55,000 per megabyte offered by the independents.

In addition, the price performance curve of mainframes to be announced in early 1979 should be much sharper than generally expected: 4:1 for processor and storage, perhaps, compared with common expectation of 2:1. IBM could make up the difference by charging for its system control programming modules, with IBM software billings to users increasing to about 50% of the total system monthly rental value. (Detailed discussion of the short term outlook for IBM developments, specifically relating them to plug compatible mainframes, will be offered at Oppenheimer's first open conference early in October. The company's computer analyst Gideon Gartner says his firm also will be covering AT&T Advanced Communications Service at the seminar.)

NIXDORF TO OFFER WP SYSTEM IN U.S.

While Nixdorf Computer is rumored to be test marketing a single station word processing unit in Europe, it's understood the firm's U.S. operation is designing a multiterminal shared processor word processing system. Test marketing of the U.S. product should begin soon. One potential user has been told the system will be based on the firm's Entrex hardware and software. The Nixdorf system's printer is likely to have a daisywheel design and Entrex software is being tailored to make the system simple to use. The announcement should be forthcoming late this year.

BRITAIN'S SILICON ISLAND

Some industry pundits in Britain now refer to that nation's electronics industry as "Silicon Island," after the fuss raised over Britain's moves into the microelectronics business (August, p. 73). The reference, of course, is to Northern California's

LOOK AHEAD

Santa Clara Valley, home of many of the leading U.S. semiconductor manufacturers. Britain's government has promised a \$300 million initial investment in the effort and about 5,000 new jobs are to be created at two major manufacturing ventures. One is Inmos, started from scratch but using talent from Mostek, a company that is far away from Silicon Valley, in Texas. Mostek, meanwhile, has taken legal action, charging that along with people, Inmos is taking away trade secrets. Inmos doesn't expect to enter the 64K RAM market until 1982, however. Meanwhile, Fairchild has a deal with Britain's GEC in which each will pump an initial \$20 million into their advanced circuits and memories operation in Europe.

What bothers many on this side of the pond are the lucrative salaries being offered talent from U.S. semiconductor firms to settle and make their fortunes in Britain and on the European continent. Mostek, for instance, already has lost seven of its top persons to Britain. Next target could be the Valley, say British observers.

ACADEMY TO PROBE PRIVACY PROBLEMS

Computer-spawned privacy problems may get a new probing by the National Academy of Science's National Research Council. The impetus for the study came last month at an NRC hosted meeting on computer based information technology. A draft report of the high level government/industry conclave is due out in October. Bundled into that report, one source reports, will be a recommendation calling for an NRC directed research effort to deal with privacy problems stemming from organizational relationships. Specific areas of concern would be electronic funds transfer system (EFT), criminal justice information system, and the Post Office's moves in the area of electronic mail.

MODEM RIGGED FOR HIGHER SPEEDS

What do you do when you have a network that requires modems to handle transmission speeds of 6000bps? If you have a 4800bps modem with a powerful enough microprocessor built in -- like Paradyne Corp.'s -- you jury-rig the slower speed device to handle the higher speeds. That is precisely what Paradyne has done with its MP 4800 modem, which has become the workhorse model of Scandinavia's Nordic Data Network which, of course, transmits data at 6000bps.

SEEKING UPGRADE TO DEC'S MAIL SYSTEM

With more than 400 subscribers already on line at Digital Equipment Corp.'s COMET electronic mail system, the firm that developed the system -- Computer Corp. of America, Cambridge, Mass. -- is looking at ways to upgrade the system. One possibility would be the use of more of a distributed network for the system, which uses PDP-11s. Several other firms are testing the system with the thought of implementing their own dedicated system some day.

RUMORS AND RAW RANDOM DATA

IBM's 1200MB disk drive, being developed under the code name Whitney, will obey Grosch's Law to the letter: its price will be twice that of the 3350, while its capacity increases fourfold, the square of the price increase...Storage Technology will introduce a charge-coupled device (CCD) memory this month that may have applications similar to Memorex's 3770 Disc Cache CCD memory that provides faster access between a disk and a cpu...The Justice Dept. is said to be stepping up its interviews with IBM competitors and others to come up with some kind of proposal for relief in the IBM antitrust case.

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"With 16,000 claims reported annually and \$50,000,000 in annual premiums, Transport Indemnity is one of the largest and busiest truck insurers in the country. To handle this enormous load with ease and efficiency, we use MARK IV. It has reduced our programming time by 75 percent and allowed us to work with a staff one-third the size of what it would be otherwise. It's really unbelievable!

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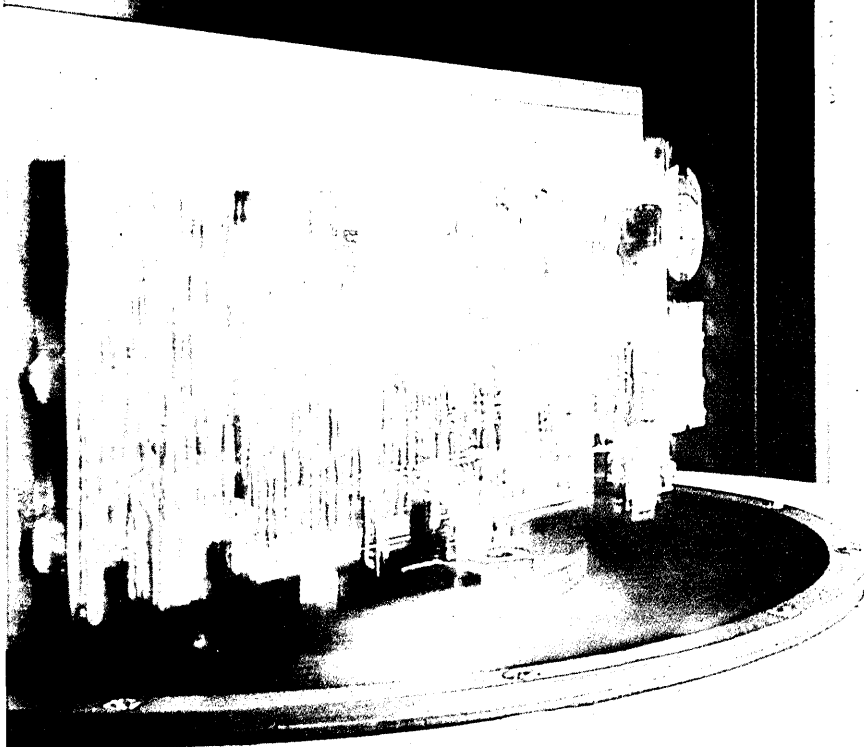
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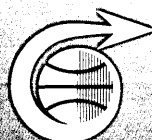
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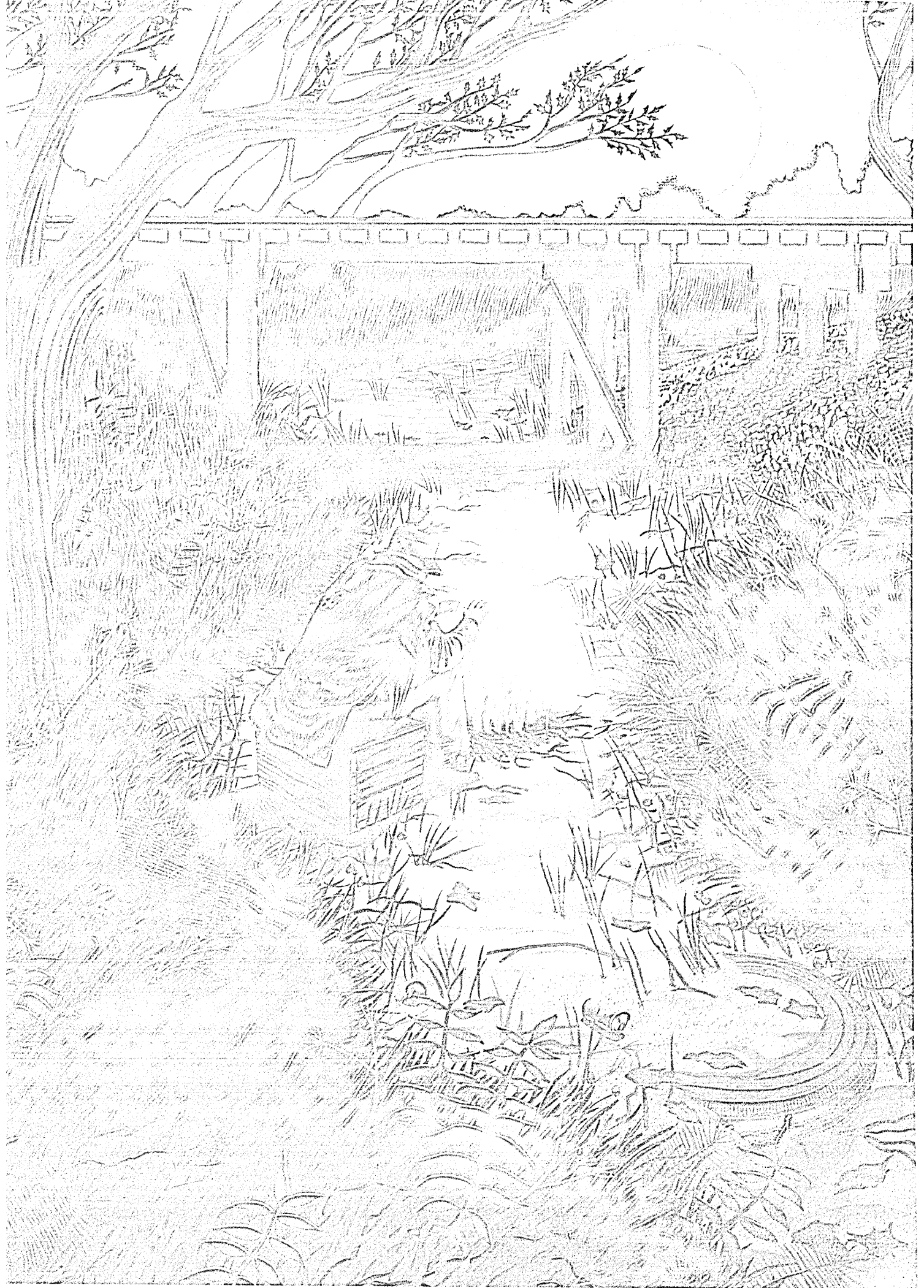


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And, while you’re at it, ask us about:

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A Restart/Recovery Management System that makes restarting in a matter of seconds... a matter of fact (UCC-15). Circle 95

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CALENDAR

OCT.

MIDWEST PERSONAL COMPUTING EXPO, OCT. 5-8, CHICAGO.

Over 20,000 attendees expected. Seminars will range from introductory to advanced. Contact: ISCM, 222 West Adams St., Chicago, IL 60606 (312) 263-4866.

ASSN. OF RECORDS MANAGERS AND ADMINISTRATORS CONFERENCE, OCT. 8-11, WASHINGTON, D.C.

Keynote speaker will be the Honorable Elmer B. Staats, U.S. Controller General. \$205 for nonmembers. Contact: ARMA, P.O. Box 281, Bradford, RI 02808.

THIRD U.S.A.-JAPAN COMPUTER CONFERENCE, OCT. 10-12, SAN FRANCISCO.

Dr. Jerome B. Weisner, president of the Massachusetts Institute of Technology, and Dr. Koji Kobayashi, chairman of the board and chief executive officer of Nippon Electric Co., Ltd., will be the two keynote speakers. The conference is to explore technical advances in the U.S. and Japan and similar and contrasting ways of using computers to solve problems. Contact the Third U.S.A.-Japan Computer Conference, c/o AFIPS, 210 Summit Ave., Montvale, NJ 07645, or call the conference general cochairman, John D. Madden, at (408) 245-5807.

AFSM THIRD NATIONAL CONFERENCE AND EXPO, OCT. 15-18, CHICAGO.

The Association of Field Service Managers is a professional association of managers of complex equipment maintenance. Speaking at the conference will be Ryal Poppa, chairman and president of Pertec Computer Corp.; Archie McGill, director of management development operations at AT&T; Hyde Harper, vice president of field engineering at Satellite Business Systems; La Vern Bassett, senior program manager at Xerox Corp.'s Office Systems Division, and others. Contact: AFSM, P.O. Box 255, Danbury, CT 06810 (203) 744-5707.

COMMON FALL CONFERENCE, OCT. 15-18, DENVER.

COMMON is an IBM users group. Some topics to be covered at the conference include dp management, data base management, and manufacturing applications. Contact: David G. Lister, administrative director, COMMON—Dept. F2, 435 N. Michigan Ave., Suite 1717, Chicago, IL 60611 (312) 644-0828.

INFO 78, OCT. 16-19, CHICAGO.

The theme is to be "Strategic Planning in the Information Age." The emphasis of the technical sessions will be on applications. Contact: Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017.

FEDERAL MICROGRAPHICS EXPO, OCT. 24 AND 25,

WASHINGTON, D.C.

No fee for admission. Contact: Robert E. Harar, National Trade Productions, Inc., 9301 Annapolis Rd., Suite 104, Lanham, MD 20801 (301) 459-1815.

IWP FALL SYMPOSIUM, OCT. 24-26, ST. LOUIS.

The International Word Processing Association's annual conference and exhibition. Panels, sessions, and workshops are to be held on a variety of topics relating to word processing management and related information systems. \$15 for nonmembers. Contact: IWP Membership Services, Maryland Road, Willow Grove, PA 19090 (215) 657-3220.

CPEUG 78, OCT. 24-27, BOSTON.

The 14th annual meeting of the Computer Performance Evaluation Users Group. The theme is to be efficient management of the dp life cycle. There will be a panel on the President's Federal DP Reorganization Project. Contact: Carol B. Wilson, Bldg. 225, Room A-265, National Bureau of Standards, Washington, DC 20234 (301) 921-3485.

NOV.

THIRD ANNUAL CONFERENCE ON DISTRIBUTED DATA PROCESSING, NOV. 5-8, NEW ORLEANS.

The focus is to be on applications. Contact: John Breyer, International Data Corp., 214 Third Ave., Waltham, MA 02254.

FIFTH ANNUAL COMPUTER SECURITY CONFERENCE AND EXPO, NOV. 6-8, NEW YORK.

Conference chairman is Dick Brandon. Featured speakers include Willis H. Ware, Donn B. Parker, and Jerry Fitzgerald. Contact: Barbara H. Shimek, Computer Security Institute, Five Kane Industrial Drive, Hudson, MA 01749 (617) 562-7311.

MINI/MICRO CONFERENCE AND EXPO, NOV. 7-9, HOUSTON.

Contact: Robert D. Rankin, Managing Director, Mini/Micro Conference and Exposition, 5528 E. La Palma Ave., Suite 1, Anaheim, CA 92807.

COMPSAC 78, NOV. 13-16, CHICAGO.

Contact: Wallace A. Depp, executive director, Processor and Computer Software Systems Div., Bell Laboratories, Naperville, IL 60540 (312) 680-2111.

INTERFACE WEST 78, NOV. 14-16, LOS ANGELES.

Three conference programs will run concurrently: Small Business Systems, Data Communications, and Microcomputer Design and Application. Contact: Interface West, Inc., 160 Speen St., Framingham, MA 01701 (800) 225-4620 or (617) 879-4502.

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Purely as a public service, we at the Yard issue the following all points bulletin for DOS and DOS/VS users:

WARNING

Professor Moriarty, Sherlock Holmes' long-time arch-enemy, is *not* dead as previously reported. He is thought to be alive and well and living in a DOS/VS computer center. He is said to be cleverly disguised as a down-at-the-heels DOS sort program.

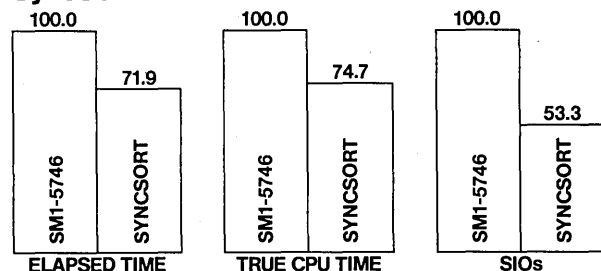
Moriarty's *modus operandi* is simple but effective. Under the guise of performing sorting jobs "well enough," he actually "skims the cream" off the users' True CPU Time, Elapsed Time and SIOs on every sorting run.

By the time the worried manager and staff become aware that their resources are disappearing mysteriously, so is Moriarty. Generally in a hansom cab, under cover of a pea-soup fog.

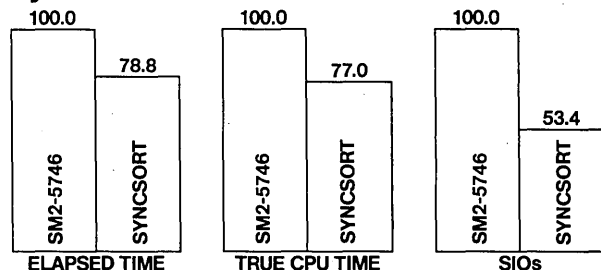
If you suspect someone has been filling his pockets with your resources, call the people at SyncSort. They'll dispatch one of their "Moriarty Detectors"—a systems engineer specially trained to sniff out bad sorts.

A couple of simple benchmarks will show you where your computer resources have been going:

SyncSort DOS vs. IBM's SM1-5746.

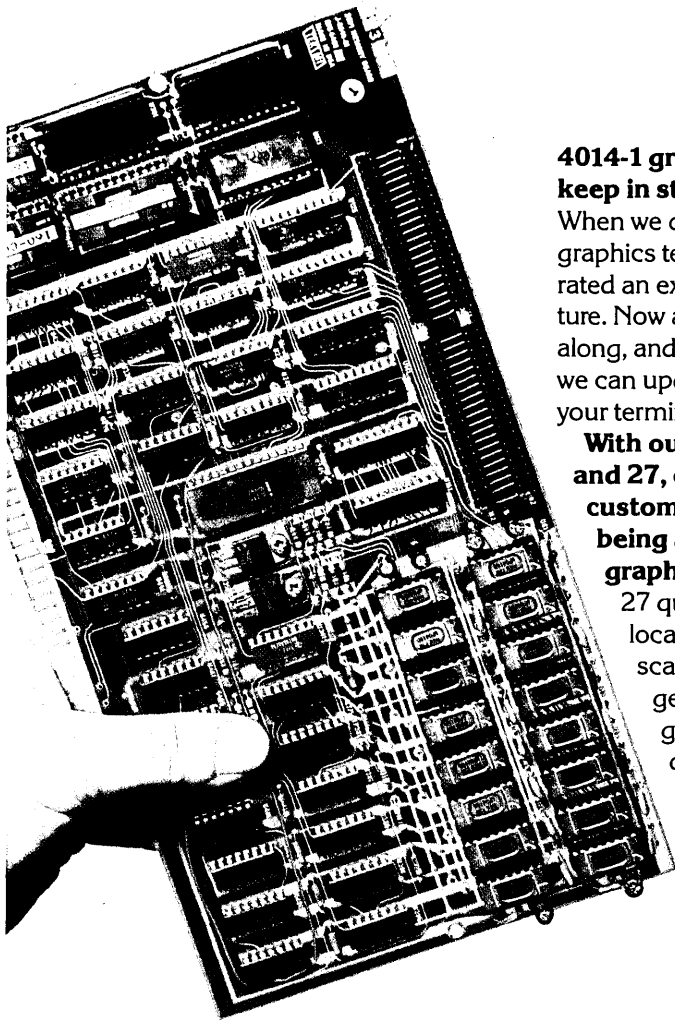


SyncSort DOS vs. IBM's SM2-5746.



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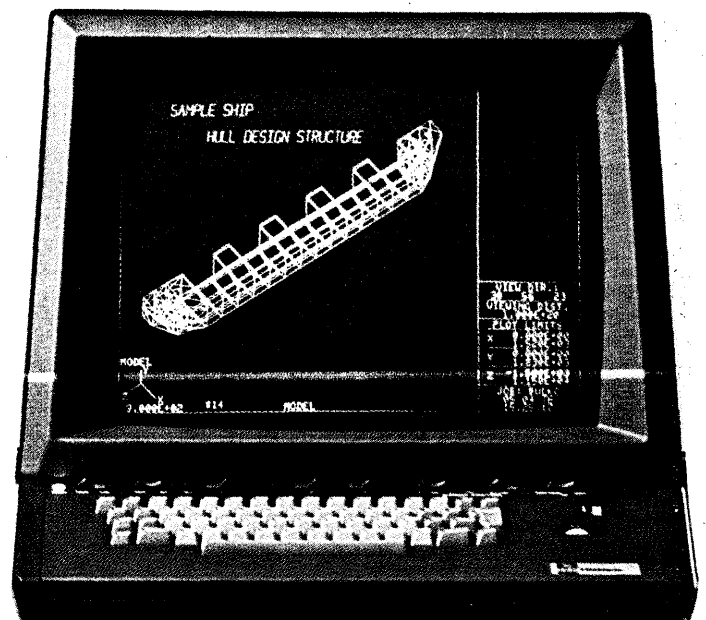
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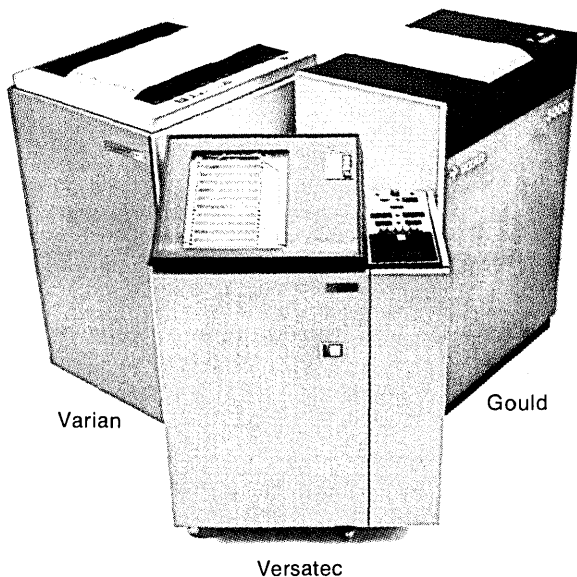
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CALENDAR

ELEVENTH ANNUAL MICROPROGRAMMING WORKSHOP, NOV. 19-21, PACIFIC GROVE, CALIF.

The workshop is to be a forum for discussion and comparison of design techniques for firmware and supporting hardware. Contact: Dr. Alice C. Parker, MICRO-11 program chair, Electrical Engineering Dept., Carnegie-Mellon Univ., Pittsburgh, PA 15213 (412) 578-2472.

EUROPEAN COMMUNITIES SYMPOSIUM ON COMPUTER AIDED DESIGN OF DIGITAL ELECTRONIC CIRCUITS AND SYSTEMS, NOV. 27-29, BRUSSELS.

Speakers have been invited from Europe, Japan, and the United States. Contact: Keness Belgium Congress S.A., Rue de l'Industrie, 17, 1040 Brussels (Belgium).

NINTH ANNUAL CANADIAN COMPUTER SHOW, NOV. 28-30, TORONTO.

Contact: Marion Hart, CIPS (Canadian Information Processing Society), 212 King St., W., Suite 214, Toronto, Ontario M5H 1K5.

DEC.

ANNUAL ACM CONFERENCE, DEC. 4-6, WASHINGTON, D.C.

Keynote speaker will be Dr. Richard C. Atkinson, director of the National Science Foundation. Contact: Dr. Richard Austing, Dept. of Computer Science, Univ. of Maryland, College Park, MD 20740 (301) 454-2004.

MIDCON 78, DEC. 12-14, DALLAS.

High technology electronics show and convention. Contact: Hal Copeland, The Hal Copeland Co., 528 Meadows Bldg., Dallas, TX 75206 (214) 361-8788.

COMPUTER NETWORKING SYMPOSIUM, DEC. 13, GAITHERSBURG, MD.

To be held at the National Bureau of Standards. Papers presented will concern both practical and research experiences with computer and communications networks. Contact: Dr. George Cowan, Computer Sciences Corp., 6565 Arlington Blvd. Falls Church, VA 22046.

WORKSHOP ON SOFTWARE TESTING AND TEST DOCUMENTATION, DEC. 18-20, FT. LAUDERDALE.

Contact: Dr. Edward F. Miller, Jr., Software Research Associates, P.O. Box 2432, San Francisco, CA 94126.

JAN. 1979

JAN. 1979 PACIFIC TELECOMMUNICATIONS CONFERENCE, JANUARY 8 AND 9, HONOLULU.

Papers presented will cover telecommunications technology, communications policy, and the economics of telecommunications. Papers on multidisciplinary topics will be emphasized. Participation of attendees from developing countries in the Pacific is encouraged. Contact: PTC '79, Social Science Research Institute,

Univ. of Hawaii, 2424 Maile Way #704, Honolulu, HI 96822 (808) 948-7879.

U.S./AFRICA TELECOMMUNICATIONS CONFERENCE AND EXHIBIT, JANUARY 17-19, NAIROBI, KENYA.

Contact: Electronic Industries Assn., Communications Div., 2001 Eye St. N.W., Washington, DC, 20006 or call John Sodolski at (201) 457-4934.

COMPUTER LAW ASSOCIATION MEETING, JANUARY 25 AND 26, LOS ANGELES.

Contact: Michael Yourshaw, 1776 K St. N.W., Washington, DC 20006 (202) 857-5079.

COMMUNICATION NETWORKS, JANUARY 30-FEBRUARY 1, WASHINGTON, D.C.

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FEB.

INTELCOM 79, FEBRUARY 26-MARCH 2, DALLAS.

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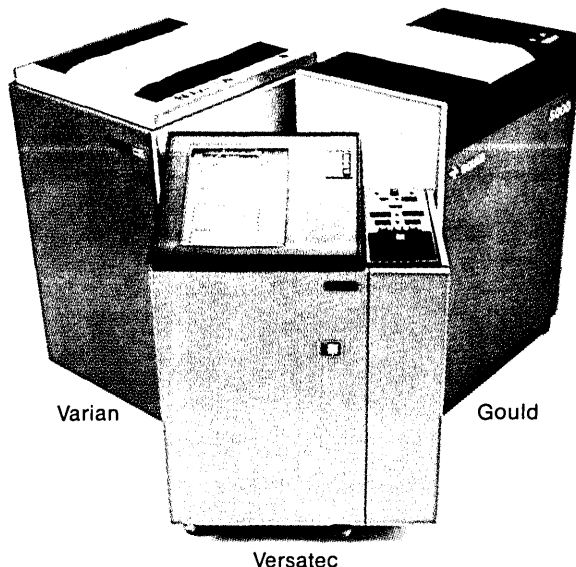
Papers on a wide variety of applications and systems are being solicited for the First International Symposium on Mini and Microcomputers in Control, to be held in San Diego Jan. 8-9, 1979. A 200-250 word abstract is due Oct. 1 to: The Secretary, Computers in Control Symposium, P.O. Box 2481, Anaheim, CA 92804 (714) 774-6144.

The theoretical, functional, administrative, political, and ethical aspects of urban data management are potential subjects for papers to be presented at the 7th European Symposium on Urban Data Management, to be held in the Netherlands April 23-27, 1979. Abstracts (in English or French) are due before Oct. 15 to: Professor Dr. M.J.M. Bogaerts, Thijssseweg 11, 2629 JA Delft, The Netherlands.

Theory and practice of control will be the subject of the 1979 Joint Automatic Control Conference, to be held June 17-20, 1979. Deadline for submission of abstracts is Oct. 1. Send to: Professor T.F. Edgar, program chairman, 1979 JACC, Dept. of Chemical Engineering, Univ. of Texas, Austin, TX 79712.

Papers are now being accepted for the Ninth International Symposium on Fault-Tolerant Computing, to be held in Madison, Wis., June 20-22, 1979. Four copies of an abstract, maximum 200 words, may be sent to: Program Chairman, Gerald M. Masson, Dept. of Electrical Engineering, Johns Hopkins Univ., Baltimore, MD 21218. Deadline is Nov. 1. *

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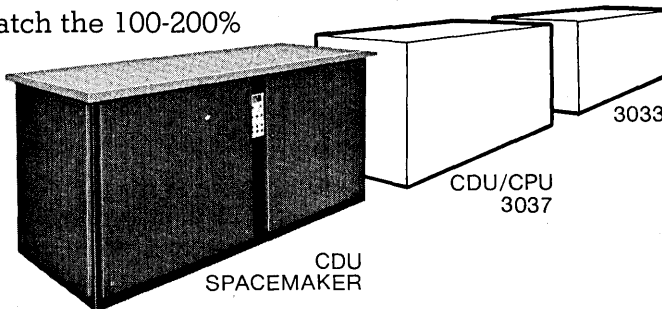
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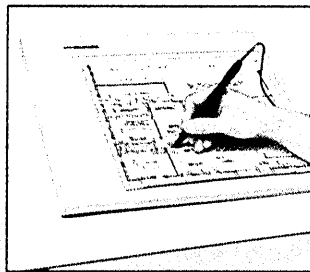
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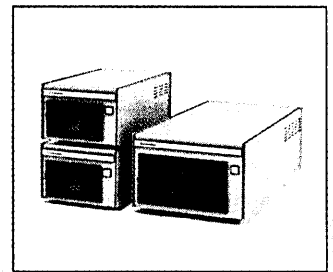
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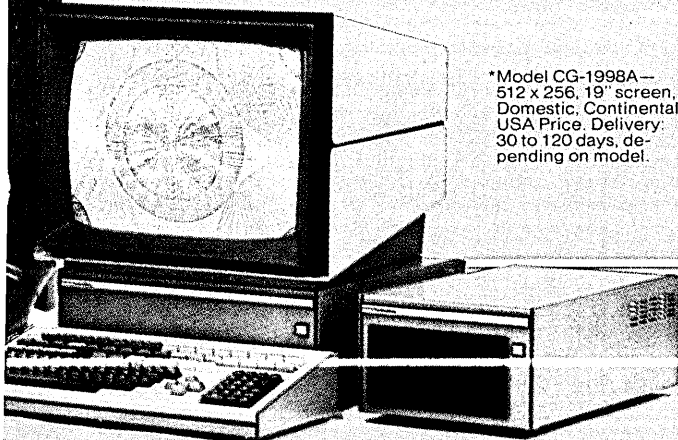
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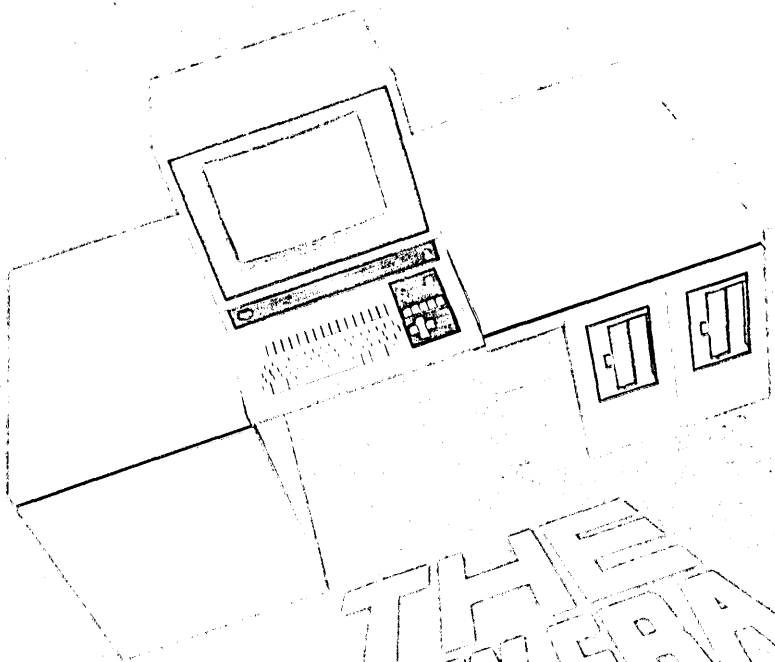


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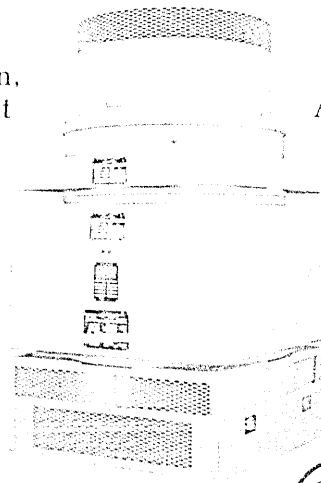
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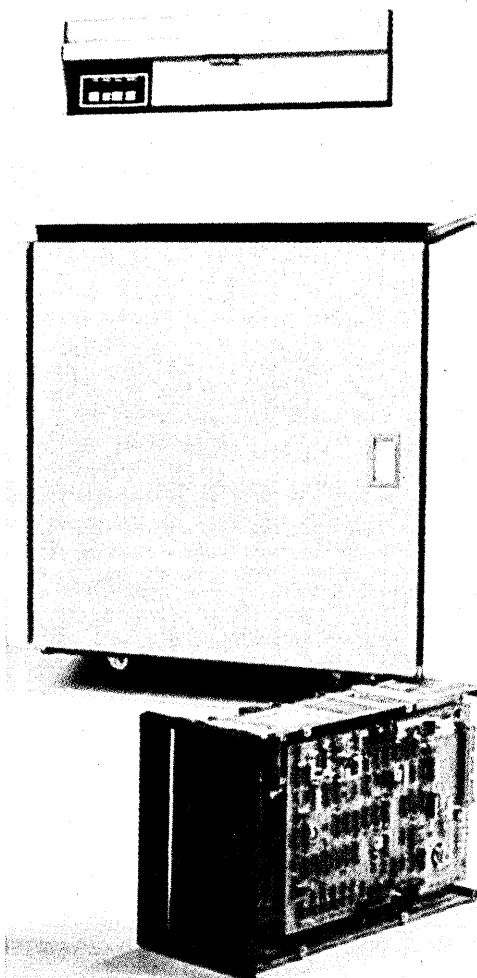
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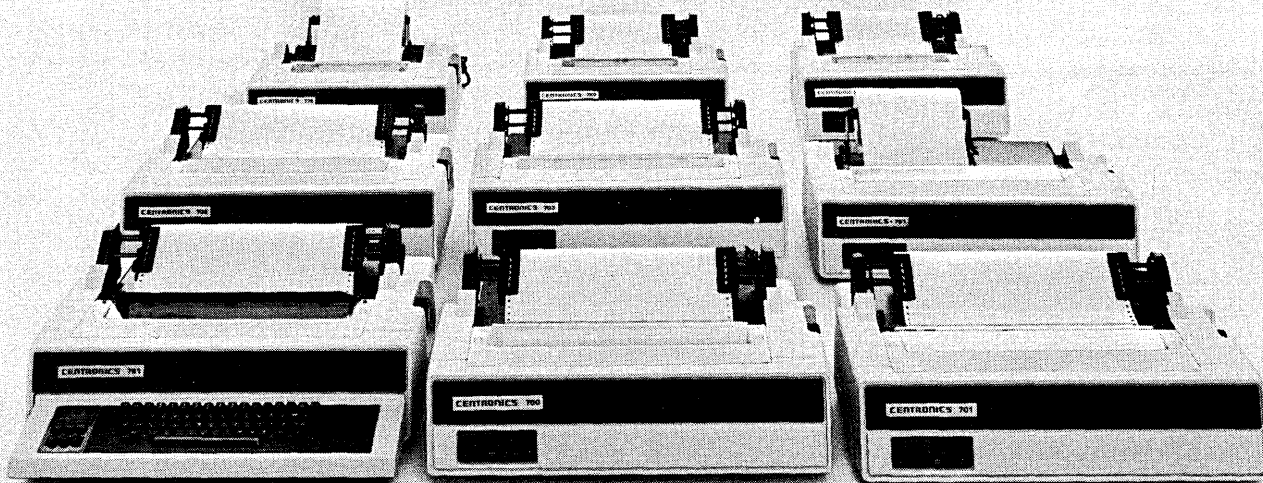
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LETTERS

RIVAL DINOSAUR

I thoroughly enjoyed the article "(Mis)use of DP in Government Agencies" (July, p. 147).

I am an employee of county government, in the human services area, so I am in a position to observe some of the impact of federal/state dp operations on the delivery of human services. The brachiosaurus of federal/state dp at the local level is the social services-welfare dp systems. There currently exists an almost unbelievable labyrinth of disconnected systems and subsystems which are poorly designed, expensively maintained and almost impossible to use. This moribund beast must be fed an inordinate amount of paper by human service professionals. This wasteful activity is extremely frustrating and demoralizing and ultimately detracts from their primary jobs—delivery of services to clients who need them.

Fortunately there are forward-thinking people at the federal and state levels who are becoming increasingly sensitive to the cost of the misuse of data processing in the delivery of human services.

I wholeheartedly agree with the suggestions of the article that the dp resource can be managed competently and can assist in the administration of human services. I hope that their recommendations will be taken seriously at the national level.

WILLIAM J. SWANSTROM, chairman
Data Processing Users Committee
Olmsted County, Rochester, Minnesota

ERRORS AND INTERPRETATIONS

I found the Forum column entitled "HUH?" (July, p. 229) an insult to the programming and systems analyst professions. The "bugs" and "Garble-De-Gook" of which Mr. Rowlett complains do not exist in a system that is up and running if the analyst has done his job.

JOHN DATSCHEFSKI
Systems Analyst
Mueller, Sieracki, Kaun & Co.
Certified Public Accountants
Elgin, Illinois

I applaud Mr. Rowlett in his Forum on error messages. I have many times wished that error messages were more

specific when debugging a program. A lesson, I think, could be learned from APL which not only has a limited number of messages but flags the character which the compiler identifies as being in error.

In the future I hope to see an article suggesting ways to write more meaningful error messages so that the entire programming community can benefit. Either that or a large journalism course for all programmers everywhere.

BRUCE I. PAUL
Systems Programmer
National CSS, Inc.
Wilton, Connecticut

If Mr. Frank B. Rowlett, Jr. would have spent as much time with the Program-

ming Staff as he did on his article knocking programmers, his monumental problem might be solved.

There are a lot of good programmers who have to put up with people who *make assumptions and were wrong!*

STEVE LITTLE
Programmer
Kingsport, Tennessee

Clearly, Mr. Rowlett, you have a misconception. Program messages are indicators, not great American novels. Message length restrictions often require incomplete sentences and abbreviated words. Details of system functions and related messages are usually found in the system user's guides. Often, message



"You see, I was always afraid of getting an occupational disease . . ."



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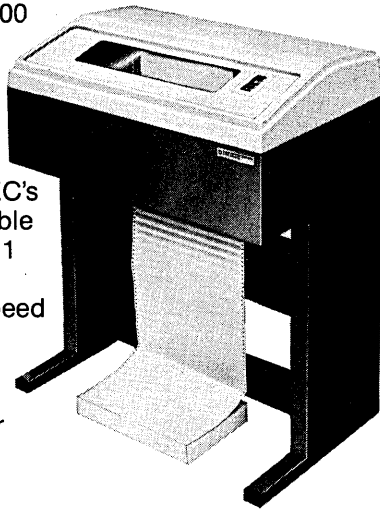
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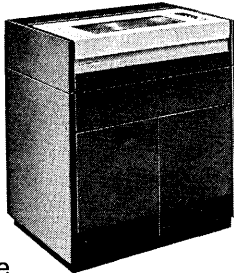
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LETTERS

length and content is defined by the analyst and user long before the programmer even sees the specification. To conclude that programmers, as a group, are incapable of correctly using the English language based on a program message you "ran across" is irresponsible.

D.C. FURGESON
Rockwell International Corp.
Identification & Control Systems
Anaheim, California

DOOM DENIED

While it goes against the grain to disagree with a Fellow of the Association of Computer Programmers and Analysts, I really must take exception to Portia Isaacson's dire predictions for the future of systems analysis as a profession ("Personal Computing," July, p. 218).

The same sort of doom was envisioned for the business programmer more than 10 years ago when software products like payroll and inventory packages started appearing. Yet, today there are more of this supposedly extinct species alive and kicking than ever before.

The statement, "when the computer becomes a home appliance, having a degree in computer science will be like having a degree in refrigerator science," shows a lack of understanding of the place of the professional in our society. Most people can use a needle and thread, a pair of scissors, and even a typewriter. I wonder how many of them make their own clothes, cut their own hair, or, heaven forbid, type their own memos?

The ACPA has never viewed its members as "practitioners of the black art" and so fearlessly awaits that dark day when "the kid down the street can program." Who knows, maybe the kid will be in the market for a good toy-soldier inventory system.

JULIE HUSHAK, CDP
North Central Regional Dir., ACPA
OCLC, Inc., Columbus, Ohio

LAST LAUGH

I really enjoyed "The Last of the First" by Aubrey Dahl (June, p. 145). A central processor "9 feet high, 10 feet wide, and 14 feet long" certainly seems strange today. I can just imagine our children in 1998 laughing at our IBM 3033s as they talk into their wristwatch-sized cpu's.

HARRY L. NAGEL, Ph.D.
Associate Professor of Quantitative
Analysis
St. John's University
Jamaica, New York

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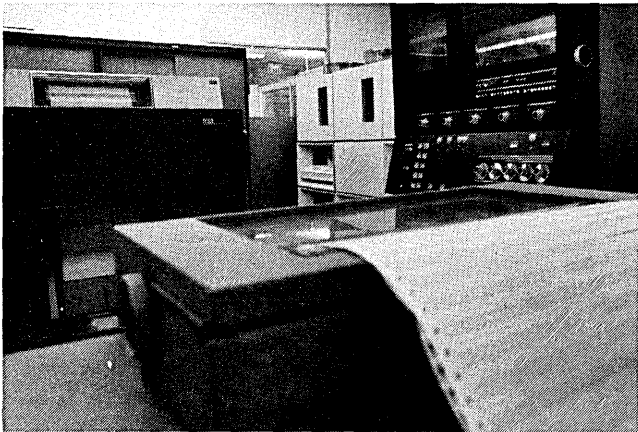
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HOW THE FENWAL FIRE SUPPRESSION SYSTEM IN THIS AUTOMOTIVE COMPANY PAID FOR ITSELF IN ONLY 2 WEEKS.

At 9:03 on a Wednesday night, an electrical malfunction caused overheating, and smoke began rising in the west end of this company's computer room.



At 9:06, while the fire was still in the smoldering stage, the Fenwal Fire Suppression System automatically sensed this smoke and discharged its extinguishing agent (Halon 1301).

By 9:30 that same night, the smoke had cleared, employees had arrived and with the appropriate Fire Department clearance entered the computer room. Traces of Halon were present but there was no discomfort.

Close examination of the problem area revealed scorched and discolored internal wiring. Some relays would have to be replaced. But no other damage had occurred.

Even though the fire was inside the consoles, at the farthest point from the Fenwal discharge nozzles, the flames were snuffed out *dry*

and major damage or personnel injury was completely averted.

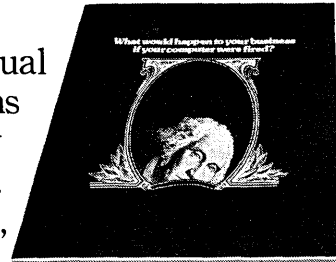
At 10:45 P.M. the Fenwal distributor who had installed the modular suppression system was called. By 5:30 A.M. it was re-charged and back in service.

This protection system had been installed just two weeks prior to the true incident described above.

It actually made the difference between a few hours of downtime and several weeks of expensive business interruption. The kind of interruption from which some businesses never really recover.

Fenwal has designed and installed more of these Fire Suppression Systems than any other manufacturer. And we make a full line of thermal, smoke and ultraviolet Detection Devices and Control Panels.

We have visual proof our Systems work in a variety of environments. Send for our film, "The Fireaters."



Or for a copy of our booklet on fire suppression. Write Fenwal Incorporated, Ashland, Mass. 01721. A division of Walter Kidde & Co., Inc., or call (617) 881-2000.

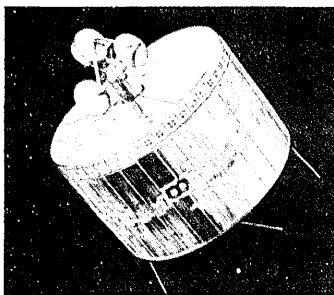
For installation and around-the-clock service, see our local distributors listed in the Yellow Pages under "Fire Protection."

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Nobody in the world has more experience in fire and explosion protection systems.



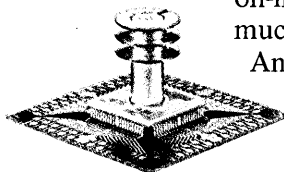
FACOM computers are made by Fujitsu, a company which puts the emphasis on systems.



A computer is above all a system, a comprehensive processing tool integrating hardware, software and application technology. Computers are of course sold by many different companies. But few of these companies can offer you a full range of data processing tools — each not only specifically designed for optimal performance but also open-ended for integration into bigger systems.

Fujitsu is one company which can offer this. Fujitsu, Japan's leading computer maker, produces everything from one-LSI-chip microcomputers to the world's most powerful all-LSI computers, as well as a wide range of peripheral and terminal equipment.

FACOM computers are doing big jobs in business and government in many countries throughout the world. And in Japan, the world's second largest computer market, more FACOM computers are installed than any other brand. These powerful, reliable FACOM computers do just about anything. They put satellites into orbit, produce real-time color graphic displays of meteorological conditions, handle funds transfers in on-line systems tying in over 7,000 bank branches, and much, much more.



LSI with cooling fins

And all FACOM computers are totally integrated systems, systems in which state-of-the-art technology, powerful software and proven application programs are combined to give you a performance and reliability that can't be beat.

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LETTERS

ANALYSIS AND PARANOIA

The July "Personal Computing" (p. 218) by Dr. Portia Isaacson was very disconcerting.

The proliferation of computers in the field and their subsequent programming by the user could eventually lead to inefficient, undocumented, data-duplicating systems that will be more costly to the organization than a centralized professional department staffed by competent personnel. Perhaps the advent of interdepartment computers will lead the systems analyst to guide the user departments' work with in-house programmers. This might allow a reduction in data duplication, a general increase in the overall effectiveness of the systems, and a greater degree of integration with overall business goals.

The idea that a systems analyst, in order to insure his job security and also insure the purchase of the latest mainframe technology, is showing paranoia by not allowing computer purchases other than those approved through the dp department appears to be mirrored by Dr. Isaacson's own blatant interest in building a micro-computer store empire, through her part ownership of the same, to insure her own job security.

I dislike articles like this one because somewhere some head of a user

department, upon reading it, will get the idea he should go out to one of Dr. Isaacson's stores and buy a "word processing system" or "instrument" and become a "shadetree" systems analyst without consulting the people who would know the most about it in his company, namely the dp department personnel. This would be disastrous for the business as a whole.

Dr. Isaacson's attitude that the systems analyst is a dp Benedict Arnold whose loyalty lies mainly with the manufacturer, whose only interest is to change jobs, and who doesn't care about his current employer's interests, is an undeserved attack not only on systems analysis as a profession but also the entire computer profession as it now exists.

J.T. ROWAN, Jr.
Systems Analyst
Lee County Hospital
Opelika, Alabama

GAUGING GRAIN GROWTH

The article "Processing Satellite Data" (June, p. 117) presents an excellent overview of satellite remote sensing applications and digital image processing systems. However, the article does contain one major error which I feel obligated to correct. The Large Area Crop Inventory

Experiment (LACIE) is a joint project of the U.S. Department of Agriculture (USDA), the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA). The U.S. Geological Survey (USGS) has no direct involvement in the LACIE Project.

The purpose of the joint LACIE Project is to determine the feasibility of using Landsat data and meteorological data to identify, measure, and estimate wheat production in the U.S. Great Plains and several foreign countries. The results of the past three years of the experiment are promising; however, several problems still must be resolved before Landsat data can be effectively used to forecast crop production on an operational basis.

One of these problems is the difficulty we experience in distinguishing between spring wheat and other spring grains such as barley, rye, oats, and rapeseed. This is caused partly by the similar growth cycle of these crops and partly by the broad spectral ranges of the present scanner sensors.

A more serious problem to any operational system is the timely delivery of corrected Landsat data. We currently obtain corrected and specially sampled data anywhere from 14 to 29 days after the satellite has scanned the area of interest. After allowing a few days for image analysis, the information is from three weeks to one month old, which in many agricultural situations is unacceptable. Data delivery is expected to improve with the implementation of a new processing system at NASA's Goddard Space Flight Center (GSFC) and the EROS Data Center. These systems are being designed to provide the data within seven days.

In 1976, the USDA LACIE Project Office funded a study by the METREK Div. of MITRE Corp. similar to that discussed in the article by Mr. Teicholz. The study followed slightly different criteria in its analysis of existing digital image processing systems. The study ultimately led to our procurement of a system that uses a PDP-11/70 with a Floating Point System AP-120B array processor and an International Imaging Systems (I²S) display system. The system operates under the DEC IAS operating system and the Integrated Multivariate Data Analysis and Classification System (IMDACS) developed by Ford Aerospace and Communications Corp. This system is currently undergoing tests in a LACIE facility located near the NASA/Johnson Space Center.

DAVID DURICA, Leader
Technical Support Group
LACIE Project Office
U.S. Dept. of Agriculture
Washington, D.C.



PDP-11, NOVA, Level 6, MDS 800/888, ZDS/MCZ Z80, EXORcisor, COSMAC

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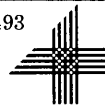
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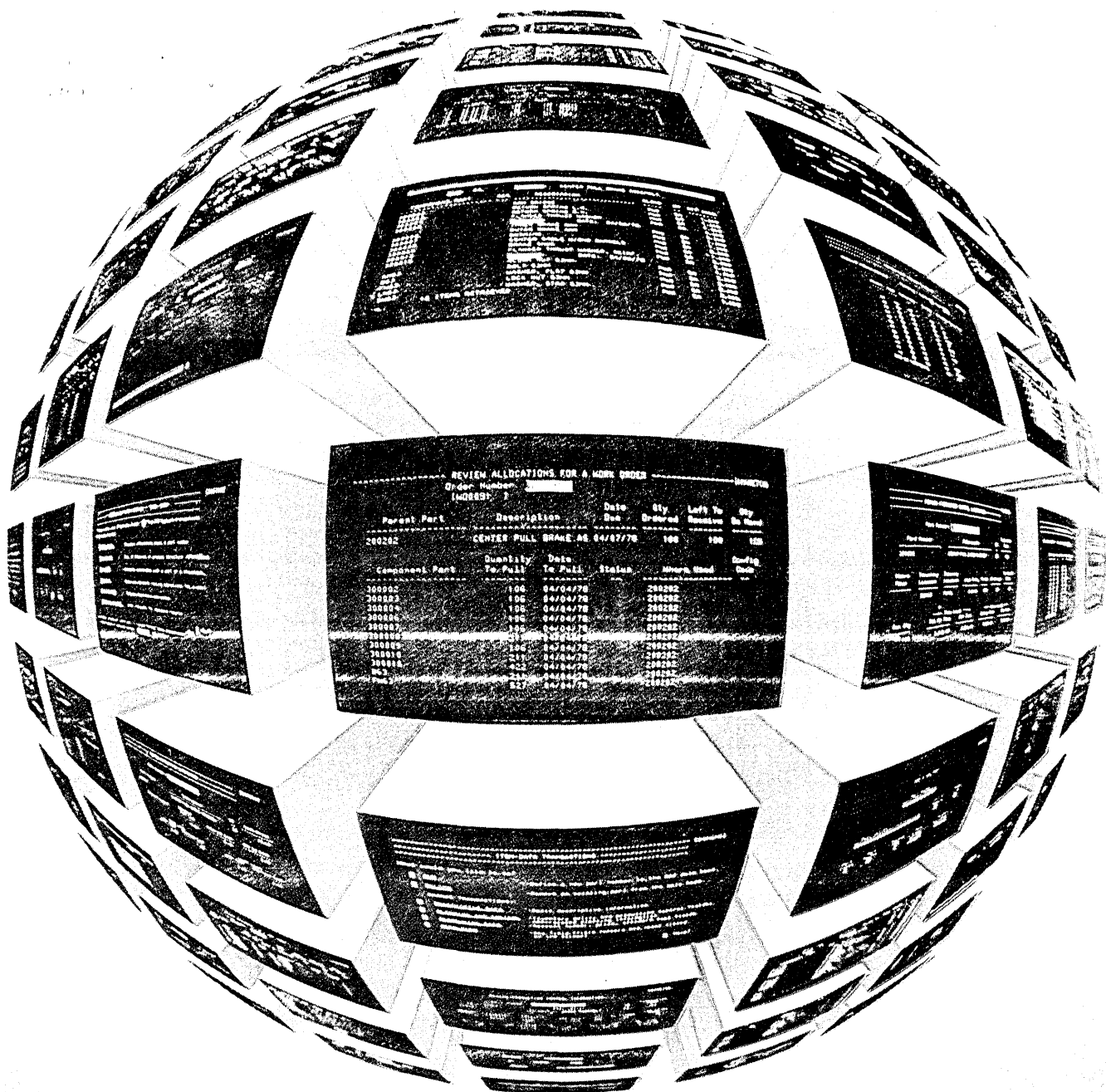
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At the heart of HP's systems are products like world's first mainframe multiprocessing

and data base management system (DBMS) from premier—line (HP 2150)

The HP 3000 Series III: more transactions, more data, more memory, more software...

Companies are placing computers out where the action is—into the hands of the people who are closest to and most familiar with the company's data—for example, employees in order processing, shipping, accounting, and manufacturing. These people enter the data to update the data base or initiate other processing and within

seconds receive a confirmation or response which completes the transaction. Instantly, that same current data can be available to authorized persons throughout the company, even those at remote locations. This is on-line transaction processing and represents what the majority of 1500 HP3000 systems installed in business and

industry are doing. Now, with the introduction of the more powerful HP3000 Series III, our systems perform even better in this demanding environment.

Fast response time

People engrossed in their work don't want to wait for a computer response. Yet when many people are all competing for the same system resources, as in a transaction processing environment, response time and throughput may suffer. To avoid this problem, the new

There are immediate answers for everyone with the new HP3000 Series III on-line transaction processing system. When multiple users share common programs and data bases—essential company business decisions can be made on the spot. Despite continuous change, valuable data is always kept current.

ONE SECOND IN THE WORLD OF TRANSACTION PROCESSING

Order Entry

An order entry clerk enters the customer's name. Address and credit status are displayed. Upon entry of the order (part numbers and quantities), availability, ship date, and price are displayed instantly, enabling prompt and accurate filling of customer orders.

Cost Accounting Update

A cost accountant accesses and shares purchasing and manufacturing data to keep standard costs up-to-date. These costs, revised in a matter of seconds, allow tight control over product prices and manufacturing expenses.

Inventory Retrieval

A manufacturing supervisor needs inventory status of several parts. Part numbers are typed in and on-hand quantity, outstanding orders, and date due in-house are displayed immediately. She can schedule production line work effectively, based on present inventory and future part orders.

Shipping Retrieval

A shipping clerk filling orders enters a customer order number on his terminal. An address label and packing list noting those items included in the shipment and those backordered are immediately printed—enabling quick, accurate order shipment.



HP3000 Series III was specifically designed for high performance in a transaction processing environment.

For example, the operating system, MPE III dynamically allocates system resources such as memory, processing time and peripheral devices to ensure low response time and high throughput in an on-line transaction processing environment. With advances such as multi-use interactive processing, and multiple languages (BASIC, COBOL, FORTRAN, RPG, and SPL), MPE facilitates transaction

processing without a special monitor.

Increased memory

By increasing our internal memory capacity to 2 megabytes, we have minimized time consuming disc swaps, and greatly improved performance.

Board density, four times that of our earlier version, was achieved by packing new 16K RAM semiconductor memory onto 256K boards—each with error correction. At \$32,000 a megabyte, the

Series III memory is 46% less expensive than its predecessor and leads the industry in memory pricing.

We further increased performance by optimizing the HP3000 for a large number of terminals sharing the same programs and data base.

First, we analyzed the workings of our memory allocation manager and learned how to increase its efficiency.

Then, IMAGE, the data base management system of the HP3000, was enhanced to be more
Continued on page 4

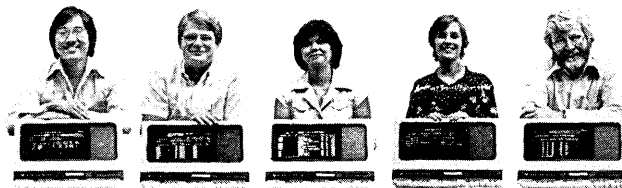
Inventory Update

A materials receiving clerk processes incoming orders. The computer indicates what was ordered and those items received are entered into the data base. Order status and inventory are updated, giving up-to-the-minute accuracy.

Others

Sixteen other users are also accessing the system. Five order entry clerks are entering, updating, and cancelling orders. Order status is also being checked. Three buyers are viewing production schedules, determining part requirements, and purchasing parts. One materials receiving clerk is processing incoming orders, while one production control

supervisor is analyzing shipping targets. There are three accounting clerks working with accounts receivable, accounts payable, and payroll systems. And two programmers are developing and writing modifications: one to a financial forecasting program; the other to a new payroll program. A batch COBOL compile is also being printed.



...less time, less money

HP3000 Series III, continued

transaction oriented. By changing to an internal buffering scheme, we can pool or share user data base control information. This reduces both disc access and memory overhead and results in a 30% increase in the number of users while response time remains the same.

Further, to guide our customers in selecting the exact configuration to handle their transaction load, we conducted a series of realistic application tests. We varied the environments and measured the performance of the Series III. The data we collected is available upon request. See the reply card.

VIEW/3000 software

VIEW/3000 plays two major roles. First, it is a stand-alone source data entry package. Data entry applications can be designed with no programming effort. Within minutes, users can begin entering data on-line. Second, as a front-end

to transaction processing application programs, VIEW/3000 augments programmer productivity.

VIEW/3000 provides the first step in the data entry process, forms design, without any programming effort at all. A form can be "painted" or drawn on the screen, and standard edit specifications chosen from a menu. VIEW/3000 also provides source data entry and validation for application designers again without writing a program.

More sophisticated data entry needs can also be satisfied with VIEW/3000. The VIEW design language provides complete field and form processing; advanced data editing, data movement, data formatting, and conditionals (if... then... else). In addition, full arithmetic capability is provided.

Finally, VIEW/3000 provides an extensive set of high-level terminal and data handling routines ("GETNEXTFORM" for example) callable from BASIC, COBOL,

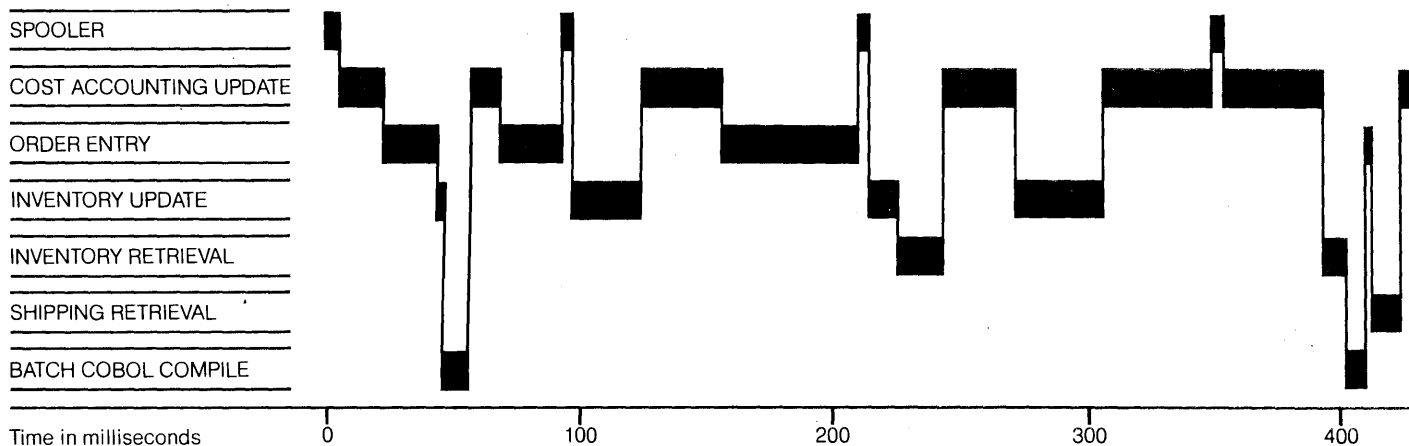
MAIN MEMORY: \$32,000 PER MB

FORTRAN, RPG, and SPL. These provide a simple interface between a transaction processing application program, the forms created by VIEW and an HP2640 family terminal.

Easy user interface

Imagine a data entry clerk able to log on to the system and immediately begin entering data. The system designer assigns a name to a sequence of MPE commands that accomplish a given task. Whenever that name is referenced, the

ONE SECOND IN THE LIFE OF AN HP3000 SERIES III



sequence is automatically executed.

To further conceal system commands from the user, the HELP facility which normally provides an on-line description of MPE commands, can be tailored to fit your application. You can display customized command descriptions. Similarly, you can tailor the system error messages to have more pertinent meaning to your users.

Large data bases

In a typical transaction processing application, data bases tend to be large. HP has significantly increased its on-line storage with the introduction of the HP7925. The Series III now supports up to eight HP7925 disc drives for a total capacity of 960 megabytes.

In a highly changeable environment, a fast and accurate method for system backup and recovery must assure data integrity. With HP's serial disc interface that backup is to a disc pack. Plus private

volume disc packs can be copied directly in a matter of minutes.

Never re-enter data

All data transactions that change the character of the data base are automatically logged by IMAGE. This includes a recovery program which restores transactions to the data base and eliminates the need to re-enter data in the event of a system failure. In addition, for MPE and KSAM files, you can set up your own logging records and establish an audit trail.

Sometimes it is essential for one user to have exclusive control of certain parts of the data base. IMAGE's associative locking provides a three-tiered, high-speed

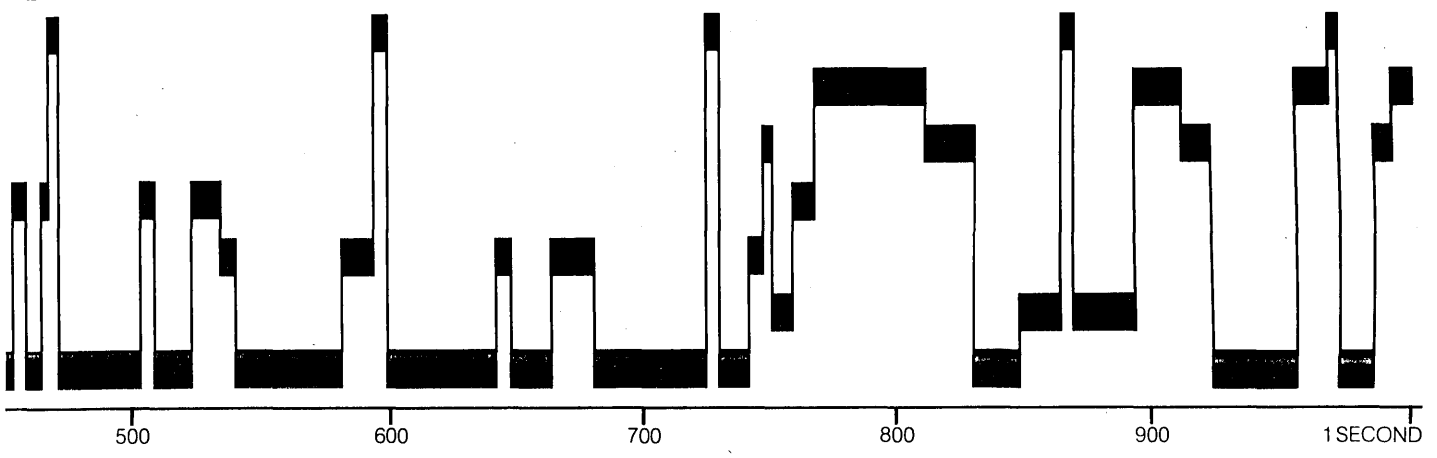
locking scheme to accomplish this. Locking can occur for the entire data base, for one or more sets, or for one or more entries in a named data set—or for any combination of the three. Data is locked, not by record number, but by specifying the data contents. For example, "LOCK FLIGHT FILE WHERE FLNO = 92 AND LOCK PASSENGER FILE WHERE NAME = JONES" locks only those portions of the files, leaving the rest fully accessible to other users.

The HP3000 Series III base price is \$115,000*.

For more information, or for the Performance Guide, indicate A to C on the reply card.

*U. S. domestic prices only.

To illustrate what efficient system resource switching is needed to satisfy the demands of transaction processing, we tracked the Series III operating system, MPE, for just one second. Twenty users were doing simultaneous batch processing, on-line program development, and interactive data entry and inquiry to a data base. MPE III determined that six users needed CPU attention. Performance was high—2638 transactions occurred each hour, and response time averaged three seconds.



The HP 250: Easy to work at



The new HP250 computer system offers a rare and useful combination of product design and software. Human engineered to reflect the way people like to work, and with software tools to facilitate user interaction and increase programmer productivity, the HP250 is a computer system for small companies or departments of larger companies.

A major breakthrough of the HP250 is the combination of true data base management and extensive software tools for report and forms generation—all for under \$25,000*.

The HP250 hardware is a state-of-the-art 16 bit N Channel MOS microprocessor which handles computation with 12 digit accuracy. Up to three flexible disc drives of 1.2 formatted megabytes each pro-

vide expanded storage. The entire operating system is loaded from flexible disc into its own internal memory space. Thus, it is always on-line, ready for instant use.

Ergonomic design

Well before the design drawings of the HP250 were done, we took the time to observe people entering customer orders at a terminal.

Nobody did the job the same way. Some individuals moved the customer reference books from left to right, as well as the source document and, interestingly enough, even the CRT display screen. Everyone had their own approach to positioning the elements, and their own preferred position for entering data at the keyboard.

To accommodate this wide range of preferences, several design conclusions

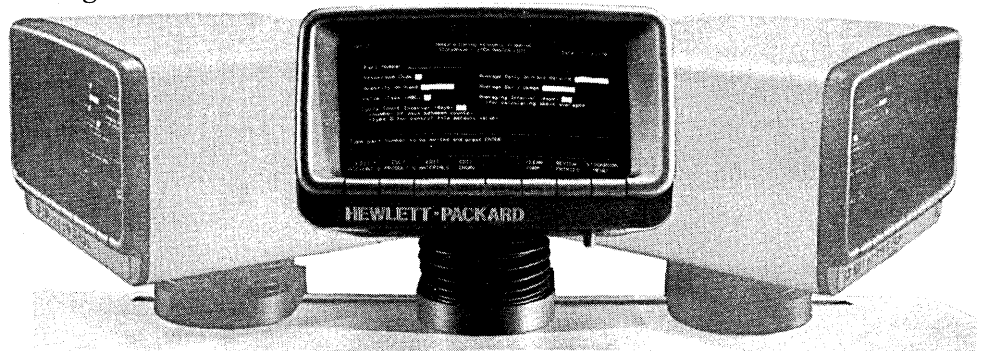
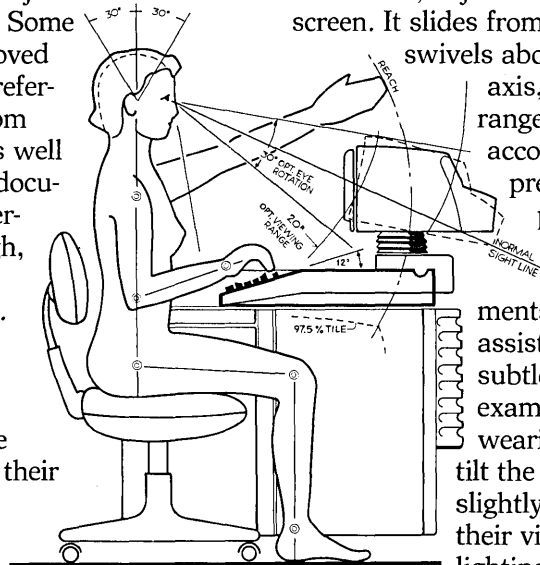
were reached. First, the desk area must provide users with ample space in which to arrange their paperwork. Second, all key elements should be within arm's reach. And third, the CRT must move.

Slide, swivel, and tilt

Perhaps the most singular expression of the HP250's commitment to human engineering is in its innovative, adjustable display screen. It slides from side to side, swivels about a vertical axis, and tilts. This range of adjustment accommodates all preferences for positioning the screen.

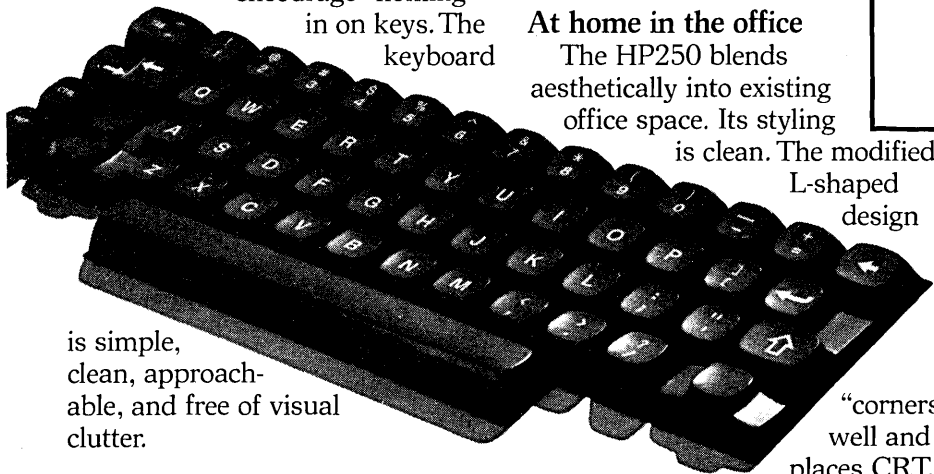
The movements are wide, but assist comfort in subtle ways. For example, people wearing bi-focals can tilt the screen ever so slightly to facilitate their viewing. Where lighting variations

necessitate slight angling to reduce distracting glare, the HP250 adjusts. Key in the development



of the HP250 was the desire to simplify its design and use to accommodate an operator's unfamiliarity with computers. It was essential, we believed, not to intimidate users with a complex array of confusing, symbolic keys. So the keyboard looks and acts like a typewriter.

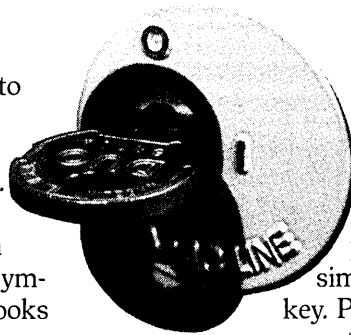
The keyboard's height, slope, and innovative contour optimally encourage "homing" in on keys. The keyboard



is simple, clean, approachable, and free of visual clutter.

Softkeys

Eight "softkeys," or special user defined function keys, are located along the bottom edge of the display screen and provide an innovative means for easy operation. A displayed message above each softkey describes its present function. Pressing this key begins an operation. Upon completion, the program branches automatically to the next step in the routine and new softkey definitions appear. This approach steps relatively untrained operators effortlessly through several layers of complicated procedures and reduces the possibility of their inputting errors.



Easy on, easy off

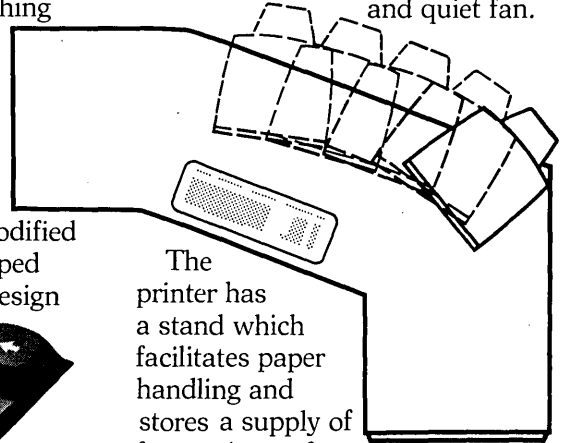
The on-off switch reduces power-on procedures to a simple turn of a key. Plus, at turn-on, an automatic self-test assures you that everything is working.

At home in the office

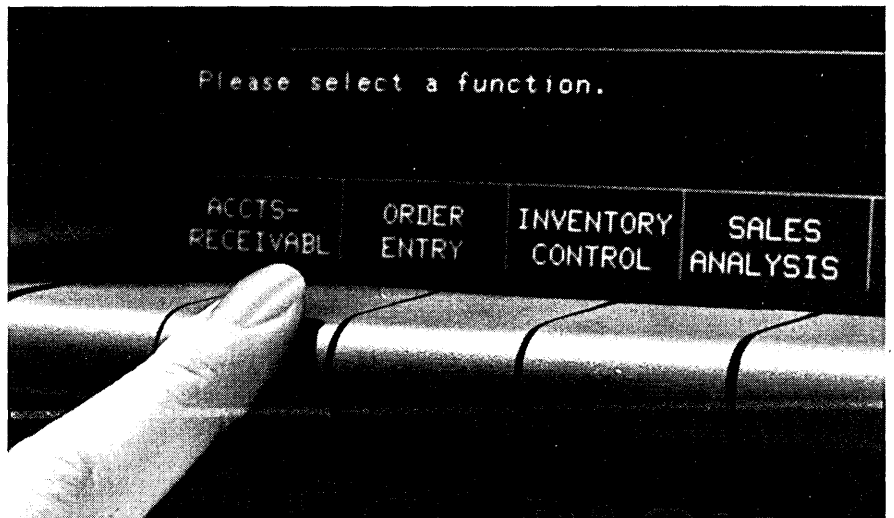
The HP250 blends aesthetically into existing office space. Its styling is clean. The modified L-shaped design

"corners" well and places CRT keyboard, and disc within easy

reach. Accent panels, available in several colors, help coordinate the HP250 to the office decor. A concern for noise reduction led to an efficient multiple-fan approach for cooling. All the heat producing elements were separated into three different heat compartments, each with its own low-volume and quiet fan.



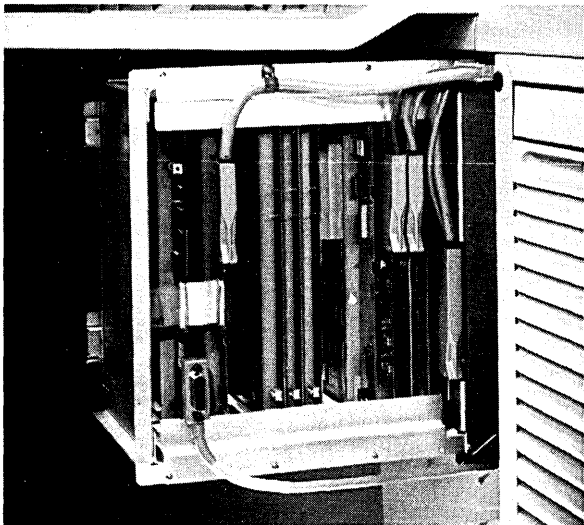
The printer has a stand which facilitates paper handling and stores a supply of forms. A set of quick reference cards in the console drawer capsulizes key instructions. Also, the HP250 can easily be rolled wheelbarrow fashion.



The HP 250: Easy to work on

Service with dignity

Our service engineers can repair your HP250 wearing their suits. A menu driven, hierarchical, self-test speedily isolates problems to a board level. The entire card cage rolls out from the front. Repair



is then as simple and clean as a board exchange. The self-test is a diagnostic tool, not a go/no-go approach. In fact, a 16 position indicator helps service engineers track intermittent problems.

Business BASIC

The HP250 represents a high standard of human engineering. This, in combination with high-level software results in a powerful, yet simple to use programming system.

The HP250's programming language is an enhanced business version of HP BASIC. It has sub-programs, string manipulations, and multi-dimensional (6) arrays (numeric and string). It includes commands for mass memory control, print formatting, softkey

control and CRT formatting.

The capability to name variables using up to 15 characters makes programs more readable. The true subprogram capability provides local variables to the subprogram with parameter passing. This is a

powerful tool for writing general routines that can be used by any program.

Data base capability

Modeled after the award winning IMAGE/3000, IMAGE/250 is a collection of utilities and commands that create, control and maintain a complex information management system with full security. Sorting and finding across data sets is one of its powerful capabilities.

IMAGE/250 has multi-volume data base capability. The user is not restricted to the on-line flexible disc capability. The data base can be organized into logical sub-sets. These different files, each on separate discs and rapidly loaded when needed, integrate to form a full data base. The operating system attends to over-head and provides checks such as locking the drive when a disc is being accessed. Plus, the HP7906 disc with 20 megabytes of storage is available to further accommodate growth.

QUERY/250 facilitates free form, authorized, unprogrammed access to this stored information. Its frequent prompts assist inexperienced users in retrieving, up-

dating or modifying data. No additional programs need to be written.

User forms on screen

With the programmer's tool FORMS/250, the paper forms that employees are familiar with can be easily recreated to appear on the CRT screen. A straight-forward, branching menu approach prompts you through the forms design process.

A full line drawing set enables careful matching to the paper form. Since the forms are treated as independent files, they can be modified or tailored later without affecting the BASIC program. Once a form is created, the user can display it on the screen, fill-in the blanks, and press a key to log the entire transaction. This technique speeds data entry and requires minimal operator training. Softkeys can also be assigned to execute a series of up to 160 key strokes. This typing aid short cut relieves programmers from re-entering frequently used phrases or sequences.

Create a report

Report WRITER/250 gives the application programmer a versatile set of commands to generate final, professional looking reports which can include totals, averages, formatting and summaries. This package greatly reduces the time and cost usually involved in developing an original report format or making changes to an existing one.

Large computer features

With the HP250, thoughtful attention and care was given to the



design of a tasteful office computer. Yet, priority remained with providing system development tools to aid a programmer to custom design application packages in the lifestream areas of a company, for example finance, and manufacturing inventory.

The HP250 computer system costs \$24,500*.

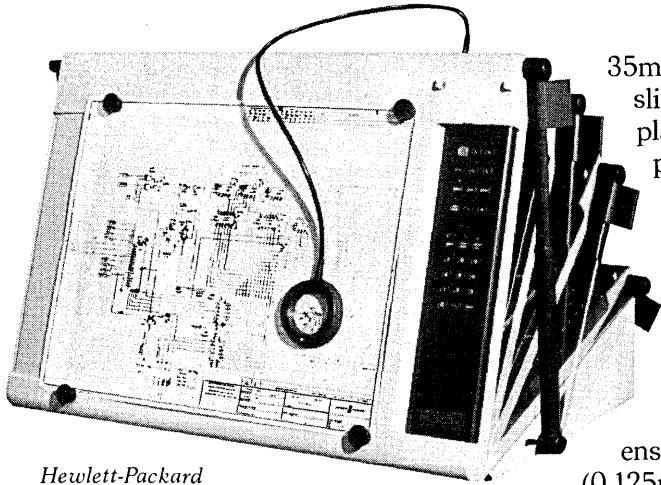
We would be pleased to share more HP250 information with you. Indicate D on reply card.

*U.S. domestic prices only.

The new HP250 computer system design reflects simplicity and end user appeal. Within arm's reach are keyboard, CRT display screen, flexible

*disc storage, and a quiet printer. With features like IMAGE/250, a true data base management system, and software tools to generate forms and reports, the price is surprising — less than \$25,000**

Got the picture? We've got the numbers.



Hewlett-Packard makes digitizing more accurate and comfortable for the user with the HP9874—a completely integrated workstation digitizer with many innovative features including a tiltable, transparent glass platen.

A new digitizer from Hewlett-Packard, the HP9874, expands the range of materials which can be digitized. Valuable data is often trapped in pictorial form—lengthy strip charts, large blueprints, and X-rays. Now there is a better way to digitize or convert this graphic data into numeric form for computer analysis and processing.

Tilt to any angle

Traditionally, digitizers have had a non-movable horizontal work area, or platen. Users had to stand and bend for many hours over a document being digitized. The HP9874 relieves this tedium—it has an innovative, adjustable, transparent glass platen. Easily tilted to any angle, you can work in a relaxed sitting position.

Digitize an X-ray

An adjustable glass platen enables the digitizing of projectable media such as X-rays, movie frames,

35mm or microscopic slides. By tilting the platen to a full vertical position and setting a projector behind the digitizer, exact images can be reproduced without distortion, then digitized.

Use of a stable material like glass for the platen ensures high accuracy (0.125mm) and resolution (0.025mm) over a broad range of temperature and humidity conditions.

To take advantage of the adjustable platen, HP developed a “vacuum-grasp cursor” which can adhere to any portion of the platen. Regardless of the platen’s position, the cursor will not slip—even if it is bumped.

The lighted cursor has an open circle target, 0.250mm in diameter, giving the pinpoint precision necessary to accurately position and then move the cursor along a line thinner than a human hair. Digitizing becomes as simple as tracing.

Smart integrated peripheral

The HP9874 is a powerful, intelligent digitizing workstation complete with its own microprocessor and 16K-bytes of built-in memory. Because of this power, the HP9874 can respond to forty high-level programming commands.

Full control of any digitizing application is at your fingertips. A keyboard, conveniently located on the digitizer, has control, numeric,

and special function keys.

Points may be digitized one at a time or continuously (based on time or distance increments) by simply pressing the appropriate key. An Axis Align key automatically aligns the x and y axes of the digitizer with those of the document—immediately establishing a new coordinate system. And, by pressing the Axis Extend key, strip charts, as long as 53 kilometers, and other large documents can be digitized with all points referenced to the initial origin.

The numeric key pad can annotate each digitized point with a numeric identifier. This feature is extremely valuable in setting up a third dimension (or z axis).

There are also five special function keys which act as triggers to initiate branching routines within a computer program. These keys, combined with the shift key, give you a total of ten.

The HP9874 is compatible with the Hewlett-Packard Interface Bus (HP-IB)** and sells for \$6,200*
Check E for more details.

*U.S. prices only.

**IEEE Standard 488-1975 Interface.

Computer Advances is written to inform professionals of the latest technical contributions from Hewlett-Packard. You are invited to receive issues at your place of business or residence. Write Carol Scheifele, Computer Advances, Editor, Hewlett-Packard, 11000 Wolfe Road, Cupertino CA 95014.

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ADDS SYSTEM 70. OEM.

7 good reasons why System 70 is easy to buy and even easier to sell

1 Buy a lot. Save a lot. Big OEM discounts mean money in the bank.

2 ADDS* PLUS Data Entry Language, Advanced Diskette Operating System (ADOS), BASIC, FORTRAN IV, Assembler, editing and debugging software are all field proven. And, this extensive software simplifies implementation and saves you dollars.

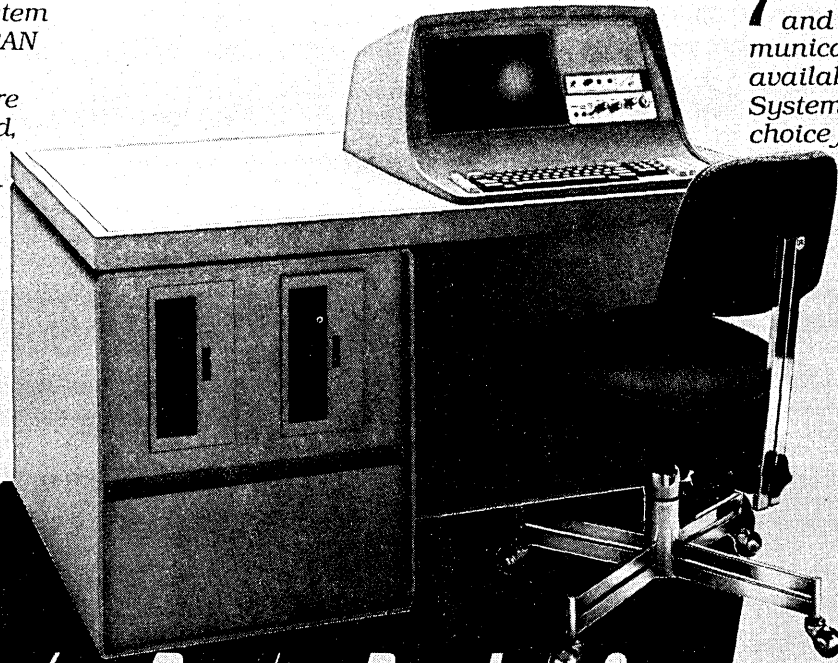
3 We build 'em for you fast. Our 45 day delivery schedule means less inventory and more money in your pocket.

4 Our Nationwide service means you've got it easy. Over 50 service locations make sure that System 70s keep on working. We provide the service. You save the dollars.

5 With more than 65,000 terminals already installed, ADDS reputation for quality and reliability is unsurpassed.

6 Our terminals fit your customers. System 70's beautiful exterior is human engineered for maximum operator convenience and ease of operation.

7 IBM 3780, Burroughs and teletypewriter communications are all available, making System 70 the right choice for almost any distributed processing environment.



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

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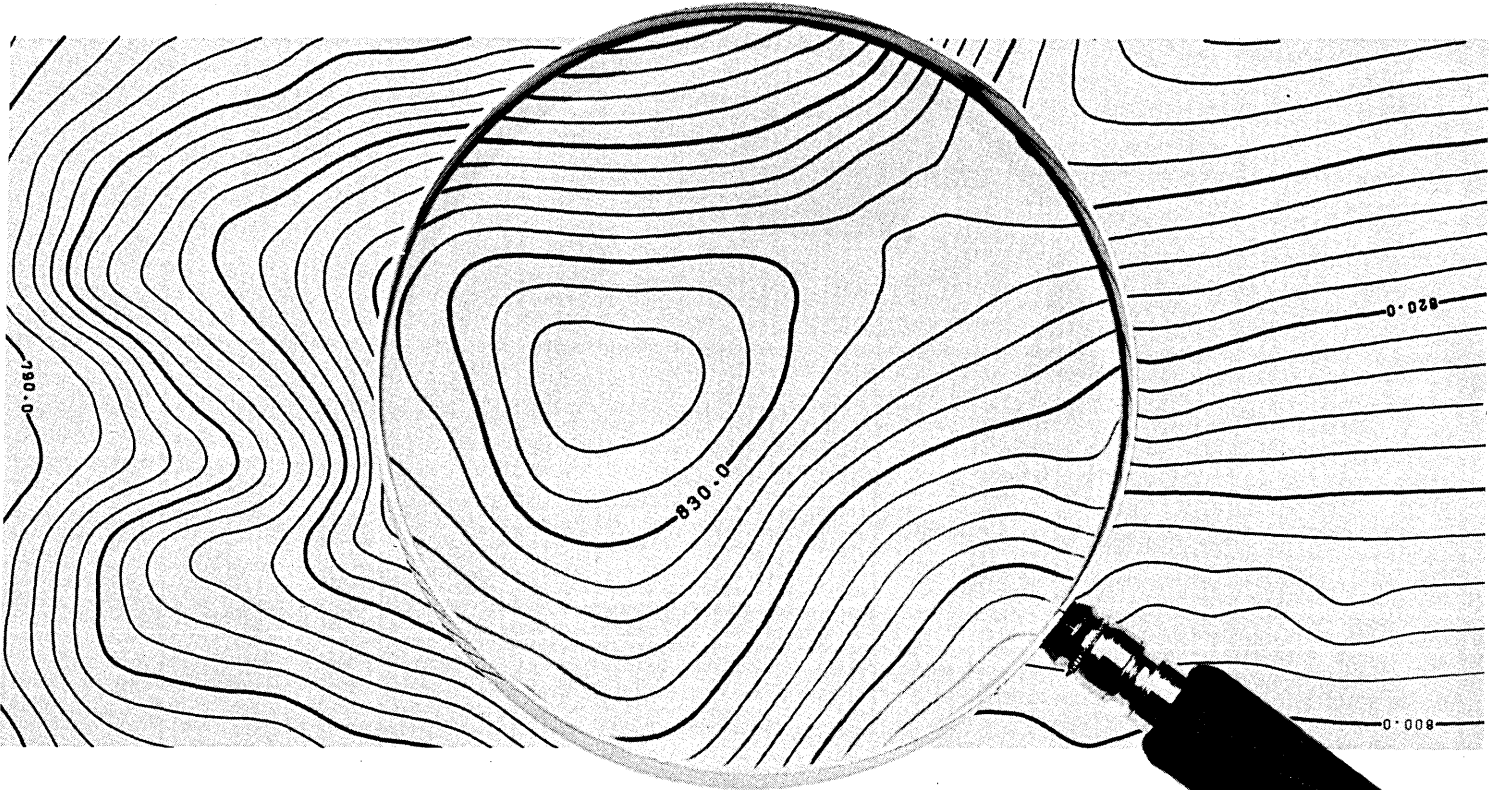
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CIRCLE 18 ON READER CARD

No one else looks this good under glass.



If you're shopping for a medium-priced drum plotter, the old eye-ball test is still a good place to begin. And so's CalComp.

Because no matter how you scrutinize our graphics – or measure our output – one thing comes clearly into focus: CalComp makes the best drum plotters in the world. Period.

Case in point: Our new 1030-Family of medium-priced drum plotters. In terms of accuracy, line quality, speed and good old-fashioned price/performance, they literally outdraw the competition. At every turn.

Better yet, all three new plotters are perfectly suited to a wide range of graphics applications. And that means, with the help of a new 1037, 1038 or 1039 plotter, any data now in your computer can work even harder for you outputted in an easier-to-understand graphic form.

A clear case of superior engineering.

For starters, we made all three new models completely d.c. servo-motor driven. For increased accuracy in every mode. On-line. Remote/time-sharing. And off-line.

Then, we gave them all a newly-designed linear drive pen mechanism. For the kind of pen force control that produces consistently superior line quality. In every application.

Next, we greatly increased overall throughput – especially in on-line environments – by implementing "smarter," microprocessor-based controllers.

Finally, there's even greater built-in versatility. Because both the 1037 and 1038 can be field-upgraded – all the way up to a new 1039 – without ever leaving your office.

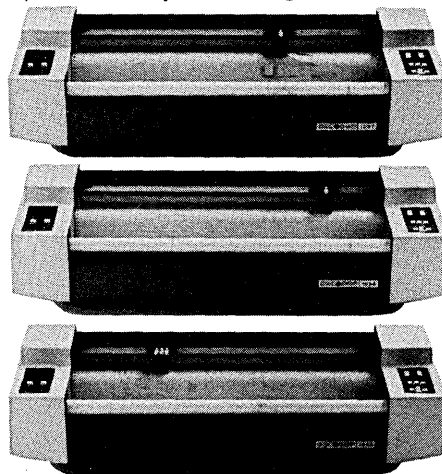
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plotter model	mm-per-second	pens	step size in mm
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1038	112.5 (≈ 4.5 in.)	1	.05 (≈ .002 in.)
1039	112.5 (≈ 4.5 in.)	3	.05 (≈ .002 in.)

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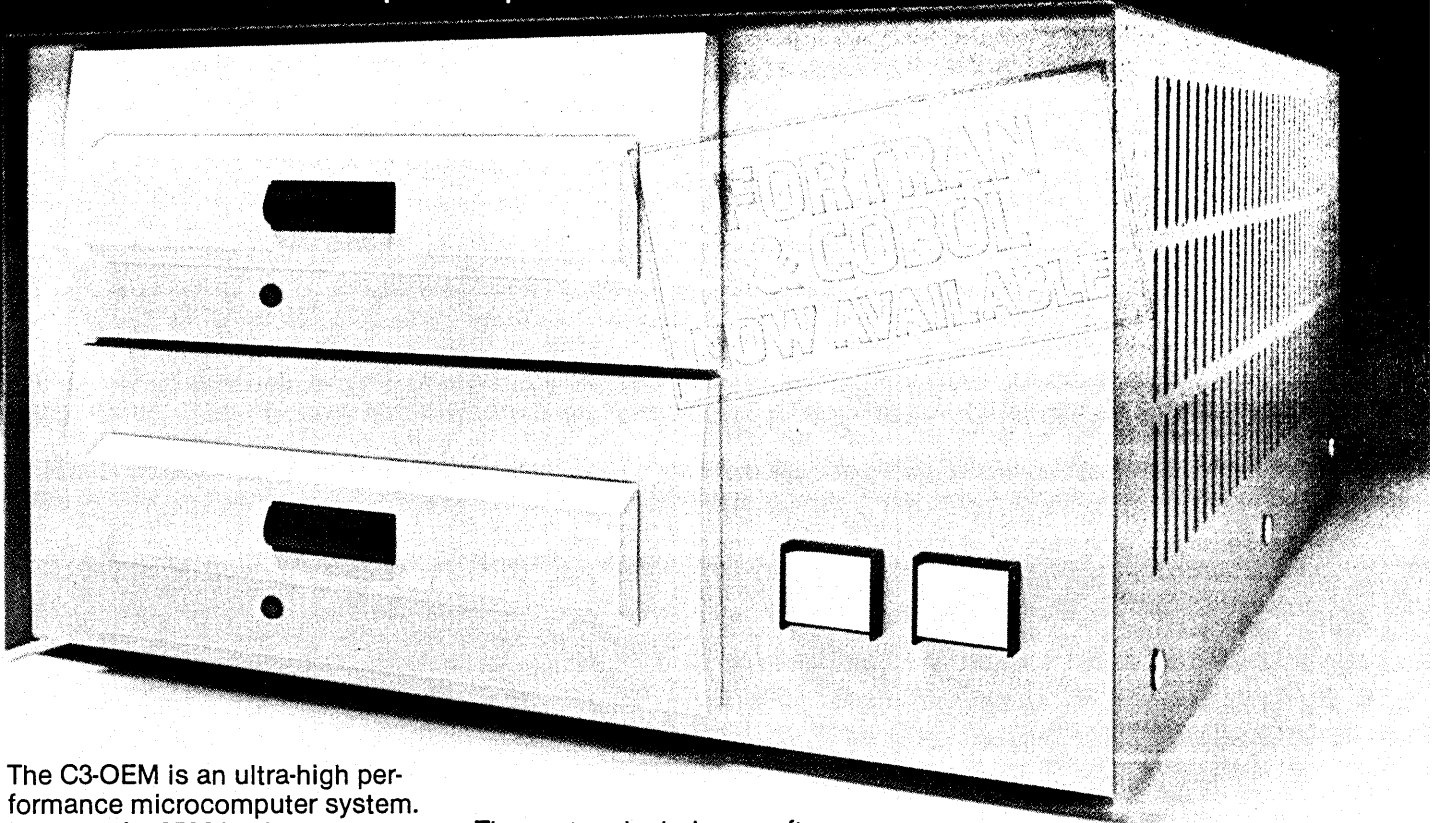
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CIRCLE 14 ON READER CARD

A 32K byte dual floppy microcomputer system for only \$2900* complete.

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- 16 line parallel I/O
- Rack or tabletop mounting
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- BUS oriented computer architecture
- Four slots used — four slots open for expansion
- Comes complete with disk BASIC
- Includes Interactive Assembler/Editor
- Main processor is an ultra-fast 6502A
- Has auxiliary Z-80 and 6800 micros which allow execution of virtually all 6502, 6800, 8080 and Z-80 code!
- User programmable interrupt vectors on all three micros



The C3-OEM is an ultra-high performance microcomputer system. Its powerful 6502A microprocessor (now triple sourced) out-benchmarks all 6800- and 8080-based computers in BASIC and machine code using the BASIC and assembler provided standard with this system.

In fact, the C3-OEM executes standard BASIC language programs at speed comparable to small 16 bit minicomputers.

Ohio Scientific has a vast library of low cost software for the high performance 6502A including an on-line debugger, a disassembler, several specialized disk operating systems and applications programs such as our word processor package and a data base management system. However, the C3-OEM is not just limited to 6502 based software. This remarkable machine also has a 6800 and a Z-80 microprocessor.

The system includes a software switch so that machine operation can be switched from one processor to another under software control!

So, one can start with existing 6800, 8080 or Z-80 programs while developing new software for the ultra-high performance 6502A.

The C3-OEM isn't cheap. It's a quality product with mechanical features like UL-recognized power supplies, a three-stage baked-on enamel finish and totally modular construction.

It is the product of Ohio Scientific's thousands of microcomputer systems experience. In fact, all the electronics of the C3-OEM have been in production for nearly a year and have field proven reliability. And, best of all, this machine is available now in quantity for immediate delivery!

A full spectrum of add-ons are now available including more memory, up to 16 serial ports, 96 parallel I/O lines, a video display, a parallel line printer interface and a 74 million byte Winchester disk drive.

*25-49 unit price

1-4 \$3590.

5-9 \$3300.

10-24 \$3100.

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or write for more information
and the C3-OEM representative
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The only source you need for remote batch, interactive, and distributed processing systems...HARRIS.

The Total Source

When you're in the market for data processing products, it's important to remember one fact that is often overlooked: you're not just buying equipment, you're buying commitment.

That's why you should be looking at Harris as the only source you need, whether your requirements are for remote batch terminals, local or remote interactive terminals, data entry products or systems for distributed data processing.

Behind Harris products is an \$800 million per year company with a solid record of financial stability and growth. Data Communications is one of the largest Harris Divisions, with established products, seasoned field and support organizations, and a commitment to continuing leadership based on heavy investments in research and development.

You buy Harris products with confidence that we'll be around when you need us — not just today and tomorrow but years from now. And you can be assured that your product base will stay at the state-of-the-art with no danger of obsolescence.

Families of Products from a Single Vendor

The Harris solution to your data processing problem is built around a modular hardware and software structure that grows with you as your requirements change and increase. We offer families of products and make it easy for you to upgrade within families. You set your own pace and Harris supports you all the way. And, if your processing calls for several different kinds of terminals, Harris can meet your needs... and give you all the advantages a single vendor can provide!

Remote Batch Terminals



HARRIS 1620 remote batch terminals feature multiple communication with up to four hosts simultaneously, a wide variety of popular emulators, and transmission speeds up to 56,000 bits per second.

Harris offers three families of remote batch processing products for entry-level, medium function, and high-function applications: the Harris 500, 1200 and 1600 series respectively. As an example of the product-family concept, our economical Harris 1610 is built around a memory-based operating system, performs remote batch and media conversion and includes a wide variety of proven peripherals.

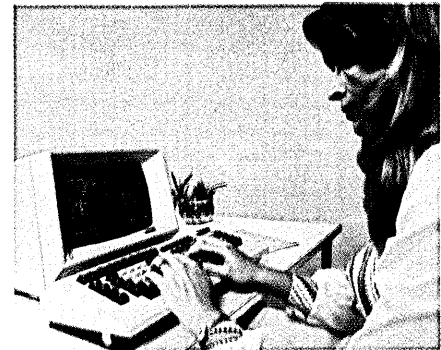
Step forward from the 1610 and you grow into our Harris 1620 with capabilities including multiple emulators (up to four concurrently), to most major mainframes. Either the 1610 or 1620 can be field-upgraded to our distributed data processing products.

Systems for Distributed Processing

You can choose from four Harris 1600 systems for distributed data processing. The Harris 1650 is the first 1600 model to incorporate a mainframe-type disk operating system. It provides data entry and remote batch processing concurrently. Next, our Harris 1660 adds programmability in either interactive or batch modes and accommodates both format-driven and program-driven interactive applications. Then we offer the Harris 1670, featuring the significant advantages detailed below, and the Harris 1680 which uses dual processors for expanded concurrency capabilities.

Interactive Terminals

For the growing interactive market, Harris offers the established 8000 series. The proven Harris 8170 emulates IBM 3270 models 1, 2, 11 and 12 and is SDLC compatible. Emulation is also provided for the IBM 3272 controller. Other Harris interactive products emulate Burroughs, Univac and Honeywell terminals. Our top-of-the-line 8180 includes dual diskettes with 500K bytes of off-line storage, five megabytes of disk storage (optional), and up to 96K bytes of memory. These enhancements permit applications such as local format storage, spooled print and queued transaction handling.

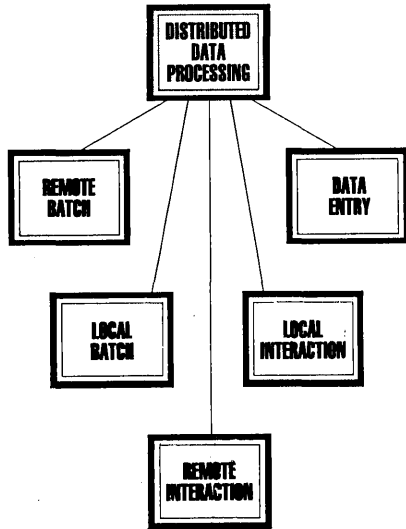


HARRIS 8000 series terminals communicate interactively with IBM, Honeywell, Univac and Burroughs mainframes.

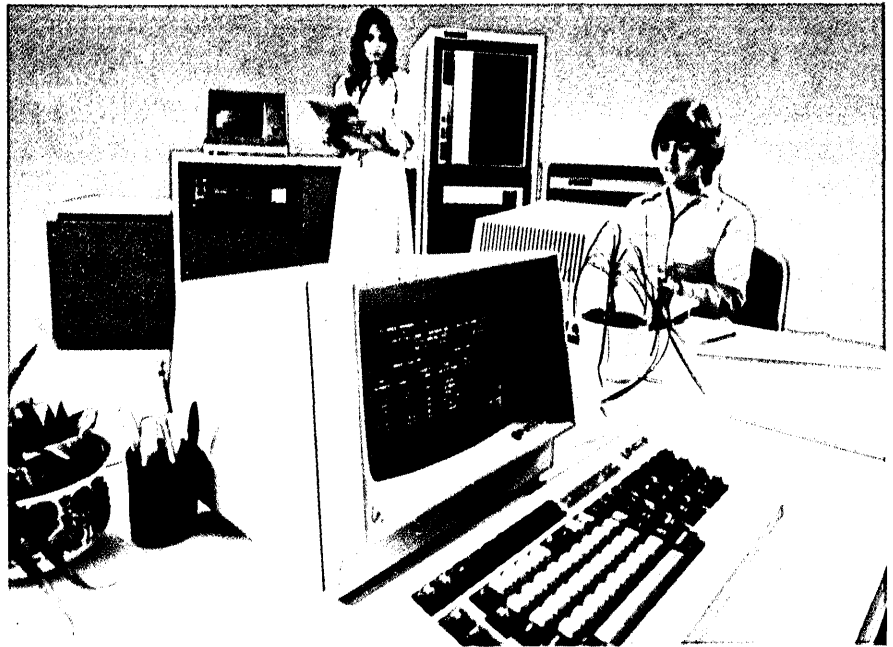
Everything You Need for Distributed Processing... in One System

We've combined the capabilities of our 8170 interactive product with our 1660 distributed data processing product, both leaders in their respective fields, to provide a powerful new system for distributed data processing. We call it the Harris 1670. It's the *one system* you've been waiting for that will perform five basic data processing functions: local or remote batch, data entry, local interaction and remote interaction *concurrently*. Combining two major Harris resources enables us to produce the 1670 in volume, assuring you a competitive price and unbeatable performance. This single, modular system can fill

your terminal requirements — batch, 3270-compatible, and data entry — and is capable of growing with your processing needs in all these areas.



The five typical elements of a distributed data processing system.



Sophisticated new HARRIS 1670 distributed processing system offers local or remote batch processing, data entry, and local and remote interaction concurrently. CRTs are individually switchable between local and host files.

Batch Processing

When devoted to remote batch communications, Harris' multi-task operating system enables the 1670 to perform any of the sophisticated RJE functions of the 1610 and 1620 models. In addition, the 1670 offers local batch processing with ANSI compatible COBOL and batch utilities, including SORT/MERGE.

Data Entry

You can choose from two format-driven data entry packages, easily implemented by data entry personnel. The two packages, Format 10 and Format 41, make your data entry jobs simple, efficient and effective.

User-Written Programs (Local Inquiry)

We offer an easily learned, English-like high level programming language (REGAL), for optimized screen management and for applications such as source document capture and interaction with the local 1670 data base.

CRTs running REGAL programs can be located either at the 1670 site or remotely. Additionally, the CRT can control station printers to produce required hard copy.

Remote Inquiry (3270-Compatible Interaction)

This capability enables the CRT operator to connect through the 1670 to 3270-compatible programs at a remote host site.

Selectable Mode CRTs can be used to perform operations in the 1670 mode (including data entry and user-written programs), or to switch to 3270-compatible host programs. Switching is controlled individually at each station by the operator, and the system automatically ensures data integrity when switching from one mode to the other. Selectable Mode enables you to off-load the host by performing processing locally for the majority of your requirements, saving host resources for those occasions when data is not stored locally. Compare this

feature when you're evaluating distributed systems!

No Changes Required at Your Host

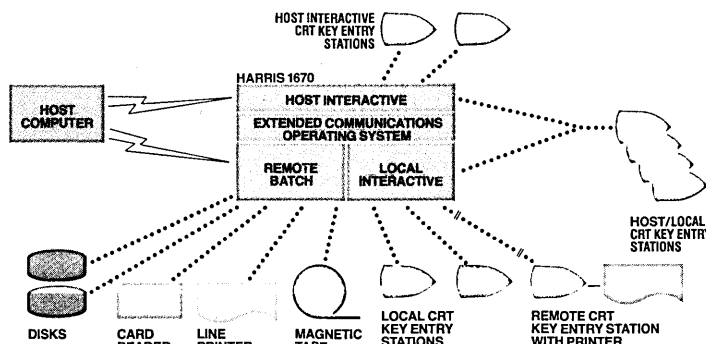
The fact is, both RJE and 3270-compatible applications can be executed using the 1670 with no changes or new investment in host software. What's more, you continue to save since we can upgrade most Harris 1600 and 8170 systems to 1670s with minimal disruptions to your operations.

Do It All with Harris

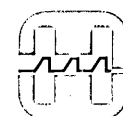
To sum up, there's no need now to shop around for a variety of systems to handle your requirements for remote batch, local or remote interaction or distributed data processing. Start with Harris and you're assured a migration path from the system you need today all the way to one you'll require in the future.

For more information, contact:

- DOMESTIC**
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- Harris GmbH., Frankfurt a.M., West Germany, 0611-67 80 39
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- AWA, Ltd., North Ryde, Australia, 888-8111
- Kanematsu Electronics, Ltd., Tokyo, Japan, 03-543-7611
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The new HARRIS 1670 combines the capabilities of the 1660 with concurrent interactive processing to a host mainframe ... and the HARRIS 1670 can be installed with no change in host software.



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

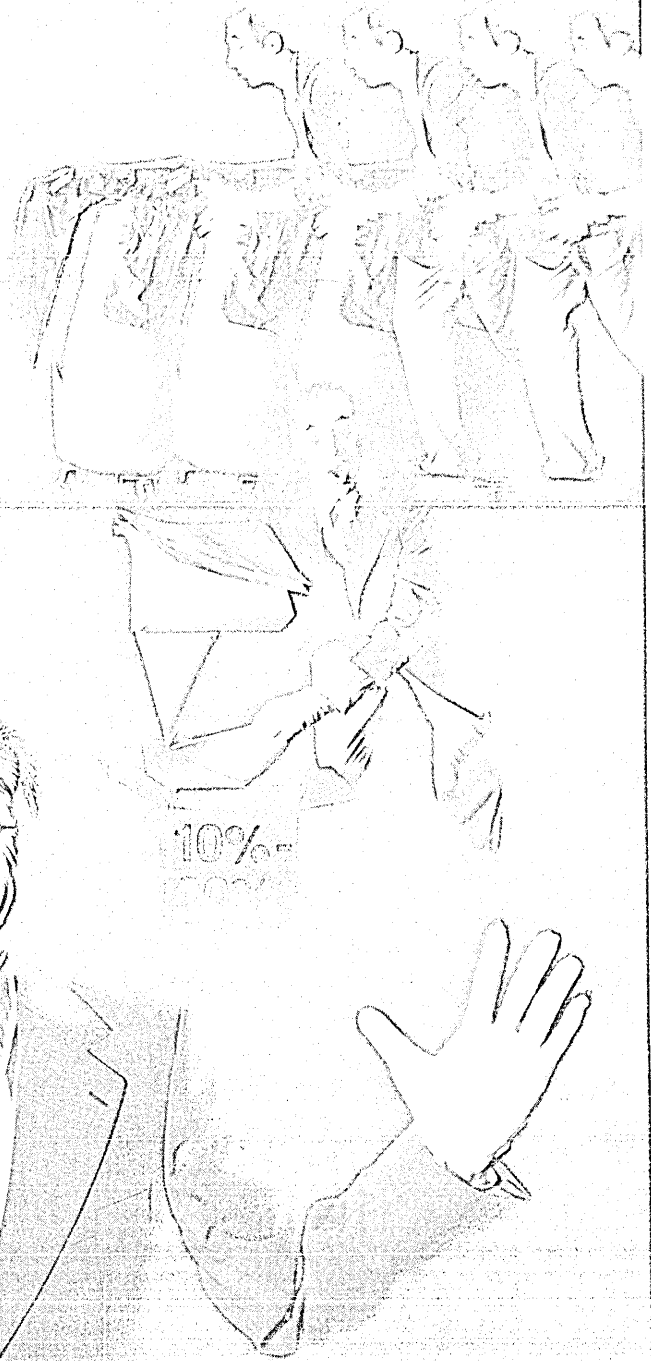
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In fact, when you add up all the savings, you'll probably find Clean Print forms cost less. Write for a Clean Print Sample Pack today.

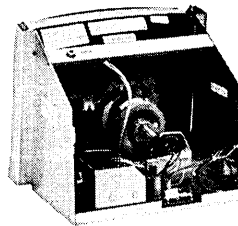


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CIRCLE 23 ON READER CARD

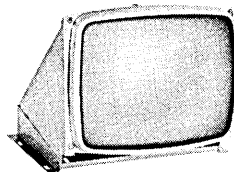
If you make top-quality data terminals, here are four reasons to use Setchell Carlson CRT display modules in your system.

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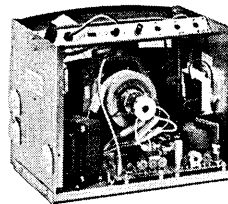
Our data displays are outstanding solid-state designs with critically matched magnetics to optimize the performance levels and dependability demanded by your customers. We use the most advanced engineering and production techniques to assure consistency of performance. No data display is built with more deliberate attention to quality and reliability.

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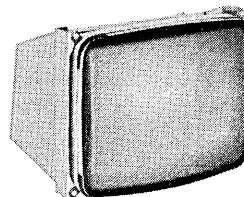
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If you're developing a new data terminal, we will be glad to cooperate with your terminal design engineers in reviewing your exact specifications and developing the most economical display possible. And quickly! Whatever you need, we have the experience and talent to design it. And improve it.

But don't take our word. See for yourself by contacting us today.

You'll come up with your own reasons for using Setchell Carlson CRT display modules.

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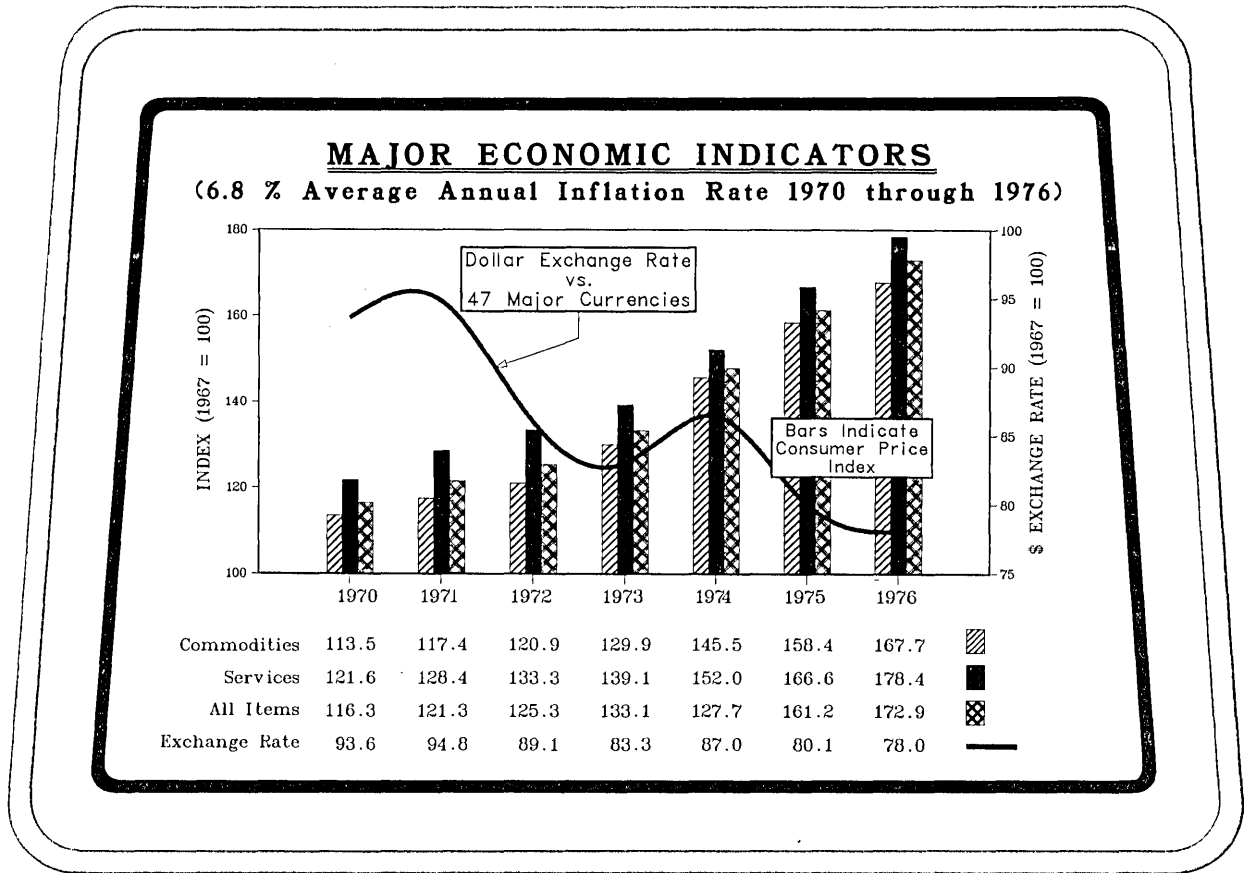
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DISSPLA[®] Software



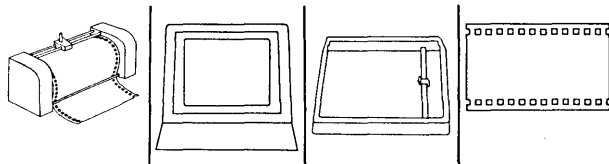
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DISSPLA is currently operating on all large-scale Amdahl, Burroughs, CDC, DEC, Hewlett Packard, Honeywell, IBM, TI, UNIVAC and XDS systems, plus the Harris midcomputer. The DISSPLA routines may be called from FORTRAN, PL/I, COBOL, ALGOL, etc.

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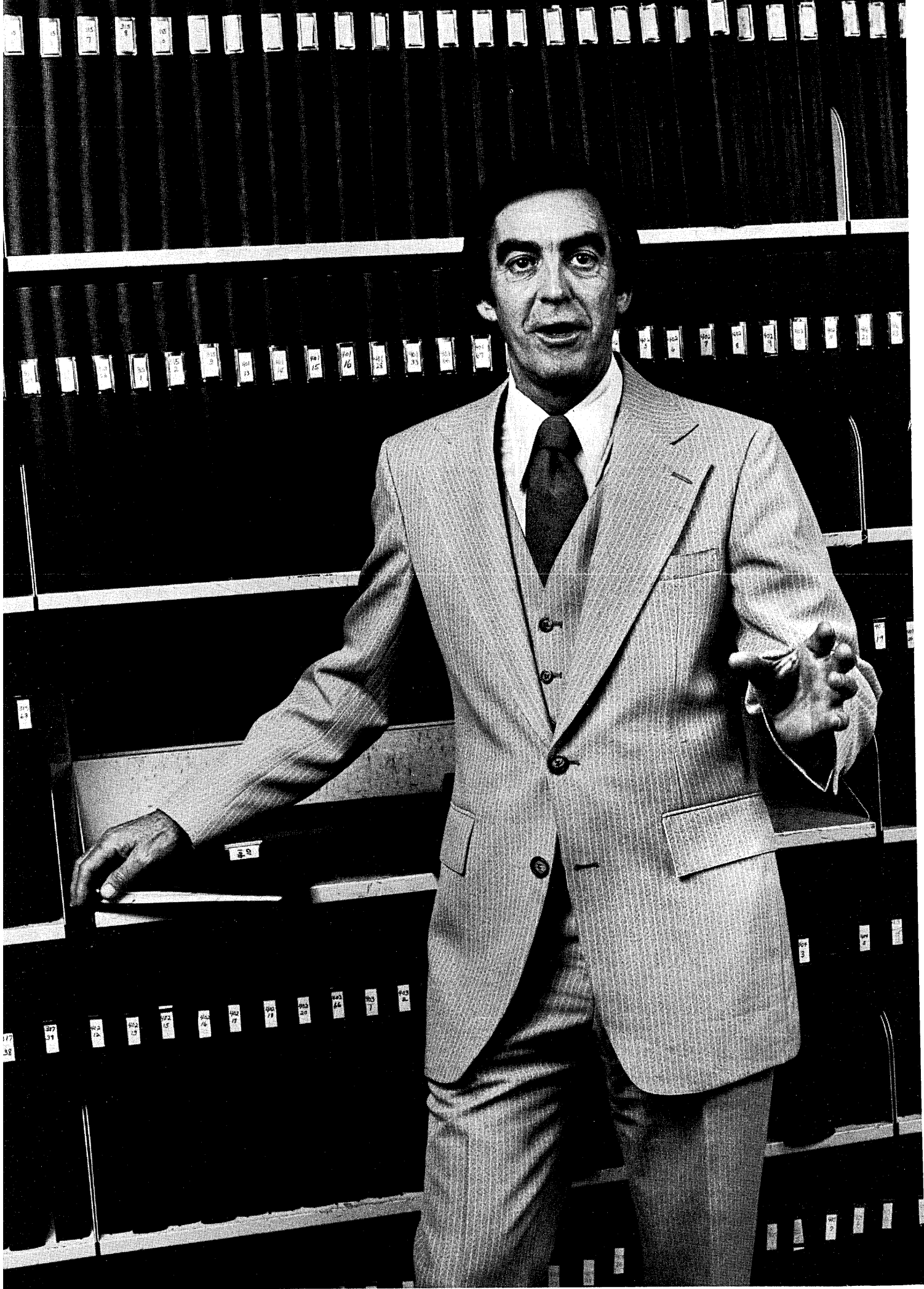
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"Our Sycor system gives our salesmen a lot more time to do what they love to do. Sell."

*Floyd Harris, VP
Data Processing
Life of Georgia*

Life Insurance Company of Georgia is the largest insurance company in Georgia. With over \$6 billion of life insurance in force, the company ranks among the top five percent of all life insurance companies in the United States and Canada. Approximately 2300 agents serve the southeastern U.S. from 128 local offices.

"The problem we faced was bookkeeping."

"Many of our agents were spending up to one day per week on bookkeeping," points out Floyd Harris. "Human errors were inevitable, and agents would spend frustrating hours tracking them down. Account reports would arrive at the home office only once a month. And they were really not providing us with all needed information.

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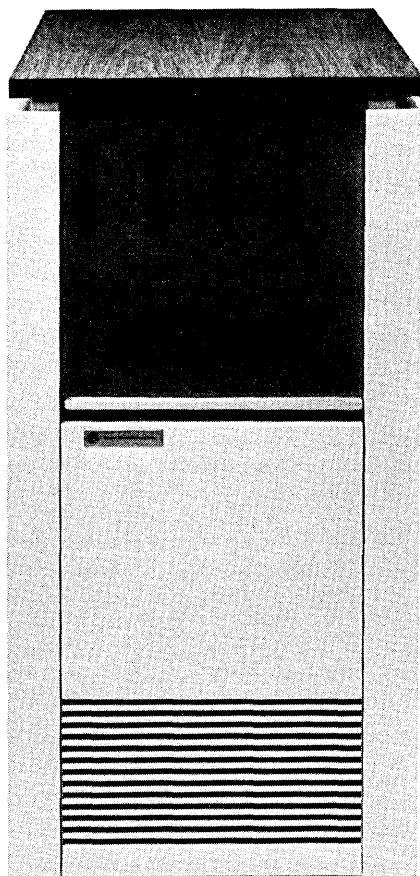
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EDITOR'S READOUT

ATTACK OF THE GIANT AMOEBA

A gray amorphous blob, looking for all the world like the movie lead in "The Amoeba That Ate Cleveland," is AT&T's diagrammatic representation of its Advanced Communications Service (see cut right).

There's a certain irony to this drawing. ACS, when finally tarified, may have a voracious appetite.

Certainly the service will have a profound impact on the evolution of the data processing field. Users, implementing their own networks, are running into sticky problems handling a variety of protocols, dealing with conversions, and building in a reasonable level of fault tolerance. Because the service will provide nearly universal compatibility between terminal and computer, all the user has to do is plug in. The internal workings of the system are none of his concern; ACS, in the current jargon, is transparent to the user (although "opaque" might be more appropriate).

ACS is not only an announcement of glad tidings for the user, but it will undoubtedly galvanize major segments of the computer industry. Manufacturers of terminals and network-oriented software and services should be rubbing their hands in glee. It's their products that will be festooning ACS like ornaments on a Christmas tree.

And, can it be a coincidence that ACS extended its first pseudopod just at the time when communicating word processors, electronic mail, and fax are coming into their own? All other attributes aside, ACS must rank as one of the most masterful marketing ploys since the introduction of the 360.

That's the good news. Now for the other side of the coin.

We don't know what ACS is going to cost. We do know that tariffs are not



determined using real numbers that reflect development and projected operating costs. No, rather there is some mystical process during rate making and tariffing that closely resembles divination by tea leaves or casting the I Ching. If the rates are too high, the benefits mentioned above may not materialize.

Another stumbling block is the hearings on rewriting the Communications Act of 1934. Because Congress appears fonder of hearing than doing, the new version—and Bell's prerogatives under it—may be off in the misty future.

Amoebas, we are told, have contractile vacuoles wherein they digest

their food. Private packet switched networks, such as Telenet and Tymnet, may be the first course on the ACS blue plate special. Other delicacies will be the various networking configurations from the mainframe vendors—DECnet with oyster sauce, BDLC on toast, and brisket of SNA.

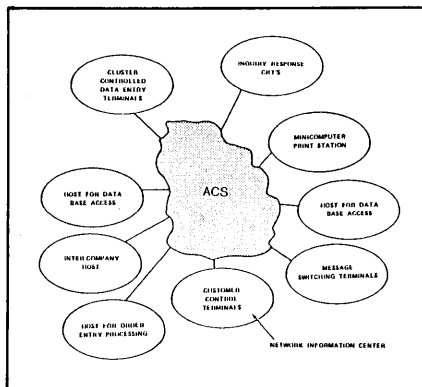
Free enterprise organizations will stand little chance against a regulated monopoly that can wield the weapon of cross subsidization.

Also in trouble are the modem manufacturers and other makers of black boxes that will disappear into the innards of the system.

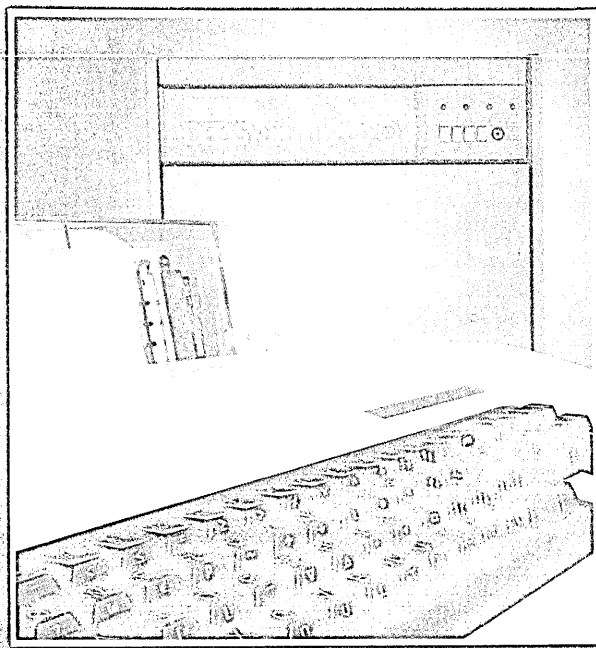
Even the U.S. Postal Service may take its lumps as low cost electronic mail becomes a reality.

So it appears that ACS will be a boon to some and a blight to others. But at this point it's too soon to judge its impact and predict when the service will become a reality.

In the meantime, users we have contacted who are considering or are in the process of implementing their own dedicated network are moving ahead with their plans. When the ACS amoeba finally does appear over the horizon, they'll take another look and decide if they want to be engulfed in its friendly embrace. *



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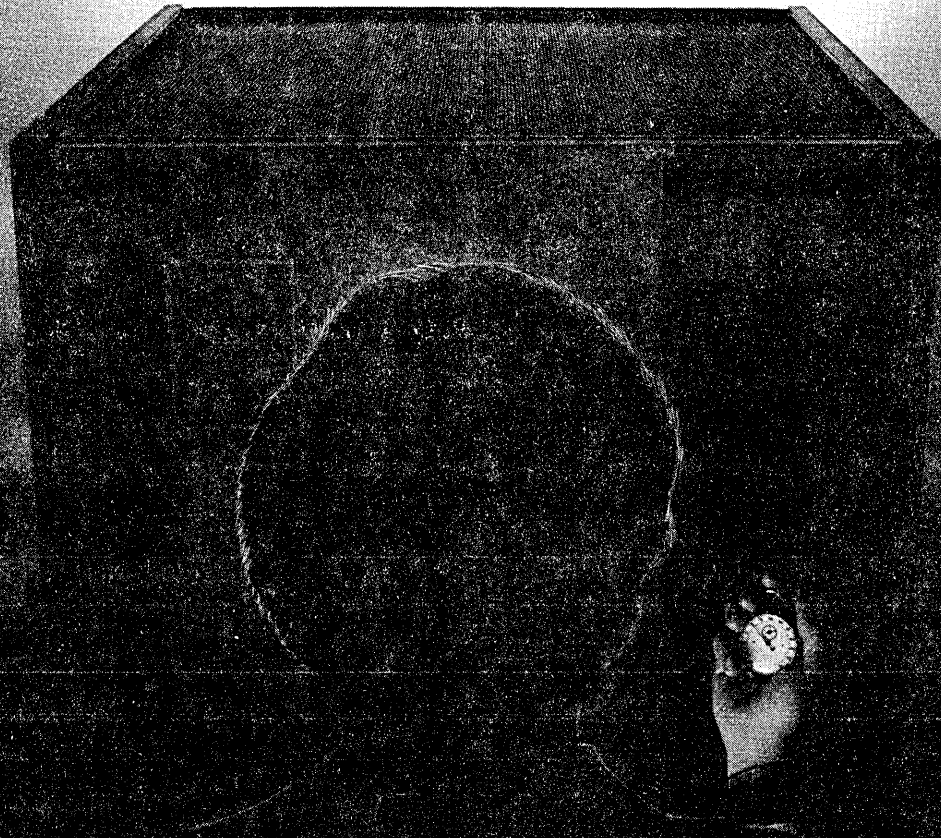
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NEWS IN PERSPECTIVE

PROCUREMENT

CSC'S HUGE HEALTH CONTRACT

After 12 years, California finally lets a competitive bid for Medi-Cal processing.

The State of California never has been comfortable with the contract it awarded in 1966 to Blue Shield and Blue Cross to process the state's Medi-Cal health care claims. Medi-Cal, which is the state's version of the national Medicaid plan to provide health services to the poor, today generates claims that run to about \$3 billion a year.

Last month, after 12 years of wrangling among state government agencies concerning profiteering by Electronic Data Systems of Dallas which did the data processing part of the contract, the state was preparing to bounce Blue Shield and EDS from the picture.

In the biggest contract it's ever awarded, California's Department of Health Services turned the job over to Computer Sciences Corp., the Los Angeles computer services firm, under a 5½ year contract worth \$129 million.

Under the contract, CSC will act as the state's "fiscal intermediary," using computers to inspect the estimated 175,000 claims a day that flow in from doctors, pharmacies, hospitals, and clinics and then verify the claims and establish the amounts due. It then will provide the state with the amounts to be paid by the state's controllers' office. It also will provide the state with management, administrative, and utilization reports that will enable the state to monitor and audit the Medi-Cal program.

Gregory Thompson, who directed the massive 11-month procurement for the California Department of Health Services, said the state will save from \$20 million to \$30 million a year under the new contract. CSC was one of five companies that submitted technical proposals to Thompson and was one of the three whose proposals were accepted in the two-step procurement process. The others were Blue Shield Services Corp., which co-bid with EDS, and Bradford National, of New York, which recently won a similar contract to process claims in New York. (Blue Cross did not bid.) The second step in the procurement for the three finalists was to submit sealed bids on their price. Computer Sciences won with a bid of \$129,599,728. It was followed by the Blue Shield-EDS bid of \$133,899,161, and Bradford National's



DR. MARIO I. MONTANA—In the ballpark with the incumbent.

bid of \$159,720,022.

Bradford's executive vice president, Howard Waltman, said his company's bid, which was \$30 million higher than the winner, simply was based on his company's "experience and consistent with our corporate profit objectives."

Dr. Mario I. Montana, president of CSC's commercial division, said, "after all, our bid was in the ballpark with the incumbents' bid."

The incumbents—Blue Shield and Blue Cross—were asked by the state to act as a fiscal intermediary in 1966 when Congress rushed through legislation creating Medicare and Medicaid, the lat-

When the Blues became bogged down with unprocessed claims, they turned to EDS.

ter providing care for welfare recipients. But soon afterwards, the Blues became bogged down with a staggering backlog of unprocessed claims and were taking months to pay the health care providers. In September 1969, California Blue Shield turned to Electronic Data Systems Federal, a subsidiary of Electronic Data Systems, of Dallas, formed by H. Ross Perot, the multimillionaire who used to sell computers for IBM. A subcontract was signed to allow Perot's computers to be used to process the backlog of California claims, and EDS cleaned it up in short order.

But there were persistent rumors that the Dallas firm was profiteering on the subcontract. In the first year, EDS refused to repay more than \$250,000 in admitted

overcharges to the state. In 1972, there were demands in the California legislature that the contract be renegotiated and later California launched a pilot project with four private insurance companies to see if the state could handle its own Medi-Cal business. After the pilot project was completed, it succumbed to intense lobbying pressure, both in the legislature and the administration.

EDS' president Milledge Hart accused the pilot project of "flushing" claims, that is, paying off the claims without verifying their authenticity.

Gregory Thompson looked at the contract and gasped.

In 1975 Gregory Thompson, a former computer specialist with United Aircraft and Honeywell Information Systems who had become a lawyer specializing in contract law, joined the California State administration of Gov. Brown. Thompson looked at the Medi-Cal contract and gasped. "Here was the state's biggest outside contract and it seemed to be locked into a single organization with nobody else having a chance to bid on it," he recalled recently.

Indeed no one could bid. Although the contract with the Blues had expired Dec. 31, 1966, it contained a provision for automatic extension every 30 days, unless either of the two parties gave 60 days written notice to void it. And it had been extended every month for nearly 12 years.

Last October, Thompson issued a 1,000 page request for proposal on a new competitive bid.

The timing was excellent.

As bidders were preparing for the March 6 deadline, a special Assembly subcommittee of the state legislature was doing its homework. It issued a report in February charging that the state had been overpaying EDS by 20% to 30% ever since the company took over claims processing in 1969. For example, the report said that before the EDS subcontract, Blue Shield's administrative charges were \$10.4 million a year. During the first full year of operations under the EDS arrangement, Blue Shield's administrative expenses rose to \$19.3 million—an increase of 85%.

The report said the increase was alarming because EDS had been brought in to reduce "or at least keep the lid on costs." And although the company had raised the average number of claims processed to 2.8 million from 2.1 million a month, the report said the higher figure continued even after the huge backlog of 1.3 million claims was reduced. It said 61% of Blue Shield's overall administrative expenses was directly attributable to



BIG BID—csc submitted 14-volume proposal and an 80-ft. long flow chart, viewed here by csc's Dr. Montana and Ross Forncrook, who heads csc's health services operation.

electronic data processing.

The report also charged that in addition to receiving 20 cents for each claim it processed, EDS had a clause in its contract that gave it half of the amount by which it

Tiny Richmond firm was a key subcontractor in many winning proposals.

was able to reduce the average cost of each claim. And it was allowed to give a definition of what constituted a claim that raised the number of claims for billing purposes by 30%, the report said.

And until 1977, there was no way to audit Electronic Data's portion of the contract. When Congress passed a law in 1977 allowing such audits, much of what the subcommittee presented in its report was substantiated, but the head of the Joint Legislative Audit Committee, Mike Cullen, reported that EDS was the only company able to provide such services.

EDS criticized Thompson's bid proposal because it gave the state all rights to the software, which EDS claimed to be an industrial secret, even though it was developed at taxpayers' expense. The

Dallas concern also protested to the Health Department's Medi-Cal division that the bidding process "denies EDSF its earned natural advantage as a successful operator of the Medi-Cal claims processing system." But when the division rejected these claims on the basis that any changes in the bidding procedure could result in the loss of federal money for the state in future years, EDS withdrew its objection.

Thompson says the request for a technical proposal was made so elaborate because "we wanted everyone to know we were serious," and that after so many years of month to month renewals, the state actually wanted a competitive bid. Computer Sciences, who co-bid the contract with The Computer Company, a Richmond, Va., service bureau with experience in Medicaid claims processing, delivered 35 copies of its proposal to Thompson's office—each copy consisting of 14 volumes and an 80-foot long performance flow chart. The whole package weighed a ton and a half.

Thompson's office spent five months reviewing the proposals. A full-time staff of 50 persons from the Department of Health Services and staffers from the Seattle management consulting firm of

Compass Management approved the technical proposals. All that was left was the price.

Although some staffers at Bradford National privately have questioned csc's ability to perform the contract at a profit, the company formally said it has no argument with the way the two-step procurement was handled. "Looking back, I would say the State of California ran the

"We wanted everyone to know we were serious."

procurement professionally," says Bradford's Mr. Waltman.

Ironically, Bradford won the New York Medicaid bid last year in a proposal in which it subcontracted with The Computer Company for the claims processing system. In the California bid, The Computer Company is a subcontractor with csc. The relatively small firm, with 325 employees and about \$10 million in revenues last year, also was the subcontractor to Systems Development Corp., which won a contract to handle Florida State's medicare processing.

Ross E. Forncrook, vice president and general manager for health services with Computer Sciences, says The Computer Company was selected by csc because the State of California asked csc to come up with an operating system "that we could add to or modify." And the Richmond, Va., firm's system was certifiable by the Department of Health, Education and Welfare, meaning that the Feds will pick up 90% of California's startup costs on the system and 75% of its operating costs. (The Computer Company also serves directly as a fiscal intermediary in Virginia, Delaware, and North Carolina.)

csc will use dual IBM 370/158s to process the more than 200,000 pieces of correspondence that will come to it when it implements the system fully 18 months from now. (California will continue to use the Blue Shield-EDS services until that time.)

Of these 200,000 documents, the company estimates that 175,000 will be claims that will be microfilmed, then entered either through an on-line data entry or ocr system. It estimates that around 40% of the claims can be processed by ocr. It said its system operates a COBOL Medicaid Management Information System, that provides two key reporting systems to the state: One is a Management and Administrative Reporting Subsystem that will provide statistical information on how the claims are being administered; and the other is a Surveillance and Utilization Review, which mainly will be used to alert the state to providers or recipients who might

be abusing the Medi-Cal program.

In cases where errors or irregularities are found, the csc system will recheck the documents in the software, not manually. If a document must be returned to a provider for clarification, it will be sent as a reentry document, not as an original one, for automatic processing when returned.

The company will hire about 1,000 persons to staff a claims processing office in Sacramento where it also will provide training to providers on how to file claims properly. It also will use training mobile vans that will fan out over the state showing physicians and their assistants how to file a claim accurately.

"But," says Montana of csc, "we're not going to turn them into computer people. After all, they're providers of health care, not employees of computer firms."

-Tom McCusker

AIR FORCE'S PHASE IV BUY

Huge procurement has a novel approach in which software conversion takes priority.

Picture this: A computer contract over a long lifetime that would be worth more than the annual sales of any computer company in the world, with the exception of IBM.

That would have to be the United States Air Force at work and the contract is called the Base Level Data Automation Program (Phase IV) acquisition. While the Air Force's cost analysis of the program is a tightly held secret, reliable sources say the total cost of the program over a 20-year period could go as high as \$4 billion. Informed sources placed the total acquisition cost at \$500 million.

The initial hardware buy would likely be between \$210 and \$260 million—and that by itself is high enough to qualify as the largest single acquisition of computers ever. Phase IV's request for procurement (RFP) is scheduled to go out in December and the computers are slated to be finally installed by the end of 1983.

According to an Air Force description of the Phase IV program, the first objective of the program would be to "extend automated data processing support to base level users through the year 2000 by competitively acquiring upgradable/expandable hardware from a single con-

tractor's series of software compatible automated data processing equipment."

Essentially, the Phase IV acquisition would replace a total of about 250 computers the Air Force currently uses in installations around the world for routine data processing applications. The systems to be replaced are Univac 1050-11s, and Burroughs 3500/3700/4700s.

"My guess—and it's just a guess—is

"We're looking for normal technology gains."

that we would end up with about the same number of computers in Phase IV," said Col. John Gioia, Phase IV program manager. "It's going to be up to the industry, which can configure Phase IV anyway it wants. We're looking for normal technology gains. We are seeking to keep up with the computing state of the art."

Even as Col. Gioia spoke, however, there was speculation among vendors examining the Phase IV draft RFP that some of the larger minicomputer firms might join in the bidding against large mainframe companies. Digital Equipment Corp., for instance, is known to have a team examining the Phase IV RFP with an eye to submitting a bid. Minicomputer companies could be expected to bid more of their smaller machines against the large mainframes.

The Air Force is taking a somewhat novel approach to the procurement in that the problem of software conversion will be faced first and before the hardware contract will be awarded.

"Two contractors," the Air Force Phase IV program description states, "will be competitively selected to perform the software transition and design their adp system. These two systems will be tested and a production option would be exercised with one of the contractors to implement his system worldwide."

Procurement for Phase IV will be carried out by the Air Force's Computer Acquisition Office at Hanscom AFB in Bedford, Mass.

One key idea of Phase IV is to inject competition into the selection of the base level computers by opening up the entire contract to competitive bidding rather than to permit individual Air Force bases to replace their saturated computers a few at a time by different vendors.

The 20 year system life of Phase IV, however, is certain to raise eyebrows because some vendors are sure to charge that it represents a de facto sole source contract. "Whoever doesn't win the contract," said one vendor's Washington representative, "is sure to complain that Phase IV is a sole source contract and, as such, not really competitive."

The problem is that once a final winner has been chosen for the production contract award, only he is likely to be able to continue to supply hardware, software, and hardware maintenance for the duration of the 20 year contract.

In an attempt to inject competition into the contract for as long a time as possible and to monitor the award, the Air Force plans to use what it calls a "rolling" contract concept.

"The initial production contract option will cover an eight year period," the Phase iv report states. "At approximately year five of that option, the Air Force will provide workload data for the next six year period following contract expiration. The contractor will then propose new prices and/or new technology for use during the new period. The Air Force will evaluate the contractor's proposal to determine what action should be taken. This 'rolling' concept would be used to satisfy the 20 year systems life.

"... The strategy is to acquire an adp system—the hardware, basic software and transitioned software—and to maintain competition as long as practical."

The software conversion part of the

program—called the transition contract award—specifies that the Air Force select the two most likely candidates and give them 18 months to prepare conversion software. Since the current base level computers are about evenly divided between Univac and Burroughs, those two vendors presumably would have something of a head start on the software conversion.

It will select the two most likely candidates and give them 18 months to prepare conversion software.

The two chosen vendors each would be reimbursed for their software conversion work, and, finally, a "compute-off" between the two would be held and a winner for the production contract award would then be picked.

The Phase iv report states: "The test and evaluation process will evaluate contractor responsiveness to Air Force requirements; use of established standards, and acceptance testing will insure that each system delivered by the contractor

meets contract provisions."

Since both the Univac and Burroughs machines use myriads of applications software programs unique to each vendor's machine—much of the code is written in each machine's assembly language—the software conversion program is likely to be a challenge. While the Air Force has no public cost analysis figures available, one potential bidder who has studied Phase iv believes the software conversion award could amount to as much as \$50 or \$60 million.

When asked whether the total 20 year cost of Phase iv could surpass \$4 billion, Col. Gioia declined to comment. He noted, however, that the lion's share of the cost of the program over the years would come from overhead and operating costs including facilities modifications and power requirements. Col. Gioia emphasized that it would cost more over the next 20 years to operate the Air Force's existing base level computers than it would to operate the proposed Phase iv computer. Thus, he said, Phase iv actually will represent a saving.

—W. David Gardner

HOW THE AIR FORCE BUYS COMPUTERS

While the U.S. military complex receives its share of publicity for squandering public funds and for cost overruns, a new Phase iv computer procurement program will undoubtedly bring the Air Force's Computer Acquisition Center into sharp focus. Moreover, Col. Robert J. Latina, commander of the center, believes his operation will stand up to the close scrutiny.

"We usually get 35 to 40 percent off the commercial price of the equipment we procure," says Col. Latina. "I think that's significant."

The U.S. Air Force is the largest user of computers in the world and the biggest chunk of its equipment is procured through the Computer Acquisition Center. Procurements run the gamut from the enormous Phase iv program—with its estimated \$500 million total acquisition cost—to smaller \$300,000 or \$400,000 contracts.

"We signed contracts valued at over \$100 million over the past 14 to 16 months," says Col. Latina.

Established more than 10 years ago to acquire commercially available off the shelf computer gear, at least partially in response to the Brooks Bill, the computer acquisition center today has some 90 employees, including 68 professionals. The center employs hardware and software specialists, some of whom develop benchmark tests that must be successfully run before vendors are awarded contracts.



COL. ROBERT LATINA—"It's bad when we get just one bidder."

Does the center have any problems acquiring computers?

"Our biggest problem is software conversion," says Col. Latina. "It's not always recognized as being as big a problem as it is. We would like to see more software converted before hardware is bought.

"You must convert the software before a new hardware buy or after, and I'd rather do it before I buy a machine. In the end, it's a cost tradeoff: will it cost me more to convert the software and to get the benefits of competition?"

On the subject of competition, Col.

Latina said the basic charter of the center is to encourage competition among suppliers of commercial edp products in Air Force data processing procurements and "to let the free enterprise system work."

"We are after off the shelf commercial products," said Col. Latina. "While the industry is moving very rapidly in a technology sense, we know pretty much where it is and our requirements are never that exotic. We're not in the business of developing computing equipment."

The procurement process begins once an Air Force agency has been given funding approval for a computer project. The user specifies to the center the general type of equipment it wants and the type of application for which it will be used. The center then issues an RFP for the contract, vendors respond with proposals and, usually after a pre-award test demonstration designed to show that the vendor can perform the job, bids come in.

"The best thing that can happen," says Latina, "is for us to get four or five bidders. It's bad when we get just one bidder and worst of all is when we get no bidders at all."

Occasionally a contract award is protested by a vendor. Latina said that seven awards were protested to Congress' General Accounting Office in the past 12 months and that all were denied as being "without basis." *

SERVICES

SERVICES TURN TO MINIS

Service firms will have installed about 7,500 by end of next year.

The \$7 billion a year service bureau industry has apparently decided that if you can't beat 'em, you might just as well join 'em. By the end of 1979, some 160 U.S. service firms will have installed 7,500 mini and microprocessor systems at customer sites.

This is one major finding of the recently published annual survey of the industry from the Association of Data Processing Service Organizations (ADAPSO).

The number of installations actually could be higher because the 160 firms represent only half of the 309 bureaus, software firms, and professional services companies that responded to the ADAPSO survey. The 309 companies represent 38% of the industry's revenues and 10% of the estimated number of companies in the market.

Why get on the mini bandwagon? Most of the processing services respondents say that some of their business (30% average) is vulnerable to takeover by in-house installation of small systems. Exposure, they say, starts with customers spending over \$1,000 a month, although

as costs decline, some expect this figure to dip to \$500. General business services and firms specializing in just one or two industries are most vulnerable (50% to 100% of business).

The threat to processing services diminishes as the size of the company increases, partly because of the size and complexity of the accounts and partly because of the ability to market and support these mini systems where needed. NCSS, Keydata, and ADP have already jumped in with both feet. The smaller firms, however, feel they can also take advantage of the declining costs of these systems and begin offering services, such as remote processing, that they have not been able to afford. And, experienced with the small company account, they also have an opportunity to support or manage the small in-house system—in what the survey calls mini-facilities management.

The software firms (which recorded a whopping 36% growth in 1977) and professional services generally see enormous

Mergers and acquisitions may gather momentum as business is lost to in-house installations.

opportunities in minis for software packages, support, and mini-facilities management.

What this industry might experience, say the respondents, is another weeding out of the "weak," who cannot respond

to technological and market change. Mergers and acquisitions may gather momentum because of the need to expand products and markets in order to grow and to counter loss of business to in-house installations.

But the industry will not see a flattening growth overall by any means, according to the ADAPSO survey, conducted by Input Inc. It estimates "conservatively" that U.S. business in all services sectors grew 19% to \$6.3 billion—\$7 billion, if captive and non-U.S. business is included. In fact, the 309 respondents themselves actually recorded a 28% growth in 1977 over 1976. (The 19% figure was derived from extrapolations on how the remainder of the estimated 3,000 firms, most of them \$2 million and under, performed.) Further, almost all sectors and all size categories grew more in 1977 than firms had projected the previous year.

ADAPSO and Input are both estimating that between 1978 and 1982 the industry will grow at an annual rate of 16% to 17% and reach about \$15 billion in 1982. Software products firms will lead the pack at 29% a year, followed by processing services (17.4%), and professional services (9.2%).

Besides mini-microprocessor trends, the services firms noted other developments that were mixed blessings. A worsening shortage of skilled labor and increasing wages were noted by many, particularly smaller services companies. But this problem also represents opportunities for them, as users seek more effective ways to develop applications.

RESPONDENTS' PROJECTED MINICOMPUTER INSTALLATIONS AT CUSTOMER SITES

TYPE/SIZE NO. OF COMPANIES IN CELL	NO. OF INSTAL.	MINICOMPUTERS INSTALLED					
		1977		1978		1979	
		MAXIMUM*	NO. OF INSTAL.	MAXIMUM*	NO. OF INSTAL.	MAXIMUM*	
PROCESSING SERVICES							
<\$2M	133	219	45	565	150	1,231	250
\$2-10M	46	486	160	835	300	1,705	600
\$10-25M	11	216	185	392	335	527	375
>\$25M	16	1,171	1,000	1,692	1,200	2,732	1,500
SOFTWARE PRODUCTS							
<\$2M	45	107	23	227	45	424	100
\$2-10M	10	6	3	45	15	180	100
>\$10M	5	11	10	35	20	125	100
PROFESSIONAL SERVICES							
<\$2M	29	56	20	141	40	349	100
\$2-10M	10	76	40	141	60	226	90
>\$10M	4	11	8	20	15	58	50
TOTAL	309	2,359		4,093		7,557	

*MAXIMUM ANY SINGLE RESPONDENT SAID IT WOULD INSTALL

SOURCE: ADAPSO and Input, Menlo Park

**PUBLISHED RESULTS OF PUBLIC
COMPUTER SERVICES COMPANIES**

COMPANY NAME	FISCAL YEAR END		1977 (IN MILLIONS)	1976	% GROWTH 1976-1977		% PROFIT ON REVENUES
ANACOMP	6/30	R	\$ 16.18	\$ 12.85	25.91%	76	12.37%
		P	2.47	1.59	55.35	77	15.27
APPLIED DATA RESEARCH	12/31	R	16.93	12.91	31.13	76	15.26
		P	3.03	1.97	69.27	77	17.90
AUTOMATIC DATA PROCESSING	6/30	R	245.49	199.24	23.21	76	18.56
		P	45.97	36.98	24.31	77	18.73
BRADFORD NATIONAL	12/31	R	80.61	65.80	22.50	76	8.62
		P	6.05	5.67	6.70	77	7.51
BRANDON APPLIED SYSTEMS	2/28	R	7.59	5.81	30.64	76	—
		P	0.59	(0.94)	—	77	7.77
COMPU-SERV	12/31	R	14.33	11.40	25.70	76	13.95
		P	1.66	1.59	4.40	76	11.58
COMPUTER SCIENCES CORP.	3/31 (FISCAL 1978)	R	276.91	234.75	18.00	76	4.95
		P	13.88	11.64	19.00	77	5.01
COMSHARE	6/30	R	18.21	13.76	32.34	76	9.38
		P	2.27	1.29	76.00	77	12.47
ELECTRONIC DATA SYSTEMS	6/30	R	164.18	132.95	23.49	76	20.03
		P	28.51	26.63	7.06	77	17.37
KEYDATA	6/30	R	14.47	14.88	(2.76)	76	10.95
		P	0.35	1.63	(78.53)	77	2.42
NATIONAL CSS	2/28	R	41.70	35.60	17.14	76	12.33
		P	5.48	4.39	24.83	77	13.14
NATIONAL DATA CORPORATION	5/31	R	34.99	32.95	6.19	76	9.92
		P	4.16	3.27	27.22	77	11.89
ON-LINE SYSTEMS	4/30	R	16.00	11.96	33.78	76	11.37
		P	2.27	1.36	66.91	77	14.19
QUOTRON	12/31	R	33.35	24.64	35.35	76	17.78
		P	7.58	4.38	73.06	77	22.73
RAPIDATA	12/31	R	17.91	15.62	14.66	76	5.12
		P	1.84	0.80	130.00	77	10.27
SHARED MEDICAL	12/31	R	45.69	35.47	28.81	76	26.14
		P	13.27	9.27	43.15	77	29.04
SYSTEMS DEVELOPMENT	6/30	R	130.09	109.94	18.33	76	3.88
		P	4.86	4.27	13.82	77	3.74
TYMSHARE	12/31	R	101.17	81.83	23.63	76	16.08
		P	15.81	13.16	20.14	77	15.63
TOTALS		R	\$1,275.80	\$1,052.36	19%*	76	13%*
		P	\$ 161.05	\$ 129.02	25%*	77	14%*

*WEIGHTED AVERAGES

R = REVENUES (GROSS)

P = PROFITS (BEFORE TAXES & EXTRAORDINARY ITEMS)

EIGHTEEN public computer service firms earned \$161 million on total revenues of \$1.2 billion in 1977, an increase of 25% over 1976. Figures are taken from recently

published report on the industry by Assn. of Data Processing Services Organizations.

**COMPUTER SERVICES COMPANIES' GROWTH PROJECTIONS
1977 TO 1983**

TYPE OF COMPANY	FORECAST 1976 TO 1977	RESPONDENTS TO SURVEY		FORECAST FOR NEXT 5 YEARS
		ACTUAL* 1976 TO 1977	FORECAST 1977 TO 1978	
PROCESSING SERVICES	16.4%	27.0%	19.5%	17.4%
SOFTWARE PRODUCTS	27.2	36.0	22.6	29.1
PROFESSIONAL SERVICES	20.1	29.0	9.9	9.2
WEIGHTED AVERAGE ALL COMPANIES	17.2%	28.0%	18.8%	17.1%

*Actual reported growth includes sources other than U.S. available revenues, such as acquisitions and revenues from foreign expansion. Therefore, these growth rates are overstated when compared to the actual 1976 to 1977 growth estimated to have been 19% for the total industry. (Source ADAPSO and Input, Menlo-Park.)

With their concentrated expertise, all services companies will be giving much more attention to new programming techniques and to standardized systems and applications packages. The survey projects an explosion in the development

Printing and publishing are ripe for communications-based services.

of implementation languages and data base management systems.

The larger services firms are impacted by the decreasing cost of large mainframes, particularly the IBM compatibles. But while the customer may move more applications in-house because of this, the service company also can increase capacity, switch the savings to much-needed product development, and/or offer more for the dollar.

The hardware expenditures (processor and peripherals) is already dropping for service bureaus, from an average 22% in 1977 to 18.5% of costs in 1978. It is down to 12% for large firms.

While some large firms are worrying about the battle between IBM and AT&T over communications-based services—and the prospect of being squeezed out—they also see growing new markets. In the next five years the value-added network services for data, text, message handling, video and facsimile will take off, says ADAPSO. In the 1980s, electronic mail, distributed data processing, and data and information bases will become major growth markets. Printing and publishing “are ripe” for communications-based services.

The survey generally concludes that distributed data processing will not be fully implemented by computer users

until the 1980s, and the implementations will not be as extensive as currently envisioned. But in the '80s, large service companies will find major business in providing distributed processing networks for medium and large firms. The need for support from professional service companies will be enormous, and software producers will be building a vast new crop of application packages and systems products.

Among all firms, but particularly among the medium-size services companies, industry specialization will be the byword of the next few years. This is not unlike prognostications of 10 years back, but specialization will be across an increasing number of industries and me-

dium firms are expected to expand out of their regional markets. Banking and finance leads the pack as the most important and growing sector for software and services. Wholesale, retail, discrete and process manufacturing are other major growth markets. (The list was longer as the size of firms responding increased.)

Non-U.S. markets are seen as another growth opportunity. Among responding processing services companies, more than \$130 million came from abroad—7% of their total reported revenues. Most of that, of course, was raked in by firms with \$25 million-plus revenues. Software companies, which have long exported their packages into Europe and elsewhere, realized 17% of their revenues from abroad (\$36 million). Professional services abroad accounted for \$28.7 million or 7% of respondent revenues.

Europe alone saw U.S. service firms penetrate 10% of its \$2.9 billion market in 1977. IBM, which is not included in the survey, has another 5%. That market has been growing at 15% a year, and more and more U.S. service companies are eyeing it.

The problems and opportunities—minis/micros in particular—are similar in Europe, as are the service company answers to them. But the Europeans are also keeping their eyes on the U.S. opportunists, and taking many steps to counter their growing competitive threat. These include making incursions into the hyperactive U.S. market. That does not arise as an issue in the 1977 ADAPSO survey, mostly because it is a fledgling trend. But it will.

—Angeline Pantages

COMMUNICATIONS

CUT-RATE SERVICE

U.S. data communications users would be offered rates at savings of 50% for private line service to Europe.

Drastically reduced rates for 1200 to 9600 bps private line service to Europe probably will be offered by U.S. international record carriers (IRC's) before the end of this year. The savings would amount to nearly 50% in some cases.

Most U.S. users who have to communicate with Europe at 1200bps and higher speeds now use analog alternate voice/data (AVD) circuits. From the East Coast, the present “half-circuit” charge for this service is \$4,545 a month. (The

half-circuit extends from the U.S. IRC's gateway, where it interfaces with the subscriber's access line, to the midpoint of the Atlantic, where facilities operated by U.S. and overseas carriers meet. The rate is the same whether a satellite or cable transmission path is used.) The total charge, including what the overseas carrier gets for its half-circuit, ranges from roughly \$10,000 to \$12,500 a month.

In 1975, the Communications Satellite Corp. (Comsat) unveiled a new service called “Digisat,” which consists of subdividable 50Kbps all-digital satellite circuits. The satellite agency proposed to lease these new facilities to the IRC's at rates way below what Comsat charges them for alternate voice/data facilities—allowing the carriers, in turn, to cut their rates to the end user.

For some time, the carriers were reluctant to provide Digisat service—partly because they feared a loss of revenue,

RATES PROPOSED BY U.S. AND OVERSEAS CARRIERS FOR IDPLS SERVICE

Service Type	U.S. monthly half-circuit charge (1)			Overseas monthly half-circuit charge (2)				Total (end-end) charge				Difference between Present and Proposed Rates, End-End (5)			
	WUI	ITT	TRT	Germany	Belgium	France	Switzerland	Germany	Belgium	France	Switzerland	Germany	Belgium	France	Switzerland
AVD	\$4545.00			\$7735	\$6688	\$5307	\$7155	\$12280	\$11233	\$9852	\$11700				
Digital Private Line:	WUI	ITT	TRT(4)	Germany	Belgium	France	Switzerland	Germany	Belgium	France	Switzerland	Germany	Belgium	France	Switzerland
1200 bps.	\$2500	(3)	\$2300	\$4050	\$3895	\$3342	\$4293	\$6350	\$6195	\$5642	\$6593	48%	45%	43%	44%
2400 bps.	3000	2500	2500	4705	4545	3879	5008	7205	7045	6379	7508	41	37	35	36
4800 bps.	3900	3500	3300	5710	5504	4710	6054	9010	8804	8010	9354	27	22	19	20
7200 bps.	4500	(3)	3600	(3)	(3)	5473	7155	(3)	(3)	9073	10755	(3)	(3)	8	8
9600 bps.	(3)	4000	3900	7500	6385	6191	(3)	11400	10285	10091	(3)	7	8	-2	(3)

1. Amounts shown are present AVD and proposed digital private line service half-circuit charges from the East Coast of the U.S.

2. All amounts shown in this column are approximate overseas half-circuit rates expressed in U.S. dollars, and are based on current exchange rates.

3. No rate proposed for service at this speed.

4. Rates shown for TRT include a charge for an "analog/digital adapter" (modem) needed to

interface an analog subscriber's access circuit. Those subscribers using digital access would pay the following rates: \$2155 (1200 bps.); \$2350 (2400 bps.); \$3040 (4800 bps.); \$3275 (7200 bps.); and \$3515 (9600 bps.).

5. Based on the lowest of the proposed U.S. half-circuit rates. The percentage shown is derived from the following formula: $\frac{\text{present} - \text{proposed rate}}{\text{present rate}}$

partly because the overseas carriers didn't appear to be interested (January, p. 183). But those problems now appear to be largely resolved. Within the past few months, Germany, Belgium, France, and Switzerland have all agreed to offer digital private line service at specified rates, and three U.S. IRC's—Western Union International (WUI), ITT, and TRT—have announced their proposed charges.

Before the service can be offered, the FCC must authorize it—by approving applications the IRC's have already filed—and by allowing the proposed rates to become effective. A commission source says the authorizations (usually called "214 applications") likely will be acted on early this month. The FCC has been pushing the international carriers hard to

It isn't totally clear what the IRCs will pay Comsat for satellite half-circuits.

offer reduced-rate digital data service—threatening at one point to let Comsat deal directly with end users if the IRC's didn't take steps to implement the satellite agency's Digisat offering—so the commission probably will accept their requests for operating authority. Once the 214 applications are out of the way, it's likely to take about another month to act on the tariffs.

Rates proposed by both the U.S. and overseas carriers for what is now generally referred to as "international digital private line service" (IDPLS) are listed in the accompanying table.

While IDPLS is far cheaper than AVD, it is limited to data communications. Separate circuit facilities would be needed for any voice messages a user is now sending

or receiving over his AVD circuit. Because of the savings generated by the new rates, a user who didn't make a lot of overseas telephone calls probably could transfer them to AT&T's international dial-up network and still save money by using IDPLS.

Another factor is that AVD is an analog service. IDPLS, being digital, is inherently less prone to errors and probably will produce higher throughput than an AVD circuit operating at an equivalent bit rate.

Since 1975, when Comsat unveiled Digisat, the satellite agency and the carriers have been arguing about whether the new service should include cable as well as satellite transmission. Also, it still isn't totally clear what the IRC's will pay Comsat for satellite half-circuits.

Earlier this year, Comsat and the FCC negotiated settlement of a long-standing rate dispute which resulted in a filing, by the satellite agency, of lower tariffs for all of its services. The FCC has told the U.S. international carriers they can lease satellite circuits at the lower rates only if the savings are totally "flowed through" to the end users. There is some reluctance on the part of the carriers to do this.

The IDPLS charges proposed by TRT, and possibly those filed by the other IRC's, are based on the lowered Comsat rate for a 50Kbps half-circuit—even though none of the carriers has yet agreed to 100% flow-through. But, according to Richard Yalen, TRT's tariff chief, even if his company has to pay Comsat the "old" rate for a 50Kbps half-circuit, the charges to end users probably won't be increased beyond what has been proposed. Basically, this is because the difference between the two Comsat rates, on a per-circuit basis, is "nominal," says Yalen, given the number of IDPLS circuits TRT expects to lease. (The company has already won a contract to supply the Department of Defense with three IDPLS circuits to Germany. Two more leases are

projected by the end of the first year the new service is in operation, three more in the second year, and six more in the third year.)

The other unresolved question—whether IDPLS should be a satellite-only or a composite cable and satellite service—is also likely to be settled without too much trouble.

Comsat has objected strenuously to a composite service. The agency alleges this arrangement would cost the end user far more than one based on exclusive use of satellite facilities. Also, Comsat argues that the satellite-only version was what the FCC ordered the IRC's to provide in a ruling issued early last year.

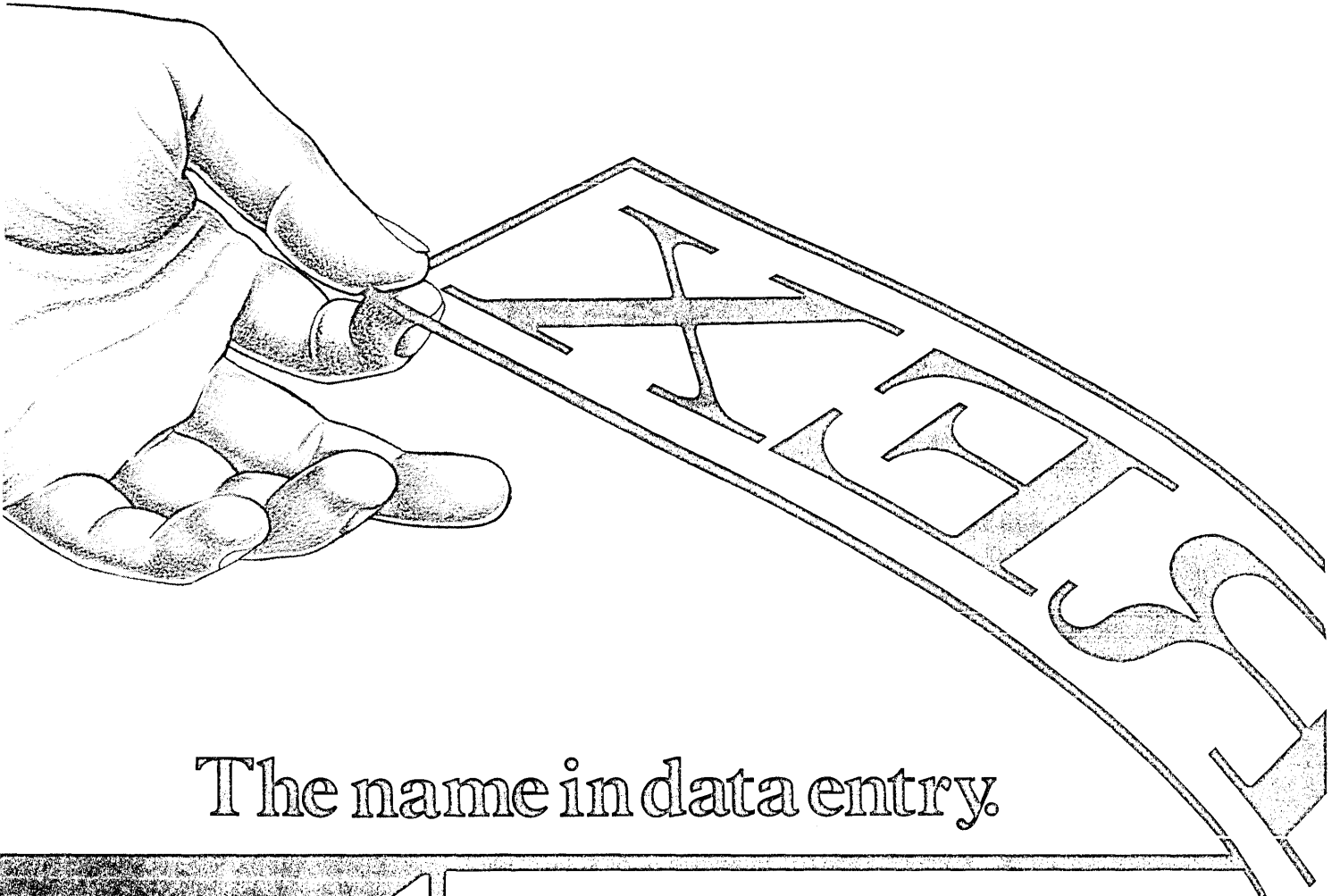
However, Comsat's real motivation may be less altruistic than these comments suggest.

Comsat has objected strenuously to a composite service of cable and satellites.

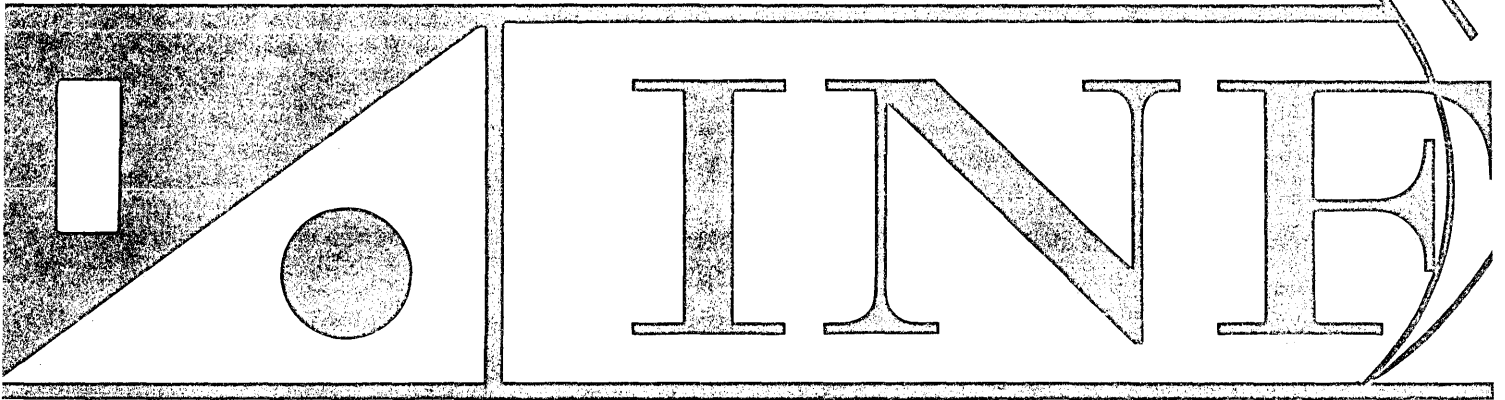
Last October, it said the FCC should let Comsat offer Digisat directly to end users unless the IRC's agree to offer a digital private line service exclusively via satellite. It was one of several moves by Comsat, before and since, aimed at repealing the FCC's 1966 "authorized user" decision and enabling the satellite agency to get into the end user market.

In any event, the question of whether satellite-only service would be cheaper than a composite offering may be academic. The tariffs proposed by the IRC's so far, all of which are based on a composite transmission path, promise the user a significant saving—and that probably will be the decisive factor as far as the FCC is concerned.

-P.H.



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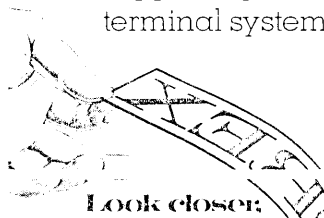
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CIRCLE 116 ON READER CARD

IN COURT WITH DEC

Tiny Computer Operations' four-year battle with DEC in court.

Stephen Silverman admits to feeling much like the Biblical David who took on the Philistine giant Goliath. And, as in the Biblical story, Silverman's Goliath, Digital Equipment Corp., is counting on being impervious to the slingshot, legal assault mounted by the 36-year-old Computer Operations Inc. president.

The small Lanham, Md., peripheral company brought an unexpected lawsuit against the mighty minicomputer maker four years ago, charging that DEC's 1968 patent on its DECTape system (used on the PDP-8 and PDP-11 minis) was invalid since it was fraudulently obtained.

That's the crux of the case, but there's a lot more to it than that, says Silverman, who feels DEC doesn't realize that, as a result of these patent fraud allegations, its ethical reputation could be on the line. "It's clear," he maintains, "that DEC doesn't take this whole thing very seriously."

A lawyer for DEC denies this, saying, "DEC has always taken it seriously. Up until now," he declares, "the war has not escalated. It's been treated on its merits."

COI, a 10-year-old company that had supplied peripheral-to-minicomputer interfaces and was also into the small systems market, switched its focus eight years ago to LINC tape products which used basically the same format as the original LINC tape drive that was developed in 1962 at MIT's Lincoln Laboratories for use on its LINC computer. (The basic difference between the two tape systems is that while the LINC tape device searches bidirectionally, reading and writing in one direction, the DECTape unit reads and writes bidirectionally.)

Wanting to expand its market, COI a few years later began looking for ways to offer a plug-compatible PDP-8 and PDP-11 DECTape system. In the late '60s, when it was just starting up, COI had opted against entering this market for fear of the legal expenses of a potential patent infringement battle with DEC.

But by 1973, after endless hours and years of pouring over the DECTape patent, Silverman decided to take a shot at the DECTape market. At this point, he didn't consider this a rash move because he was following the go-ahead of his patent counsel who claimed the patent was invalid on several grounds. So in April 1973, COI plunged head-first into the DECTape business, offering a system



STEPHEN SILVERMAN—It's much like David vs. Goliath.

which it dubbed DECTape compatible, and which in reality was indeed DECTape.

Eight months after COI began its DECTape drive, DEC reacted with a letter to the company which stated that DEC believed COI was infringing on its patent, and if it was it had better stop. And this is where the battle began.

Lawsuit centers around legality of a DEC patent.

Undaunted, COI sent DEC back a letter, claiming the DECTape patent was invalid because the company in applying for the patent had not complied with patent law. What COI charged was that DEC had not disclosed prior technology, namely the Lincoln Labs' development work on the very similar LINC tape system which is in the public domain since it was government-funded.

DEC didn't buy COI's arguments and in another letter to COI, insisted that if the company didn't have better reasons it should halt its DECTape operation. Instead, COI filed its suit in the U.S. District Court in Brooklyn in the summer of 1974. The suit asks for the court to declare the DECTape patent invalid and seeks damages (antitrust) resulting from DEC's assertion of the patent against COI.

DEC countersued for patent infringement. Both suits were combined, and subsequently shifted to the U.S. District Court in Boston.

During discovery in the case, Silverman claims COI's legal team turned up "more and more frauds" related to the

DECTape patent. "We didn't know what a good case we had," he marvels. And that good case, he contends, hinges on the fact that allegedly DEC "not only offered DECTape systems (then called Microtape) for sale and took orders, but actually delivered the product more than a year prior to its patent application" in violation of patent law. "Just that alone," he contends, "would hang them." (Patent law requires that a patent be applied for within a year after a product goes on sale.)

DEC vehemently disputes this charge, and to defend itself in the case returned to the Patent & Trademark Office in February 1975 to apply for a reissue of the DECTape patent. According to one DEC counsel, the company willingly invited COI's participation in the reissue which at the time it felt was a sure thing.

Both firms funneled numerous documents into the PTO and COI, the ostensible beneficiary of this effort, was allowed by the office in an unusual move to be a party to the reissue action. COI in December 1975 filed a petition to "strike" DEC's patent reissue application. And after almost a year of deliberating the PTO, in November 1976, asked DEC to "show cause" why COI's strike petition should not be granted.

After requesting several extensions, DEC finally responded. But its response was not good enough for the PTO which last April granted COI's strike petition on the patent reissue, citing a surprised DEC with nine counts of fraud—eight of which are spelled out in the pending COI suit.

COI was understandably pleased with the ruling in which the patent commissioner found "clear and convincing" evi-

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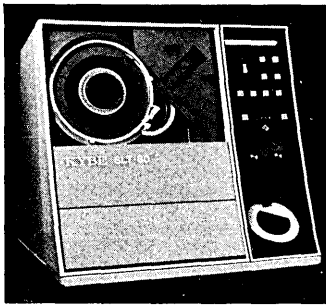
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CIRCLE 185 ON READER CARD

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CIRCLE 186 ON READER CARD

NEWS IN PERSPECTIVE

dence that DEC had committed these alleged frauds in its original DECTape patent application. COI president Silverman feels the PTO decision will help vindicate his company's suit.

A chagrined DEC, on the other hand, has set out to short-circuit the potentially damaging decision. In mid-July, the company filed a civil action in the Boston court against the patent commissioner, maintaining that he erred in his ruling. This suit could be combined with the original COI vs. DEC suit.

Meanwhile, COI hasn't rested on its victory laurels either. In May it submitted a motion for a summary judgment in the Boston court, asking for attorneys' fees (which are more than \$200,000 to date)

Patents office cited DEC with nine counts of fraud, but DEC has challenged the ruling.

and a date to be set for the antitrust trial to determine damages. The company previously had been turned down by the New York court on its first petition for a summary judgment, but hopes to be more successful this go-round in light of the PTO finding.

In preparation for its antitrust moves, COI has brought on board a special antitrust lawyer to help it evaluate the damages it claims are due. Although the company leaves these damages unspecified in its suit, it feels that if the court rules in its favor on the DECTape patent's invalidity, then in the subsequent antitrust suit it could be awarded damages on the basis that it was deprived of a certain percentage of the DECTape market had it started marketing the product on a certain date. Similar suits have resulted in treble damage awards of over \$10 million.

The little company also takes comfort in the fact that the Justice Dept.'s Antitrust Div. is routinely investigating the matter, deciding whether it also should hit DEC with an antitrust action. More fallout from the situation could result if the PTO's solicitor general decides to prohibit one of DEC's attorneys involved in the original patent application from practicing before the PTO commission for one year. The PTO ruling, to various degrees, implicated DEC parties to the patent application (including company president Kenneth Olsen) in the alleged patent fraud.

One DEC attorney close to the case insists the company is "very ethical" and has been totally honest in its dealings with the Patent Office. The important thing to remember, he says, is that there has "certainly been no intent to deceive" on DEC's part.

He also says that DEC's patent applica-

tion for DECTape did mention and describe LINC tape, although "not by name nor in any great detail." On the key issue of whether the company sold the system within the one-year time limit, he maintains that an experimental "breadboard" version was indeed delivered to a customer (Kie Corp., predecessor of Keydata Corp.) in the fall of 1963 but it was not operational, he argues, until January of 1964.

DEC filed for its patent in November 1964. So if this argument stands up in court, which DEC is sure it will, then the one year restriction would have been met. COI on the other hand claims to have proof (from DEC's very own documents) that the mini maker accepted purchase

Final step is for the court to determine whether the DECTape patent is valid and was infringed by COI.

orders and quoted delivery dates in the summer of 1963 for Microtape, since known as DECTape.

The central issue in this whole legal morass over DECTape is whether in fact the patent is fraudulent. If the court agrees with the PTO that it is, then it must also decide whether COI was hurt and whether the alleged fraudulently procured patent was "a material" cause of that damage.

If the court disagrees, the whole case is washed up as far as the antitrust aspects are concerned. The final step then will be for the court to determine whether the DECTape patent is valid and was infringed by COI. If it is valid, DEC would pocket damages from COI. If not, DEC would have to ante up damages for COI.

Whichever way it goes, there definitely will be an appeal which could go as high as the Supreme Court. DEC is hoping the messy suit can be resolved in the next one to two years. Committed to seeing the thing through to the end, the company is, and always has been, set against any settlement with COI—even though COI has repeatedly sought to recoup its mounting legal fees, legal fees which COI, with \$1.4 million in annual revenues, can ill afford.

COI confirms it made several offers to DEC, prior to the PTO ruling, to drop the suit if DEC would agree to pay its attorneys' fees and let it market its DECTape products without a royalty restraint. COI's Silverman claims the company's efforts "were rebuffed every time."

DEC is reported to have viewed some of these "conciliatory" attempts as "scare tactics," and would have nothing to do with COI. And it's sure, of course, that it is and has been right all along. DEC presi-

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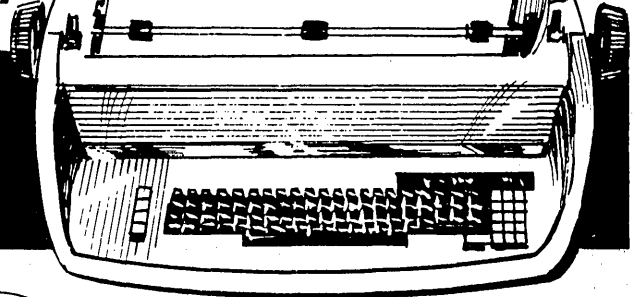
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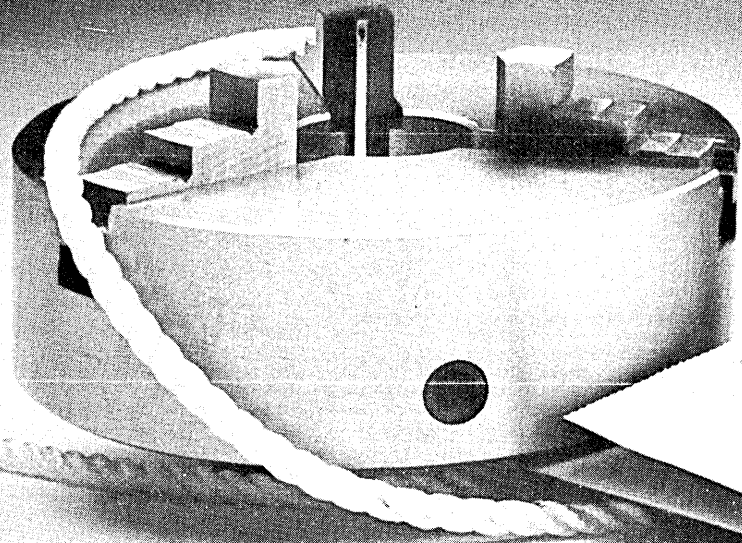
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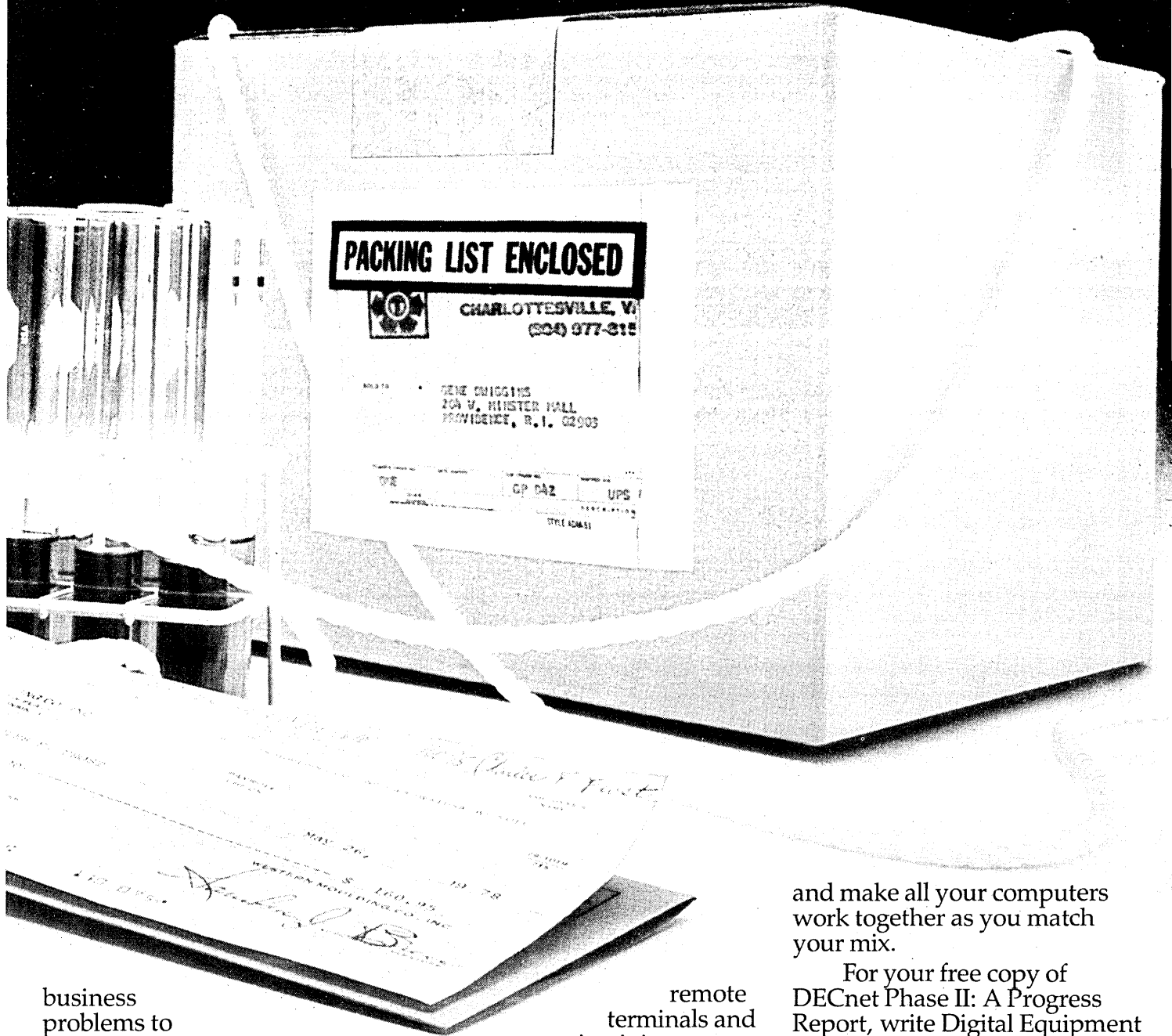
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NEWS IN PERSPECTIVE

dent Olsen's stand on the suit also reflects this attitude. In a recent meeting to rally his legal troops he urged them to "press on."

The current animosity between the warring companies is such that no reconciliation overture on either's part is likely. COI clearly won't back down even though, as Silverman laments, "the growth of this company has been inhibited by this lawsuit."

DEC seems fully aware of COI's position and is puzzled about what the tiny company thinks it stands to gain in the long-run. This is especially true since it consid-

ers the product a has-been supplanted by floppy disk technology. But like COI, DEC is not about to throw in the towel.

Says the DEC lawyer: "COI has rolled the dice. It has started a game and now it can't stop because it has too much invested." And that investment will mount on both sides as the litigative maneuvering continues, because as one observer points out, such court battles can be long, drawn-out processes. "It's a long day at the races," he reflects, "and the horses are still running."

—Linda Flato

PEOPLE

EMPHASIS ON SOFT

Dr. Robert Spinrad takes over Xerox's Palo Alto Research Center.

"The big question in computers today is what to do with them," said Dr. Robert Spinrad.

Spinrad believes we're at the start of an information handling revolution and he likes the charter given Xerox's Palo Alto Research Center (PARC) by board chairman C. Peter McColough to help Xerox "become the architect of information."

Spinrad moved to Palo Alto last month to become vice president of research and manager of PARC. He left a position as

In 1968, after being courted for years, he joined Palevsky at SDS.

vice president of the Systems Development Div. of Xerox Business Systems in El Segundo, Calif. At PARC he succeeded Dr. George Pake, director of the center since its founding in 1970, now head of all research for Xerox Corp.

Spinrad is concerned today with chips and the lowering costs of logic. He also is concerned with software which is a major emphasis at PARC. But early on he was involved with big machines. Even then, he thought software was "the gutsy problem."

A native of New York City, Spinrad did his undergraduate work at Columbia Univ. where he took what may well have been one of the first computer sciences courses in 1953. "We worked with a big computer at NYU," he recalled, "with big steel tapes."

From Columbia, Spinrad went to work for Brookhaven National Laboratory as a researcher in physical sciences. He was reintroduced to computers. "In 1956, I was asked to copy the MANIAC computer at Los Alamos. It was a wondrous old engine."

But Spinrad still was more a physicist than a computer scientist. In '59, having received a masters from Columbia, he went back to get his doctorate at MIT. There he became involved with small computers of the PDP-1 class.

In '62, he returned to Brookhaven and put much of its research on-line to small computers, "a first," he said. In the same year, he purchased the second Scientific Data Systems computer ever built. "The first had not yet been delivered." He was consulting for Bell Labs at the time, "with Brookhaven's blessing." He saw a

MINICOMPUTERS

MARKET FOR 32-BITS

SEL scores a coup in hiring away two principal members of DEC's team.

The 32-bit minicomputer market is rapidly emerging as one of the more hotly contested battlegrounds in the dp industry with two vendors squaring off as the prime competitors, at least for the time being: Systems Engineering Labs and Digital Equipment Corp.

The most recent salvo in this confrontation was fired by the Ft. Lauderdale, Fla. based SEL which scored a coup in hiring away two principal members of DEC's 32-bit hardware and software team.

Joining SEL, which has been in the 32-bit market since 1969, were Roger Gourd,

expect to be a \$100 million company in two years."

In going after Gourd and Hughes, SEL may be reacting to inroads DEC reportedly has been making in the 32-bit arena. Prior to the VAX introduction, that arena had been dominated by SEL and Interdata.

An industry analyst close to DEC notes that VAX "is really scoring." Thus far, the VAX orders have been restricted to one or two machines per customer but the potential for large volume orders is there, he asserts.

Moreover, DEC's admitted problems with the VAX software—problems SEL has underscored in selling its own machines—haven't really hurt DEC's sales since at the outset the computer giant is selling primarily to large sophisticated users who can provide their own software.

Fueling the growth of the 32-bit market is the fact that costs for the components which go into manufacturing 32-bit systems have dropped to the point where the cost differential of producing a 16-bit and 32-bit machine is rapidly closing.

And with the advantage of its larger address field and richer instruction set, the 32-bit technology represents an attractive architecture for anyone off-loading an IBM 370 and moving to a decentralized environment, Frick observes.

SEL itself is expanding from its traditional vertical markets, such as simulation, engineering monitoring and laboratory processing, and is making a run at the manufacturing sector. Additionally, it recently introduced several machines aimed at the lower end of the 32-bit market, including the SEL 32/5720 which sells for about \$40,000.

Now if Interdata, which is retrenching, gets back on its feet and Hewlett-Packard, which is rumored to be coming out with a 32-bit machine, enters the fray, the 32-bit arena could really explode.

—Laton McCartney

Costs for the components used in manufacturing 32-bit systems have dropped close to the 16-bit price.

who was involved in the software design of DEC's VAX-11/780 machine. Gourd assumes the position of director of software engineering.

Additionally, Leonard Hughes, who had served as manager of the VAX hardware group, came over to SEL last month where he'll function as director of hardware development.

Says SEL vice president of marketing and sales, Philip W. Frick, of the new hiring: "We wanted a compatible team because it's difficult to isolate hardware and software. Gourd and Hughes bring to us their ability to manage the development of large systems and we need that kind of expertise, particularly since we



ROBERT SPINRAD—Computers—what to do with them?

spec sheet for the SDS 910. "I was impressed and I called them. They said they'd send somebody to talk to me. The guy they sent knew everything I wanted to know about the machine. That was the first time I met Max Palevsky."

He was asked to join Palevsky's SDS over a period of years and did serve the firm as a consultant, again "with Brookhaven's blessing." It wasn't until 1968 that he finally succumbed and went to SDS full time as vice president for programming.

Spinrad has other distinctions. He was the conference chairman for what now has become fondly dubbed "the last of the fall joints"—the Fall Joint Computer Conference in Anaheim in 1972. "It's something everyone should do once," he said. He wouldn't do it again and has had no involvement with the successor to the semiannual Spring and Fall Joint Computer Conferences, the annual National Computer Conference.

But he is involved with the Univ. of California Engineering Advisory Council, the International Institute of Applied Systems Analysis, and the visiting committees for computer sciences at Stanford Univ. and math for MIT.

Of his work for the Fall Joint Computer Conference, he says, "it was a very real, worthwhile thing to do." He said it took two hours per week of his time at the beginning but, at the end, the last two months, it took up half his time.

Of his latest job switch, he says it's a return to what he likes best—research. And he hopes to do something about what he considers the "dominant problem in computing today—programming."

—Edith Myers

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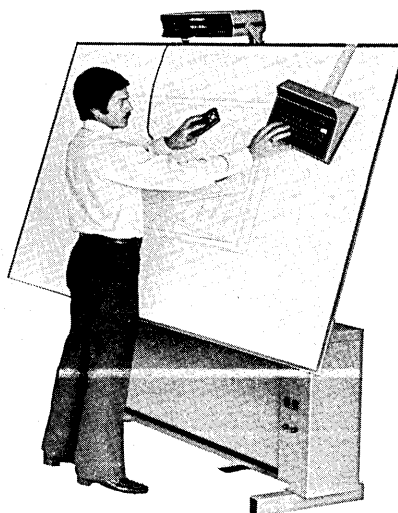
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DP IN ISRAEL

Huge conference draws 400 professionals from overseas.

Ever since Israel started a computer industry in the 1950s, it has leaned heavily on outsiders for technical support. This was very much in evidence last month during the U. S.-sponsored Third Jerusalem Conference on Information Tech-

nology (JCIT 3) when about 400 computer professionals from overseas were as much of an attraction as the technical sessions.

But about 2,400 Israeli computer people also attended, an unusually high number because the country's complement of dp professionals totals only about 4,000. Conference chairman, Anthony Ralston, a former president of the American Federation of Information Processing Societies, said that if the same percentage of U. S. computer people came to the National Computer Conference, the attendance would be some-

thing like 125,000. (The NCC turnout last June in Anaheim, Calif., was 57,000).

Support from overseas computer professionals for the Israeli dp effort was in evidence at the Jerusalem conference in the form of innumerable corridor discussions between the natives and the visitors. But these discussions reflected only one small part of a unique system Israel has designed for exploiting the expertise of its friends overseas.

In 1967, Prime Minister Levi Eshkol proposed establishment of international committees to advise each of Israel's major industries. The following year, several committees were established, including two for the Israeli computer industry: one is composed of U. K. and Western European computer professionals, the other is drawn largely from the United States (the balance comes from Canada).

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WERNER FRANK—heads U. S. group assisting Israel's dp efforts.

The U. S. group—currently headed by Werner Frank, executive vice-president of Informatics—consists of about 100 of this country's top dp professionals. Although none of the committee members represents his employer, the list of affiliations is impressive. It includes most of the leading teaching institutions in the United States, as well as the major mainframe, software, and service suppliers. All committee members give their time and advice at no charge.

Since it was established in 1968, the U. S. committee has provided a number of support services, formal and informal. For example, just before last month's JCIT began, Israeli dp users and suppliers needing help with systems or products spent an entire day consulting with members of the committee. According to one participant, if the advisors at that meeting had charged commercial rates, the bill would come to at least \$100K.

Recently, the U. S. committee helped Israel's biggest dp firm, Elbit Computers, set up a joint venture software company with Rand Information Systems, San Francisco. Previously, it opened doors for two other Israeli vendors—Sci-Tex and Elscint—who now are marketing their products in the United States. The committee has provided marketing and technical advice to several other Israeli dp firms as well, and thanks partly to a series of short courses brought to Israel several years ago by one member of the committee—Bernie Galler, professor of computer and communication sciences at the Univ. of Michigan (and former president of ACM)—the Israeli government was encouraged to establish a permanent education program for its computer professionals.

The U. S. committee also sponsors the

U.S. committee sponsors JCIT in collaboration with the U.K. group and another one composed of Israelis.

JCIT, in collaboration with the U. K. group and another one composed of Israelis. Although Americans were well represented on the steering committee for this year's meeting, most of the drive came from conference cochairman Dov Chevion, president of the Information Processing Assn. of Israel (IPA).

Chevion, who also directs a government computing center, is a walking encyclopedia of facts and figures about the Israeli computer industry. In the past five years, he reported, the number of installed systems has increased more than 50% (from 400 to "over 600"), the number of terminals has increased even more ("from 800 to more than 2,000"), and adp expenditures have grown from 1.2% to 2.6% of GNP. Although he admits the industry is still small in absolute terms, Chevion adds that "we rank higher in computing power per capita than half of the world's developed nations."

The main targets of this sales pitch are the hardware and software vendors in the U. S. and elsewhere. The government wants them to set up shop in Israel, preferably on a joint venture basis.

The importance of this "outside partnership" is suggested by a recent government study, which found that foreigners own, partly or completely, 22 of Israel's 28 largest data processing equipment firms. Because a significant share of the total revenue earned by Israeli dp vendors comes from exports—the percentage is more than 40% in several cases—the technology and technical expertise provided by overseas partners may be even more important than their capital contributions.

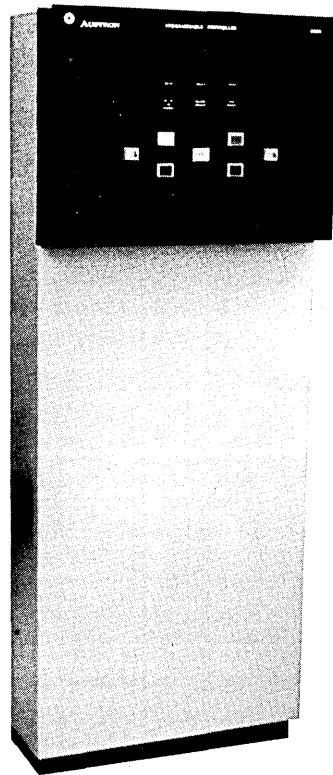
In exchange for this technical and financial support, U. S. firms which establish manufacturing/assembly facilities in Israel and then ship from there into the Common Market, avoid the 7% duty assessed on products exported directly from the U. S., explains Uzia Galil, president of Elbit Computers. "Also," adds Galil, "we are thoroughly acquainted with European marketing methods, so we can frequently provide valuable advice to our partners, particularly those who have not previously sold outside their own country."

Galil is intimately familiar with both

exports and partnerships. Elbit was established in 1967 as a joint venture between the Israeli government and private investors. Three years later, CDC acquired a 51% interest. The company manufactures a small business computer system called PACT, plus a line of IBM and Teletype-compatible terminals, which are marketed throughout the world. In 1977, 55% of Elbit's sales came from abroad.

One of the handouts at this year's JCIT was a 276-page report, issued by the Ministry of Industry, Commerce and Tourism, entitled "Thirty Years of Computing in Israel." Any U. S. company

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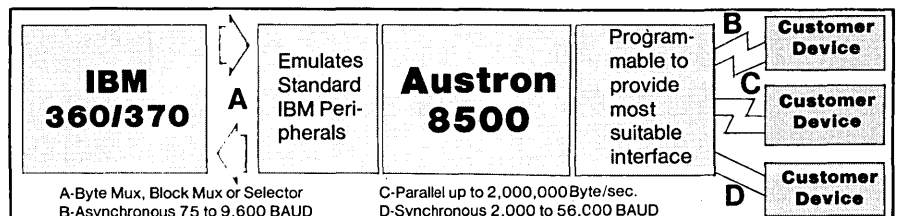
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NEWS IN PERSPECTIVE

that's interested in marketing abroad will almost certainly find its contents interesting.

The report contains detailed breakdowns showing the distribution of Israeli computer installations, by system size, among the country's major economic sectors, plus similar analyses of rental and maintenance costs, average operating hours a month, and projections of growth in the installed base. Supplementing this data is a lengthy survey showing who the users are in terms of number of employees, annual revenues, type of usage (service bureau versus in-house system), and several other characteristics.

There also is a detailed profile of each of Israel's major computer products vendors, and a chapter analyzing the educational attainments, professional training, and job responsibilities of Israeli programmers, systems analysts, and system managers. (One table, among many in this chapter, lists the average number of jobs which have been held by programmers, analysts, and managers, along with the average number of employers for whom members of each group have worked. The two figures are then compared to show the job-hopping and promotion patterns within each group.)

Unlike most publications of this type,



GEOGRGE GLASER—the whole issue is boring.

the Israeli report concedes that problems exist. For example, the chapter on manpower cites a number of deficiencies in the educational system for computer pro-

fessionals, and says improved procedures must be developed to overcome "a seemingly immature structure of management functioning."

It also calls for new incentives to encourage more women to become computer professionals (they comprise 33% of the overall Israeli workforce, but only about 16% of the professional computer community). The report includes a paper written by Werner Frank which proposes a basic restructuring of Israeli's software industry to counter "the lack of encouragement given by a less-than-enlightened user community."

Several interesting papers were presented at JCIT 3. Some summaries:

The byzantine struggle among U. S. financial institutions, consumer groups, and civil libertarians over EFT is likely to get worse, said George Glaser, president of Centigram Corp., Sunnyvale, Calif., a former president of AFIPS. "It's entirely possible that progress (in deploying EFT systems and networks) will be slowed dramatically if not crippled altogether" by the arguments currently raging in Congress over such questions as the need to share EFT terminals, promote competition among suppliers of EFT services, and protect users' privacy.

A further complication, is that the whole issue is "boring, if not incompre-

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hensible to the public and to most legislators. The stage is set for two or three years of classical political struggle affecting . . . the entire financial industry. It will be fought by special interests and won by those best able to manipulate public opinion."

In a paper entitled "The Future of Computer Technology," I. M. Barron, of the United Kingdom, predicted that by 1980, an integrated circuit chip containing 100K transistors should be economically feasible (this would be about four times the maximum density of today's IC's). It will then be possible to accommodate "the majority of systems" on a single chip, Barron explained, and "further increases in the level of integration will do little" to reduce user costs.

Regarding software, "the use of computer aids may simplify the mechanical aspects of programming . . . but further reductions in the cost of developing software seem unlikely because the effect of the various computer aids is to make the design of software harder. What technological development will do is to reduce the need for a programmer to have specific expertise in computing . . . As a result, programming as a profession should largely disappear."

Barron added that the electronic typewriter is the key to the information soci-

ety of the future. "It is already cheaper to store information electronically than to use paper and filing cabinets. It is also cheaper to transmit information through the telephone system than to use the postal service. The main barrier to the widespread use of these techniques has been the cost of data capture. Once that barrier is broken, the changeover from

"Improved procedures must be developed to overcome a seemingly immature structure of management functioning."

paper to electronic information should be rapid," Barron said. He added: "Given the progress in semiconductors, it is realistic to expect that completely silicon word-processing systems will soon become feasible."

The major impact of the information revolution will be to increase unemployment, Barron argued. Pointing out that historically, "each time there has been a significant increase in productivity, (it) has been followed by unemployment and a severe depression," he explained that "a substantial proportion of the working population, perhaps 65%, have jobs

which are primarily concerned with information. All of these jobs will be changed by the use of electronic information systems and it may be expected that the new technology will lead to considerable improvements in productivity and hence to a potentially high level of unemployment in the information sector."

R. D. Bright, of the British Post Office, presented a progress report on Prestel (formerly known as Viewdata), the on-line public information service which has been under development in the U. K. for the past five years. Originally, it was planned to conduct a 12 to 18 month trial of the new service beginning in June 1978, and then decide whether to make it permanent. But public response has persuaded BPO to launch the full-scale service during the first quarter of 1979. Prestel will be available initially in five or six British cities and by the end of next year will be offered in a total of 10 cities. "By the end of 1983," said Bright, "it is envisaged that the service may grow to over 50,000 ports capable of supporting up to 3 million terminals."

—Phil Hirsch

(Mr. Hirsch, a frequent contributor to DATAMATION on communications related affairs, once was the magazine's Washington correspondent.)

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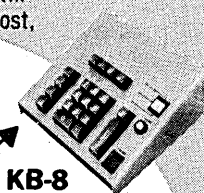
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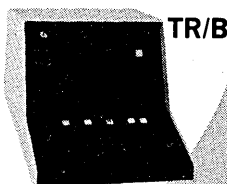
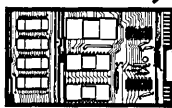


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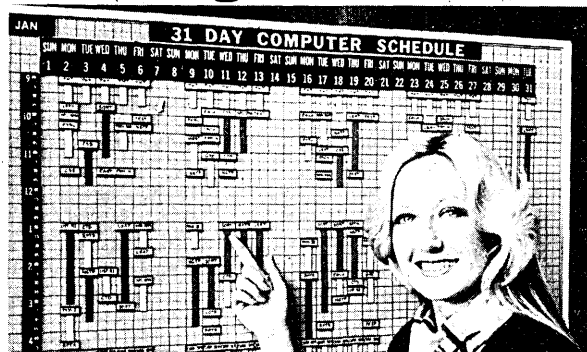
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BENCHMARKS

BREAK FOR MEMOREX? Some observers think Memorex Corp. has been throwing money down a rathole in its antitrust suit against IBM which ended in a mistrial this summer when a jury deadlocked (August, p. 56). Last month IBM won a directed verdict by a federal judge which, in effect, held that the giant didn't compete illegally against Memorex. Said IBM chairman Frank T. Cary: "There ought to be a limit to the number of times we must go to trial on these same issues." Although Memorex has spent somewhere between \$1 million and \$1.5 million a year in its suit, it hasn't been counting on a victory to finance its growth, having placed \$50 million in new debt last June and selling 1.3 million shares the next month to raise \$41.5 million. After the directed verdict was issued, Memorex stock dropped 1.5 points, but then rebounded past \$55 a share, a result of the company's recent strong growth. Memorex said it will appeal the directed verdict. (Transamerica Corp., next of the so-called western litigants against IBM, said it will pursue its case against IBM, scheduled for trial Nov. 6.)

AT&T TRIAL DATE: In hearings before the House Communications Subcommittee last August, Assistant Attorney General John H. Shenefield said the government hopes to start its antitrust trial against AT&T in October of 1979. He also hopes the trial will be completed in three to six months, but could take as long as a year. He said the appeal process might take at least 18 months. In a related development, U. S. District Judge Joseph C. Waddy, who had presided over the Justice Department's suit since it was filed, died last month. In late June, District Judge Harold H. Greene took over the case when the seriousness of Judge Waddy's illness had been learned.

NCR IN MICROFILM: NCR Corp. may become the first major mainframer to offer microfilm recorders, even though IBM once sold one but eventually decommissioned it. The Dayton company last month offered \$7.5 million to acquire Quantor Corp., Mountain View, Calif., which in its last nine months has lost \$1,807,000 on revenues of \$15.5 million. Quantor has been making computer output microfilm and microfiche devices since 1969 and NCR has been a major distributor of the line in foreign markets. NCR also offers COM services in its 70 computer centers in the U. S. and abroad. The acquisition first must be approved by directors and stockholders of Quantor, but is expected to be completed before year-end. Said NCR's chairman William S. Anderson: "The acquisition will provide the base for ex-

pansion by NCR in the micrographics and related fields."

CDC ACQUISITIONS: Almost as CDC chairman William C. Norris was condemning "power-play corporation takeovers" before a congressional antitrust committee, CDC announced it had taken over control of Computer Peripherals, Inc. and had become a one-third owner of Scan-Data Corp., the Norristown, Pa., data entry firm. This spring CDC said it would invest \$500,000 in cash and make several supply and marketing arrangements with Scan-Data in a deal which would give them the one-third interest. It rearranged its deal with NCR and Britain's ICL in Computer Peripherals in which CDC and NCR each owned 42% of the company and ICL owned 16%. CDC now owns 60% and NCR and ICL now own 20%. CPI makes tape drives, printers, and mass storage systems.

In his testimony before a Senate Judiciary Subcommittee on Antitrust and Monopoly, Norris said a law is necessary to require stockholders of a predatory company to "exercise more rein over management by voting on unilateral takeovers that are contemplated." Basically he wanted more control over unwarranted takeovers. Norris said that all of CDC's takeovers dealt with voluntary acquisitions and never with acquisitions that were contested.

THIRD ENTRANT: Japan's Mitsubishi Electric Corp. will develop IBM software compatible computers for shipment in 1983 to the Japanese market where IBM holds about 30% of the market. The company said in late August it will budget the equivalent of \$108 million to develop the machines. Hitachi and Fujitsu, two other huge Japanese electrical manufacturers, already make IBM compatible machines.

ADR IN DATA BASES: Applied Data Research of Princeton, N. J., said it hopes to acquire the software business of Insyte Corp., Houston, which sells data base management and teleprocessing monitor packages for IBM mainframes. Officials of both companies said the deal could be completed before year-end. Insyte has some 200 software packages installed at more than 100 locations, while Applied Data has some 8,000 products installed at 5,000 locations. Said ADR's president John Bennett: "Insyte's line will fit into ours quite well because we sell to the same customers."

FIRST INSTALLATION: National CSS, the Wilton, Conn., service firm, announced it has installed the first 3200 minicomputer at its Sunnyvale, Calif.,

data center. The 3200, a 32-bit virtual memory system manufactured by Two Pi Corp., also of Sunnyvale, supposedly was up and running on NCSS's time-sharing network two hours after delivery. James McGuire, president of NCSS's Computer Div., said initial customer deliveries will start as planned in the late fall. The computer, ranging in price from \$200,000 to \$600,000, is the only computer system in its price range, according to McGuire, that can handle all of the major programming languages: COBOL, FORTRAN, PL/1, APL, BASIC and assembler language.

ADD IBM REORGANIZATION: IBM seems to be fostering greater decentralization and autonomy in the company as it continues to grow in complexity. Recently it announced it was studying forming a General Business Group subsidiary (August, p. 76) and last month it announced it was splitting its Systems Products Div. into two separate divisions: The Systems Products Div., headed by Jack D. Kuehler, president, with responsibility for development and manufacturing for intermediate performance range products; and the Data Systems Div., headed by John E. Bertram, president, which will develop and manufacture "large complex systems with primary emphasis on high-performance products." These would be the current 370/303X lines such as the 158 and above. SPD would be responsible for lines such as the 370/148 and below. Industry observers feel the SPD's responsibility eventually would be for the long-touted new product, the E-Series, which will be offered as replacements for the 115 through 148 models of the 370 line. At the higher end, DSD would be geared to handle the H-Series, which is expected to replace the 303X line and to extend beyond it. Formation of the new divisions, both of which report to Paul J. Rizzo, head of IBM's Data Processing Product Group, is understood by analysts to indicate IBM's concern with meeting such competitive threats as plug-compatible mainframes and alternative network plans such as AT&T's proposed Advanced Communications Service.

HINCHMAN SUCCESSOR: Dr. Larry F. Darby, acting head of the Common Carrier Bureau of the Federal Communications Commission since July 15, was named chief of the bureau in August, succeeding Walter H. Hinchman who left the bureau officially last August 31. Dr. Darby joined the bureau in March 1977 and has been chief of its Economics Div. since last fall. He's also been a close advisor of Hinchman.

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PROJECT PARADISE COMES DOWN TO EARTH

Citibank's decentralization plan is given a second look

by Laton McCartney

"Project Paradise," Citibank's highly touted program to decentralize its corporate data processing operations, has been relegated, temporarily at least, to the back burner as the world's second largest bank seeks to gain greater control over what well may be one of the most ambitious ventures yet undertaken by a dp user.

Started in the mid-1970s when Citibank began replacing its IBM mainframes with minicomputers—at least 250 minis currently are installed in the bank—the Paradise project has been widely heralded as a bold and highly innovative attempt to break away from the confines of the traditional, monolithic dp approach.

The scope of the project is staggering. In touring the various bank departments, each one of which seems to have its own individual data processing operation, one views the latest minicomputers, peripherals, office information processing and data communications equipment from scores of vendors.

Everywhere innovation seems to be the watchword. Much of the gear, such as the Datapoint ARC system the bank's personnel department is installing to handle everything from employee benefits to monitoring hiring patterns, has scarcely hit the market yet.

And some equipment such as the word processing terminals Citibank is incorporating into its microcomputer-based management workstations—terminals that were developed by Lexar Corp. in Los Angeles to Citibank's specifications and with Citibank's funds—hasn't even been publicly introduced yet.

With this enormous wealth of new technology, an ardent data processing devotee needn't die and go to heaven to see his fantasies fulfilled. He or she can simply get a job at Citibank.

Indeed, Paradise was designed to be just that—heaven on earth, or at least Nirvana in a decentralized processing environment. Its benefits, Citibank executives enthused publicly, were multitude: elimination of mountains of paperwork, tremendous savings in reduced manpower, more responsive service to the



ROBERT WHITE, Citibank's executive vice president and principal architect of Paradise, now says the bank's major program is "technological consolidation."

customer, greater access by the user to the dp function, and more direct user control over that function.

Recently, however, it's become increasingly apparent that Paradise may not be quite the unqualified success it's been touted as, and Citibank itself is

Paradise may not be quite the unqualified success it's been touted as.

evidently experiencing some serious second thoughts about the project.

Late last fall, in fact, Robert B. White, the 44-year-old Citibank executive vice president who is the principal architect of Paradise, gave the first indication the project was being reassessed and, in effect, put on hold. One of the bank's major programs for 1978, he announced, would be a "technological consolida-

tion."

Subsequently, Richard J. Matteis, a senior vp who reports to White, told the bank's corporate operations staff, the Service Management Group: "In the past, we were all given carte blanche to try new things, to come up with the most 'far out' kinds of ideas and to test them out in our own worlds. And now it is perhaps difficult to remember that it was never the intention that every program, every project, every effort would be locked in for eternity. Our aim was to try a variety of things precisely *so that* we could select from that variety the ones that succeeded best in practical business terms."

Outside the bank there was speculation that the consolidation was, in fact, forced upon White's group by the bank's top management which wanted to initiate more stringent controls on corporate dp spending that increased 23% in 1976 and 26% last year. "The whole Paradise thing had simply gotten out of hand," says a Wall Street analyst who follows Citibank. "White's group used to make a big point of saying that they weren't technology freaks with a big bankroll to spend on all kinds of new toys, but that's exactly how a lot of people perceived them."

Indeed, the "do your own thing" approach to technology has engendered a number of problems, and disappointments—some minor and others major. Despite its big gamble on the mini vendors and the fact that with its clout, the bank had a direct pipeline to top management within *these* companies, Citibank remains less than enthusiastic about the service it has been receiving. Consequently, the bank is seriously considering setting up its own in-house service organization. "In a macro sense, I don't think the level of service you get is as good as that offered by IBM," notes White.

Conversely, vendors and consultants who've been involved in the project complain that when they've gone in to try to convert a mainframe software program to a mini system, they often would be unable to find any documentation for the previous program. Moreover, the author of the software had frequently vanished into another section of the bank so there was no one around to explain the old

program.

"One of the problems with decentralization," a former Citibank employee notes, "is that when you decentralize, you also disperse your talent. Subsequently, you have to determine where the people are who know what's going on.

"You also had what I call the hyper-mobility syndrome there," he adds, "with lots of aggressive, talented data processing people looking to move up the ladder as quickly as possible. They would come in, write a program, be promoted, and then move on. That's not exactly the kind of environment that afforded continuity or made for a smooth transition."

Additionally, some segments of the bank's corporate processing—particularly where it interfaced with outside institutions like the Federal Reserve, which operates on a centralized dp structure—simply couldn't be "Paradised" at all, at least not for the time being.

As a result, some of the bank's early repudiations of mainframe architecture came back to haunt it. For example, speaking before a distributed processing seminar early in 1977, then Citibank vice president Jon S. Gould confidently outlined the bank's plans for eliminating its two remaining IBM 370/158s through downward migration. Within a year the 158s would be replaced by four to six 145s or 148s. Gould said, after which a dozen or so PDP-11/70's were to be brought in.

Today, in fact, the 158s *are* being replaced, but by an IBM 3031. White, however, maintains that the 3031 is "definitely coming out in 1979," and will then be replaced by minis.

Certainly the most troublesome phase of Paradise, though, involved efforts by the bank's Securities & Government Services Group to replace an IBM 370/165 with eight Interdata 8/32s, which were due to be fully operational by July 1975.

At the time, the 32s had just come onto the market and a source close to the Citibank acquisition of the machines explains they were selected primarily because Citibank insisted that the stock transfer processing be done in COBOL. The 8/32s boasted a COBOL compiler, while other mini-vendors in competition for the contract, like DEC, did not have a COBOL capability.

The Interdata machines had hardly been unpacked from their shipping crates when then Citibank vice president John L. Hughes, who was responsible for the project, began extolling the merits of the new decentralized system. The bank, he told DATAMATION, would cut in half previous annual processing costs for stock transfer that amounted to \$2.8 million for the IBM hardware.

The only real problem Hughes foresaw was the difficulty in overcoming what he termed the "IBM mental set." "You must

get your people to think in terms of functional systems, and small modular programs," he advised. "Do not accept any excuses as to why their program or system is unique and cannot be converted to a mini."

Overcoming the IBM mental set, however, turned out to be the least of Hughes' problems in converting the stock transfer application. Among other things the In-

terdata hardware and software mix reportedly was not capable of allowing the multitasking that was critical to the application. The power of the 8/32s couldn't be utilized effectively because the I/O transfer rate (one channel transfer had to be completed before a second could be initiated) slowed access down enormously. And the COBOL compiler, which had been key to Interdata's land-



CITICORP'S NEW CORPORATE HEADQUARTERS—No more "carte blanche."

ing the initial \$2 million contract, was so new that neither Citibank nor Interdata knew how to make it function effectively.

The upshot of the Interdata venture was that the bank's stock transfer system was in such chaos that at one point Citibank reportedly had to enlist the aid of other banks to handle some of its transactions. In addition, it lost some of its major institutional clients such as Merrill Lynch, Pierce, Fenner & Smith.

To rectify the situation, Citibank has spent upwards of \$10 million writing new software for the stock transfer operation, it is estimated. The bank also is reported to have brought in a small army of consultants and eventually established a centralized data center management group under bank vp Max Gould to control the decentralized effort. Further, the creation of the group "allowed us the leverage to get what we wanted out of Interdata," adds Robert Gottlieb, another bank vp who now manages the stock transfer operation.

Today, with some 35 8/32s (at a total hardware cost of about \$10.5 million) and a host of additional equipment such as Wang small processors for on-line certificate issuance and Compuscan word processing gear to log customer inquiries, the securities operation apparently is functioning smoothly.

In retrospect, White maintains the problems that arose had to do with the way the operation was managed rather than with the decentralized philosophy that lies at the heart of Paradise. "The people we had in charge of that operation were not technically ready to run a brand new hunk of hardware and software," he explains.

Candidly, White also concedes that if he had a chance to do the stock transfer operation over again, he'd probably use the DEC 11/70 gear rather than Interdata. Moreover, he doesn't preclude eventually replacing those Interdata machines with DEC equipment.

In the wake of the stock transfer experience and the consolidation effort, Citibank is busy sorting out the weeds from the flowers, to use the bank's analogy. "We had a period we called 'let all the flowers bloom,'" Dick Matteis explains. "A number of projects developed during that period proved more successful than others, and now we're selecting the better projects and developing them to serve as building blocks for the future."

Chief among these building blocks is the Corporate Banking Station, or CBS. Here processing is broken out by corporate clients which use such Citibank CBS products as letters of credit and investment management monitoring tools.

Citibank has designed the system so that the data for perhaps five or six corporate customers is stored on an 11/70. (Originally the 11/70s were devoted



CARL L. HOWARD



ROBERT GOTTLIEB, who manages stock transfer operation (left) and Bruce Hasenyager, who heads bank's Text Communications staff.

to product, rather than customer, data bases, but Citibank has recently changed that.) The machine in turn is accessed via crt by the manager who is responsible for dealing with those half dozen or so corporate clients on the computer. Again the philosophy here reflects the thinking behind Paradise: First, give management direct access to the dp function which handles its customer's processing; second, make sure the customer's requirements are the prime consideration in designing the processing structure.

Citibank is also high on the management workstation, which typically incor-

A digitized phone can tie the terminal into Citibank's digital network or be used for voice communications.

porates two Lexar text editing and display terminals, a Qume printer and a microprocessor for distributed processing and data storage within the workstation environment.

Additionally, the bank is using a digitized phone that can tie the terminal into Citibank's digital communications network, CITINET, or can be used for voice communications by personnel at the workstation. "I'm already satisfied that the workstation is successful in bringing together computer and communications capabilities into the office environments," says Bruce Hasenyager, who heads the bank's Text Communications staff.

And while these programs and other efforts such as Citibank's Global Com-

munications Network and its new check processing system are being carefully nurtured, the bank has begun taking a more controlled and integrated approach to the various and diverse outcroppings of its "let all the flowers bloom" phase.

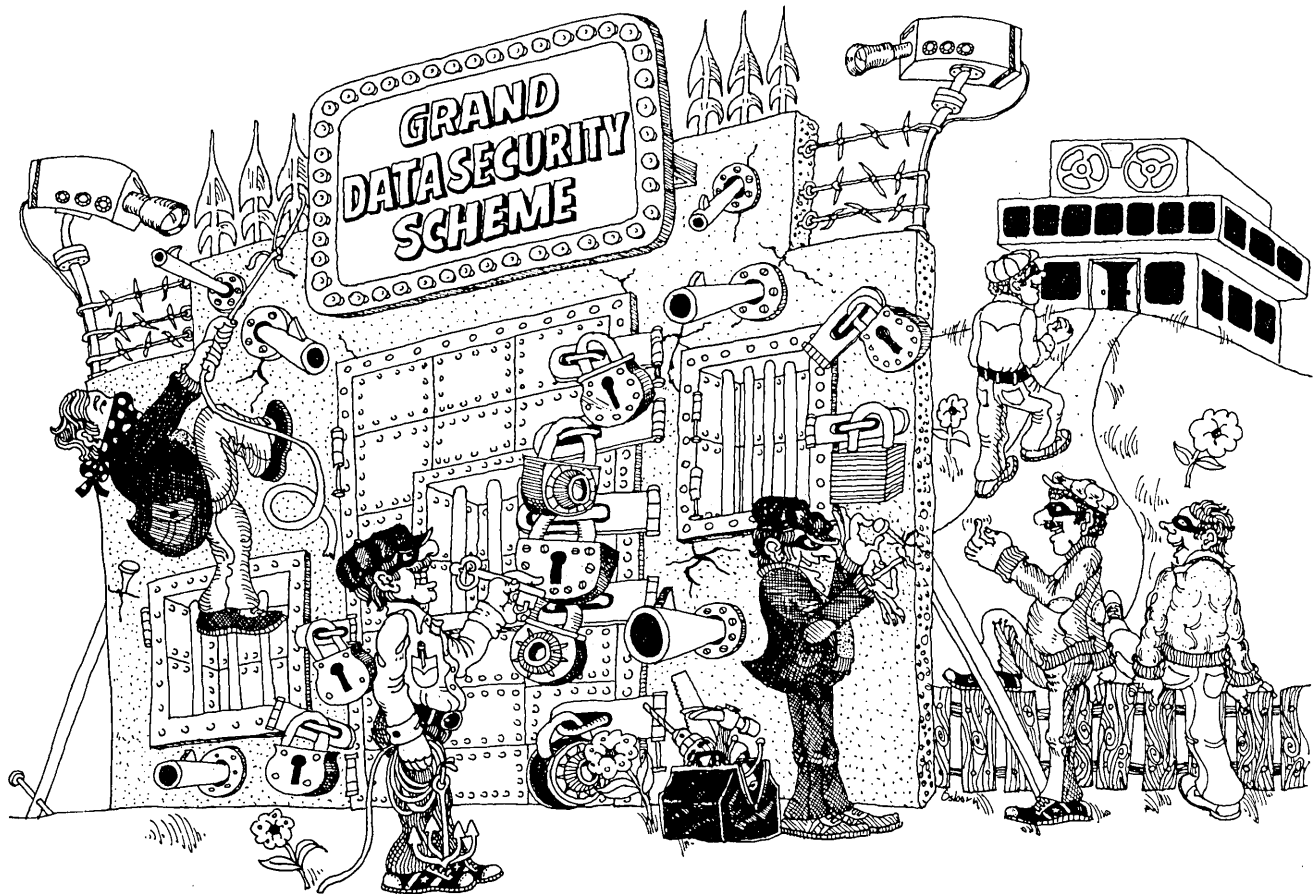
It is installing data capturing mechanisms in a program called Citiproof to track transactions that have a financial impact on the bank. Concurrently, an MIS system dubbed IAMUS is under development so that the bank's top management and its own internal financial people can monitor spending within the various bank departments.

Even more significantly, the bank has spent more than a year modifying and customizing the DECNET-RSTS data communications software so that it ultimately could function as standardized front-end software architecture for the entire Citibank corporate dp operation. "This can serve as the nucleus for future systems as we add new applications," White says.

Further, the newly formed Communications and Processing Group headed up by Matteis has as a major objective, as Matteis says, "to support the integration process—to help fold in our recent achievements throughout the processing environment so as to bring them into the mainstream of our thinking and planning and acting."

The linchpin of the integration process is CITINET, the packet-switched network the bank is putting into operation. Utilizing Arpanet software customized for the bank by Bolt Beranek and Newman, the network, which employs Honeywell Level 6 minis as distributed nodes, now is being interfaced with the various mini-

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CIRCLE 56 ON READER CARD



CITIBANK is estimated to have spent \$10 million to write new software for its stock transfer operation.

CARL L. HOWARD

computer and mainframe systems that make up corporate processing.

Here Citibank seems to be paying the price for its technical diversification. The price tag for each software interface amounts to \$50,000, bank executives estimate. Moreover, the do-your-own-thing atmosphere that prevailed in selecting minis is not evident here. "If someone needs computer to computer communications, we won't fund the project unless they come on to the network," Matteis asserts.

In effect, then, Paradise, is being brought back down to earth. With the consolidation effort, White now seems determined to use this technology not only to ensure savings in the form of fewer employees, but to generate profits and bring in new business as well.

Though it has generated revenues in the past by processing New York City income taxes and the city's parking violations, White's group hasn't really had much success in this area. It lost out on a three-year, \$100 million assignment to process New York's Medicaid program, and efforts to enter the time-sharing market were hamstrung by a suit initiated by the Association of Data Processing Service Organizations.

However, bank observers say that

White's group is anxious to have a greater impact on the bank's bottom line now because of a rivalry with Citibank executive vp John S. Reed, who heads the Consumer Services Group—the equivalent to White's group on the retail side.

Reed, who initially hired White, has spent an estimated \$175 million in automating retail banking operations and in aggressively trying to capture a bigger share of the retail market. A former Citibank executive says that White has become increasingly profit conscious as a result of Reed's efforts.

Already, SMG has begun selling its money management services—complete with a terminal installed in the customer's office—to big corporate clients, directly competing with firms in the field like Rapidata and National Data Corp. The latter ironically supplies the same service to Citibank.

Further, White currently is evaluating the potential market for the text processing terminal and the workstation. "We're looking for ways we could package this approach and sell it to other people," he notes, "but we're constrained legally because a bank can't sell hardware."

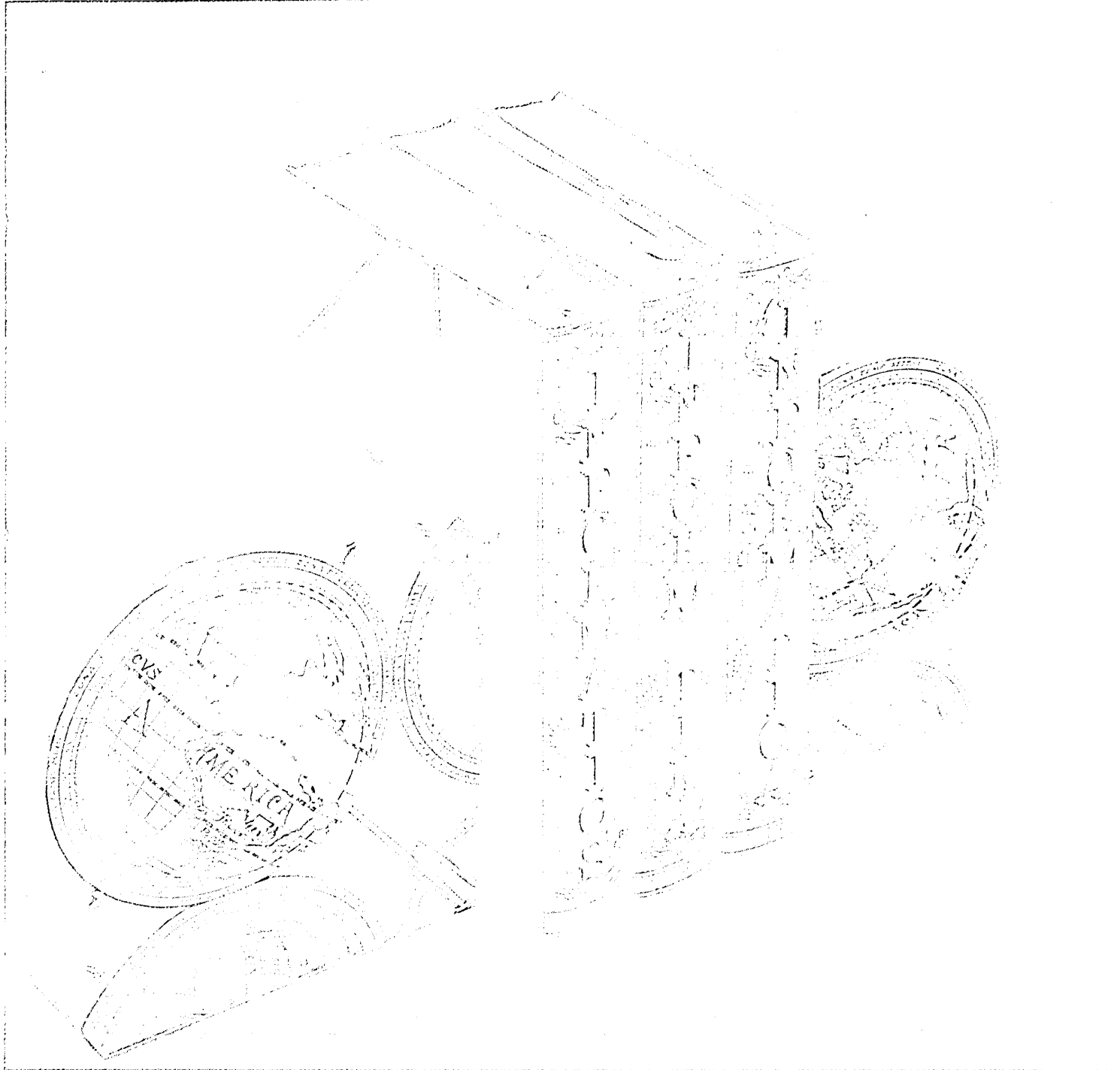
Even if Citibank were not constrained, however, it would face a problem in marketing the Lexar equipment it fund-

ed. Lexar officials say that the product is entirely theirs, and that Citibank has no claims upon it unless Lexar licenses another company to sell it. Then Citibank would receive a portion of the licensing fee.

Whatever happens with Paradise, in White's view at least, the project has accomplished its primary goals. The Citibank back-office staff has been cut back, and the bank today is far more responsive in dealing with its customers than it was in the pre-Paradise era, White claims. Further, the problems that have surfaced in implementing Paradise don't really count for much in the context of the overall objective of making Citibank a more efficiently run business, White maintains.

"You can optimize the edp arena, but often that optimization comes about at the expense of the business itself," White explains. "Our operations are dramatically inefficient in a data processing sense, but we're much more efficient in a business sense as a result."

If White is right, the dp hierarchy may have to throw out the conventional rule book and go by a whole new set of guidelines. If he's wrong, it certainly won't be for lack of boldness or imagination. *



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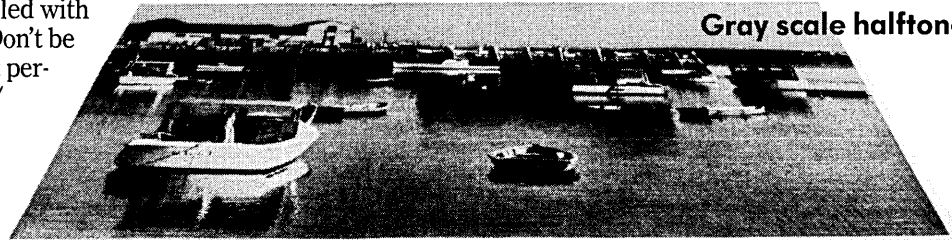
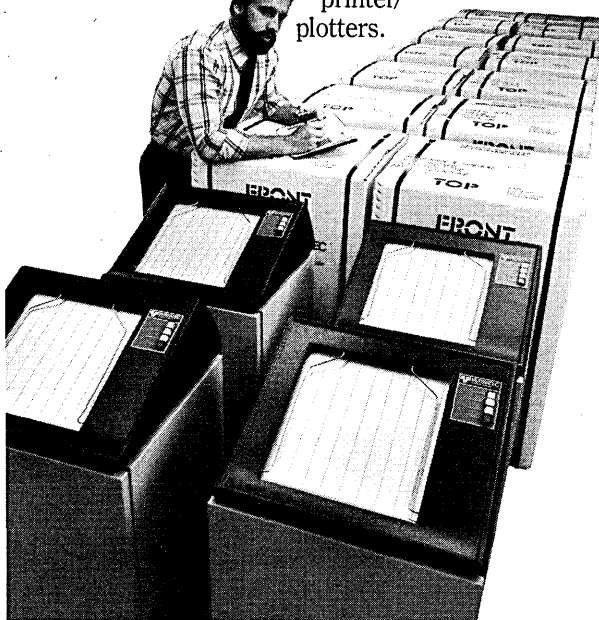
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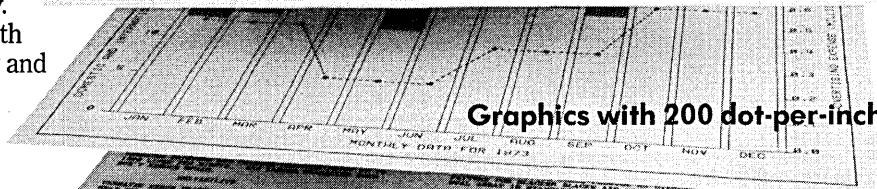
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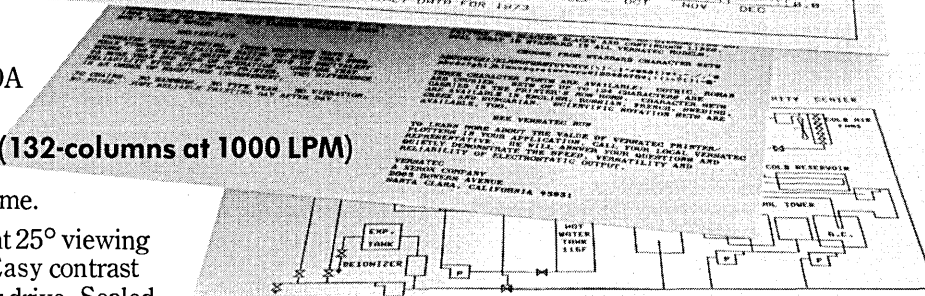
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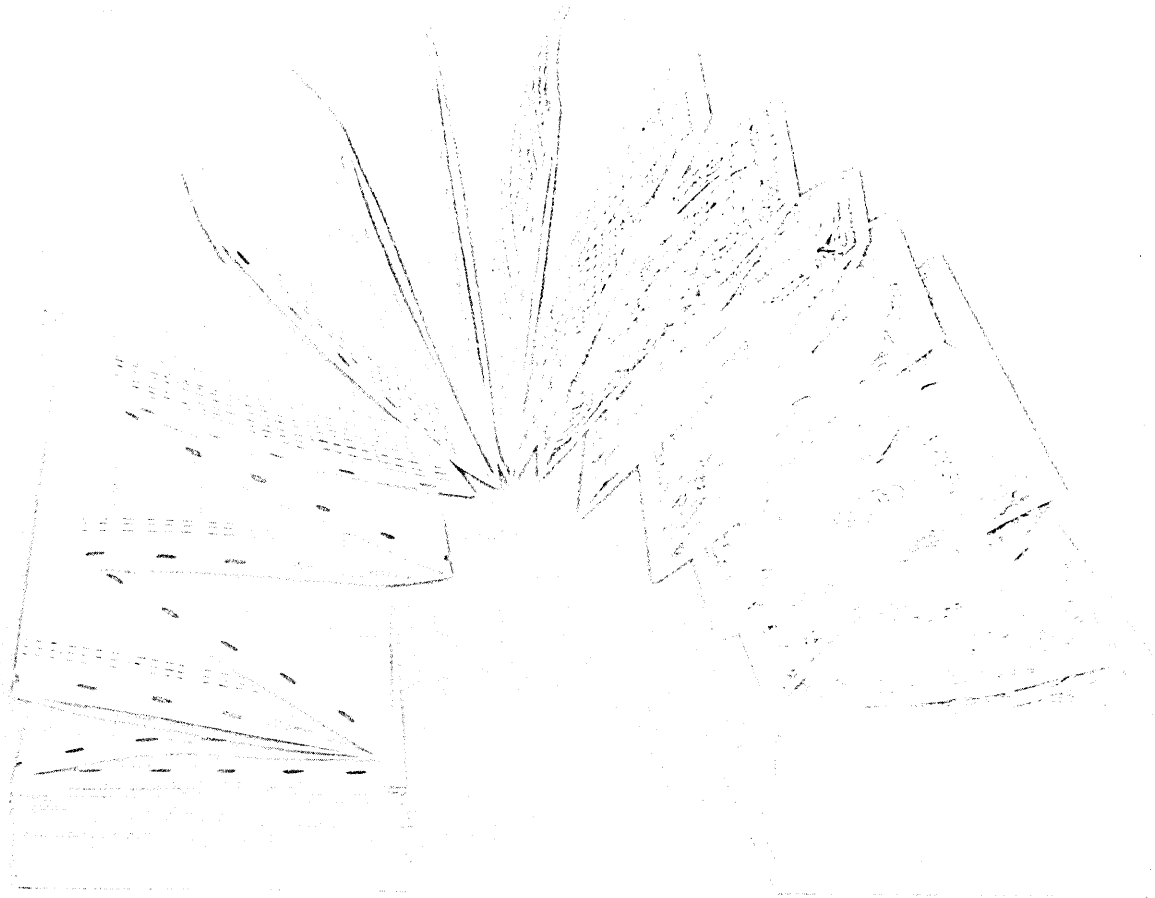
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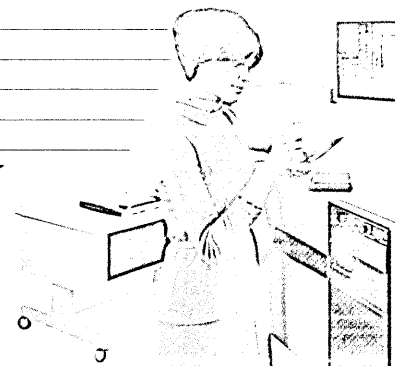
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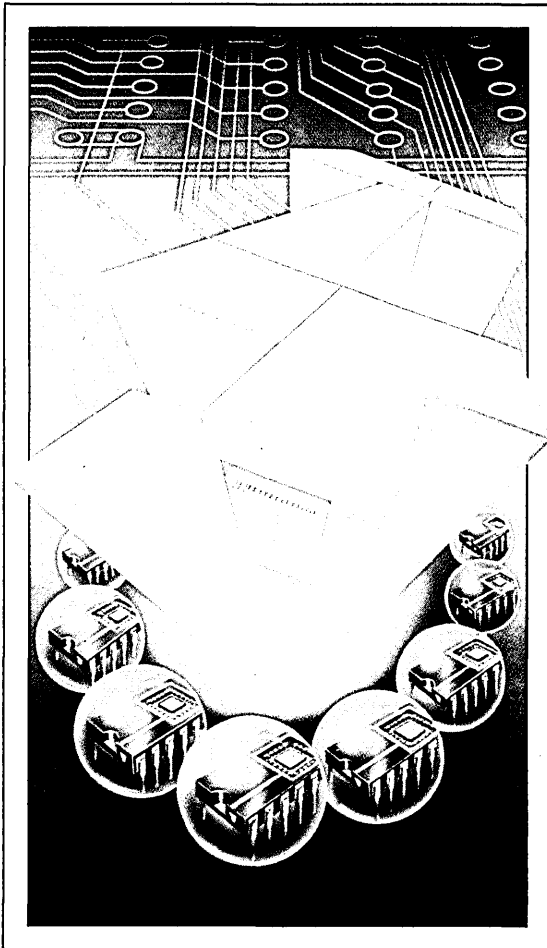
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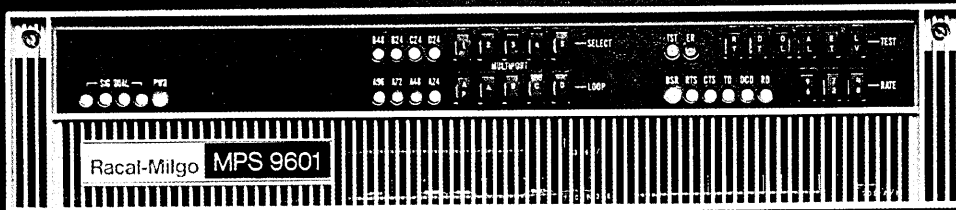
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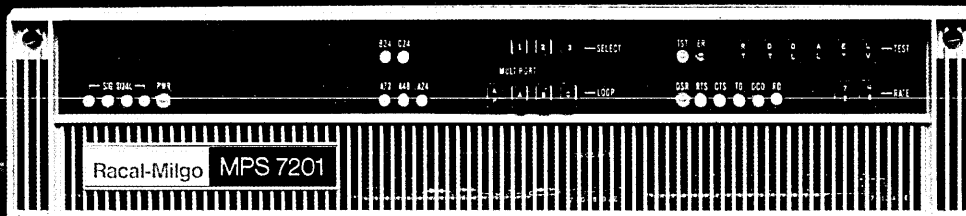
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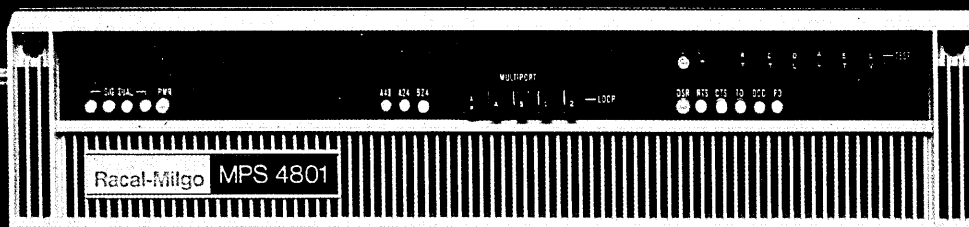
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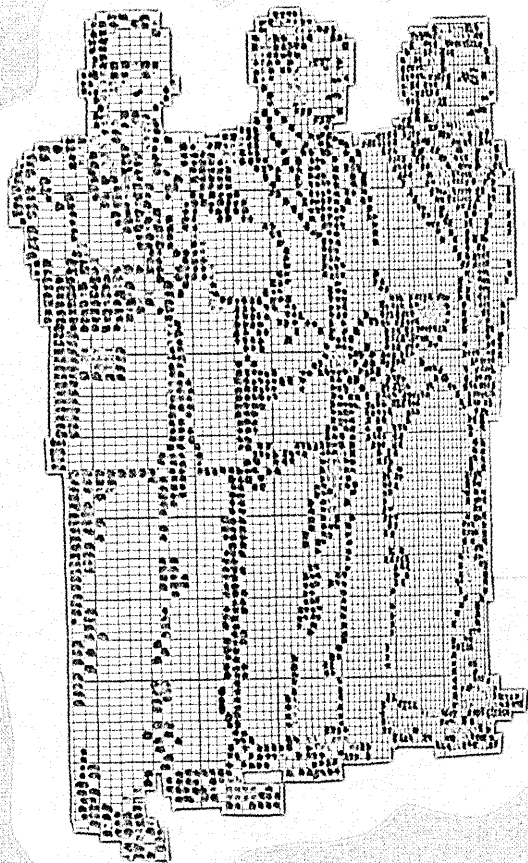
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Dp professionals are not like those in other fields.

WHAT MOTIVATES DP PROFESSIONALS?

by J. Daniel Couger
and Robert A. Zawacki

On a recent trip to Des Moines, we were forced to make a change of planes in Lincoln, Nebraska. While we were waiting in the terminal, another passenger made a surprising seat request. He wanted to sit in the middle seat in the three-abreast arrangement of the Boeing 727. One of us asked the Frontier clerk if



this request was as unusual as we suspected. "First time it ever happened in my five years with the airline," he responded.

Odds are that this passenger wasn't a programmer or an analyst. We have just concluded the first part of a survey on what motivates dp employees. The survey revealed that systems professionals have a startlingly low proclivity to social interaction. In fact, the results showed that these jobholders have

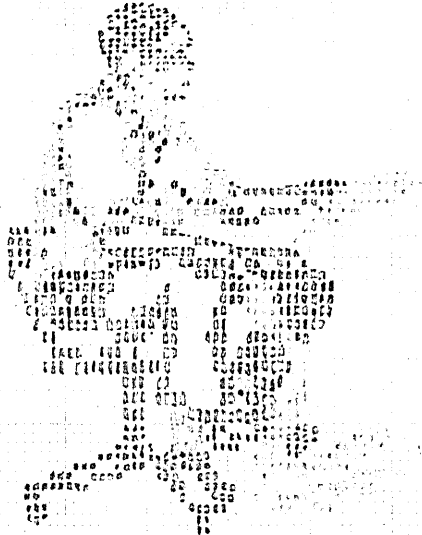
negligible need to work with other individuals.

It follows that programmers and analysts are not necessarily seeking the kind of interaction that programming team concepts are imposing. (Other results suggest that systems professionals won't readily take to the increased specialization that team concepts call for either.) These approaches might be well accepted in other fields, but their implementation requires special consid-

erations for dp personnel.

Dp professionals are different from others in a variety of ways, the research shows, including having a higher need for personal growth than other professionals do. The results show much more too, verifying some of the suspicions we have always had about dp professionals, and providing some surprises in other areas.

We're learning that the computer profession, now more than 25 years old,



They have a stronger need for personal growth than any other professionals exhibit. . .

may be assuming some of the behavioral problems characteristic of older disciplines, such as engineering and accounting. Worker alienation is a major problem in many fields today. Jobs have not kept pace with changes in our society such as in worker attitudes, aspirations, and values. Managers have attempted to reduce alienation and improve the quality of work life by trying a plethora of ideas for humanizing work, including sensitivity training, management by objectives, shortening the work week, expanding worker involvement in the decision making process, etc.

Those old signs of job dissatisfaction are emerging in the computer field too. Although the aura of excitement of a dynamic field continues to attract persons into the profession, it no longer retains them. Individuals are seeking a more meaningful experience than just being part of a fast growing profession. The job itself must produce the essential elements of satisfaction.

The behaviorists have identified factors key to motivation and satisfaction in other disciplines. But are they the same for our profession? Even if they are identical, does each factor have the same degree of importance in our field as in others? What does motivate the dp employee?

A straightforward way of answering those questions is to compare the data processing professional's perceptions of their jobs with job perceptions of other professionals. This can be done using the model in Fig. 1.

KEY JOB FACTORS The model identifies five important characteristics of a job (called "core job dimensions" by the originators of the model). Skill variety (tasks that challenge the individual's skills and abilities), task identity (completing a "whole" and identifiable piece of work), and task significance lead to experienced meaningfulness of the job. Task autonomy leads to experienced responsibility for outcomes of the job. Finally, feedback concerning effectiveness of the employee's efforts provides knowledge of results of the job.

Since the model has been used to collect information on other professionals, it allows us to compare dp professionals to some kind of a norm. It turns out that systems analysts and programmer/analysts rate their jobs higher, in terms of the existence of these

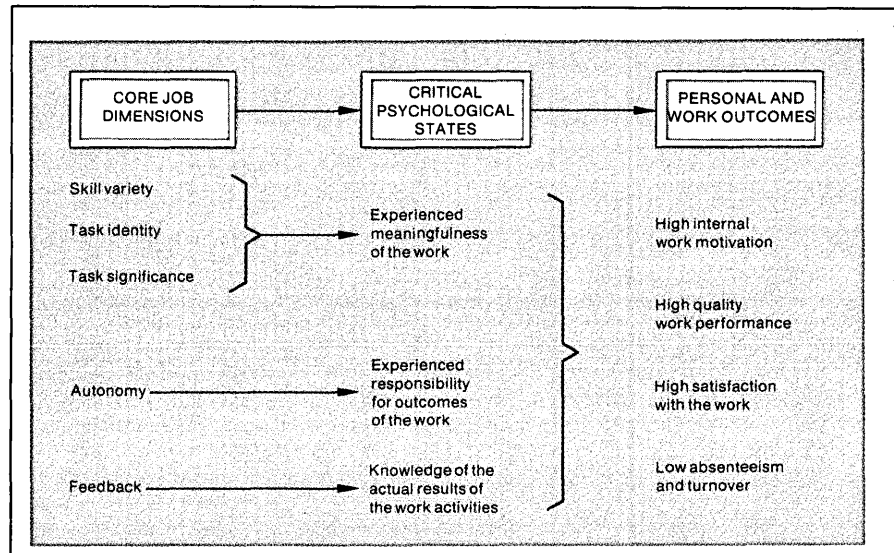


Fig. 1. According to the behaviorists' model, developed by Hackman and Oldham, the presence of five key job characteristics leads to the employee feeling that he experiences meaningfulness from his work, responsibility for outcomes of the work, and knowledge of the results of the work. These "critical" psychological states," in turn, lead to high productivity and low job turnover.

Numerous studies have been done using a Job Diagnostic Survey, to determine whether those core job dimensions are available in various jobs. The authors have tailored the survey mechanism to fit dp employees, making it possible to learn how dp employees see their jobs and whether their perceptions of their work differ from those of other employees.

Core Job Dimension Factors	Data Processing Professionals			Other Professionals
	Analysts	Prog./Analysts	Programmers	
Skill variety	5.55	5.45	5.23	5.36
Task identity	5.37	5.29	5.00	5.06
Task significance	5.75	5.72	5.46	5.62
Autonomy	5.31	5.48	5.13	5.35
Feedback from job	5.20	5.05	5.10	5.08

Table 1. Data processing analysts and programmer/analysts rate their jobs higher in terms of key job characteristics than do "other" professionals. Programmers, on the other hand, rate their jobs lower.

The "other professionals" data comes from studies by Hackman and Oldham of over 6,000 persons in the sciences, law, religion, education, writing, art, and entertainment and recreation fields. (Scale: 1 to 7.)

key job dimensions, than other professionals do. However, programmers rate their jobs slightly lower than other professionals do. (See Table 1.)

The model identifies three "critical psychological states" associated with high levels of internal motivation, satisfaction, and quality of perfor-

mance—and with correspondingly low levels of absenteeism and job turnover.

The two behaviorists who developed the model, Greg R. Oldham from the Univ. of Illinois and J. Richard Hackman from Yale Univ., use the three "psychological states" experienced by a golfer to illustrate the

effect of core dimensions: "Consider, for example, a golfer at a driving range, practicing to get rid of a hook. His activity is *meaningful* to him; he has chosen to do it because he gets a 'kick' from testing his skills by playing the game. He knows that he alone is

responsible for what happens when he hits the ball. And he has *knowledge of the results* within a few seconds." (J. R. Hackman, G. R. Oldham, Robert Janson, Kenneth Purdy, "A New Strategy for Job Enrichment," *California Management Review*, 1975, vol. 17, no. 4,

pp. 57-71.)

1. *Experienced meaningfulness.* The individual must perceive his work as worthwhile or important by some system of values he accepts.

2. *Experienced responsibility.* He must believe that he personally is

ABOUT THE SURVEY PROJECT

We began our research project with the hypothesis that data processing professionals *are* different. We sought to identify key variables in job satisfaction and motivation. The ultimate objective is to identify ways in which jobs can be redesigned to improve satisfaction and productivity.

Our research team (a computer scientist and a behavioral scientist) organized the project into three phases, only the first of which has been finished. *Phase I* involved identifying norms for the field. We surveyed data processing personnel in 25 organizations, both in industry and government. The industries represented include: food processing, airlines, electronics, retailing, banking, insurance, and mail order sales. Their data processing organizations ranged in size from 25 to 150 employees and were located in all geographic regions of the United States.

The government organizations included operations at the city, state, and federal level. Their dp groups varied in size from 30 to 200 employees, and were located in 15 states.

Together, more than 600 dp professionals (analysts, programmer/analysts, and programmers) were surveyed, as were more than 1,000 persons in other dp jobs. Tentative findings are presented here on the motivating potential of the three types of "professional" jobs within our career field, and on the motivation patterns of the people in our profession.

Phase II of the project will continue through next year. In it, five to eight firms in five different industries (including, incidentally, the software development industry) will be surveyed to determine the interindustry differences. Government versus private industry comparisons also will be made.

To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing—aside from any "feedback" co-workers or supervisors may provide?

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7

Very little; the job itself is set up so I could work forever without finding out how well I am doing.

Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.

Very much; the job is set up so that I get almost constant "feedback" as I work, about how well I am doing.

In *Phase III*, which will go on through 1980, we will use techniques proven in other fields to analyze dp jobs for ways to improve job satisfaction, employee motivation, and productivity. This research will include all jobs within a dp unit: key entry, data control, computer operation, programming, systems analysis, programming/analysis, supervision, and management. (These job redesign projects begin this year under a government grant. Similar projects will be undertaken in private industry as funds become available.)

We originally sought to define a survey instrument tailored to the dp field. After two months of evaluating various instruments we decided to use, instead, the Job Diagnostic Survey (JDS) developed by Oldham and Hackman, for two principal reasons:

1. The Hackman/Oldham instrument is conceptually sound. Its validity and reliability have been substantiated in studies of more than 6,000 subjects on more than 500 different jobs in more than 50 different organizations.

2. A major objective is to compare our results with prior studies of

personnel in other professions. Our hypothesis on the difference between dp professionals and other personnel could be tested if we used the JDS.

We expanded the survey questionnaire to include other elements: employee perceptions on relative importance of problems relating to maintenance, realistic work schedules, access to the computer, access to supervisors and access to others (such as users or personnel in other departments whose work affected ours). Also added to the survey instrument was a section on the relative importance of eight categories of compensation.

The resulting Job Diagnostic Survey contains 94 questions and produces information on 45 variables. The survey is administered individually, in approximately 30 minutes.

Most survey questions ask participants to record their response on a scale of one through seven, as in the example below.

All survey results were analyzed with the computer packages for Analysis of Variance (ANOVA) and SPSS (Statistical Processing for the Social Sciences). ❁

accountable for the outcomes of his efforts.

3. *Knowledge of results.* He must be able to determine, on some fairly regular basis, whether the outcomes of his work are satisfactory.

If these conditions exist, a person "tends to feel very good about himself when he performs well." Those good feelings motivate him to try to continue to do well. This is what the behavioral scientists mean by "internal motivation," as opposed to external motivation factors, such as incentive pay or compliments from the boss.

The relationships between the three psychological states listed above and the on-the-job outcomes is illustrated in Fig. 1. When all three are high, then internal work motivation, job satisfaction and work quality are high, and absenteeism and turnover are low.

Data processing employees, according to our results, feel they experience about the same level of meaningfulness from their jobs as do other professionals, but have lower perceptions of the degree of responsibility and knowledge of results. (See Table 2.) The poor ratings on "knowledge of results" stems directly from another category we tested, "feedback from supervision," since feedback from the job itself is about the same for our industry as for others. It appears that our supervisors are not doing anywhere near as good a job as their peers in other professions in providing feedback to employees. (See Fig. 2). This is an area where immediate improvement is possible.

Also, using the model, a single index can be computed which characterizes a job's motivating potential. That index is called the "motivating potential score," and can be used to compare dp jobs with others. The meaningfulness of this index can be illustrated by showing its relationship to things like absenteeism and job performance, as in Fig. 3.

The right hand side of the model (Fig. 1, again) pictures the "personal outcome" from an individual's job. However, the Job Diagnostic Survey (JDS) used with the model does not measure actual work outcomes: productivity, employee perceptions of their productivity, turnover, or absenteeism. Instead, employees report directly how satisfied (or dissatisfied) they are with various aspects of their job. Table 3 provides those results. It indicates that dp professionals generally are satisfied. However, although their general satis-

Psychological State	Data Processing Professionals			Other Professionals
	Analysts	Prog./Analysts	Programmers	
Experienced meaningfulness	5.56	5.49	5.23	5.40
Experienced responsibility	5.31	5.48	5.13	5.75
Knowledge of results	4.59	4.42	4.55	5.00

Table 2. In measures expressing how meaningful they feel their jobs are, or how responsible they feel for the outcome of those jobs, dp professionals—especially analysts and programmer/analysts—are not far different from other professionals. In terms of feedback on the results of their work, however, dp employees rate their jobs lower than other professionals do; their supervisors may be at fault for that. (Note that the ratings are **derived** from those in Table 1. Scale: 1 to 7.)

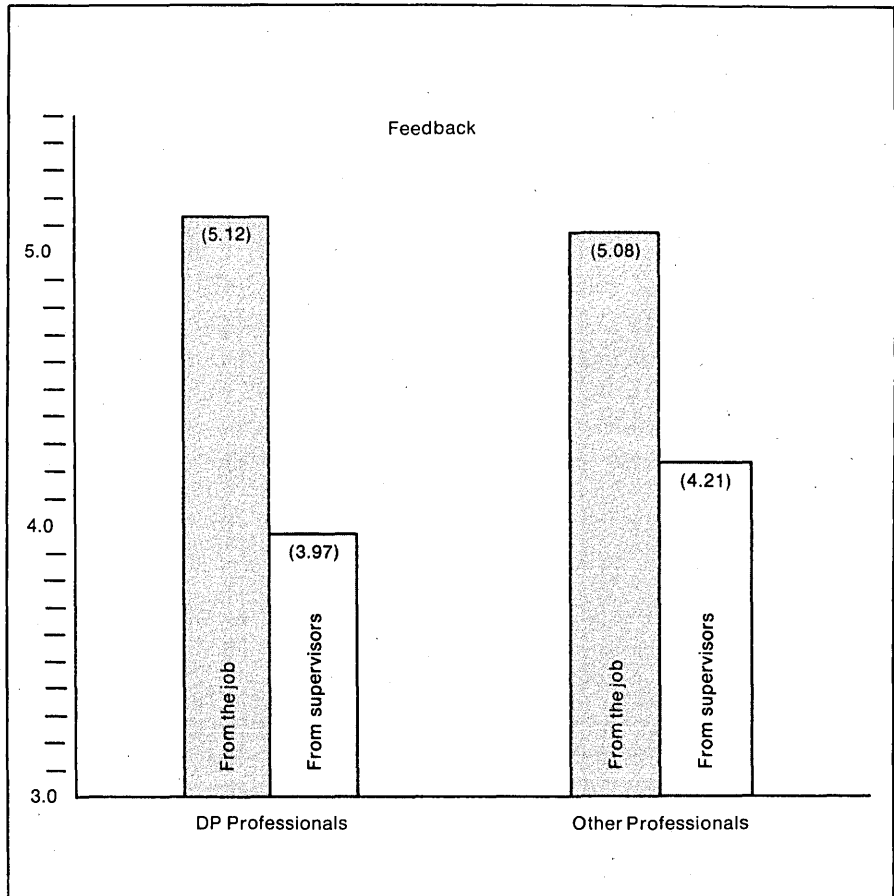


Fig. 2. Data processing professionals say they receive most of their feedback on their performance from the job itself, as do other professionals. But the amount of feedback dp employees feel they get from their supervisors is substantially lower than that seen by other professionals—an obvious place for improvement. (Survey responses are given on a scale of 1 to 7.)

fraction is higher than that of other professionals, they are less satisfied with supervision.

The JDS proved to be an especially good discriminator. One organization surveyed was not "healthy," in behavioral terms. All others were. In fact we attempted to survey only organizations whose working environment was healthy, because we wanted to build "norms"; in the past our profession has been without benchmarks in the behavioral areas. The unhealthy organization was significantly below the norms on most of the core job dimensions. With the information from the model we have a substantive basis for beginning the job redesign process in that organization.

GROWTH NEED VS. SOCIAL NEED

We expect that people who have a high need for personal growth and development will respond more positively to a job high in motivating potential than people with low growth need strength will.

Obviously, not everyone is able to become internally motivated—even when the motivating potential of the job is quite high. Behavioral research has shown that the psychological needs of people determine who can (and who cannot) become internally motivated at work. Some people have strong need for personal accomplishment—for learning and developing beyond where they are now, for being stimulated and challenged, and so on. These people are high in "growth need."

The need for growth is quite high for dp professionals, compared to other professionals and to other job categories. Table 4 shows this effect. This outcome has little surprise for managers accustomed to insistence by their staff that they be provided training, be allowed to attend conferences and seminars, etc. (A frequent result of behavioral research is that intuitive beliefs are substantiated. Survey data on growth need is a good example.)

However, the key reason for computing growth need is to compare it with the job's potential to fulfill that need. A job low in motivating potential will frustrate a person with high need for growth. It is a perfect example of the old cliché of a round peg in a square hole.

The motivating potential score shown in the right column of Table 4 enables a comparison of the job potential to the employee growth need.

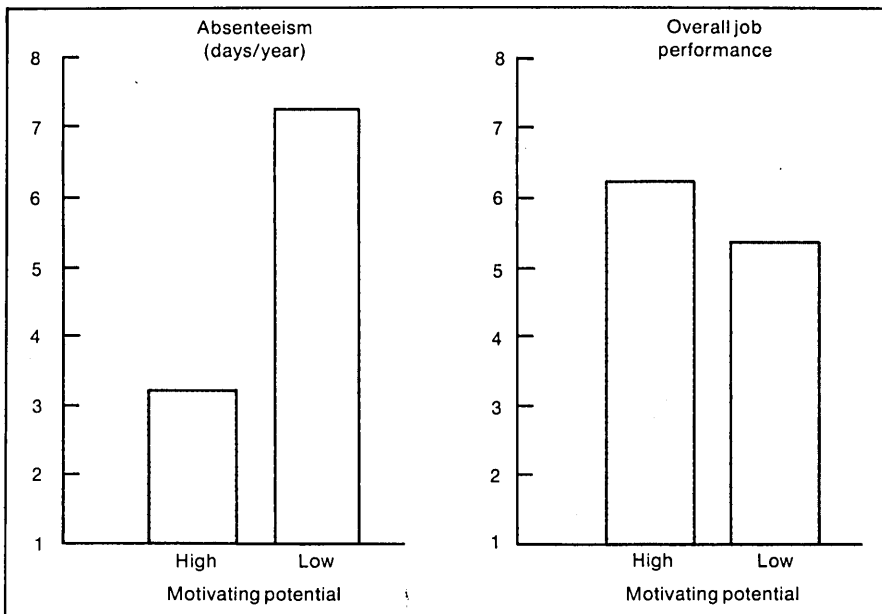


Fig. 3. The motivating potential of various jobs can be calculated from the results of the Job Diagnostic Survey, and the index proves to be very well related to things like absenteeism. The results above are from the Hackman/Oldham study of more than 1,000 employees working on about 100 jobs. (The job performance is as rated by supervisors on a 1 to 7 scale.)

Job Category	Growth Need	Motivating Potential
Dp professions	6.02	157.5
Other professions	5.59	153.7
Sales	5.70	146.0
Service	5.38	151.7
Managerial	5.30	155.9
Clerical	4.95	105.9
Machine trades	4.82	135.8
Bench work	4.88	109.8
Processing	4.57	105.1
Structural work	4.54	140.6

Table 4. Putting an employee with high growth need into a job with high motivating potential leads to a high quality performance and to low absenteeism and turnover. Trying to put an employee with low growth need in such a job, such as the structural worker in this table, risks overstretching the individual.

Fortunately, there is a good match in what dp jobs have to offer and what dp employees need. (The scale for growth need is again 1 to 7; the "motivating potential" scores are derived numbers and are not relative to any scale.)

Hackman's and Oldham's survey results shown include an example of the imbalance of growth need and motivating potential. Notice that the lowest growth need is for structural work. On the other hand, the motivating potential for that field is near the midpoint for all jobs reported in the table. Thus, jobs in that industry have a motivating

potential above the growth needs of the workers.

The dp field provides some better matches. Both the dp individual's growth need and the dp job's motivating potential score are high—the highest in the table. (Unfortunately, our research indicates that such a balance is not so prevalent among the other jobs in the

data processing organization. We'll report on that in later articles.)

Although the average for all organizations in our study showed a high positive correlation between growth need and motivating potential, this was not always the case for individual organizations. For example, the organization with the next to the highest growth need in our survey was the lowest in motivation. In contrast, another organization with the lowest growth need was highest in motivation. Now that they are aware of this disparity, these organizations can analyze their jobs to reduce the inequity.

The most surprising result of the survey was the measurement of the variable labeled "social need." Survey questions related to this variable determine an individual's need to interact with others. The average score on this variable for all other professionals was 5.48. For all data processing professionals in our survey, the score is 4.19. (See Fig. 4.) However, for five organizations the average was only 2.23! So, while some professions attract people who have a high propensity for—and reinforcement from—interaction with others, our profession does not appear to exhibit this characteristic.

The implications are significant. Programmers and analysts have increasingly been grouped into teams in anticipation that productivity will be increased. The chief programmer team concept has been widely publicized and advocated. Some have suggested that it is the social interaction of the team that has produced whatever productivity benefits resulted from the programmer team approach. If our study is representative, it mandates caution in accepting such views.

What does this survey statistic mean to a manager of dp professionals? The lack of need for social interaction does not mean that teams should not be utilized. It simply indicates that dp professionals are not actively seeking a team experience. (Managers of other parts of the company will find their employees eager to interact, and a team approach is a natural organization to facilitate such interaction.) This conclusion is supported by data from Table 3. Dp professionals in the survey organizations were satisfied with their co-workers. In other words, they were getting the interaction they needed—as long as it was not overdone.

Our industry, like others, has a number of experientially derived theorems that have not previously been validated by statistical studies. For

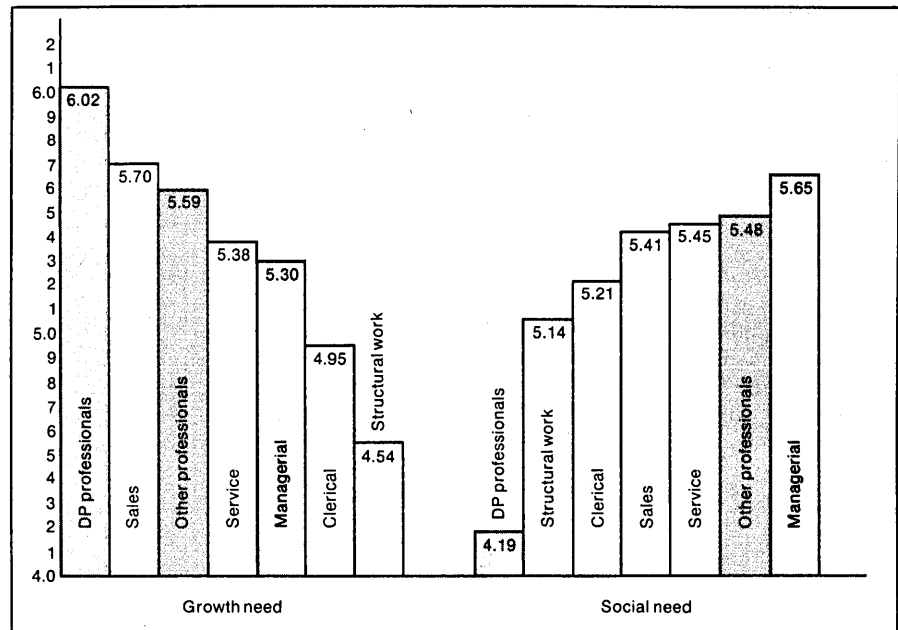


Fig. 4. Are programmers, analysts, and programmer/analysts "loners"? The results seem to confirm that. They are also unusual in their need for individual growth. (As before, responses are on a scale of 1 to 7.)

Measures of Satisfaction	Data Processing Professionals			Other Professionals
	Analysts	Prog./Analysts	Programmers	
General satisfaction	5.10	5.37	5.30	4.88
Satisfaction with co-workers	5.01	5.22	4.96	5.48
Satisfaction with supervision	4.64	4.60	4.60	4.89

Table 3. The results show that dp professionals are fairly satisfied with their jobs in general, somewhat less satisfied with co-workers, and even less satisfied with their supervisors. (Scale: 1 to 7.)

example, how often have you heard the comment that programmers are "loners"?

The growth need section of our study lent authenticity to one of those theorems. Here is another case. Perhaps the theorem is best expressed by Gerald Weinberg in his widely quoted *Psychology of Computer Programming* (Van Nostrand Reinhold Co., N.Y., 1971). "If asked, most programmers probably say they preferred to work alone in a place where they wouldn't be disturbed by

other people."

However, we interpret the survey results on social need as follows: management does not need to reduce emphasis on the project team, it just needs to control the frequency and duration of team meetings. Consider the oft cited guideline that structured walkthroughs should be limited to two hours. You don't find similar guidelines in the literature on management meetings! (The social need strength for managers in the Hackman/Oldham

We are emulating the industrial engineers of the 1940s, chipping away at each job on the assembly line, splintering it into the ultimate specialization.

surveys was 5.65. Managers could be in meetings all day—and love it.) The structured walkthrough guideline was empirically derived, probably by judging the increasing level of impatience by analysts and programmers when a meeting dragged on.

Also, a low social need may indicate the need for additional training on supervisory techniques when dp professionals are promoted to management positions.

WHAT IT MEANS

Although we have barely begun the in-depth analysis of our data base, some tentative propositions are:

1. *Dp professionals have some unique differences from the general population.* They have substantially higher growth need strength than any of the job categories surveyed by Hackman and Oldham. This is true of analysts, programmer/analysts, and programmers. Also, they have the lowest social need strength among professionals—significantly lower than others.

2. *A good job match is possible.* For the survey firms—intentionally selected because they are healthy—the motivating potential of the jobs match the growth needs of dp professionals.

3. *Supervisory feedback to employees can be improved.* Employees in the survey firms are generally satisfied with co-workers and with supervisors. Nevertheless, they believe that feedback from supervision should be improved. They rate this category lower than do their counterparts in the other professions.

4. *An appropriate conceptual model exists.* The Hackman/Oldham model is applicable to the computer field. Our analysis substantiated that of the original researchers, with comparable statistical reliability and validity. The conceptual model (in Fig. 1) is useful for management in our field to analyze individual motivation patterns, and the Job Diagnostic Survey is useful to gather data to determine satisfaction levels and work outcomes.

5. *Job redesign has potential.* Studies of other industries show that job redesign can increase satisfaction and productivity. With the norms resulting from our study, managers in the computer field have the basis for determining which jobs have potential for improvement.

Productivity consists of two parts—improved techniques and increased motivation to utilize those techniques. An enormous amount of time and energy has gone into the first part, technique improvement. Why has

the second part, motivation, been given so little attention?

Is it the qualitative nature of that part? Are we so oriented to the analysis of the quantitative part of the job that we willfully ignore the harder to measure aspects of employee motivation?

Or is it the fact that we are “systematic” people who deal in practicalities. We want something we can touch or see. “Lines of code per hour” is a measurement that can be substantiated. Degree of motivation cannot be seen, felt, tasted or smelled—but it exists.

We are emulating the industrial engineers of the 1940s, who kept chipping away at each job on the auto assembly line until it was splintered into the ultimate level of specialization. We seem to be concentrating just as fervently on fragmenting the jobs of analysis and programming. The chief programmer team concept is the latest in the long list of moves for enhancing specialization. The analysis/programming task now is fragmented into the elements performed by the chief programmer, the moderator, the librarian, the recorder, etc. Perhaps jobs should be *enlarged* in scope, rather than reduced.

If we devote equal time to the analysis of motivation and the ingredients of job satisfaction, this alone may increase productivity. However, productivity increase is the wrong reason for initiating such a study. Shouldn't a supervisor gain as much satisfaction from helping employees achieve fulfillment as from meeting cost/schedule objectives?

Fortunately, researchers like Hackman and Oldham have proved in other industries that productivity can be increased by a better matching of jobs with individuals.

We already have a data base rich with information for further analysis. For example, our data on problem areas and on compensation preferences presently is being analyzed for another DATAMATION article.

During the next year we will be increasing our data base to include more than 2,000 professionals, to ensure a representative set of “norms.” At the same time, we will be conducting job redesign studies, to better understand the factors which produce job satisfaction.

Our profession has been very progressive in developing new product related techniques. Let's hope that progressive attitude will now extend to better utilization of the behavioral sciences. ❁

J. DANIEL COUGER



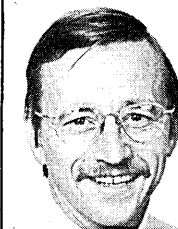
Dr. Couger is professor of computer and management science in the Univ. of Colorado's College of Business. Before joining the cu

faculty in 1965, he spent 13 years in industry. He has more than 20 years experience in computing, being one of the first to enter the field.

As an example of his diverse activities, Dr. Couger has testified as an expert witness before the Royal Investigation Committee of the Swedish Parliament, served as a curriculum consultant to more than 30 U.S. universities and colleges, and lectured in 45 countries on the subject of computer-based management information systems. He has served as a consultant to more than 30 organizations, including Dow Chemical, IBM, and Hewlett-Packard.

Last year he was selected as DPMA's U.S. Computer Science Man-of-the-Year. He is listed in “Who's Who in America,” “Who's Who in Computing,” and “Outstanding Educators of America.”

ROBERT A. ZAWACKI



Dr. Zawacki is an associate professor of management and organizational behavior at the Univ. of Colorado, where he teaches personnel management and

organization behavior courses. Before joining the cu faculty, for nine years he was on the faculty of the Air Force Academy where he held a variety of positions such as director of the Academy Research Div., a cadet professional counselor, chief of cadet personnel, and as a faculty member in the department of behavioral sciences.

His consulting experience has included work for businesses, hospitals, government agencies, and academic institutions.

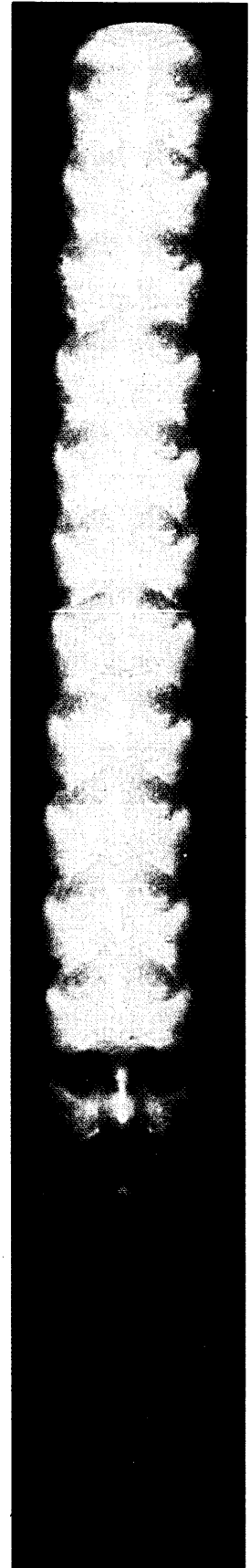
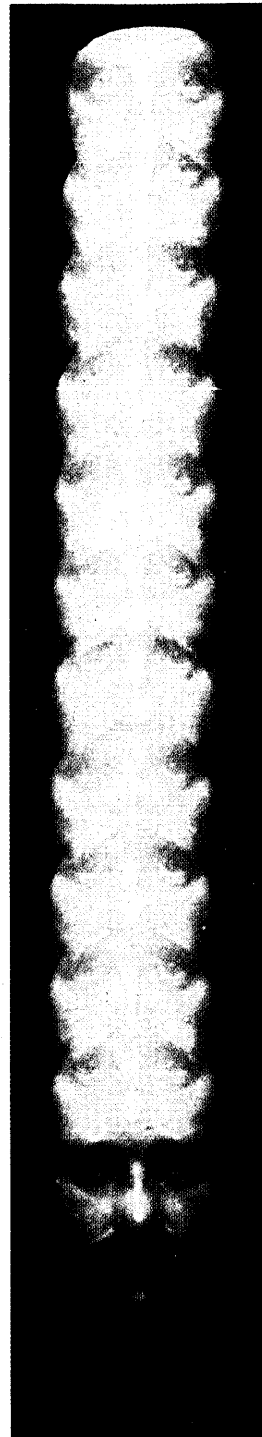
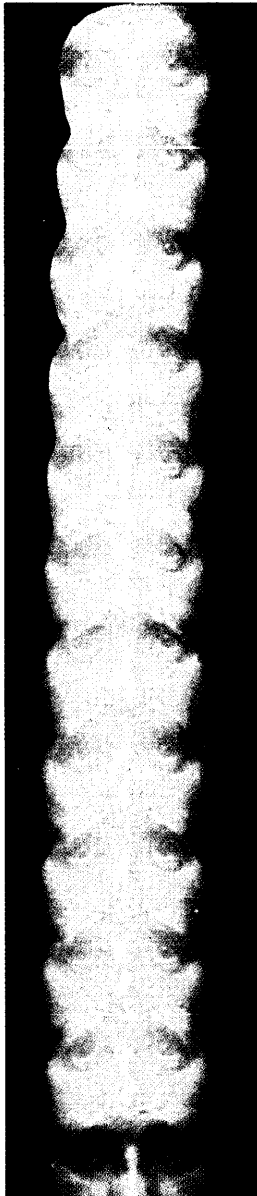
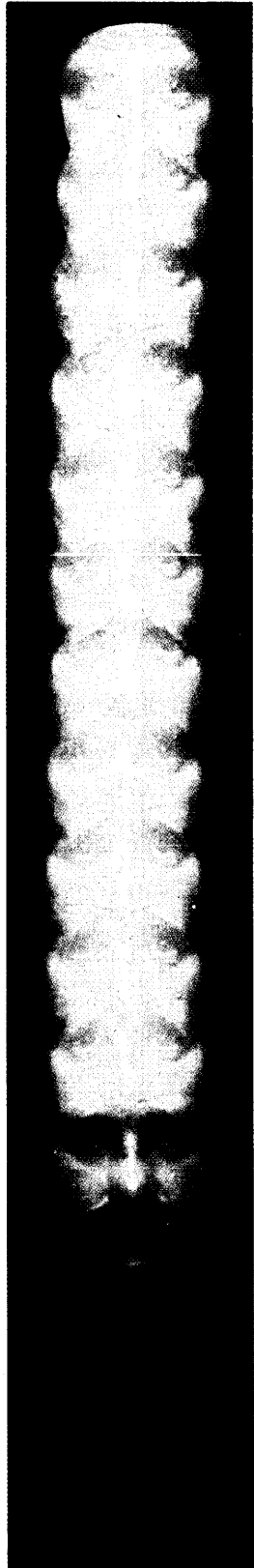
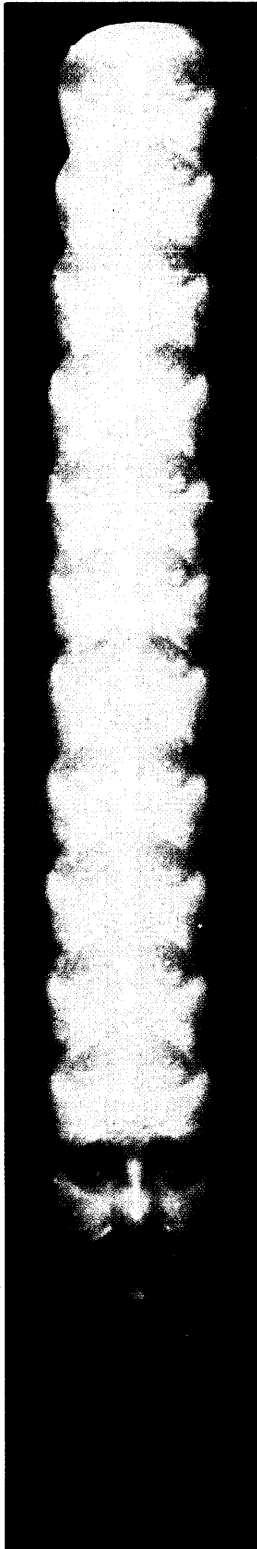
**Work
Itself**

Achievement

Advancement

Recognition

**Possibility
For Growth**



WHO IS THE DP PROFESSIONAL?

by Jac Fitz-enz

The average programmer is excessively independent—sometimes to a point of mild paranoia. He is often eccentric, slightly neurotic, and he borders upon a limited schizophrenia.

D.H. Brandon

Statements such as this one by D.H. Brandon, president of Brandon Consulting Group, Inc. of New York City, and a long time lecturer on data processing management topics, have served to stimulate investigations into the nature of the data processing professional.

A legend has developed around the mysterious creature who inhabits a large, air-conditioned room and spends his time conversing with a big, black box. Some people claim he is a genius, too bright for the common person to comprehend. Others say he is a recluse who is only capable of communicating with a box. Most accounts of his personality and behavior are inferences built on top of speculations. Solid data concerning his nature is hard to find.

Many managers and researchers have formed the opinion that programmers, as an occupational group, are rather unusual individuals compared with people who select other careers. They supposedly are willing to work in isolation, wish to avoid interaction and possible confrontation with others including direct supervisors, prefer minimal structure and routine, and are motivated primarily by achievement rather than external rewards, status, or approval of others.

In the data processing environment, so much happens so fast that training data processing personnel to be better managers usually takes a priority far behind technological concerns. If we will but find the time to teach our managers something about why people behave as they do, to train them in better communication methods and to show

them how to structure work so that personal drives can be unshackled, we could obtain an increase in productivity far surpassing what the latest piece of hardware or software can give us.

We conducted research in a dozen companies in the western United States during the latter part of 1977 to attempt to find out something about the dp pro's motivation to work and his desires for communicating with the organization that employs him. Data was gathered using a survey questionnaire designed and pretested for the specific project. Some 1,500 subjects in several industries, occupations, and job levels responded to the questionnaire.

Any study of motivation must proceed from the premise that motivation is an inherent trait. We talk about motivating employees. This is not possible. In reality, all a manager can do is provide a setting which allows an individual to satisfy his internal drives. As we reviewed our data it became apparent that this is a personality truism.

During the 1960s, Fred Herzberg directed a motivational research project which led to his now popular two-factor theory of motivation. It claims that basic motivational elements can be split into two categories labeled "hygiènes" or "dissatisfiers" and "motivators" or "satisfiers." Herzberg identified eleven hygiènes: Salary, Possibility for Growth, Interpersonal Relations with Subordinates, Status, Interpersonal Relations with Superiors, Interpersonal Relations with Peers, Technical Supervision, Company Policy and Procedures, Working Conditions, Noninterference with Personal Life, and Job Security. These, he said, are aspects of the job which must be maintained at an essentially positive level before motivation can flourish.

His motivators or satisfiers number five: Achievement, Recognition, the Work Itself, Responsibility, and Advancement.

Herzberg's theory has been widely publicized. Because it is currently the most widely referenced theory in industrial training, we chose to correlate our findings with his.

Table 1 is a comparison of Herzberg's rankings with those of our subjects.

There are similarities and differences. Responsibility, which ranked fourth in the Herzberg results, dropped to seventh in our study. When we cut the data by Job Level, a reason for the shift surfaced.

Fig. 1 presents a cross section of the responses from programmer/analysts, project leaders, and managers.

While managers ranked Responsibility first and project leaders (PL's) ranked it fourth, programmer/analysts (P/A's) ranked it ninth. For the P/A's, Responsibility fell far below what are normally considered lower level hygiene factors. Even Personal Life topped Responsibility. This finding brought up some tantalizing questions.

If P/A's do not want the responsibility that goes with their work, it may suggest that they are coping out. Does it mean that they are approaching their jobs from a purely self-centered direction? Does it mean that they do not want to be accountable for their results? Of the first five Herzberg factors, four can be viewed as essentially ego-centered. Responsibility is the only factor Herzberg found to have an organizational orientation. Achievement, Recognition, Advancement, and the content of the Work Itself all supply the individual with personal satisfaction. Although having necessary responsibility to carry out the job is also ego-reinforcing, it has the corresponding element of obligation to the organization. Did the respondents rank it low because they took it as a given? Probably not. If that were so, it would follow that PL's and managers who rose from a programmer level should also take it for granted.

Men chose work itself as the greatest motivator. Women chose it fifth.

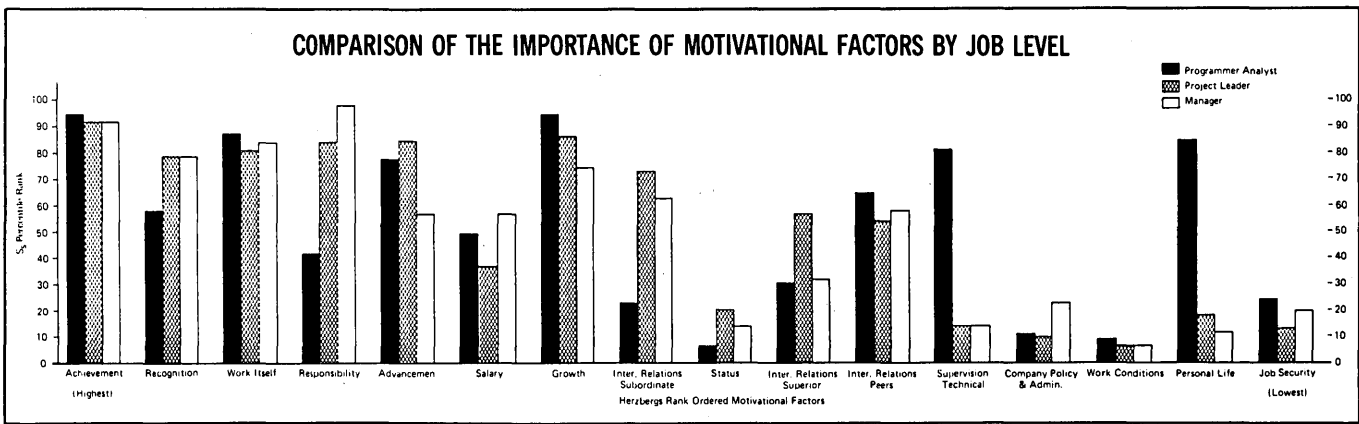


Fig. 1. Rankings of motivational factors are compared for programmer/analysts, project leaders, and managers.

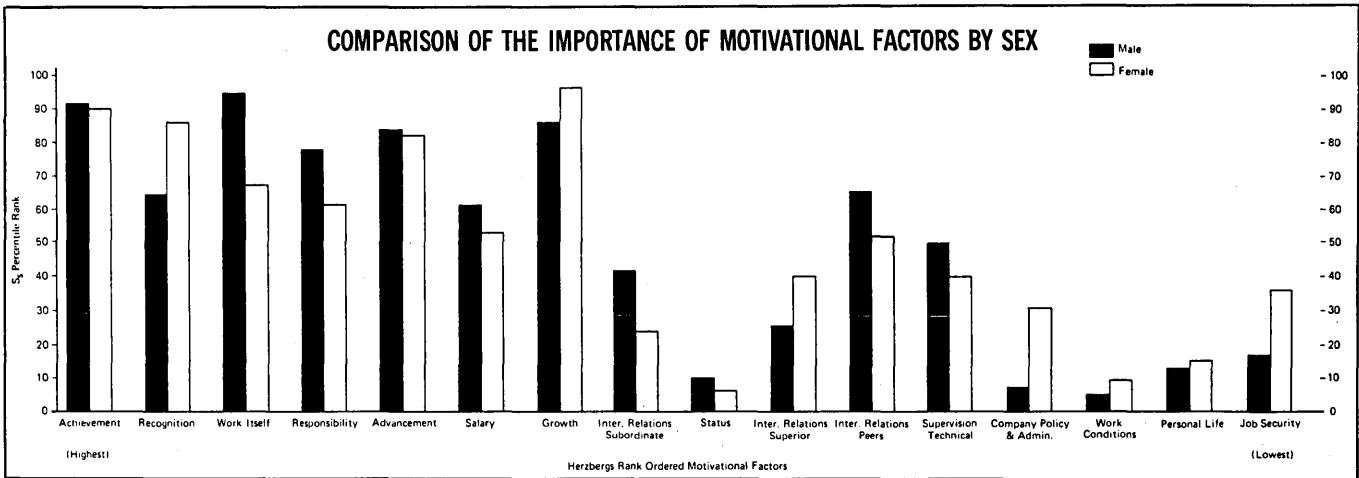


Fig. 2. The rankings of motivational factors are compared by sex.

RANK ORDER COMPARISON OF FIRST LEVEL FACTORS	
Herzberg Results	Study Results
1. Achievement	1. Achievement
2. Recognition	2. Possibility for growth
3. Work itself	3. Work itself
4. Responsibility	4. Recognition
5. Advancement	5. Advancement
6. Salary	6. Supervision, technical
7. Possibility for growth	7. Responsibility
8. Interpersonal relations, subordinate	8. Interpersonal relations, peers
9. Status	9. Interpersonal relations, subordinate
10. Interpersonal relations, superior	10. Salary
11. Interpersonal relations, peers	11. Personal life
12. Supervision, technical	12. Interpersonal relations, superior
13. Company policy & admin.	13. Job security
14. Working conditions	14. Status
15. Personal life	15. Company policy & admin.
16. Job security	16. Working conditions

Table 1. Results of the 1960s Fred Herzberg study are compared with those of the author's study.

GENERATION GAP

Subsequent to the survey, follow-up interviews were held with a number of programmers to elicit a reason for this difference. The interviews were not very illuminating. No seemingly sensible alternatives to the self-centered theory were given. As a result, we are stuck with one of two speculations. First, indeed the generation gap does exist. Today's younger workers may not value Responsibility the same way that Herzberg's subjects in the 1960s did. The second possibility is equally provocative. There may be something in the way the programmer's job is structured that robs him of a sense of responsibility and hence a desire for it. If that is the case, dp managers have a major problem on their hands. At this time, the finding leaves us perplexed and calls for further investigation.

When the data was subdivided by sex, as shown in Fig. 2, other peculiarities appeared.

Men chose the Work Itself as the greatest motivator and placed it in the 93rd percentile. Women chose it fifth in the 68th percentile. Conversely, the women placed Recognition third in the

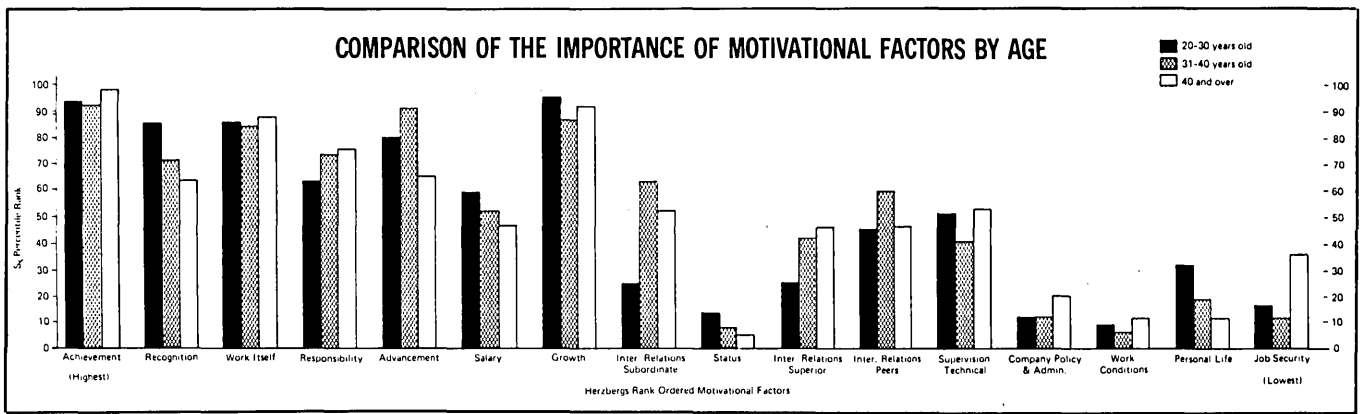


Fig. 3. The rankings of motivational factors are compared by age.

86th percentile; while men ranked it seventh in the 65th percentile.

Finally, the age breakdown in Fig. 3 brings out an interesting point. As age increased, the importance of Salary decreased almost in a straight line from 59th to 52nd to 46th percentile, and from seventh to ninth to eleventh in rank order. This result supports another popular conception of human motivation. Abraham Maslow proposed a theory in the '50s which placed needs in a hierarchy from basic survival through safety, social, and ego needs, to complete human fulfillment which he labeled

self-actualization. He claimed that as one level of need is satisfied it is supplanted by a higher level need. In this case, as individuals aged and presumably made more money, thus satisfying survival and safety needs, salary became less motivating while need for personal growth and interpersonal relationships strengthened.

There are a number of other interesting variances overall from Herzberg's theory. The more we dissect the data, the more we can see that while there are basic similarities in the motivational patterns of people, individual

differences do pertain. It is apparent that, to some degree, dp professionals have motivational drives which do not fully correspond to other occupational groups. The implication for management is that in order to have motivated employees, supervisors must understand and bear with individual needs. The monolithic notion that "people are all alike" simply is not supportable.

We also surveyed our subjects' attitudes toward organizational communication. We asked them to rank order, in terms of importance to them, organizational topics in which they were most interested. We also asked them to choose for each topic the source which they most and least preferred to have deliver the information. Table 2 shows the rank order of interest by job level, sex, and age.

Without exception, Job Performance and Career Opportunity information have been ranked first and second, well above all other topics. Personnel programs, such as salary and benefit information, usually rank third, closely followed by Company Profit performance and Changes in the work or organization of the unit. The remaining topics are of considerably less interest.

In this instance, overall changes ranked third, slightly ahead of Personnel information. Our guess is that since most dp departments are rapidly growing and changing organizations, this topic is of unusually high interest. In more stable units such as Accounting or Purchasing, change is not as prevalent. Profit information dropped from fourth to fifth in the ranking, and the degree of interest dropped off quite sharply.

Given the above, we would expect that the greatest effort would be being made to communicate information on performance and opportunity. Yet all evidence shows undeniably that organizations do their poorest jobs on these topics. A review of the literature over the past 20 years consistently shows cor-

PERSONAL INTEREST OPTIONS								
Rank ordered Interests	Job Level			Sex		Age		
	Percentile Rank		Manager	Percentile Rank		Percentile Rank		
	Programmer/ Analyst	Project Leader		Male	Female	20-30	31-40	40+
1. Current job performance	90	85	92	92	99	95	90	92
2. Future career opportunities	87	89	82	89	94	92	86	78
3. Changes in organization & activities of dept.	63	63	62	62	71	66	57	61
4. Changes in personnel policies	55	53	45	44	46	49	50	61
5. Corporate profit performance	29	26	47	23	24	19	42	37
6. Company operating policies and procedures	24	37	21	15	22	31	29	23
7. General company activities	7	5	6	1	10	9	5	6

Table 2. Personal interest options are ranked by job level, sex, and age group.

We should spend more time helping supervisors become good communicators.

MOST PREFERRED COMMUNICATIONS SOURCE

Source options: A Immediate Supervisor (one level up)
 B Senior DP Executive
 C Senior Executive outside of DP
 D Senior Staff Specialist

Topic	Job Level			Sex		Age		
	Programmer/ Analyst	Project Leader	Manager	Male	Female	20-30	31-40	40+
1. Current job performance	A	A	A	A	A	A	A	A
2. Future career opportunities	B	B	A	B	A	B	B	A
3. Changes in organization & activities of dept.	A	A	A	A	A	A	A	A
4. Changes in personnel policies	A	A	A	A	A	A	A	C
5. Corporate profit performance	C	C	C	C	C	C	C	C
6. Company operating policies and procedures	C	B	A	A	B	A	B	C
7. General company activities	A	A	A	A	A	A	A	A

Table 3. Most-preferred communications sources are ranked by job level, sex, and age group.

porate failure in coming up with a satisfactory performance appraisal system. Career counseling programs have received slightly less attention and no more success. The greatest gains in improving employee attitudes and morale are probably to be found in concentrating our efforts to effectively communicate this information.

The data on communication sources displayed in Table 3 is equally clear-cut.

ON THE SPOT The supervisor is unquestionably the person on the spot. Our early research was based on the assumption that while the immediate supervisor would be looked to for performance evaluation, other sources would be preferred for other topics. This was not and is not the case. Most often the supervisor appears as the most preferred source. Never is he chosen as the least preferred. On four to six topics out of seven, the supervisor is chosen first. The supervisor is better known, usually more trusted, and more

capable of translating and interpreting for the subordinate the probable effect of most information.

Other research has shown that a supervisor has a great deal of influence on the general morale of his subordinates. More than any other individual, and more than other such potent forces as the company itself, the supervisor is the critical element. Hence, it is obvious we should spend more time helping supervisors become good communicators. They are important in both positive and negative situations. First, they are the most sought after communicators when it comes to telling the company story. Second, they can be the deciding force when there is individual or group discomfort.

Again, the opportunity is before us. We can achieve the greatest gains by training supervisors at all levels to communicate better. Conversely, we have the most to lose by continuing to ignore the current deficiency.

Charles Andrew, speaking at a recent conference of Production and

Inventory Control Specialists, said:

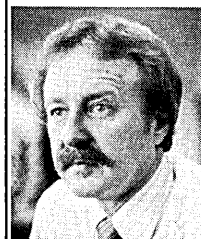
"Successful implementation of an edp system has to start with a valid, realistic management theory—a balancing of the operations orientation with some practical thoughts from the behavioralists."

Gerald Weinberg, in his book on the application of psychology to computer programming, goes even further by noting that personality is displayed in everything we do or say. In particular he asserts, it is reflected in programming efforts. Weinberg believes that the personality of the programmer is observable in the manner in which he approaches the task and the product that results from his labor.

Our study attempted to determine some of the needs and communications desires of people in the business of data processing. When applied at this particular point in the rapid evolution of information processing, we feel it has particular significance.

The study has shown that while data processing professionals display some idiosyncracies, they have much in common with other people. A basic knowledge of human behavior can help us perceive and cope with the attitudes, interest, needs, and values of our employees. We must keep in mind that no matter how sophisticated our technology becomes, we will always have to rely on human beings to design, build, sell, install, service, and use it. Efficient and effective performance of these tasks is directly dependent on our ability to understand and manage these people. *

JAC FITZ-ENZ



Dr. Fitz-enz is director of industrial relations for Four-Phase Systems, Inc. in Cupertino, California. Prior to this he was vice president of

organization development for Imperial Bank, in Los Angeles. He has published articles on personnel, training, and psychological subjects and has consulted with a variety of organizations. Dr. Fitz-enz received his Ph.D. in communications and industrial relations from the Univ. of Southern California, M.A. from San Francisco State, and B.A. from Notre Dame.

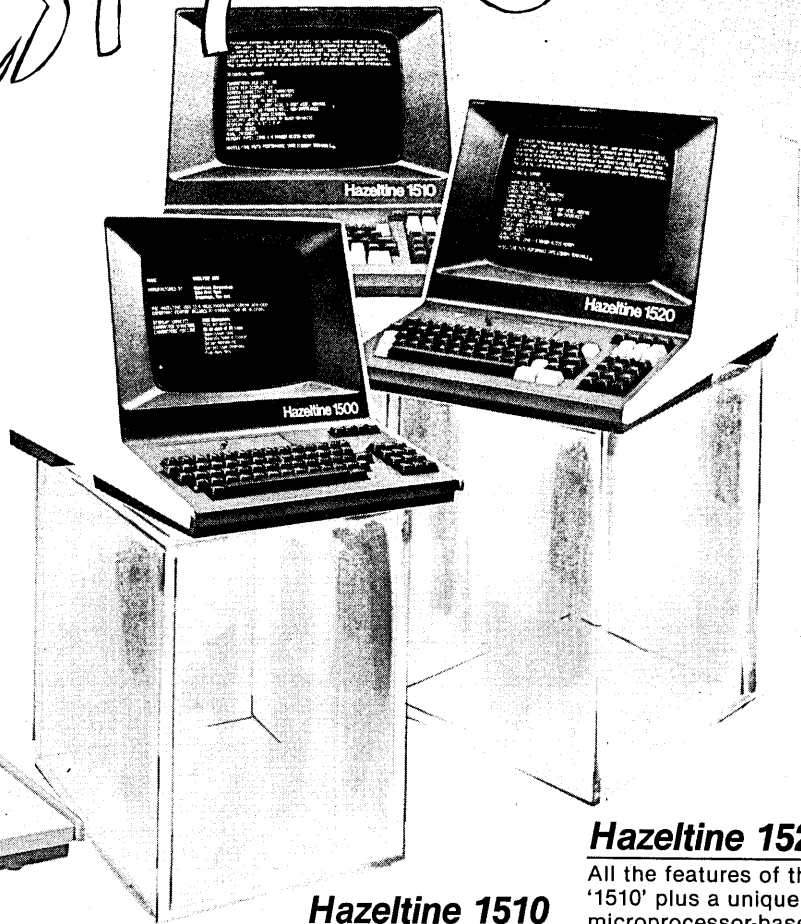
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Those other behaviorists haven't gone far enough afield in studying the psychology of computer programming.

ANOTHER REPORT FROM THE PSYCH LAB

by Donald Kenney

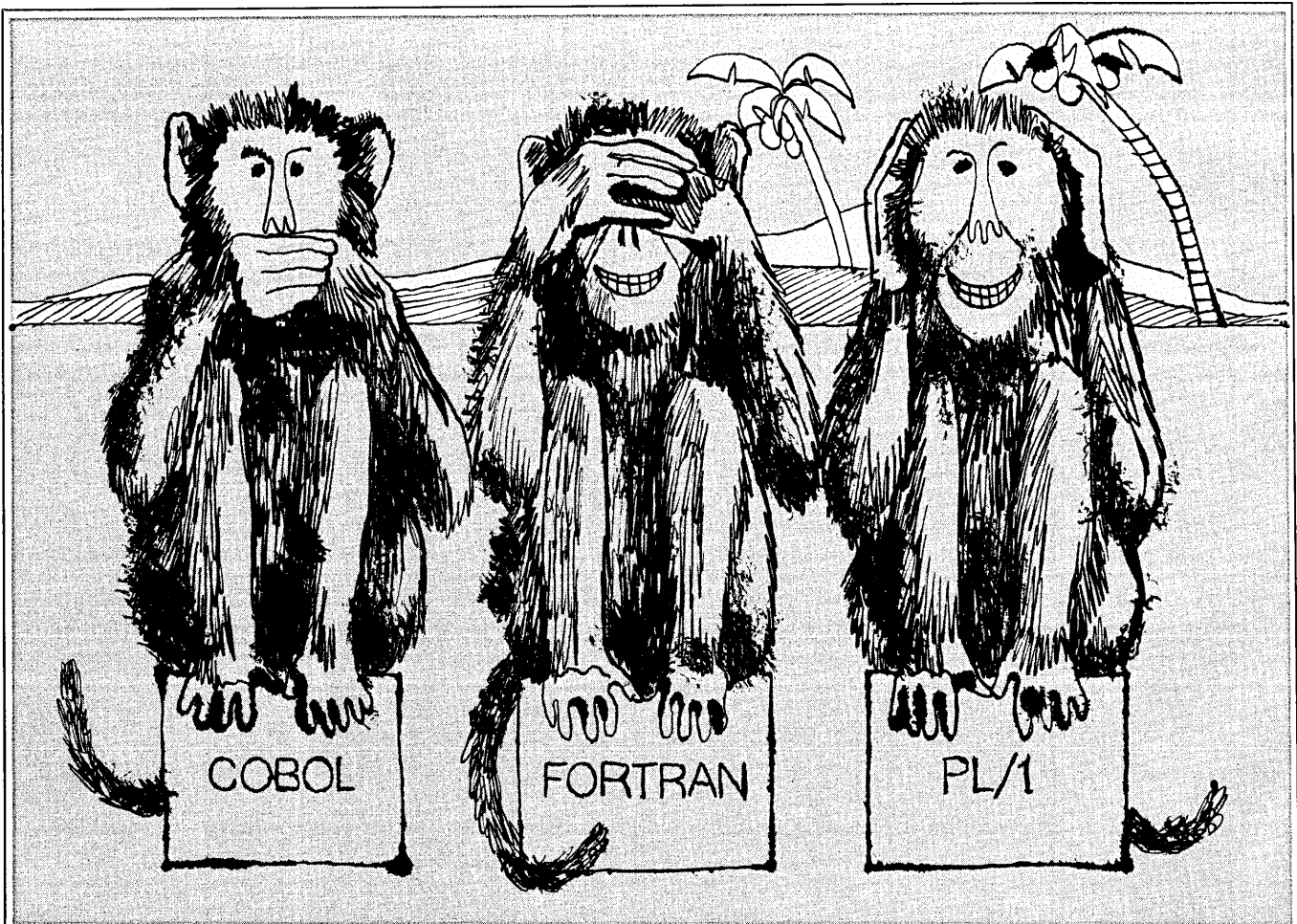
Prior to now, little or no valid work has been done on the psychological aspects of computer programming. The problem is, not surprisingly, economic. Even using that least expensive of human research subjects, the graduate student, achieving adequate sample sizes is prohibitively expensive. Moreover, the end of the military draft has sharply decreased the number of graduate students available for study. Recognizing this problem, my colleagues and I set out to study the feasibility of investigating the psychology of computer programming using nonhuman (and therefore cheaper) subjects.

It quickly became clear that a modicum of intelligence is required for the process of computer programming. A few simple tests quickly ruled out paramecia, flatworms, fruit flies and most other invertebrates as possible subjects for study. (At least for computer programming—several very interesting experiments are underway in software project management and configuration control using both fruit flies and flatworms.)

For a while we hoped that the social insects—ants, bees, termites—might make suitable subjects. We were eventually forced to give up on this by our discovery (which we termed the Civil Service Effect) that the apparent

structure of such insect colonies consists almost entirely of individuals working at cross-purposes and that there is no discernible method to input either data or direction into the insect society.

A few experiments were made with cephalopod mollusks (octopi), with somewhat ambiguous results. Their habit of hiding in a cloud of ink whenever anything went wrong, plus their general ill nature (they bite) and the highly corrosive characteristics of their salt water environment proved to be more than we could cope with. This phase of the experiment was terminated when our prize subject—a four foot specimen of *Argonauta argo* named Millicent—removed the author's



DP Dialogue

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



Here, telemetry devices transmit experimental data to a mobile laboratory. Similar advanced technology is reflected in Deere's worldwide data base of thousands of components, letting engineers utilize existing parts when developing new products.

At John Deere, No One Reinvents the Wheel

Engineers at John Deere don't spend time reinventing the wheel or designing new hydraulic pumps or valves when existing ones will do the job. At their fingertips are data on all Deere parts and

design parameters on commonly used parts and components. This multinational manufacturer of machines for farm and construction has created a multilingual data base called WISE — Worldwide

Information System for Engineering.

"If an engineer in, say, our Mannheim, Germany plant needs a hydraulic cylinder design," says Gordon Millar, vice president of engineering, "he can use an online terminal to call up complete descriptions of similar cylinders already in use in Deere worldwide. He will probably find a design he can use with little or no change.

In Four Languages

"Since WISE is literally a worldwide system, it cuts across barriers of language, distance and culture," adds G.T. Underwood, manager of Deere's corporate engineering standards department. "Our master list of terminology is already in four languages: English, French, German and Spanish and all dimensions are in metric and English. WISE has greatly enhanced our worldwide standardization efforts. Also our engineers around the world can readily access design specifications, application information, cost, vendor lists and the like."

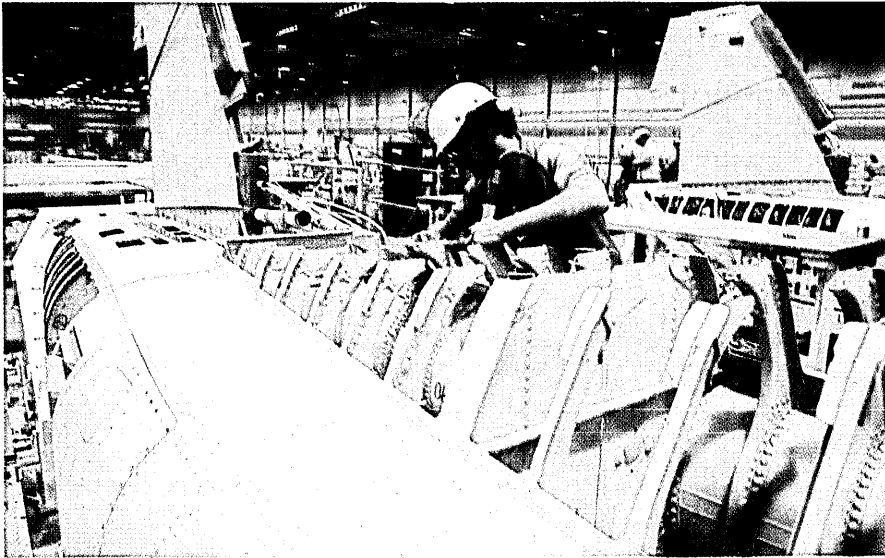
"WISE was the first element of a corporate parts data base," says Larry Moore, administrator of engineering information in Deere's corporate engineering standards department. "Now it has links to other business systems in the company, supporting applications in such areas as service parts, warranty service, and parts catalog publications.

"Currently there are about 50 CRT (cathode ray tube) and 100 computer output microfiche display stations in 20 design centers in the U.S., Europe, Argentina, Australia and South Africa. CRT's access our IBM System/370 complex in Moline through the same telephone lines that carry our voice communication.

"The engineer can search the data base by attribute, such as the size or pressure rating of a hydraulic cylinder. In effect, he describes a desired part to the system and automatically receives back a listing of all Deere parts which fit the description.

"We're achieving better parts commonality, and better, faster communication among engineering and manufacturing groups all around the world, by means of the computer."

The CADAM® System: Interactive Graphics for Design Engineers



Engineers at Northrop Corp. use computer graphics to speed the structural design of high-performance jet aircraft.

Producing a modern aircraft can require more mechanical drawings than rivets.

Traditionally, engineers sketch, then draftsmen draft. Then engineers discover needed changes or improvements, and draftsmen draft some more. A lot more. Move a stiffener or bracket, say, two inches to the left, and a chain reaction of changes ripples through the entire set of drawings.

But now the computer has opened up a new way to meet design engineering needs with speed and reliability for a broad range of products, from high-performance aircraft to complex integrated circuits. The CADAM (Computer-Graphics Augmented Design and Manufacturing) system, a set of interactive programs available from IBM, allows the designer to sketch directly on the screen of a graphic terminal. He defines lines and contours by pressing keys and positioning a light pen, and the computer displays what he has expressed.

Curve fitting, or reducing the design to a set of control equations, is completed iteratively at the terminal, eliminating coding, card punching, and repeated computer batch runs. Then the CADAM system converts the preliminary design to a dimensioned drawing with auxiliary views.

If something needs fixing — if, for example, the dimensioned drawing reveals a problem of component or subassembly compatibility — the pieces can be moved around with the light pen and the CADAM system will revise all of the affected drawings. Automatically.

The CADAM system encourages doodling, an important source of design inspiration. The user can translate or rotate any graphic element. Or change its scale. Or stack parts, separate them, or watch moving parts move.

The CADAM system stores the design as it is developed, displays any element on demand, then generates the final detailed drawings. It supports complete design of the part, including structural members and such elements as ribs, stiffeners, lightening holes and fasteners. Once a design is stored in the CADAM system, analysis programs can calculate its weight or determine its structural properties. Any frequently used design element or drawing symbol can be stored and reproduced automatically wherever it is needed.

As its name implies, the CADAM system includes a direct link to manufacturing. It can generate a "part program" (path of travel) for the cutter of an automatic machine tool.

The CADAM system has cut drafting manhours drastically for engineering departments — by as much as 90 percent or more on a few special tasks. It helps prevent and correct errors and improves the quality of the engineering product. One user's experience is described below.

Productivity Up

Northrop Corporation is one of the world's largest manufacturers of high performance jet aircraft. Today, Northrop engineers design complex aircraft parts with the CADAM system in a fraction of the time they once spent working at drafting boards.

Says Northrop's Aaron Feder: "In addition to the time savings, we can identify improvements in design quality. Because changes are so easy to make at a terminal, we can keep up with changes traditionally required during the design development of an aircraft part and still release the drawing on time." Feder is manager of technical computer graphics at Northrop's Aircraft Division in Hawthorne, California.

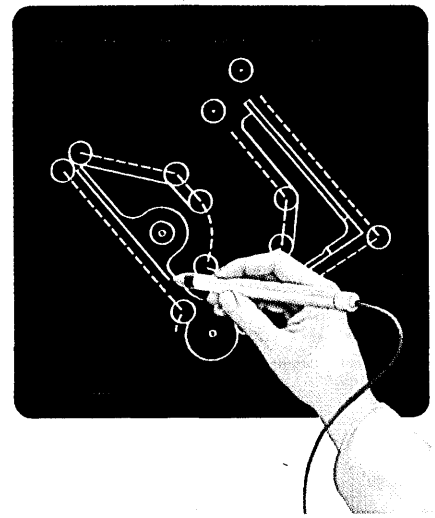
"Before installing the CADAM system," Feder points out, "we ran a number of carefully controlled tests. When we saw productivity gains ranging from four to one to as high as 17 to one, for changes to a drawing, we saw the potential and decided to adopt it.

"We compared the manhours required to prepare several types of drawings using the CADAM system with the time requirements using our established manual systems.

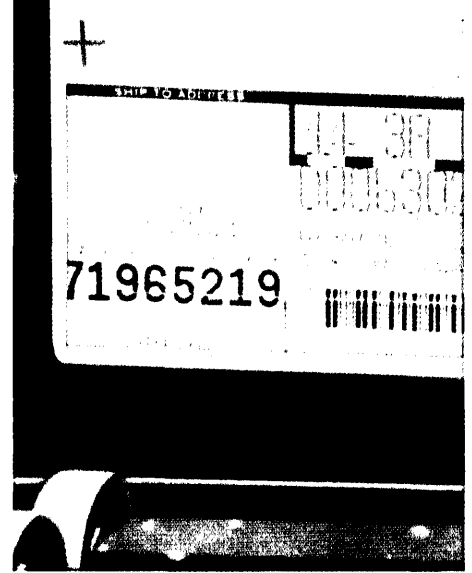
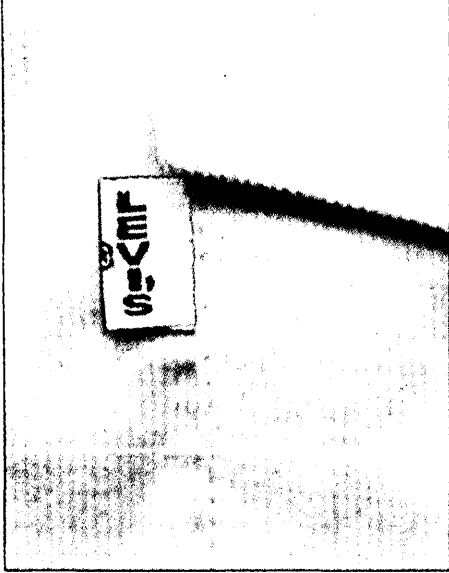
"This involved a broad sampling of different types of drawings, including layouts, structural and electrical drawings. We saw productivity gains of four to one or better on every one of 14 test problems. Even though productivity is lower in the hectic, day-to-day development design world, the CADAM system has still proven cost-effective.

"Once a tentative design is in the computer," Feder adds, "we can run engineering analyses: calculating weights and determining the capabilities of the design aircraft and the dynamic behavior of its structure.

"The data required for this kind of analysis is already in our System/370, as a byproduct of the graphic design effort. That means another major savings in manhours, the elimination of a significant source of error, and the assurance that all departments are working from the same data."



The CADAM system converts freehand sketches, made directly on the CRT screen with a light pen, into fully defined and dimensioned graphics.



Packing for shipment (center) is the only manual handling of garments in the Levi Strauss Sportswear distribution center. Laser scanners (right) read labels so a computer can direct cartons through the conveyor system.

Levi Sportswear: Handle with Speed

Levi Strauss & Company, known for its jeans, is today one of the world's largest suppliers of other fashions as well. Its Sportswear Division can ship as many as 180,000 garments a day from a new divisional distribution center in Little Rock, Arkansas. The highly automated facility controls a total of 44,000 stock-keeping units.

Panatela, David Hunter, and Wildfire

"We run physical distribution as if our Panatela, David Hunter and Wildfire sportswear were perishable merchandise," says James Benson, national distribution manager for the division. "We have to be there with the

proper styles, in time to meet what customers are buying. Sales lost to stock outages can never be regained. Our operating goal is to ship every order within 24 hours of receiving it, and we are meeting that objective."

An IBM System/370 Model 145 computer keeps a digital "image" of all storage space in the 425,000-square-foot distribution center, and maintains a record of the inventory in each location. As cartons of garments are received from the factory, the labels are read by a laser scanner and the computer assigns them to storage locations.

When sales orders are entered, the System/370 generates picking tickets for customer shipments, which are passed

to the control computer, an IBM System/7. This machine monitors the conveyor system through sensors, and controls the movement of goods by actuating track switches, diverters and conveyor motors.

"The System/370 stores the dimensions of folded garments and calculates the proper-sized packing carton," Benson explains. "Order fillers pack the cartons, each is automatically sealed, a laser scanner reads the label, and the control computer diverts it to the right conveyor track for the selected carrier.

"The payoff is service," Benson adds. "When customers phone, we can query the system through a terminal and tell them the exact status of an order. For Levi Strauss Sportswear, physical distribution is not just a cost to be minimized; we believe it should provide a benefit to the company and to the customer. With the help of our IBM computers, we are meeting that goal."

Improving Project Management Skills

Executives, project managers and key DP development personnel can improve project management skills and educate users with the aid of *Managing the Application Development Process*, an Independent Study Program (ISP) available from IBM. It demonstrates how to plan, estimate, schedule, track and control an application development project from the defining of objectives through final testing. The course is based on the experience of IBM DP Services, a unit of the Data Processing Division.

Topics covered within the ISP workbooks and audio tapes include:

- The process of application development.
- Identifying elements of a successful project.
- Defining project objectives.

- Project tracking and control.
- Identifying level of risk and planning to contain risk.
- The role of systems assurance and planning for independent project reviews.
- Creating work and manpower plans.
- Establishing a reliable tracking and reporting system.
- The development of an estimate-to-complete.
- Developing guidelines for a standards manual.
- Saving useful data from completed projects.

For more information on this and other Independent Study Programs, contact your local IBM branch office or write to the Editor of DP Dialogue at the address on the right.

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Data Processing Division

Motivation? We will establish an impossible schedule and subtly imply that their failure to meet it is due to their own inadequacies.

left little finger to the first joint after 15 consecutive unsuccessful attempts to input a wet papertape through a rusty papertape reader.

We therefore elected to continue our study using that old standby, the white rat. Our initial experiments proved promising. Several of the rats were taught COBOL, which they learned (or at least, appeared to learn) with surprising ease. They quickly mastered the art of punching cards by jumping over the keyboard, although the long jump from the "3" key to the "Z" presented some problems for the smaller specimens. It was necessary to devise a latch for the numeric shift key since there is no way for a 6-inch rat to hold down a shift key which is 14 inches from the number keys which must be depressed simultaneously. We gave some thought to designing and installing a better rodent engineered keyboard, but we never got around to it.

Our initial success with the white rats proved illusory. Rats are rather short lived creatures and COBOL is, to understate the case, anything but a concise language. None of our rats lived long enough to complete even the shortest and simplest of COBOL programs (most were still working on the DATA SECTION when they expired of old age). Attempts to teach them other programming languages were an utter failure although one rat did produce a rather extensive program in what our colleagues in the mathematics department describe as "an ALGOL-like language."

At this point, it appeared that our project had come to an unsuccessful conclusion. However, just as we started to wrap it up, I was contacted by a gentleman from an unidentified government agency. This man, known to us only as "Charlie," expressed an interest in our project. After a series of meetings in the back booths of obscure road houses, a long, if chilly, consultation on a popular East Coast resort beach (in February) and an "accidental" encounter on a Vermont ski lift, a substantial amount of money in small, used, unmarked bills was made available to us. The nature of "Charlie's" interest in our project was never revealed.

Given a fresh infusion of money, we decided to try monkeys as subjects. It should be noted that at this point the project had gained a momentum of its own and had lost reference to its original goals. Laboratory monkeys were *not* cheaper than graduate students since the ASPCA and other organizations make sure that the former are ade-

quately fed and housed while the latter can be left to shift for themselves.

A group of half a dozen monkeys was procured and was trained in COBOL, FORTRAN, and PL/I. All six proved able to write programs in any of the three languages provided that they were given detailed, definitive specifications. Unfortunately, much of our time was consumed because of the primates' practice, apparently instinctive, of eating any page from the specifications which was erroneous or ambiguous. The monkeys would then sulk until one of us found the ambiguity or error and corrected it. In reviewing our work later it was recognized that we had stumbled upon a solution to the program documentation quality problem, but a majority of us felt that it was unlikely that the solution would find favor with either software designers or programmers.

Things were going well, and we had prepared a series of quite interesting experiments when disaster struck. Tired of setting up the monkeys' job decks for them (and, to be honest, piqued by their habit of jumping up and down, pointing and laughing whenever a job came back with a Job Control Language error, which happened with distressing frequency) we attempted to teach them JCL.

One monkey, a two year old female named Sarah, went into a cataleptic trance from which we have been unable to rouse her. Another, who was in critical condition for four days after eating an entire JCL manual (Acco fastener and all) in a fit of rage, has recovered, but refuses to have anything to do with computers. He is currently making good progress in a mail-order course in radio-tv repair.

A third monkey, Mike, has apparently concluded that JCL preparation is a random process. Although he uses the JCL manual in the initial preparation of his decks, his procedure for correcting errors consists of closing his eyes, whirling his chair around, and—with his eyes closed—striking random keys with his toes. Surprisingly, perhaps, this process works, but it is our subjective impression that it takes Mike at least twice as many runs as the average human requires to get a JCL deck debugged.

Two of the remaining monkeys studied the JCL manual for a few hours, and apparently decided that it was some sort of joke—and in rather poor taste. They adamantly refused either to write their own JCL decks or to use ours. We were forced to cut them from the proj-

ect. I understand that they have since formed their own company and are doing quite well on programming fixed priced contracts.

The remaining monkey not only learned JCL, he took to it so enthusiastically that he refused to work on routine programming tasks. He was able to master not only JCL, but the operating system's purported utilities which had, to that time, remained a complete mystery not only to ourselves, but to the computer center staff. For a time, we regarded his progress with admiration and pride, but he soon became a substantial annoyance reorganizing our disk structure "for greater efficiency"; "correcting" our JCL decks whenever he could get his hands on them (the corrections didn't always work, but he always had a good explanation why they *should* have worked); and "improving" our operating system, with unpredictable results.

Eventually we were able to control his activities by keeping our job decks under lock and key, and making it clear to him that he would be barred from the computer center if he continued to make unauthorized changes to the operating system. Nonetheless, his constant begging for small change to feed the coffee and cigarette habits he had acquired was a nuisance. None of us was really heartbroken when he expired from malnutrition, apparently as a result of his attempt to live exclusively on the food available in the computer room work area candy machines.

That summarizes our progress to date. The results of our current, and final, we feel, attempt at teaching non-humans to program are not yet in. We have overcome the technical problems of interfacing dolphins and standard computer peripherals, largely because of the recent availability of waterproof cards. The dolphins have had no trouble *learning* to program, but after an initial spurt of high productivity they have shown little desire to actually *do* any programming.

We are considering various methods of motivating them. A consensus seems to be forming around the concept of using a conventional motivational technique. We will establish an impossible schedule, and subtly give the impression that their failure to meet the schedule is due to their own inadequacies. We will back this up with vague threats of cutting off their salaries (paid in fresh fish) if they fail to come through.

We confidently expect to be reporting on the success of this experiment within six months or so. *

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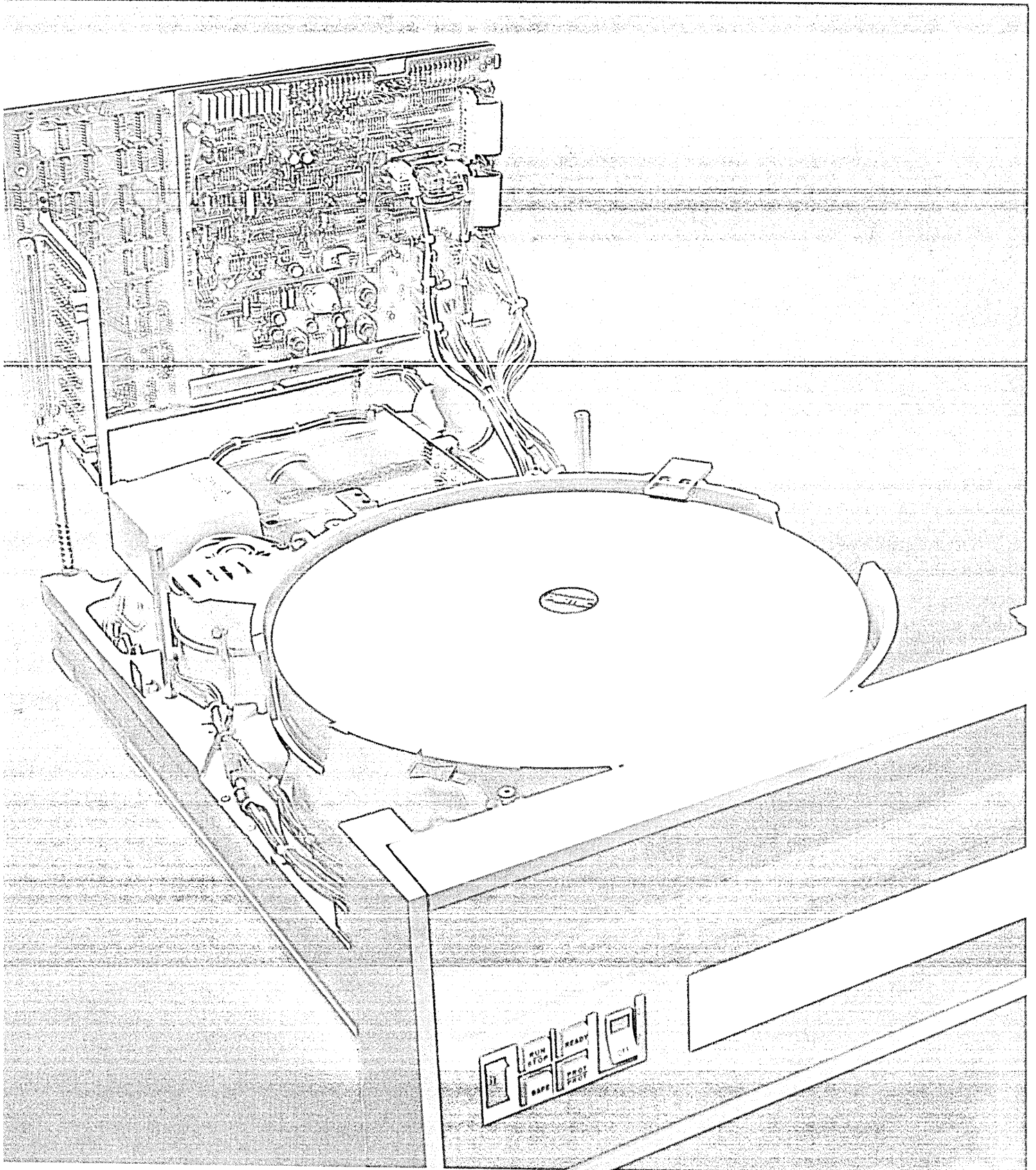
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				2400	D3462			
2315 Front Load	24.0	QUAD	2200	1500	D3481			
				2400	D3482			

Name _____

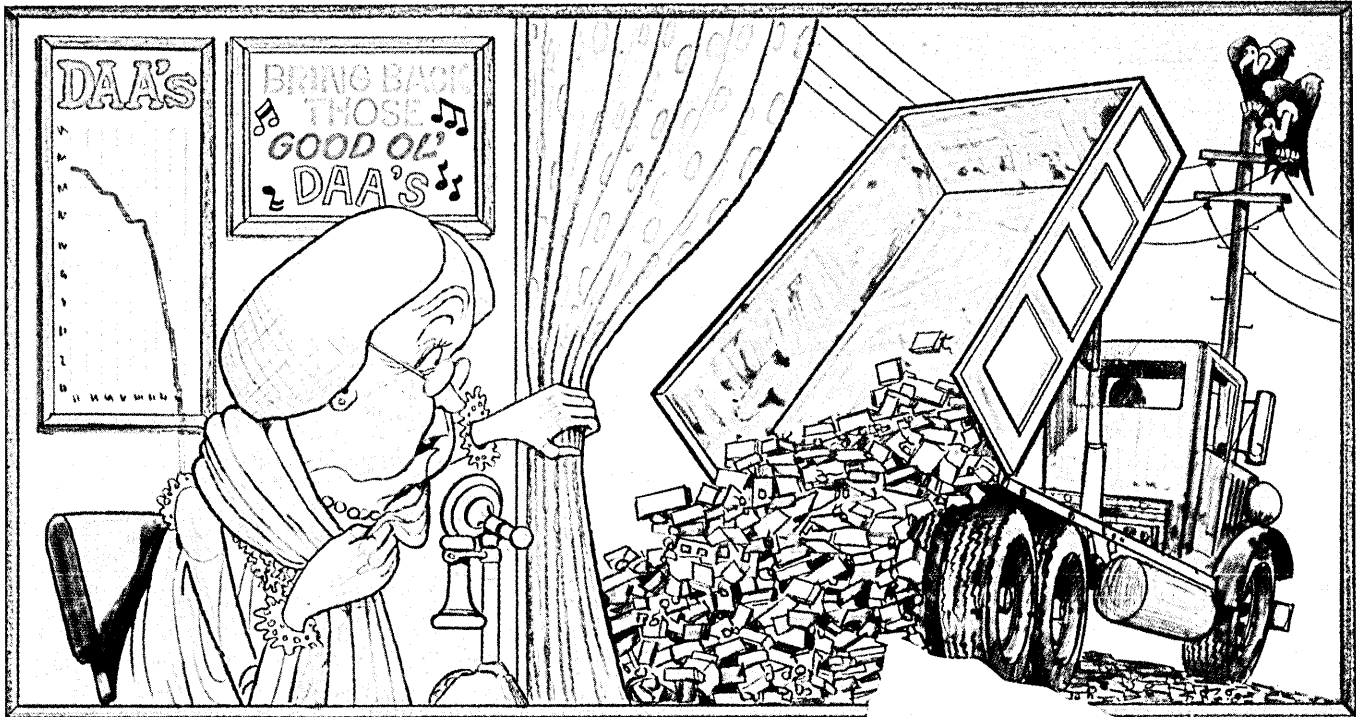
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PERTEC DIVISION



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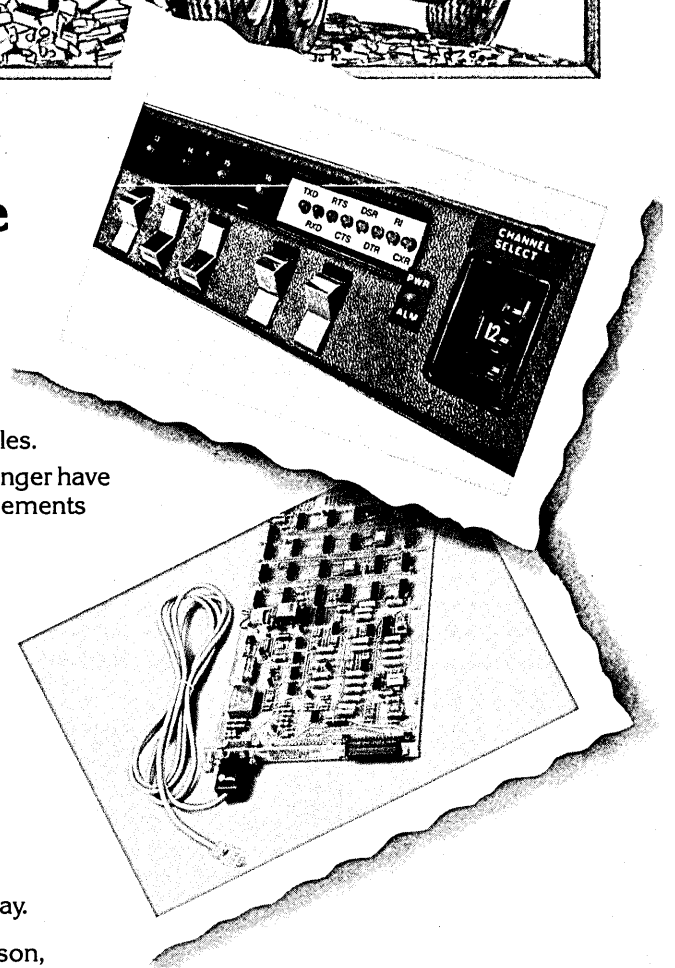
These direct connect products are compatible with your 103s & 202s and also include Vadic's VA3400 full duplex 1200bps modem. By the way, Ma, Vadic also has a new triple modem that automatically becomes a 103, a 212 or a VA3400!

Better get the whole story, Ma, by phoning or writing Vadic today.

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CIRCLE 113 ON READER CARD

The most prominent characteristic of the field is its rapid rate of change.

GETTING READY FOR WORD PROCESSING'S SECOND GENERATION

by C. B. Carls

When I announced to the three secretaries outside my office that we were going to remove their word processing terminals, two of them threatened to have me mugged and the third said "No way am I going back to washing my clothes on a rock!" They needn't have worried; we'll replace their systems with more capable ones, not with typewriters.

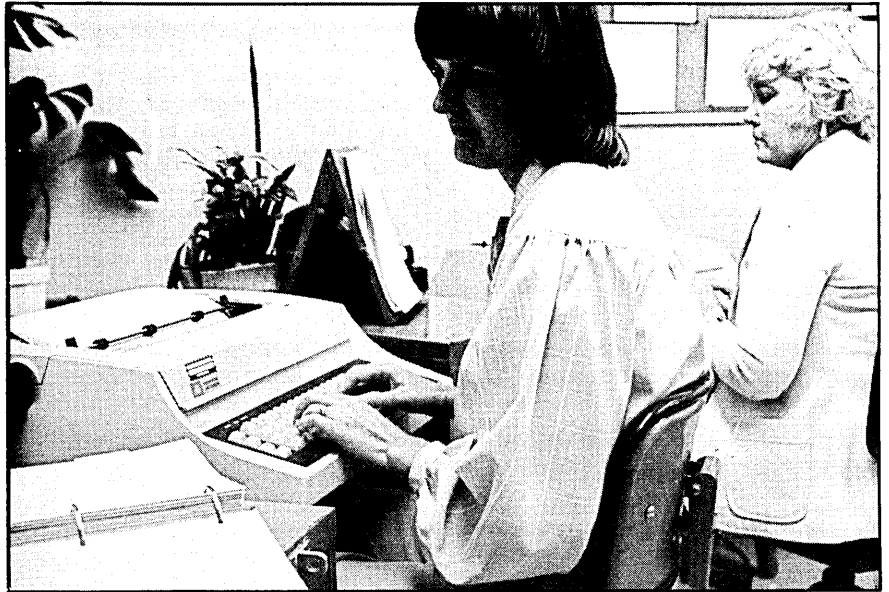
We're sold on word processing, and use several varieties of it. Our company has been using some form of it since the late 1960s—although it wasn't called "word processing" then. In fact, we thought we'd gotten to be old hands at the subject until we went out to evaluate a replacement system. That was a comeuppance.

It's been about 10 years since we installed IBM's Administrative Terminal System (ATS) in Hughes Aircraft Company's corporate data processing center near Los Angeles. We were neophytes at it then, but by now we have modified nearly every module in the package, or purchased or swapped for other enhancements until the existing ATS looks very little like the one we first acquired. Our system has grown to support 136 active user sites throughout Southern California and Arizona. We handle up to 80 concurrent users who access space on six IBM 3330 Model I disks which are connected to an Amdahl 470 V/5.

ATS is used—sometimes misused—for applications ranging from proposal writing, brochure preparation, data entry, parts lists, budgets, a ton of mini-applications, trip reports, and all those other cases where the author wants to change his mind four or five times before the final copy is produced.

Although the Amdahl-based system is the single most used one for text preparation of any kind, we also have several standalone WP configurations scattered around. Therefore we've gotten used to the large and small scale ends of the business.

So it was that we had a great deal of confidence when we began a



search for a new system. That was two years ago.

IBM's ATS has been used at Hughes Aircraft Co. for almost 10 years, and is currently running on an Amdahl 470 V/5. Although showing its age, the system handles up to 80 concurrent users and is accessible from 136 active user sites throughout Southern California and Arizona.

By 1976, ATS had patches on top of patches and was showing its age. Our two biggest problems with it were the inordinate amount of time needed for the master terminal operator to move data into or out of ATS for batch processing, and the less than satisfactory "interface" between ATS and the system control program—unlabeled tapes.

COLLECTING THE DATA

We assembled a project team consisting of a system programmer, a person responsible for a standalone WP system at one of the sites, an engineering type, and an administrative coordinator. Naturally each of us had different WP needs, and we began our study by compiling a list of the features each of us wanted in a word processing system. It was a long list. (See Table 1.) To organize it, we attempted to rank the important items at the top of the list, or to weight them, or to drop some less important ones.

Then our education began. What looked to be of little use to one of us was critical to another. Users composing proposals on-line didn't care about the letter writing feature, but others used the systems primarily for letter writing. The letter-writers couldn't have cared less whether the system was capable of filling in leading dots like those used in a table of contents, but the proposal-writers couldn't do without them. And on it went. In the end, we alphabetized the features and kept them all.

Only slightly daunted, we set off to find which vendors provided which features, inwardly hoping that some vendor would be able to check off most of the items as "available off the shelf." We decided that an ideal system would provide the following:

- an easy to use, comprehensive set of text editing and data manipulation commands
- some arithmetic and text sorting capability

Begin by getting the data into machine readable form, even if the choice of machine hasn't been made.

- a video display terminal (nonglare) with 132 horizontal character positions and at least 55 lines
- hardcopy printing at a terminal or spooling to a high speed line printer, with resulting camera-ready copy
- an interface for photocomposition, microfiche, and graphics systems
- communications with other processing systems
- large scale data storage, archive, and access

We're the first to admit that our list is biased, especially to data processing needs. The point is that potential users should come up with a list which reflects what they need, not what the vendors advertise.

The vendors present enough of a problem in using the checklist anyway. Our first vendor-related stumbling block was in learning to communicate in the same language with the various suppliers. It appears that in the wacky world of word processing they cannot even agree among themselves on the differences between "text processing" and "word processing." Other problems related to selling techniques much like those in vogue on used car lots, which we presume most buyers can handle, and the ever-popular "oh yes, that's on the drawing boards and will be available whenever you are."

In spite of vendor hassles, we brute-forced the study through to completion. We learned a good deal by doing it, including: (1) how to determine whether a word processing system is cost justified for a given application; (2) the advantages and disadvantages of a small standalone WP system compared to a large scale on-line system like ATS; and (3) that the product information matrix, the end result of our project, was of little lasting value.

We used the following relation to compute the crossover point between manual and automated methods of document production, the number of pages one must produce each year before the WP systems begins to pay for itself in cost savings:

$$\frac{\text{WP system fixed costs}}{\text{difference in page costs}} = \text{crossover point}$$

Simply stated, dividing the annual cost of the WP system by how much it saves per page tells you the number of pages per year you must produce before the system is cost justified.

It's an easy relation to use. The hard part comes in figuring out what it costs to produce a typed page using a typewriter and what it costs on the WP system.

For Hughes, we assumed that the typewriter was paid for and the only costs of producing a typed page was the typist's salary. For most of the documents we produce—proposals, manuals pages, etc.—we have found the following time estimates to be realistic:

- first draft 30 minutes
- coordination draft 30 minutes
- final copy 15 minutes

At first glance, the numbers seem very high, but they are not unrealistic in our environment, considering all the changes an author makes and the complexity of the material being typed. Someone else's numbers may be quite different, but the method is the same for any application.

Compare that time to the time for preparing documents using ATS, for example:

- first draft 14 minutes
- coordination draft 7½ minutes
- final copy 6 minutes

Thus, to calculate the crossover point or breakeven point in converting from manual methods to ATS, the following numbers plug into the equation:

■ WP fixed costs	\$1,900 (rental of the terminal)
■ Manual cost/page	\$11.24 (approximately \$9/hour including fringe benefits)
■ WP cost/page	\$6.42 (at \$9/hour plus ATS costs)
	$\frac{\$1,900}{\$11.24 - \$6.42} = 394$

For this case, it is cheaper to use word processing instead of manual typing if only 395 pages per year are produced. And in practice, more than one user can contribute to the 395 pages if they are close enough to use the same terminal and have similar applications.

PLUSES AND MINUSES

We were in a unique position to contrast the advantages and disadvantages of large scale and small scale word processing systems. Sometimes, even old ATS didn't fare so badly in the comparison.

Large scale on-line system advantages

- On-line systems can support more concurrent users, and more easily accommodate growth. Smaller systems tend to get the "slows" when additional devices are added, or to have unacceptable limits.
- On-line terminals can be used to access other subsystems, such as TSO, in addition to supporting word processing applications.
- Extremely large documents can be processed more easily, and quick access provided to any portions of those.
- High speed printing facilities are made available.
- Immediate access can be provided to a large volume of documents stored on direct access devices.
- Sorting can be accomplished, either directly or through spooled access to the host.
- Less floor space is required in the user area; only room for the terminal, modem, and workspace is needed.
- Routines can be added to the software more easily.
- Massive or frequent changes are readily accomplished.
- The per workstation cost is lower; per station costs actually decrease as the network grows.

Standalone system advantages

- The system is more readily available, 24 hours per day, 7 days per week if desired. The user is not tied to the schedule of the mainframe.
- The use of classified or sensitive data is easier to control. The system can even be locked in a room if desired, and there is no need to transmit sensitive information outside of that room for processing.
- The installation is easy. The system is ready to go when placed on the site.
- Users may be able to choose a system more precisely tailored to their needs—if those needs are fixed.
- The software may be less complex.

Some factors may be a push as far as comparisons are concerned. For example, the same printing mechanisms are available for printing at the user site or central site. Similarly, the ease of use is proportional to the complexity of the system and the features offered (although standalone versions are usu-

WORD PROCESSING SYSTEMS CHECKLIST

Format control

Auto centering
 Auto format control
 Auto hyphenation
 Auto indentation
 Auto leader dots
 Auto page numbering
 Auto right justification
 Auto underscore
 Automatic table of contents/
 index creation
 Box item in text
 Bury comments within text
 Figure title control
 Footnotes
 Form letters without operator
 intervention
 Include text by file name
 Justified block format
 Keep/release mechanism for
 assuring a section of text
 is not broken up
 Letter writing package
 Maximum line width setting
 required
 Maximum number of lines per
 file required
 Maximum page depth required
 Number of text columns required
 Odd-even headings/footings
 Optional line spacing
 Page number reset—actual/relative
 Revision bars in margin
 Scientific or math notation
 Subheadings/footings
 Substitute symbol/switch code
 Super/subscript
 Translate characters
 Upper/lower case Roman page
 numbering
 Variable line widths within a page
 Variable page lengths within
 a file
 Widow line control (treat left-
 over line as "keep")

Session commands and software features

Background processing via
 command
 Block moves
 Boolean compares
 Compare file versions

Copy portion of file
 Duplicate *n* number of times
 Front to back editing
 Full cursor edit
 Full screen editor
 Instant display of changes
 Line correction during input
 Locate and list/count occurrences
 Locate/change first, range, or
 all occurrences
 Multiple commands/corrections
 per line
 On-line sort
 Programmable (soft) keys
 Repeat next command *n* number
 of times
 Session elapsed time printed with
 sign-off
 Set terminal message on/off
 Single/multiple line deleting
 Stack commands
 Suppressed password with sign-on
 Upper/lower search/change
 User-executed background sort
 User message switching
 User requested archive list

Terminal devices

Auto reset terminal status
 Boldface
 Crt support
 Full cursor edit
 Hard copy input/output devices
 Maximum display line hard copy
 Maximum display line crt
 Pitch changes
 Printing speed required
 Scrolling capacity
 Transmission code (ASCII,
 Correspondence?)
 Type font

Disk processing

Auto file save
 Growth option
 Hardware types supported
 List files
 Massive file delete
 Maximum length of file name
 Optional disk formats
 Partial file retrieval
 Rename file

Resave file
 Restrict other users from
 read/write
 Save portion of file
 Selective list of files
 Storage device file capacity
 required
 Tape file to permanent storage

Tape processing

Device type
 Label input/output
 Optional purge with archive
 retrieval
 Print from archive tape
 System lookup (auto) archive
 retrieval
 Tracks/density required

High speed print

Bulk transmit
 Direct printouts to another
 user-ID's mail banner
 Dynamic allocation for remote
 printing
 File released directly to print
 queue
 Manual updating of forms validation
 table
 Maximum line length
 Microfiche interface
 Multiple copies option
 Photocopy (high quality output)
 interface
 Print abort (dequeue) message
 to user
 Proportional spacing
 Remote printing option
 Repro quality output
 User controlled hold/delete/
 release
 Variable point size
 Various font styles on same page

Accounting

Change session accounting
 Disk accounting compatibility
 required
 Performance statistics
 Peripheral accounting compatibility
 required
 Session accounting data
 compatibility required *

Table 1. Potential customers for word processing systems are urged to compile a checklist of features they require in a system. The list should be kept to a reasonable size (perhaps unlike the one the Hughes study team developed) and the items should be weighted or listed in order of importance. The

list becomes a valuable tool for evaluating systems; its compilation provides valuable side benefits as well, such as forcing a department to categorize and define its word processing requirements.

Hard copy made easy.

With the help of a high-speed microprocessor, Hewlett-Packard combines exceptional performance and convenience in a new low-cost printer and printing terminal.

The HP 2631A printer and HP 2635A printing terminal with alphanumeric keyboard are the first members of a new Hewlett-Packard family of hard copy terminals.

Each machine was designed to give you a number of high-performance features. And both can support a variety of interfaces, including RS232 and CCITT.V24, to fit into systems made by HP and other manufacturers.

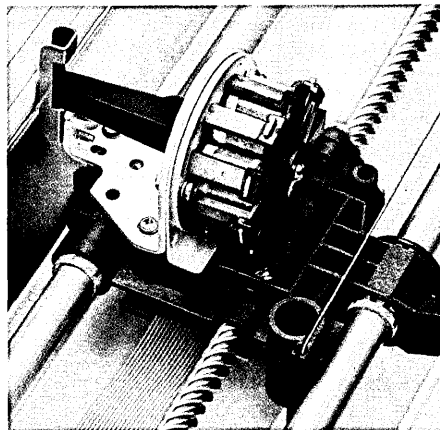
Bi-directional printing increases throughput. Both printers zip along at 180 cps in both directions, depending on your line layout. The microprocessor chooses the quickest path, and increases the speed even more by suppressing leading and trailing blanks.

High-speed slew for columnar data. When the microprocessor senses more than ten blanks in a row, it slews the print head at 45 inches per second to the next print position.

Three ways to print. The Character Compress/Expand Modes let you print more data on a page and emphasize points with headlines and titles. You can get as many as 132 characters on an 8-inch line, or 227 on a 14-inch line.

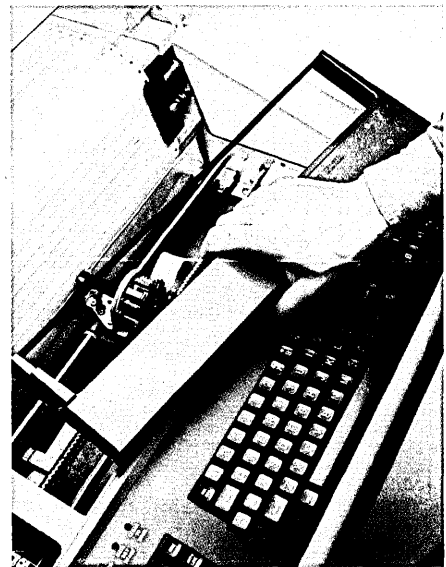
High-quality print, with six copy resolution. A 7 x 9 dot matrix (versus the usual 7 x 7) gives you clear, crisp printouts, right down to the sixth copy and meets the 128-character USASCII standard. And the extra two dot rows allow true underlining and descenders without character blurring.

Programmably interchangeable character sets. The HP 2631 can be made to print alternate character sets without reconfiguring the printer.



Long lasting, quick change print head saves service calls. The 9 wire print head is conservatively rated at a 100 million character life-span. It's also self-aligning. When you finally replace the head, you can do it yourself in a couple of minutes.

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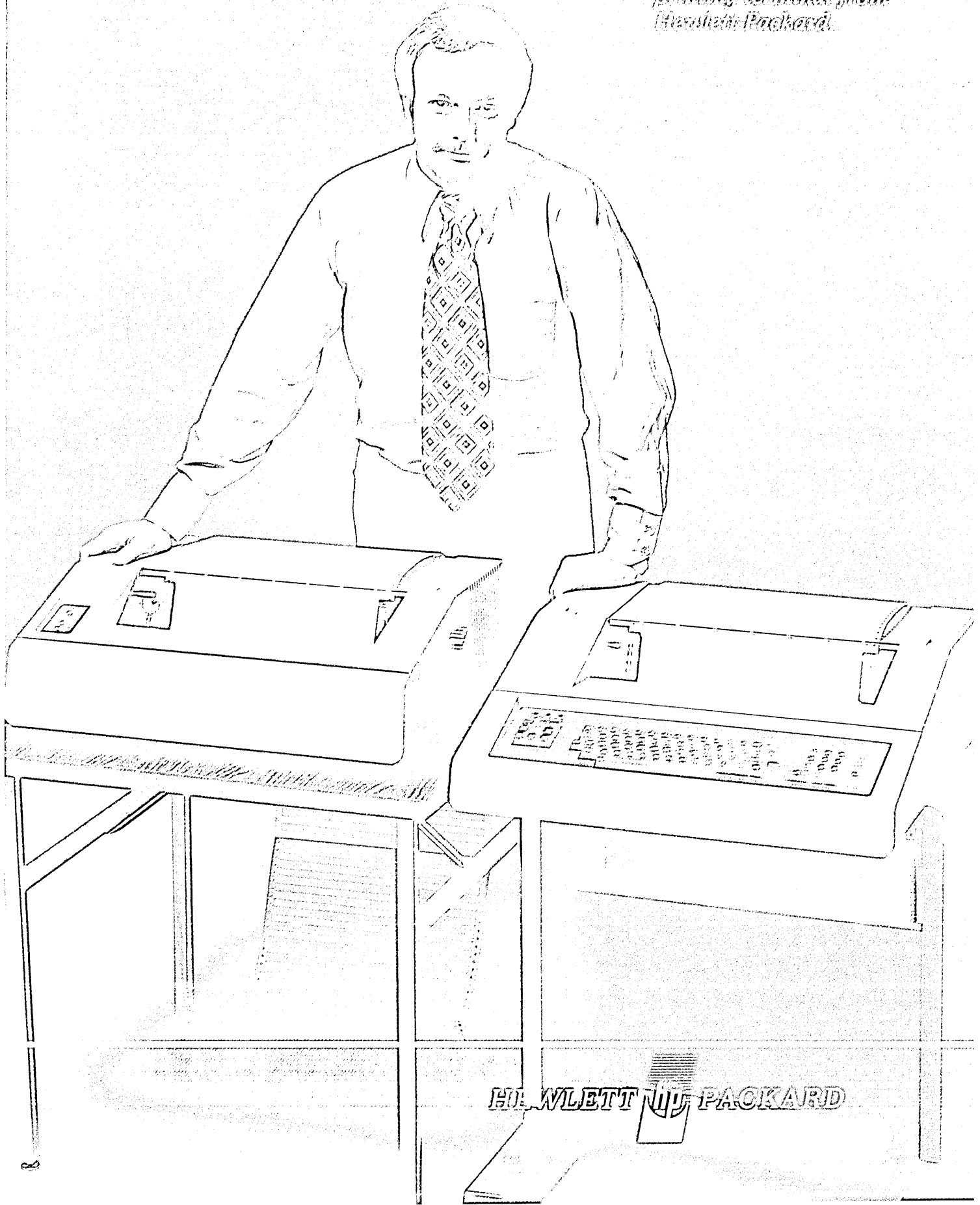
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Don't wait until the system is installed to get the data ready for it.

ally available in a less complex form than the minimum on-line system).

GETTING READY

The most important thing we learned in the survey project was how dynamic the field really is. The product feature matrix we built 12 months ago is now useless—not just out of date, but useless. The rate of change we're seeing will continue, too. As the cost of labor increases and software/hardware combinations become more economical, management throughout the country is taking a closer look at how to process words and vendors are coming up with more and more attractive packages to get managers' attention.

Faster printout speeds, more interfaces for photocomposers, and improvements in micrographic equipment are being announced daily. Camera-ready copy for volume reproduction is becoming much easier to produce. Practical color displays are just around the corner, as are larger display surfaces.

The only place where there seems to be a delay is in the software gap. Mini manufacturers are producing some very reliable hardware, but their word processing software leaves much to be

desired. We can reasonably expect that to change as well.

Fortunately, word processing managers can begin to prepare for the new systems without first deciding which one to acquire. The first step in that preparation should be to document the current word processing workload. How big is the volume? Are the documents usually originals, revisions, form letters, proposals? Is a special notation needed, as for scientific work? What about the formatting? Usually columns? Usually straight text? Are there special requirements, as for security? For archival storage?

The second step should be to choose the appropriate items from Table I or some list like it to produce a checklist for evaluating products. If possible, weight the items or group them according to importance.

Then visit other users. It's surprising how much one can learn that way.

Don't wait until the system is installed to get the data ready for it, either. Begin by using typewriters with ocr fonts, so that existing paper documents can serve as input for magnetic files later. Or use a service bureau to get your feet wet, at least on a casual

basis. Service bureaus are a good start for a variety of reasons, including getting used to large scale equipment if that becomes your choice, or getting the data ready for conversion to smaller standalones if you go the other way. The big gain will be in experience.

Get that experience now. Chances are you'll need it very soon.*

C. B. CARLS



Mr. Carls is head of the administrative systems section within Hughes Aircraft Company's corporate data processing

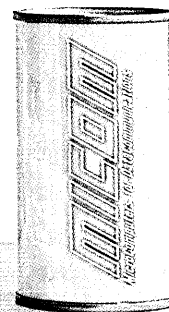
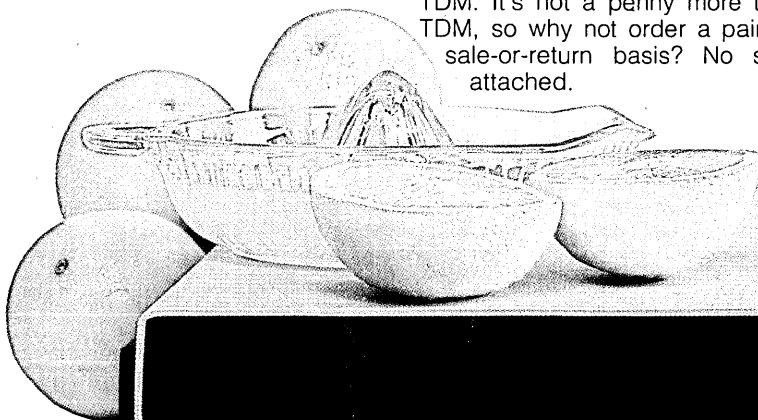
center. He began his career in data processing in the late 1950s with Occidental Life in Los Angeles, programming the IBM 650. At Hughes over the last 15 years, his responsibilities have spanned financial system design and programming, operating systems, hardware configuration management, standards development, and staff services.

Still squeezing data through the old-fashioned way?

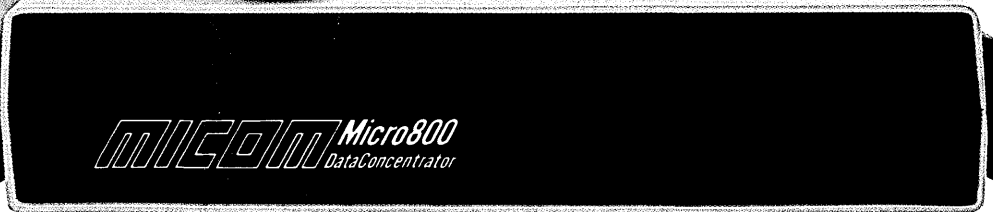
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By A. Letter

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It's durable too. In fact, the wheel that printed me today was no youngster. It was over 16 million characters old, but you'd never know it to look at me.

Not that I'm vain. But I am "camera ready" as soon as my page is finished.

And in my line of work it's important to make the right kind of impression.

Of course, it's only since they started using the Diablo 1355 WP metal-clad print wheel that I really became letter perfect.



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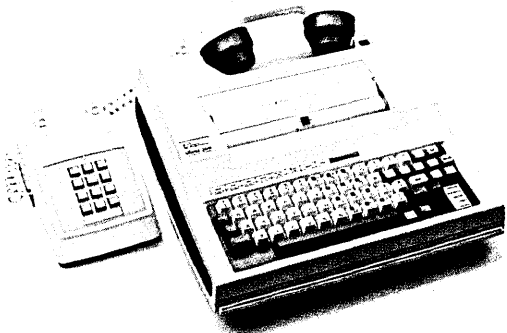
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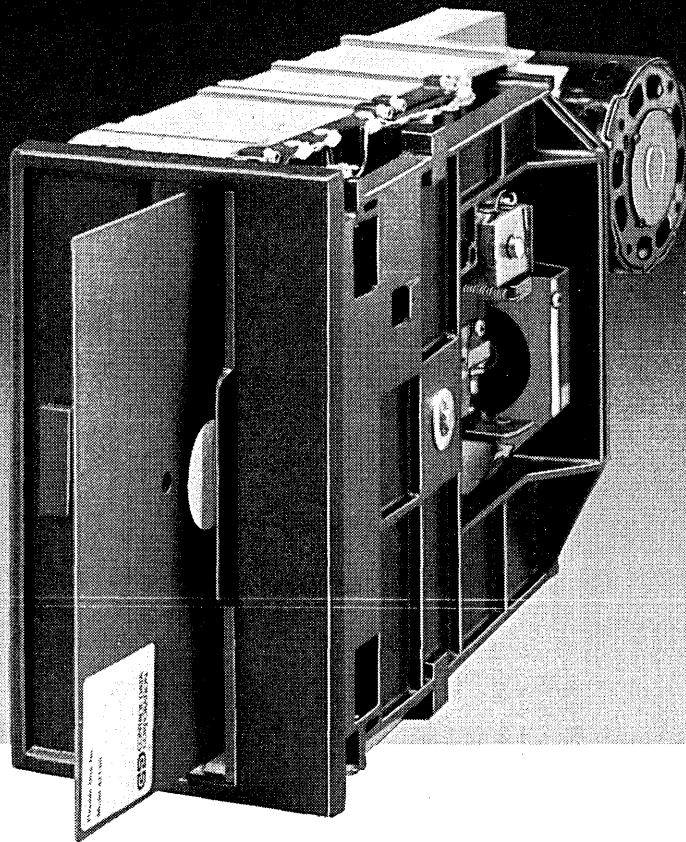
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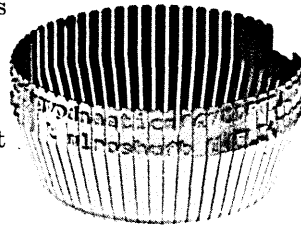
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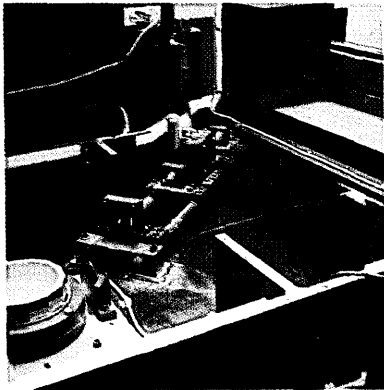
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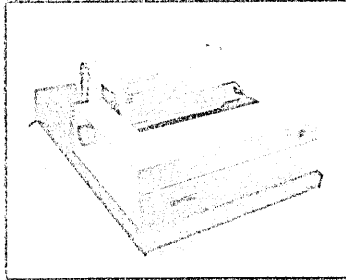
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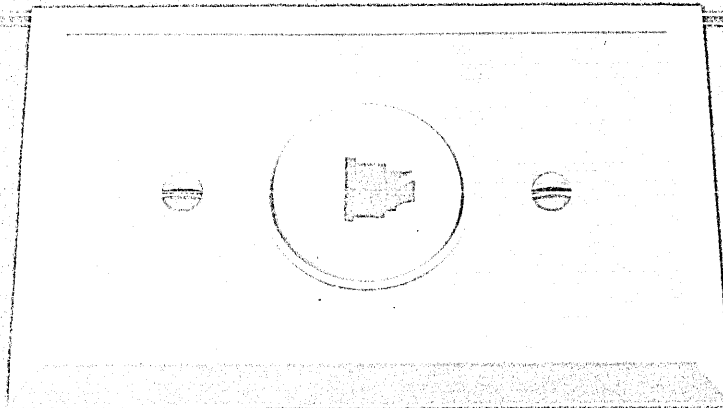
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The bank's top management decreed that the move into word processing would provide better service, save money, and be well worth the trauma.

CONSIDER THE BANK OF AMERICA

by Howard Anderson

When the Bank of America couldn't hire enough qualified secretaries in 1974, it began in a big way to move into word processing, then a new phenomenon in the office environment. The prime motivation was to increase secretarial productivity and stretch secretarial talent further. Today, hundreds of word processing units later, the bank finds that one of its most difficult chores is, again, personnel—how to find enough trained word processing operators.

One word processing trend that has surfaced at the Bank of America is that secretaries and former secretaries don't tend to make good word processing operators. Because of the relative tedium of word processing, the work seems better suited, for instance, to former keypunch operators.

Actually the seeds of the problem began in 1971, when the bank spent \$7 million for secretarial typing support; by 1974 that cost had escalated to \$25 million and the bank's management, concerned that the situation could get out of hand, decided to do something about it.

At the same time, like many other organizations, the bank was facing the problem that productivity had increased little while the cost of operating the bank had increased dramatically. The classic answer to the productivity problem would be to hire more people, but that would mean more salaries, more rental space, and more associated expense. Further, the bank was looking at a clerical wage rate that was increasing 10% to 11% a year.

It is interesting to note that increased managerial productivity was not a factor in the bank's early thinking on the issue. Later, however, managerial



Says Bank of America's Neil Jackson, "A terminal of any type on the desk of a senior manager at the bank probably wouldn't work . . . he has to have something simple and invisible, something where he pushes one button and he gets what he wants."

productivity became the fulcrum in selling the concept of word processing, particularly when cost justification became an issue.

Neil Jackson, an assistant vice president at the Bank of America, says: "One of the things that made word processing cost effective was that we had large enough locations to do our testing. We have over 60,000 employees. Our Pasadena center has 1,800 employees and turns out 120,000 letters per month; our San Francisco center has somewhat fewer people, but still turns out 95,000 letters per month.

"If you are a small organization or a small company, you aren't going to save very much money, if any, by putting in word processing. You have to have a big enough concentration to be able to put the resources on the task."

One of the marching orders from top management was that this fledgling word processing department should provide better service and save money. Moreover, Jackson tells of an executive vice president who very patiently explained that just providing better service and saving money wasn't worth it—the trauma of implementing a new system was such that it didn't make sense if the bank ended up where it started or just slightly ahead.

FROM HERE TO THERE

In a large company, expertise in an area such as word processing should not be located everywhere; it is more prudent to have a concentrated number of experts within the bank who can serve as internal "consultants" to the rest of the bank on matters such as word processing.

Under the direction of a senior-level vice president, experts from the word processing group—called the Word Processing Feasibility Group—get "invited" in to various divisions of the bank at the division's request. In other words a division may call on the experts if it perceives a need. Because there may be some real difference between what the division's managers consider a "need" and what the employees in that division see as a need, the feasibility group must tread lightly.

In 1974 there were two analysts assigned at the bank concerned with word processing; now there are nearly 200 analysts, supervisors, and other operators.

The feasibility group first conducts lengthy interviews with the department that sought its assistance. These interviews include everyone from the managers to the word originators,

the secretaries, and sometimes even photocopier operators. The goals of these interviews are twofold: first, to find out what the department did and how it did it (information that was necessary to build an effective questionnaire); and, second, to begin to gain the confidence of the users, managers, and executives.

However, even the best solution isn't worth much unless it's implemented; generally, the feasibility group won't run the risk of coming up with solutions which everyone agreed with in principle but which won't work in a practical sense for one reason or another. Once this is understood, the study group moves ahead.

After the initial interviews, a specific questionnaire is developed for the department that requested the study. Typical questions asked in, say, a lending department environment are:

■ Is the current secretarial support adequate for your needs? (Typical answer: Yes 58%; No 42%.)

■ How do you input material for typing? (Typical answer: longhand 98%; dictation 2%.)

■ What is the most frequent cause for retyping? (Typical answer: typographical errors 78%; misunderstanding input 22%.)

A Global Processing Network

The Bank of America, the world's largest commercial bank, is currently developing a global word processing network with operations offices on five continents. There are presently over 200 Lexitron 900 and 1000 wp's dispersed throughout the bank's offices; many of these machines are equipped with asynchronous communications. Documents can be transmitted from a text to the bank's computer system. Communications are now on-line to Los Angeles, San Francisco, New York and Chicago. Offices in Houston, Europe, Asia and South America are in various stages of planning and testing.

The development of a communicating word processing system was fueled by the bank's rapidly expanding international operations, and the need for closer coordination and control of transactions. Also, since

worldwide transactions are often complex and lengthy, the ability to transmit entire documents quickly is an important asset.

The use of communicating word processor systems began in early 1977 with links between San Francisco, Los Angeles, and Chicago. The bank standardized on Milgo modems. The system is up and running with transmission rates of 300cps.

Neil Jackson, an assistant vice president at the bank, is emphatic about the importance of electronic mail to the bank. Uses include transmission of credit applications and other transaction data, as well as memoranda that will enable executives in different cities to confer on major decisions with more complete information.

Future plans at Bank of America include expanding word proces-

sing to its nearly 1,100 California branches. To accomplish this, plans are being developed that could tie wp's to an existing on-line computer network. The bank is presently testing an OCR system, and preliminary results look promising; it will be hardwired directly to a Lexitron unit. In addition, the San Francisco wp center already has a photocomposer installed, and that will soon be linked to the communicating word processing network, allowing documents from all over the country to arrive electronically to be photocomposed.

Also under development are extensive switching systems that will enable facsimile terminals, central files, data terminals, and other devices to fit into the network. Management terminals to complement the centralized dictation and wp systems are also being considered. *

And then the bank turned its attention to managerial productivity and discovered a major justification for the system.

■ Are your deadlines usually met? (Typical answer: Yes 88%; Yes, but must be retyped due to errors 9%; No 3%.)

■ Are there any activities that you currently perform that can be performed by the secretarial staff? (Typical answer: Yes 27%; No 73%.)

■ Do you have any suggestions? (Typical answer: improve quality of typing 22%; improve telephone reception 23%; improve photocopy service 28%.)

Next, these questionnaires are processed and the results presented to the management of that department. The comments are also included. Activities are listed and the questionnaire is specific as to the number of days this task is performed and the number of minutes that it is performed over a weekly period. For example, the activity "handwritten correspondence" may take 11% of a typical day and represent an "equivalent staff" of 7.7 "people."

Now these "people" aren't clerical or secretarial staff, they are \$25,000 to \$35,000 per year managers and executives. And it was this that forced Bank of America to look at managerial productivity, since improving on "handwritten correspondence"—often a management activity—would have a major effect on cost justification. As it turns out, much more savings can be realized in managerial productivity savings than in cutting out one or two secretaries. All this, however, is not an easy task, since proving to top management that these kinds of savings are legitimate can take considerable time.

MOMENT OF TRUTH

Finally, the moment of truth arrives: The Word Processing Feasibility Studies Group must "sell" its recommendations to the user group.

The problems here can be severe. How are the "savings" realized? Does the bank lay off the secretaries? Or does the bank give early retirement to those extraneous loan officers? Luckily, the bank has a policy of not laying people off, and normal attrition usually is sufficient to "slim down" a department within a reasonable period. The feasibility group attempts to get a commitment—in writing, no less—that the department will not add more people when it increases its workload.

This is also the philosophy expressed by Robert White (April 1977, p. 83) of Citibank in New York. The Citi-

bank argument is slightly more complex but its aims are similar to those of the Bank of America. Citibank says that normal (employee) growth rate shows that the bank will grow from 49,000 employees to 55,000 over the next six years, and that the typical current ratio of managerial control is seven subordinates to every supervisor. If, Citibank philosophy goes, it were possible to substitute sufficient office automation hardware for people, that span of control could increase from 7:1 to 9:1. That means the bank could do 15% more business with no increase in staff.

With a potential labor cost savings of \$35 million annually and a potential hardware cost of \$10 million, the proposition is intriguing. Citibank is still experimenting and it is too soon to tell whether the bank has been entirely successful. What is intriguing is that Citibank and Bank of America have arrived at the same destination from different points of departure.

Now there is a new problem: What are managers going to do with the extra time? And how can management productivity be measured? One solution is to gradually increase the workload of managers, raise their span of control, and simultaneously make available the technology that can allow them to handle the workload. Further, as part of their ongoing evaluation, these managers can be graded on both how well they can handle their increased workload and how well their subordinates can handle *their* increased workload.

For example, a manager we know has 500 people reporting to him in a \$1.5 billion dollar minicomputer company. Previously he had an "open access" arrangement where anyone could call or drop by his office with a problem. Some days he did little but put out fires.

Now he insists that such "problems" be transmitted to him on the firm's recently acquired computer-based electronic mail system. He now can make the decision himself about what is important and what is not important. Further, he has told his people that their performance rating will depend on how well they adapt to and adopt this new technology. The executive spends one hour a day at his electronic mail terminal and he swears that it is the most productive hour he has every day. His number of phone calls has decreased and his amount of real work, he says, has dramatically increased.

But the minicomputer company executive is unusual. Most executives view keyboards as they view the bubonic plague. Office automation for them will begin and end outside their office doors.

The Bank of America's Neil Jackson says, "A terminal of any type on the desk of a senior manager at the bank probably wouldn't work. He has to have something simple and invisible, something where he pushes one button and he gets what he wants."

Jackson goes on to say that the results with the bank's word processing effort so far, even with the basic system, have been encouraging. Savings for the last three years, after all expense items, were pegged at \$4.5 million and the bank expects the savings to be \$6 million in 1978. Not all of those are hard dollar savings; some are cost avoidance or "soft savings" and the results have proved so fruitful that the bank is studying the next phase of automation.

For example, a loan application from South America must be approved by the bank in San Francisco before it can go on the books. The mails and even the bank's time-sharing network are too cumbersome. But by having compatibility of word processors and electronic communications, that load can quickly be sent directly to San Francisco, approved, the modifications made, and retransmitted to South America. For a \$20 million dollar loan, the estimated savings of five days could possibly represent increased revenue to the bank of \$25,000. And it is exactly that kind of \$25,000 manna from heaven that makes it all worthwhile. *

H. ANDERSON



Mr. Anderson is the president of the Yankee Group, Cambridge, Mass., a consulting firm specializing in the communications area. He has recently completed an analysis of AT&T's Advanced Communications Service and has written previously for DATAMATION on the subject of IBM's computer and communications strategy. Mr. Anderson is a graduate of the University of Pennsylvania and the Harvard Business School.



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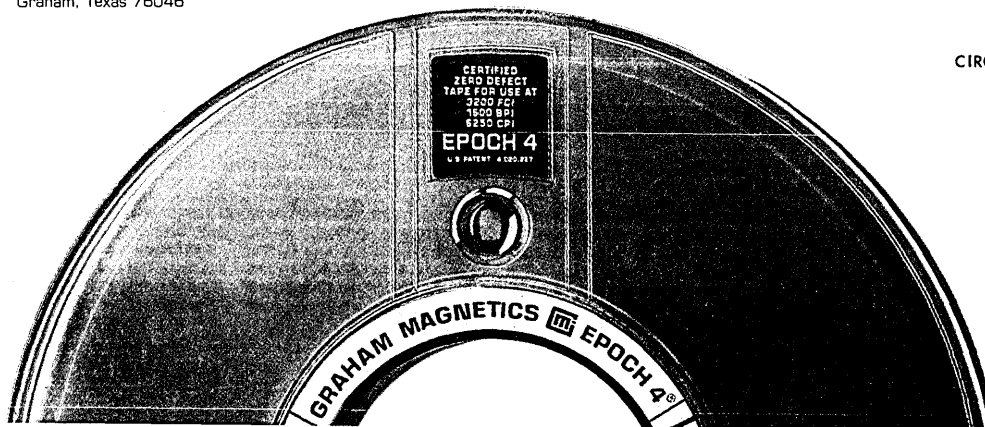
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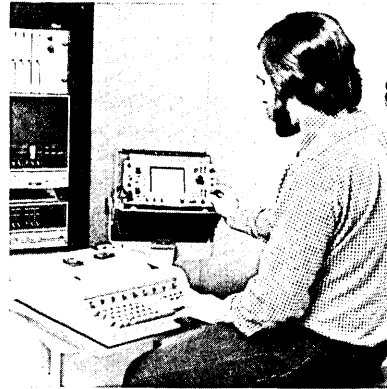
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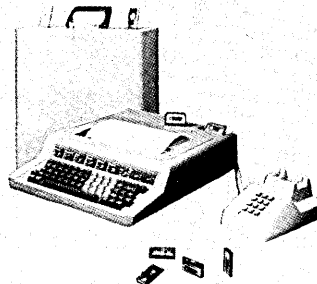
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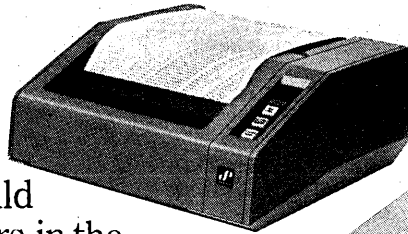
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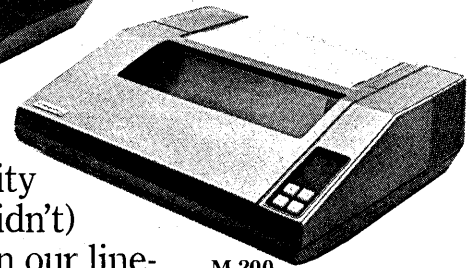
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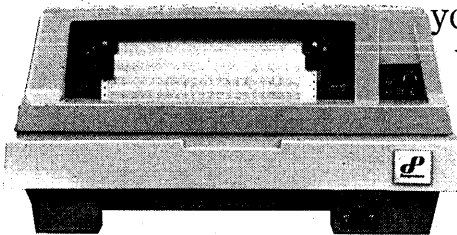
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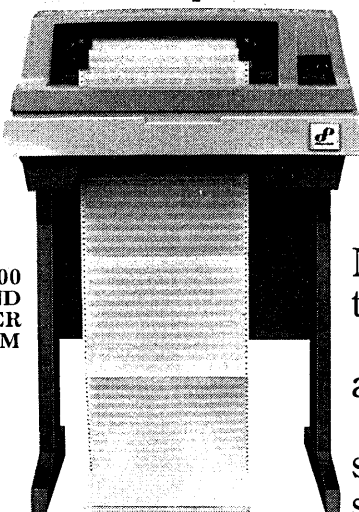
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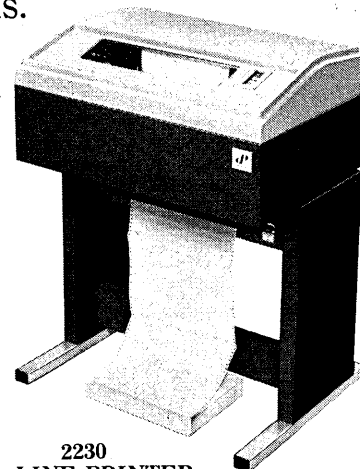
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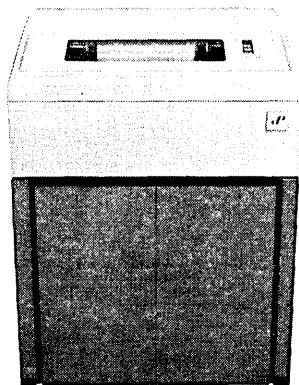
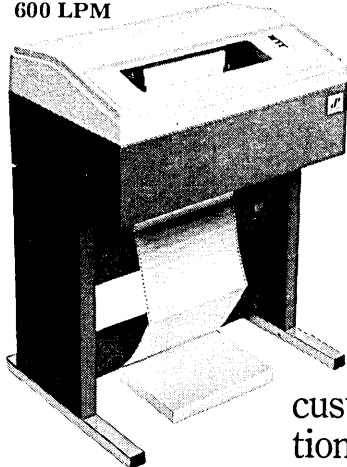
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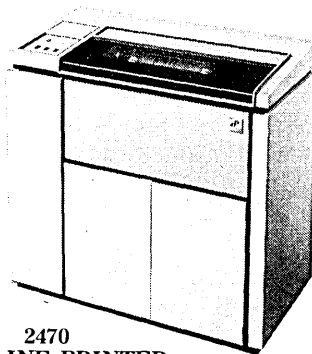
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300 LPM

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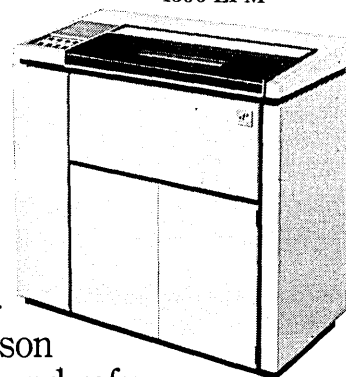


2290 LINE PRINTER
900 LPM



2470
LINE PRINTER
1250 LPM

2550
CHARABAND PRINTER
1500 LPM



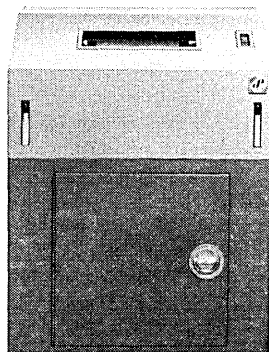
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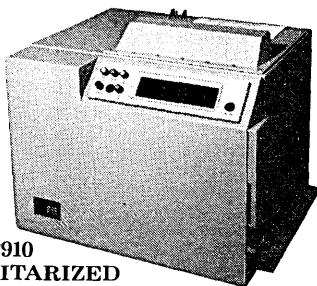
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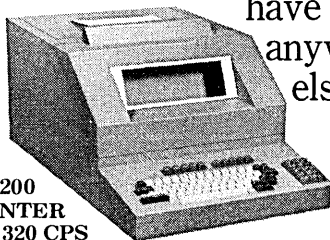
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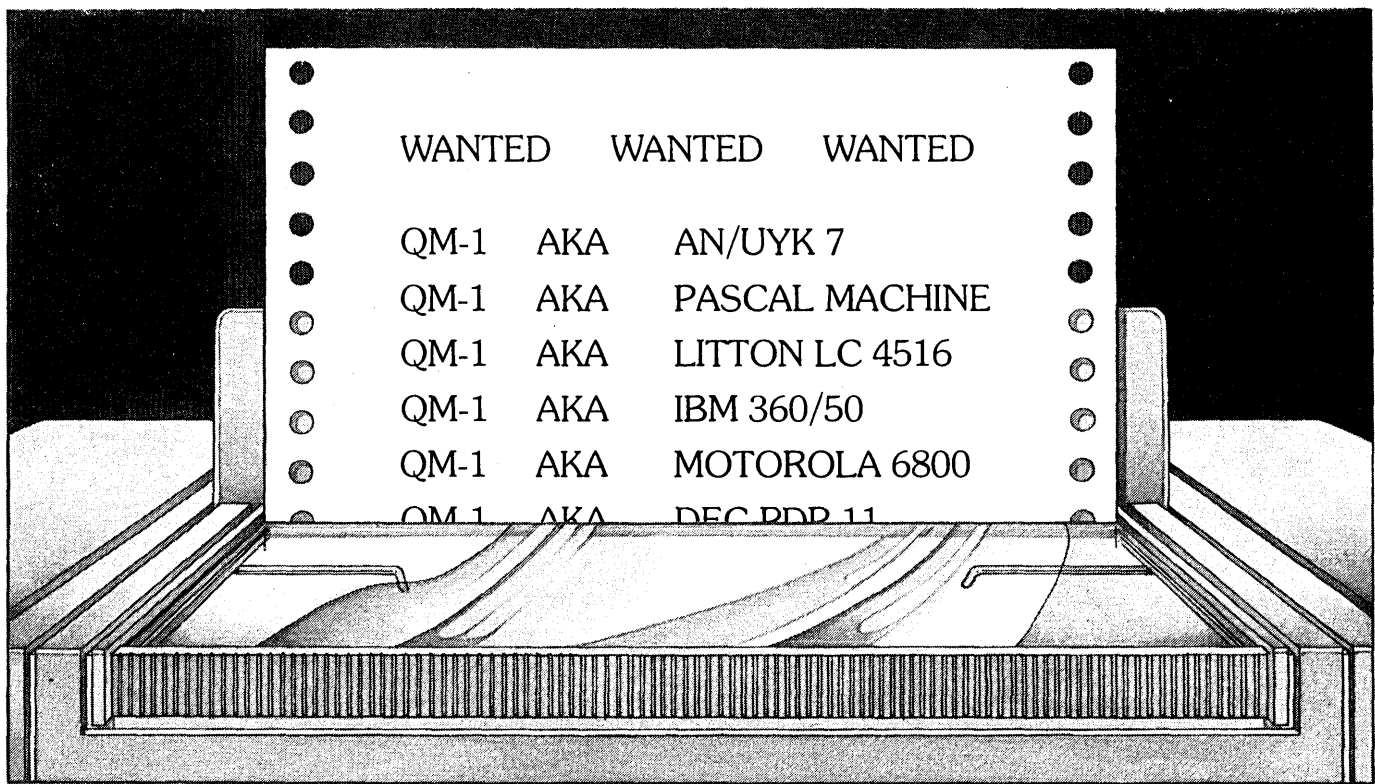


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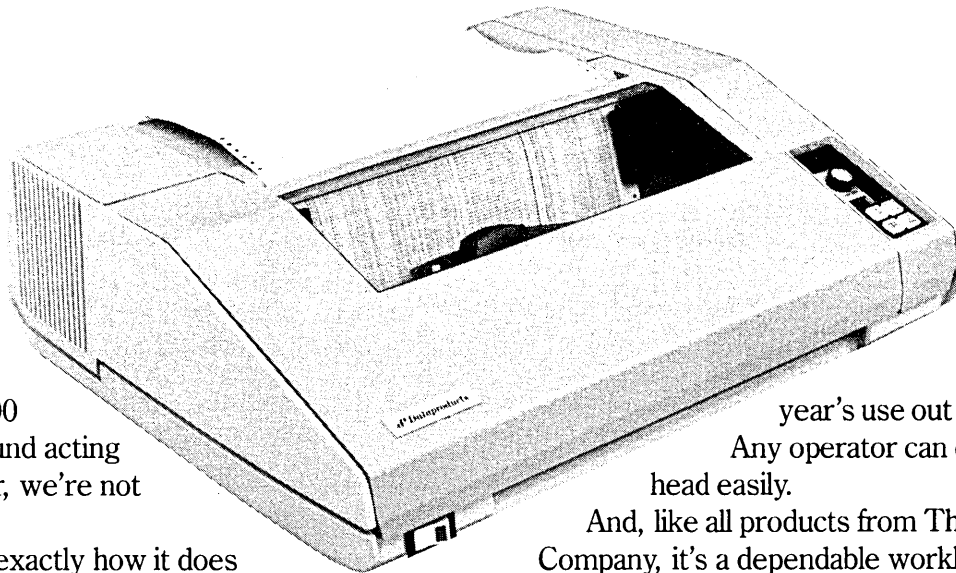


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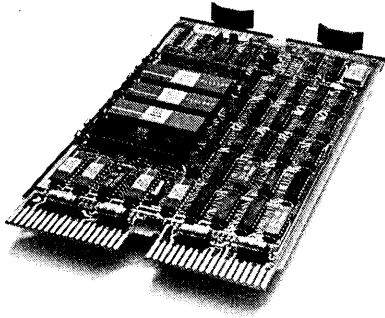
THE M-200 MATRIX PRINTER

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Nice going, DEC[®]

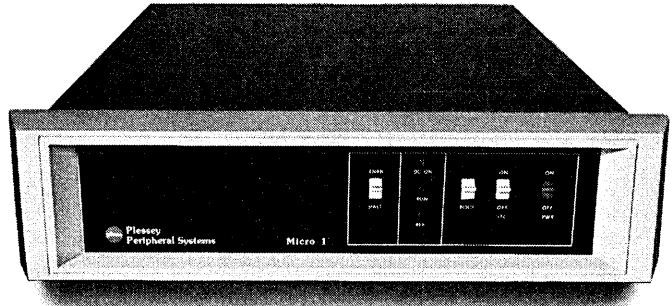


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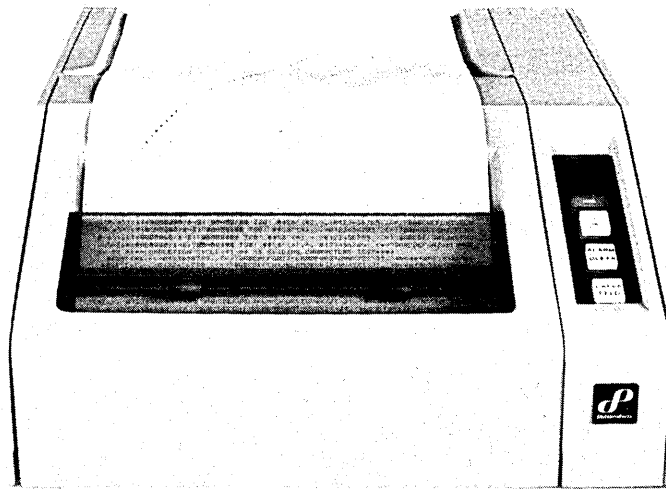
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Word processing technology and user's needs are in flux;
system designers must provide for this change.

WHYS AND HOWS OF WP SYSTEM FLEXIBILITY

by William A. Lippold

Any user designing a word processing system today is faced with three inescapable facts: first, WP equipment technology and capabilities will continue to advance and improve; second, practically every user's needs for WP will continue to change; and third, the WP manager will be expected to meet his or her organization's changing needs for WP with the most efficient capabilities available. These three facts create a situation where the design of a good WP system is never-ending. The equipment configuration and operational procedures will undergo continuous modification and the day when things settle down will never arrive. Therefore, system flexibility, as well as price and performance, must be a primary concern in selecting WP equipment.

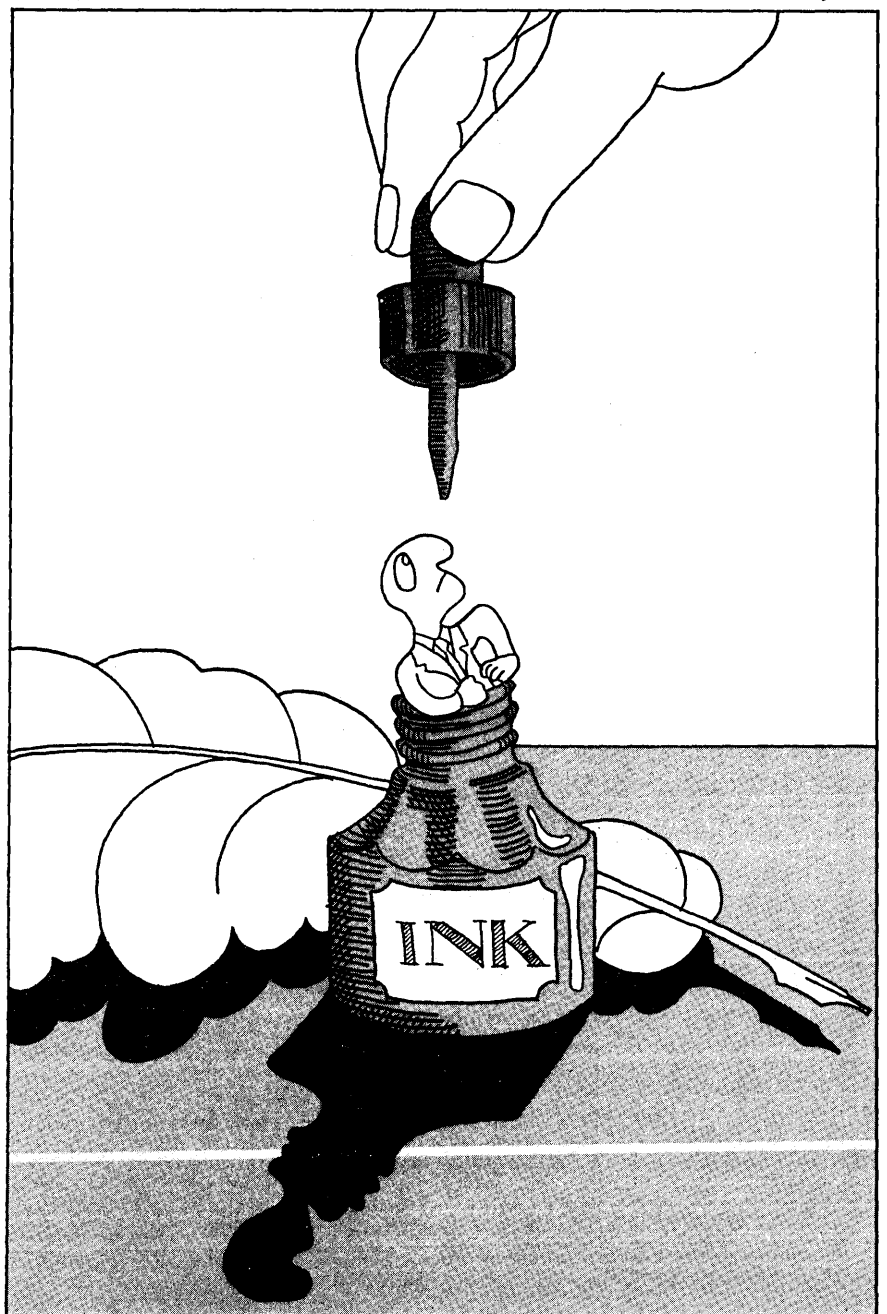
In most organizations, it is unrealistic to expect that anyone can accurately define the current needs for WP before the equipment is installed and used. No matter how thoroughly the current procedures are studied and how many statistics are gathered and analyzed, the actual needs are bound to be different than those anticipated. It's unlikely that the planned operational procedures will turn out to be just right, or that the productivity estimates were precise. In many cases, a system is designed around the presumed needs and then the organizational procedures modified to fit the system when it becomes apparent that the presumptions about needs were wrong. And productivity has a way of meeting expectations, rather than being maximized.

Even if some of the actual needs can be precisely defined, the application of WP to these needs is likely to change them. For example: the defined need is to reduce the time required to produce a finished document from two days to one day; once this is done, the need will be redefined to produce it in one hour. Or, once the defined need to print justified copy with variable word and letter spacing is accommodated, the new need may be to typeset it. Initially,

the organizational needs may lag behind the capabilities of a WP system, but once these capabilities become apparent to the users, their needs will soon match and then exceed them.

Therefore, a good WP system will not only be able to accommodate future

needs, it will also be able to adjust to current needs as they become known. Absolute system flexibility in this regard is impossible to achieve, but there are some things the WP manager can do in designing a system and selecting equipment that will maximize flexibility.



FLEXIBLE SYSTEMS DESIGN

One of these is to select an equipment supplier that has a flexible system architecture—that is, an architecture whose basic design principles enable easy expansion and change in the system's capabilities. If the supplier allows you to select from two or three printers of varying speeds and printing quality, the same system can probably accommodate the new printer that will be invented next year. And, if you can now choose between small floppy disks and larger rigid disks, you'll be able to upgrade your storage capacities in the future.

If the system is controlled by a programmed computer and you can now select various software packages, you'll probably be able to take advantage of new programs the supplier will develop in the future, without having to change your equipment. The more options the supplier offers, the more likely it is that the system can be configured, and reconfigured, to meet your exact needs as they become known. And the more likely it is that you'll be able to add new capabilities in the future as they become available.

Another factor in designing a flexible system is *not* presuming that all WP equipment will be physically located in one central location. Although you may initially want to perform all of the WP work in a single center, two or three years from now you may also want to establish satellite centers, or locate single terminals at remote sites. The equipment you select should be able to accommodate such needs, and provide the means of moving or transmitting copy among these centers and remote sites. Ideally, you should be able to reconfigure the initially centralized equipment into multiple satellite centers, or single remote stations, rather than having to buy more equipment.

Remember that implementing a centralized or decentralized WP system does not restrict you to using shared-logic or freestanding equipment. Just as the terminals and printers of a shared-logic system can be located some distance from the central controller, multiple freestanding terminals can be located together in the same location. And you can buy systems that consist of

both shared-logic and freestanding terminals.

In selecting equipment, you should also consider the need for OCR, data communications, phototypesetting, and the need to move data between the WP system and your company's computer.

Incorporating such flexibility into a WP system presents several problems to the designer. However, two of these are *not* availability and cost. Although many systems are either inflexible or of limited flexibility, there are several systems on the market that provide excellent flexibility characteristics. And there is no strong correlation between system flexibility and price. That is, systems that offer a high degree of flexibility generally cost no more than those that do not.

Designing for flexibility does, however, require more effort in the equipment selection process. More factors must be considered and more systems must be studied than if the equipment were to be selected simply to meet the designer's current presumed needs.

DEALING WITH MANAGEMENT

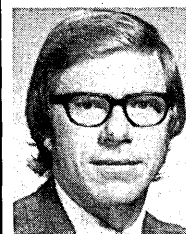
Perhaps the biggest problem in designing a flexible system, however, is in regard to management's attitude. Many corporate managers are unfamiliar with WP equipment and procedures. This lack of knowledge sometimes results in the establishment of attitudes and policies concerning WP that have been derived from their experience with data processing. They see the WP problem in a static, rather than a dynamic, frame of reference. For example, they may not understand why current needs cannot be precisely and quantitatively defined, they may not understand the office procedures in detail, and cannot appreciate the importance of the human element in the operation of a WP system.

Compared to the needs of a WP system, the business data processing tasks are well defined and established. Few corporate managers can remember when their payroll was not done by computer, and they haven't experienced the problems associated with automating such manual tasks. The

transition from having private secretaries typing documents and maintaining manual paper files to having these tasks performed in a WP center in electronic form is not trivial, and the best equipment and procedures to perform these tasks in an automated manner cannot be precisely defined. The extent to which office procedures can and should be automated will depend upon the unique needs and environment of each company and will be strongly influenced by personal preferences.

Someday the design of a WP system may be as straightforward and quantitative as replacing or upgrading a dp system is today. But until then, WP systems must be capable of evolving toward an organization's needs as they become known. This requires flexible WP equipment, but more importantly, it requires an understanding on the part of corporate management that a gradual transition will be required, that the justification for installing WP equipment may not be as quantitative as with dp equipment, that mistakes in planning and system design will be made, and that the problem of automating office procedures will require his attention and the organization's resources for an indefinite period. *

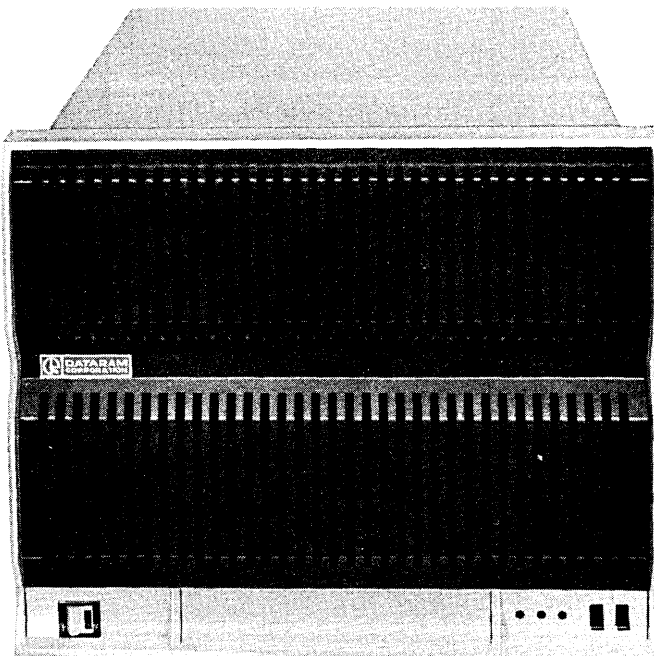
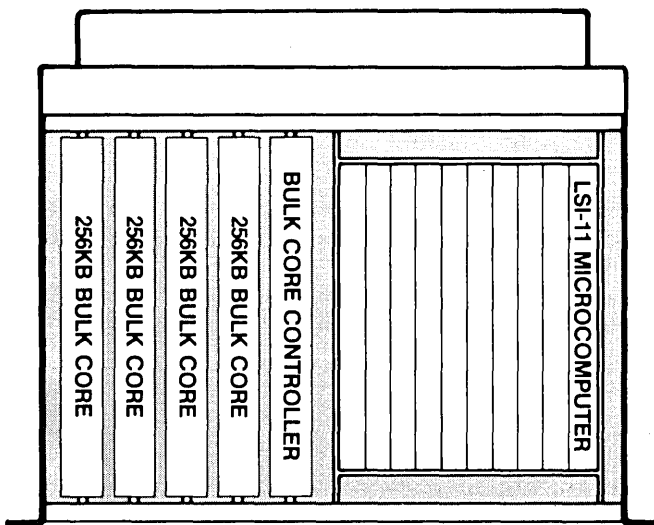
WILLIAM A. LIPPOLD



Mr. Lippold is the president of Harvard Associates, a Harvard, Mass. consulting firm specializing in word processing, electronic editing, automated composition, and typesetting systems. During his more than 17 years in the industry he has held various engineering, product planning, and management positions with IBM, Honeywell, Digital Equipment Corp. and ECRM. Much of that experience was in the design of computer hardware and software, and in managing projects that required significant changes in work methods, personnel, and organizational structures.

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You've made your career in dp. And then one morning your company asks you to manage the word processing function. Now what do you do?

THE NEW WORD PROCESSING MANAGER

by Randy J. Goldfield

While top management is usually familiar with the data processing environment, it is frequently unaware of the scope and impact word processing (WP) may have on its organization. As a result, a candidate to fill the WP manager's position may be selected without giving proper consideration to the unique responsibilities of the job.

Because word processing is still a new field, qualified word processing talent is still scarce and, in many cases, even requisite managerial specifications do not exist. Too often this lack of awareness and necessary in-house expertise can ultimately lead to the complete failure of the WP system.

Given the lack of widespread managerial expertise in WP, the question arises: Is it possible to prevent such a costly—and sometimes embarrassing—breakdown from happening? The answer is "yes," but it is a qualified "yes." The chances for success increase only as management's knowledge and expertise in WP increases.

As in data processing, the three key elements of word processing are equipment, procedures, and people. But unlike data processing, successful managers in word processing agree that procedures and personnel are the most important aspects, despite the "sex appeal" of technology. Word processing equipment takes a back seat to the other two elements. This is explained by the fact that users were titillated by WP gear when it first appeared in the late 1960s. As experience with WP grew, it became apparent that the gear worked fine, but there were often problems with the *personnel* who operated it, and the *procedures* that were supposed to rule it.



Managing the delicate balance among the three components differentiates the word processing manager's job from the data processing manager's job. To illustrate this, consider the following case history:

Five years ago, a company implemented a word processing system and appointed a manager with data processing but no word processing experience. For our purposes here, we shall call him Harry. Over a period of time, Harry had developed a good rapport with his users and his peers; he had more than 10 years'

service with his firm; and he had established a solid foundation in data processing technology. However, Harry lacked some very important knowledge and skills.

To begin with, Harry was unaware of the rapidly changing use and application of word processing equipment and concepts. For example, his data processing orientation gave him a tendency to favor minicomputer shared logic systems over less sophisticated standalone systems. He also lacked essential secretarial managerial skills.



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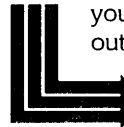
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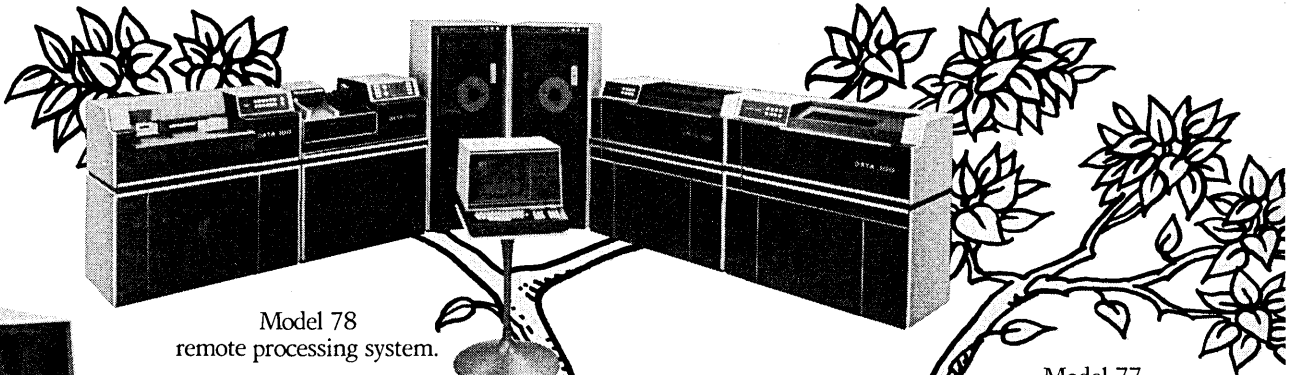


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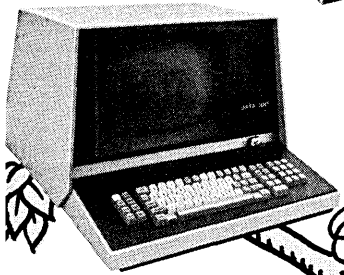
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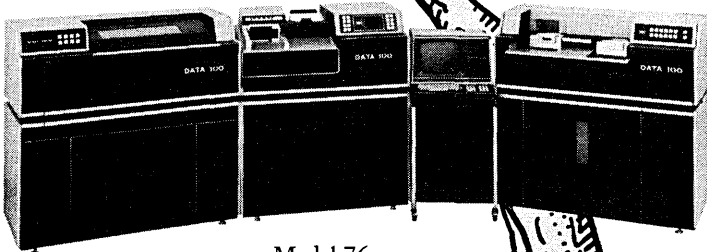
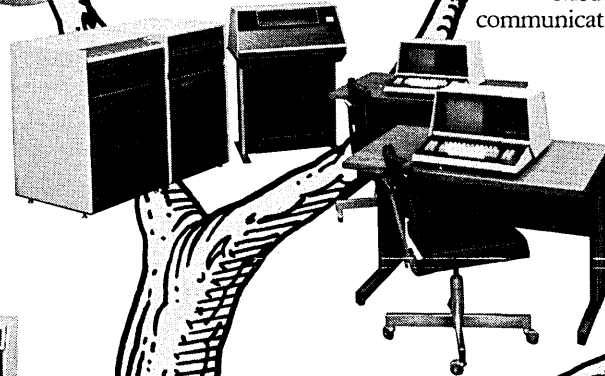


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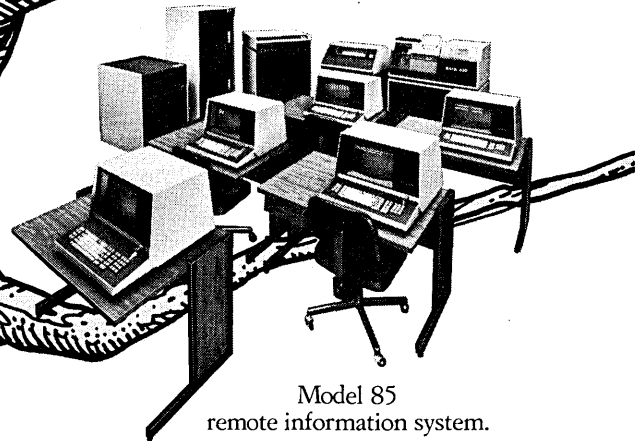
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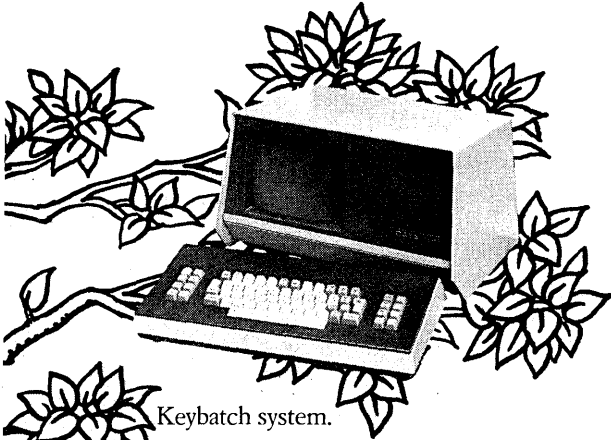
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In one extreme case, the center received a memo requesting typing service scrawled on a cocktail napkin. The center supervisor was incensed.

was unfamiliar with secretarial tasks, and unaccustomed to dealing with secretaries. His firsthand experience or knowledge of the office environment was limited because the data processing department was very different from most "offices" in the company, and his training and personnel development skills in the office environment were weak. In addition, neither he nor upper management responsible for his appointment anticipated the significant differences in the intensity and scope of user/management liaisons between a word processing center and a data processing department.

In this case, the resistance to change from prospective users precipitated by the conversion to a word processing center was massive. Unlike most data processing application installations, the changeover was not looked upon by users as a system to aid or improve their efficiency, but regarded suspiciously as something new and therefore dangerous. And, unlike data processing conversions, word processing, by reorganizing, reassigning, and reducing secretarial staff was viewed by many professionals as a direct infringement on their domain and a detriment to prerequisites they had heretofore enjoyed. Their dissatisfaction was shared by the participating secretaries who feared that the diverting of their typing and dictation responsibilities indicated that their jobs had become obsolete.

In addition, the professional caliber of word processing center staff was so different and also so much less sophisticated than the data processing staff, that Harry was not able to relate to their personal and professional needs.

Accustomed to a work environment in which the user's needs were dependent upon the technical capabilities of the hardware and the high level technical expertise of staff, Harry was unprepared to interface with both user demands and his own word processing staff's sinking morale.

Users who had been previously indulged by private secretaries were not properly educated in formal center capabilities and procedures. As a result, they had unrealistic expectations or were unaware of and unconcerned with methods of document input and protocol. In one extreme case, the center received a memo requesting typing service scrawled on a cocktail napkin. Not only was the center supervisor incensed by this apparent lack

WP MANAGER CRITERIA	Typical EDP Skills Relationships
<ul style="list-style-type: none"> • Data Analysis Skills • Systems And Procedures Development • Financial Planning • Creativity • Management Skills • Top-Management Interaction Skills • Personal Qualifications • State-Of-The-Art Knowledge In Word Processing And Office Environment • Widespread User Liaison Skills • Training Skills For Users And Secretaries • Secretarial Development Skills 	<div style="display: flex; flex-direction: column; align-items: center; gap: 10px;"> <div style="display: flex; align-items: center;">●</div> <div style="display: flex; align-items: center;">●</div> <div style="display: flex; align-items: center;">●</div> <div style="display: flex; align-items: center;">◐</div> <div style="display: flex; align-items: center;">◐</div> <div style="display: flex; align-items: center;">◐</div> <div style="display: flex; align-items: center;">◐</div> <div style="display: flex; align-items: center;">○</div> <div style="display: flex; align-items: center;">○</div> <div style="display: flex; align-items: center;">○</div> <div style="display: flex; align-items: center;">○</div> </div>
<div style="display: flex; align-items: center; gap: 20px;"> <div style="display: flex; align-items: center;">● <i>Strong</i></div> <div style="display: flex; align-items: center;">◐ <i>Varies Individually</i></div> <div style="display: flex; align-items: center;">○ <i>Weak</i></div> </div>	

Fig. 1. The dp professional who moves into the word processing environment brings a variety of previously acquired skills to the new job. To be successful however, the manager must learn other skills that are unique to the word processing world.

of consideration, but the user also became understandably indignant by the lack of cooperation and handling he felt he was receiving. Before the implementation of the center, he had never encountered any difficulty with his private secretary. Now, he was having nothing but trouble.

Meanwhile, many members of the remaining administrative secretarial staff who did not work in the center resented the word processing center, and did their best to sabotage the facility. Work destined for the center was left on desks and submitted at the end of the day to sabotage turnaround time. Calls from the center were not returned and administrative secretarial errors were blamed on the center staff.

CRISIS OF CONFIDENCE

He saw it as childishness, and he left the bewildered center supervisor to handle it. Unable to present a clear picture of the complexities of a word processing system or to fully understand his new

role vis-a-vis the users and his staff, Harry failed to gain the confidence of either group.

The company also managed to compound the problem by failing to support Harry in his new role while never really allowing him to acquire and develop appropriate skills through either internal and professional group efforts or through outside training programs.

As one would expect from such a situation, center productivity started to drop substantially while typing errors became increasingly frequent. Center secretaries with good skills felt unappreciated and tried to leave the center at the first opportunity. Those who remained, having the poorest skills and therefore no alternative, developed morale problems, often quarreling among themselves. Considered by outsiders to be the worst position in the company, no secretary would bid for a replacement position.

Users, of course, continued to complain about the poor service. The fatal blow occurred when one department discontinued using the center altogether, insisting upon the return of its

The word processing staff is sometimes overawed by technology

private secretaries. Management wondered what went wrong.

MANAGERIAL SKILLS

The whole unhappy situation is not traceable to the incongruity of a dp background with wp management: there is really no reason a data processing professional cannot convert to a word processing managerial position successfully and capitalize on the added benefits of his technical expertise. He must, however, possess the qualifications necessary to ensure smooth operations in the unique word processing environment and be aware of and prepared to deal with the differences between the two. All these qualifications are not inherent in the dp environment. The essential criteria for word processing facilities management combine new and previously acquired skills.

Managerial skills can be developed through proper training and understanding of people. Leadership, decision-making ability, and sound judgment are universal managerial elements. The word processing manager must also possess an understanding of

secretarial as well as professional and word processing staff needs, and be capable of motivating staff and dealing with users accordingly.

Skills for training users and secretaries must be developed by the word processing manager to orient users and train secretaries in methods and procedures, equipment capabilities, and language arts reinforcement. It is important during training seminars to stress what the system can and cannot do so that the center receives input that it can accommodate. Unlike the data processing environment, word processing staff is sometimes overawed by technology and fearful or reluctant rather than curious about it. The effective word processing manager is aware of this syndrome and deals directly with these problems.

In addition, there are other key areas of expertise that a good wp manager should develop. Consider the following:

Personnel development skills including the ability to construct proper job descriptions and career pathing programs are pivotal to the development of full staff potential. Typically, word pro-

cessing personnel need a great deal of development and very often no job description other than "secretary" exists. wp management must acquire realistic aspirations and an understanding of secretarial objectives before enlightened programs can be created.

Top management interaction skills can be evidenced best through meaningful communication with top management with a focus on how its original goals are being achieved, whether they be cost reduction, cost avoidance, or improved service.

Financial planning entails budget handling, long term planning, and projecting the company's secretarial support staff requirements. Most data processing professionals possess these fundamental skills and need only to adapt them to the secretarial environment.

Data analysis skills are important; maintenance of standards and implementation of required changes can be accomplished only after accurate data and statistics have been gathered. Here, most data processing professionals have great strength and can provide creative, useful methods for handling historical

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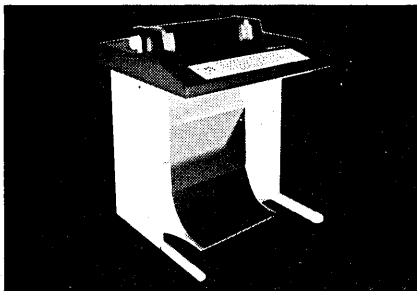
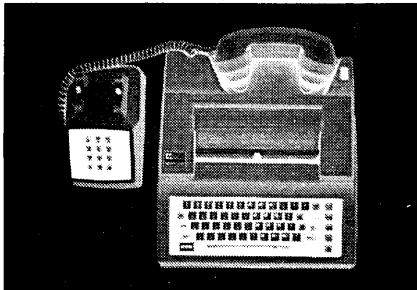
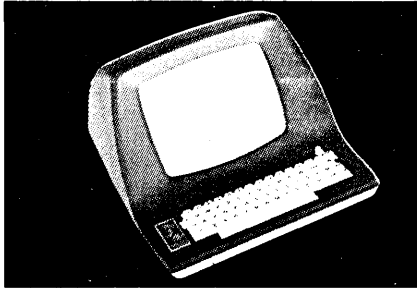
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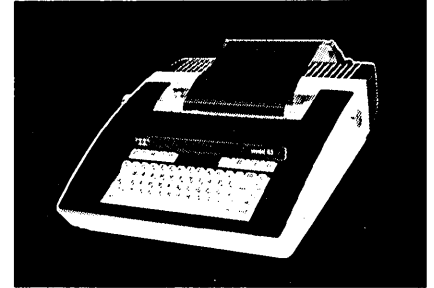
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There can be a happy ending. Harry was replaced by a candidate with better qualifications. But we wonder what's become of Harry.

data and making systems adjustments based on findings.

If the person a firm has in mind for the word processing manager's position is going to be transferred from dp and does not meet all of the criteria of a good word processing manager, there are many ways in which these skills can be learned and developed.

Many colleges and universities offer word processing courses as well as special business degree programs for employed people, like part-time and summer programs. In addition, many larger firms offer seminar programs in word processing concepts, manuals and procedures writing, management skills, effective time management, spoken and written communications skills, staff training methodology, and creative problem solving.

Junior colleges and adult education programs offer a wide range of self-development programs including assertiveness training, dictation and speech courses, career counseling, and business psychology aimed at enhancing interpersonal skills.

Finally, many vendors offer word processing training programs. Vendors

not only have some excellent training courses, but some offer management training as well. Do-it-yourself packages for feasibility studies, cost justification, and center diagnostics are available from some vendors. Also, vendor salesmen and market support representatives are constantly in the marketplace and can be a great source of new ideas.

Obviously, Harry, the new manager in our case study—and his situation was not that unusual—met few of these criteria and was unwilling or unable to change. Fortunately, however, there can be a happy ending. Harry's company eventually reassessed its position and realized that it had made a mistake. They quickly replaced Harry with a candidate with better qualifications. With the importance of people more clearly recognized and accounted for, the new manager went on to establish training programs for both staff and users alike, while instituting incentive programs and formal center procedures.

Productivity began to climb steadily, while the center developed into a closely-knit family at the same time. Then one day an administrative secre-

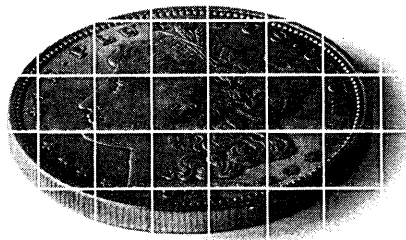
tary requested placement in the center. It was the miracle of miracles, but at once everyone realized that the situation had improved. Gradually, the overall attitude of users was transferred from one of hostility to one of respect. Today, that installation is considered to be a model of how a word processing center should be operated. *

RANDY J. GOLDFIELD



Ms. Goldfield is a senior associate in the administrative management services group of Booz, Allen & Hamilton. She specializes in word processing systems studies, including feasibility, diagnostic and implementation planning. Prior to joining Booz, Allen, Ms. Goldfield spent four years as an independent WP consultant. She has also been employed by Redactron Corp. as a customer education and support manager.

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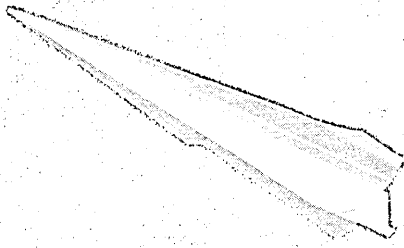
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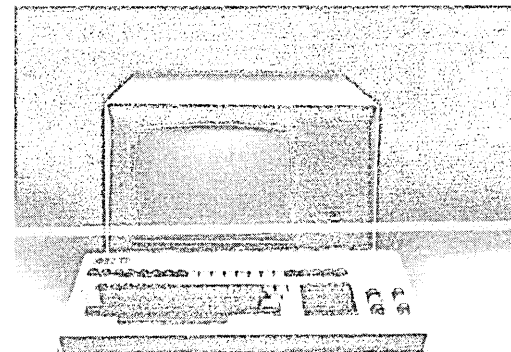


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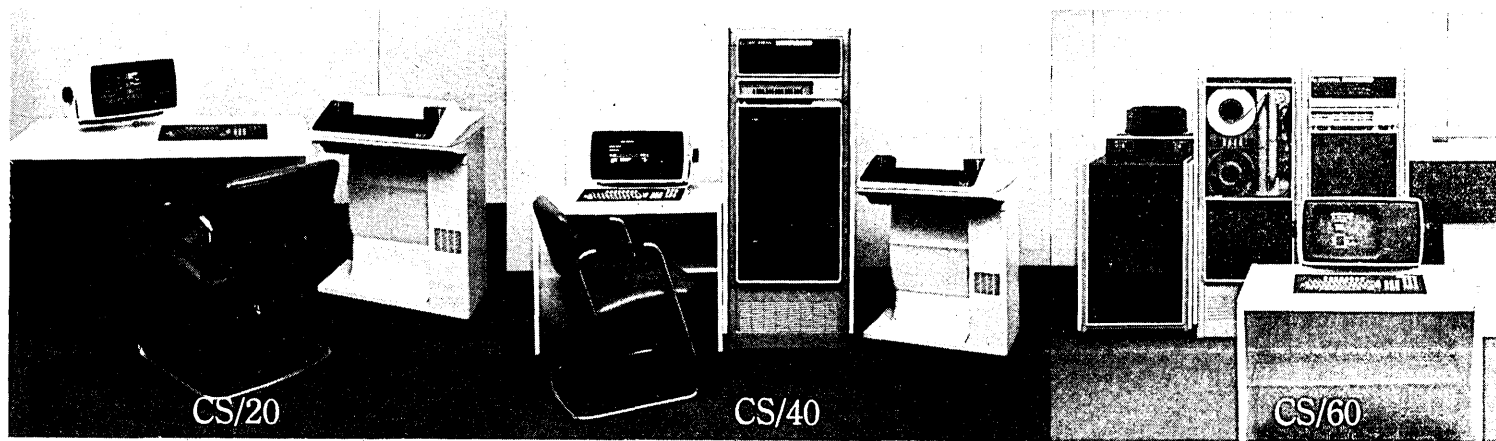
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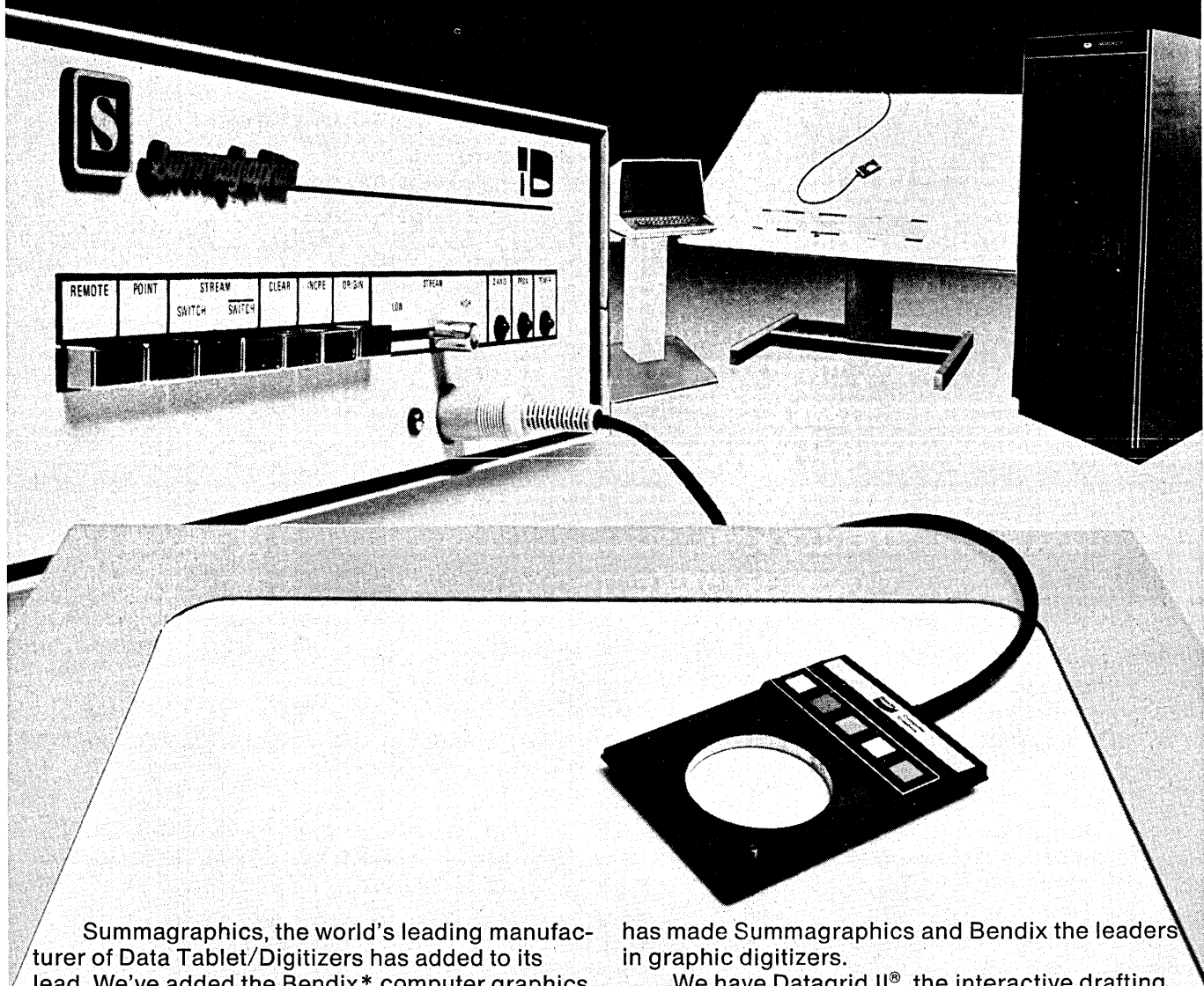
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THE ADM-31 PROVES DUMB IS ONLY SKIN DEEP.

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And the Standard Edit option lets the ADM-31 clear to protected spaces, clear to unprotected nulls, and set and reset copy-print.

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THE SMART CHOICE FOR A SMART TERMINAL.

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ADM 31

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Conference report: Syntopican VI underscores the inevitable but uneasy combining of two related disciplines.

MERGING OF DP AND WP IMPACTS USERS AND VENDORS ALIKE

Word processing and data processing managers have gotten a glimpse of the enemy and each is trying to figure out if the real villain is the other. Amid their confusion, they know one thing for certain: Their two fields of expertise are merging. That, at any rate, was one notion that surfaced at a recent word processing show.

To illustrate: To Jack Gilmore, Digital Equipment Corp.'s word processing product line manager, word processing and data processing are simply "two logical subsets of information processing." He is not alone, of course, since an increasing variety of products meshing the two functions are making their way into the office automation marketplace, giving proof positive to the much-prophesized pairing of the two fields.

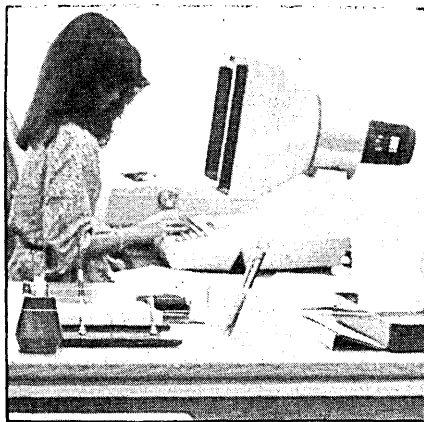
To Gilmore this fledgling field reminds him of "the old days in data processing," and he believes that the growing move toward distributed intelligence will bring more computer-based devices into the office environment.

More and more computer companies have taken the plunge into word processing, prompting one product sales manager to predict that "ultimately all the data processing companies will be into word processing."

There was more than ample evidence of this trend in Washington recently as the International Word Processing Assn. hosted its Annual International Conference and Exhibit, Syntopican VI. Carrying the theme of "Emerging Information Systems," the three-day conference attracted an overflow audience estimated at 8,000.

The Syntopican show drew word processing specialists, plus a smattering of dp and information processing managers. The conference program, which featured panels and over 30 workshops and sessions, attracted approximately 1,850 attendees.

Exhibit goers who had 98 booths to visit totaled over 7,000. The IWP's



hope for even a better turnout next year when the conference moves to Philadelphia on June 27-29. The two intermediate conference sites are St. Louis, on Oct. 24-26, and Los Angeles, on Feb. 13-15.

The word processing specialists—most of them from government and military circles—showed a keen interest in the dp capabilities of the wp configurations.

One company, Wang Laboratories Inc., has used its multiterminal crib-based systems and a distributed intelligence approach to word processing, as opposed to the traditional standalone or shared-logic system approach taken by other word processing equipment manufacturers. Like DEC, Wang claims to be a firm that early recognized the need to actively compete in both the computer and word processing markets—markets which many industry observers see merging.

"There's going to be a continued merging of data processing and word processing," says Charles Farrell, Wang's product line manager of office systems marketing. "That will happen because of the need to do more than simply improve power typing."

At a press conference during the Syntopican show, Wang Labs executive vp of field operations, John

Cunningham, summed up the company's word processing goals even more succinctly: "We are going in one direction only: to the top of this industry." To get there Wang is pinning its hopes on boosting its wp business volume which it contends has doubled each of the last two years.

Cunningham forecasts that the company will do \$100 million in word processing systems over the next year. By the end of 1980 we expect word processing to represent 40% of Wang's total business, which by then we hope will be running at a rate in excess of \$350 million annually."

DEC manager Gilmore sees the word processing war in the next two years being waged between four major market contenders—Wang, IBM, DEC, and Xerox. Digital says it is getting many customers for its standalone wp set up with an attached communications option.

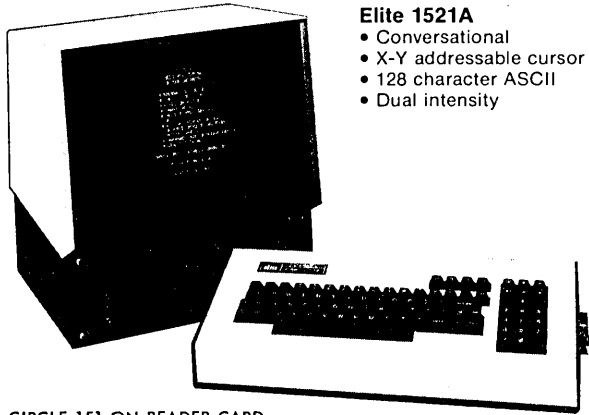
General Computer Systems, recently acquired by Telex Computer Products Inc., also sees this need and demand for communications power in the word processing area. Says Roy King, Telex senior marketing vp: "Down the road, there's going to be a marriage between intelligent terminals and word processing capabilities."

SHARED LOGIC SYSTEMS

GCS, which has been in wp for the last four years, is focusing on shared-logic systems as the answer to word processing problems. Lloyd Schiller, GCS marketing vp, describes the company's marketing strategy as "piggybacking on Telex's established customers and on GCS' established key-to-disk customers."

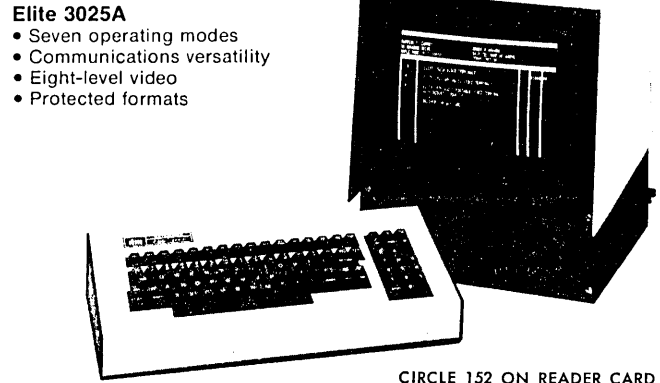
Another exhibitor, Cado Systems Corp., of Torrance, Calif. sees the word processing field as a natural "adjunct" to its three main product markets: standalone dp systems for small businesses, distributed processing, and electronic mail.

See things your way



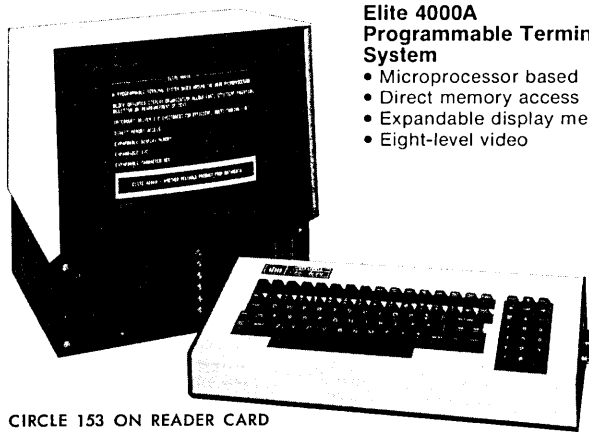
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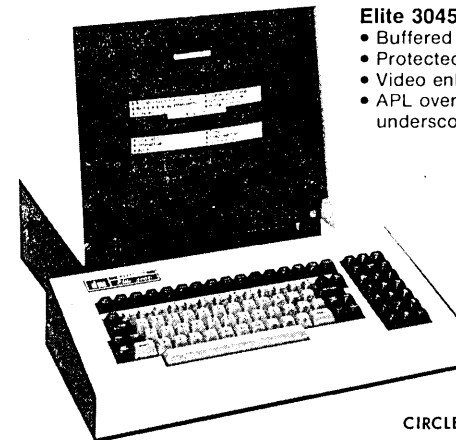
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CIRCLE 152 ON READER CARD



- Elite 4000A
Programmable Terminal System**
- Microprocessor based
 - Direct memory access
 - Expandable display memory
 - Eight-level video

CIRCLE 153 ON READER CARD



- Elite 3045A**
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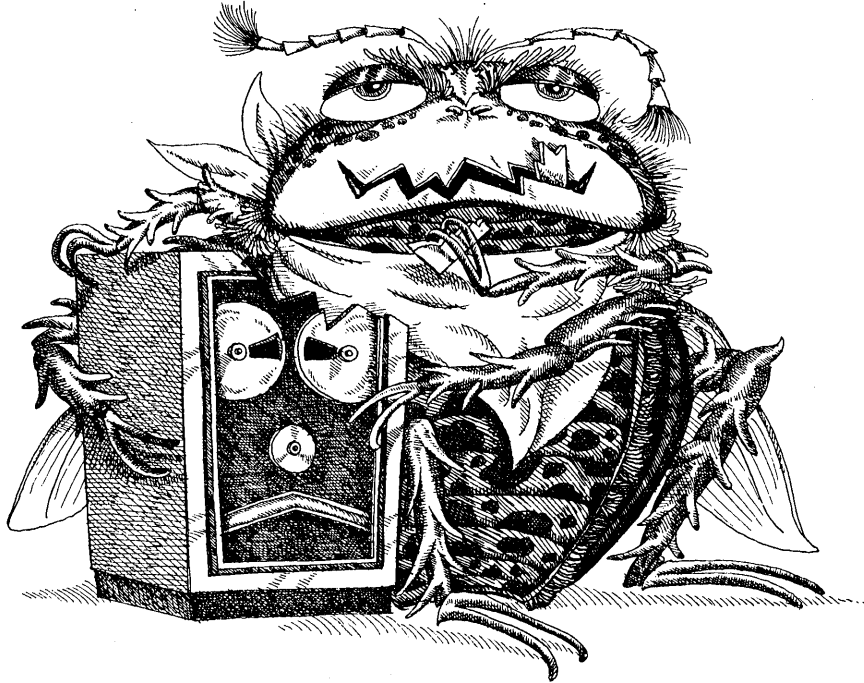
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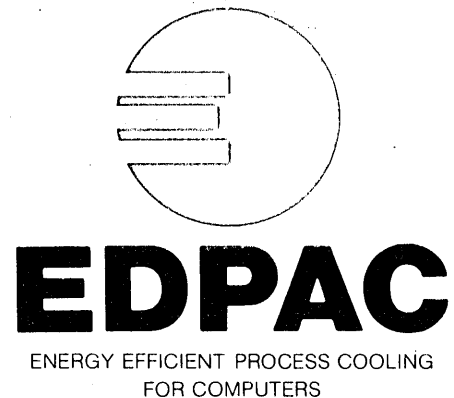
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If IBM would take the plunge it could be the strongest competitor in the field.

Joel Leslie, Cado Systems' product sales manager for distributed processing, believes strongly in the company's combination approach to word processing.

"By adding these text editing and word processing functions," Leslie explains, "it's a more cost effective solution for the user who doesn't need an extra system to do those functions." Cado's answer then is a "totally integrated system" which Leslie says "performs data processing, distributed processing including remote job entry functions, electronic mail/TWX/Telex message handling as well as word processing all concurrently."

Another first-timer at the show was Augment, Tymshare Inc.'s newly acquired office information systems division. Also promoting an "integrated office information system" approach, the Augment system was developed at Stanford Research Inst. The sophisticated system provides capabilities including text processing, graphics, and photocomposition as well as electronic mail and access to various data bases through the Tymnet network.

Other traditional dp vendors feel the wp'ers recognition of the data pro-

cessing tie-in will be slow in coming. Observes Linda Vyhnal, senior product marketing analyst for Four-Phase Systems Inc.: "Word processing people feel no strong need to be connected to data processing, while some data processing people seem increasingly interested in word processing."

Vyhnal points to the ensuing "struggle" between data processing and word processing. "At some point," she believes, these two factions will have to converge. "More and more of these people are willing to look at each other's point of view. It's a long process but people are slowly coming together."

IBM also has its own definitions of shared-logic systems. While typically refusing to comment for the record, one IBM rep casually conceded that there was a lot of competition in the word processing field, as pointed up by the Syntopian show.

NIBBLING AT THE EDGES

However, industry insiders still believe IBM could prove to be the strongest competitor in the field if the firm would really take the plunge into word processing by coming out with a single- and multiple-station system. So far the mighty company has

been content to nibble away at the edges of this market with such products as the Office System 6 and the WP/32. But industry pundits wonder just how long the company can afford to hold back in the face of the challenge the growing array of word processing companies presents.

Over the next several years, word processing aficionados see more direct clashes between IBM and its hungry competitors in the expanding office automation market. They also see more friction building between the dp and wp managers.

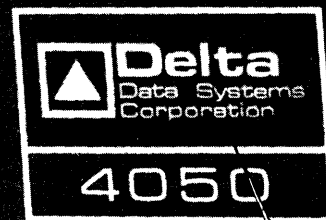
"The data processing manager," says one wp consultant, "sees word processing as a way to build an empire. The office manager will have to have more and more data processing knowledge." Word processing managers and their staffs are delving into higher technology realms such as communicating word processors.

"Word processing managers are familiar," says the consultant, "with all the computer catch phrases and words, and are especially fascinated by electronic mail." Another word processing consultant summed it up by saying: "Data processing has finally captured word processing." *

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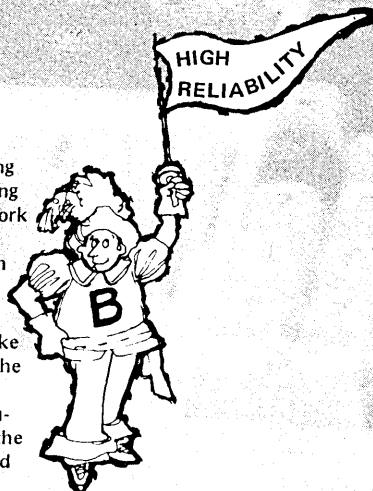
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DYNAMIC FILE ALLOCATION DFAST allocates file space from available area on a disk pack. The user is only required to specify the number of tracks for a file, not the starting relative track number.

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***ALLOCATION BY LOGICAL RECORDS** Disk allocation may be requested by number of anticipated logical records. The system will calculate the correct allocation based upon the available DASD device types.

AUTOMATIC VOLUME RECOGNITION (AVR) The AVR feature of DFAST allows the system to automatically make logical unit assignments by the serial number in the EXTENT card. DFAST will make these assignments if the logical unit is unassigned or assigned to the wrong pack.

PUBLIC SPACE MANAGEMENT DFAST will allocate area within a user-defined pool of disk drives.

DEVICE INDEPENDENCE Programs may be run on any DASD device type without re-compiling.

***GENERIC DEVICE INDEPENDENCE** DFAST allows the generic device type to be changed at execute time. Disk files may be changed to tape or vice versa without re-compiling the problem program.

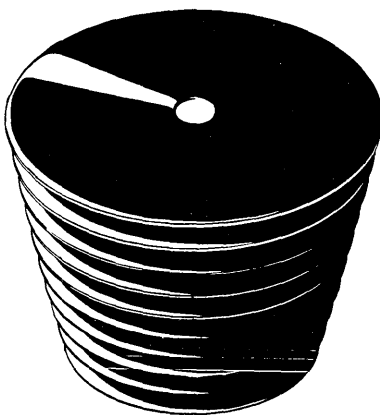
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***ALLOCATION ON TRACK BOUNDARY** Allocation of files is by track boundary resulting in more efficient DASD utilization.

FILE DELETION DFAST deletes files automatically, or a support



program that will expire files by file name may be included in production job streams to delete files when they are no longer needed by the system.

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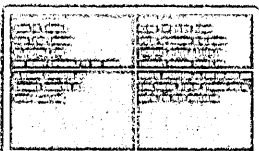
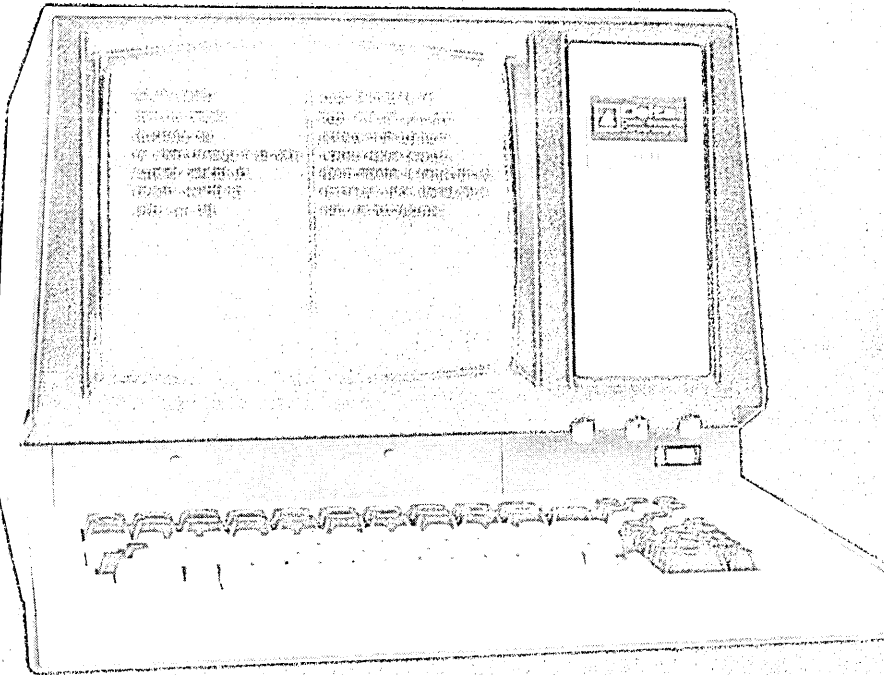
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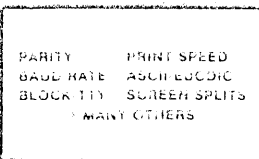
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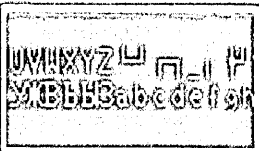
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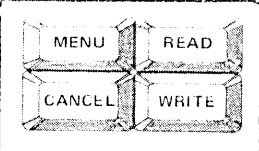
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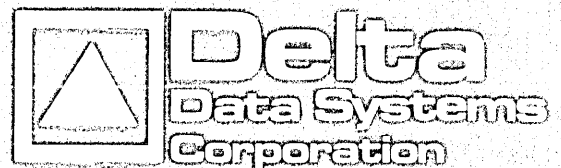


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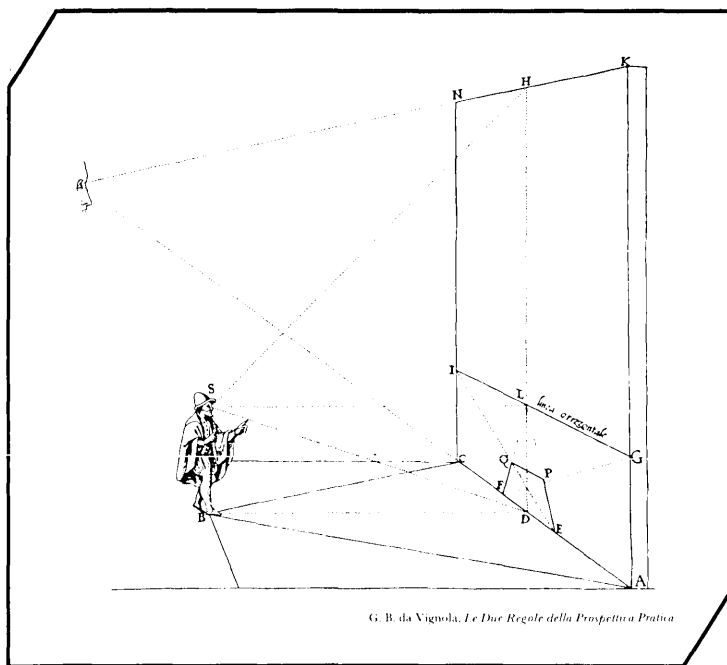
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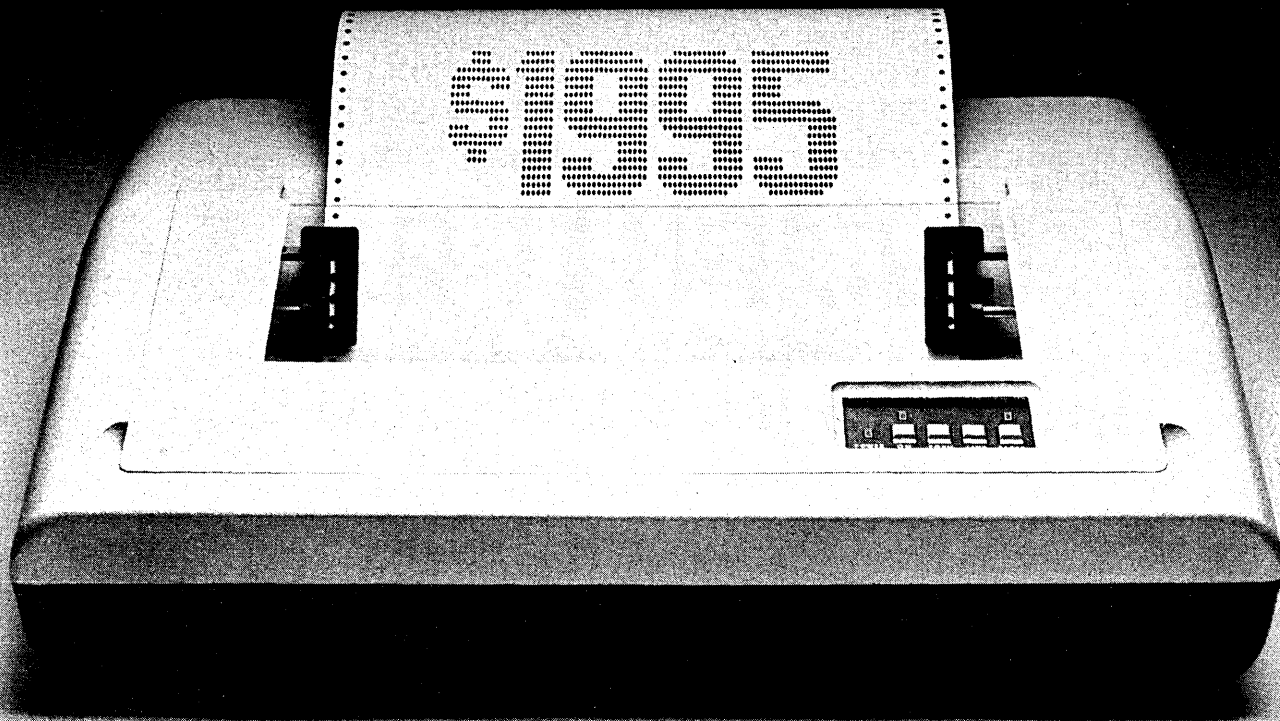
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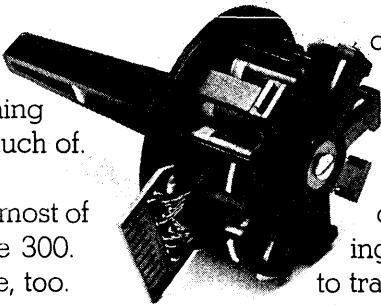
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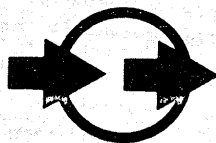
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The difference between high and low reliability with standard systems is due to management dedication (and considerable yelling at customer engineers).

WHAT MAKES A SYSTEM RELIABLE?

by George A. Champine

Users commonly feel that they have no influence over the design of new computer systems and feel very frustrated in that they can not get corrected what they consider to be design errors in present systems. And yet, there are many cases of a single user having considerable influence over the design of new computers, if he has a valid case and states it graphically to the right audience at the right time. An example of this is a talk given by Dr. Robert Worsing, then director of the computing department for Boeing and now vice president, development and operations for Infonet at Computer Science Corp. The talk was to a group of customer engineers in 1967 on the topic of system reliability. He said in part, "How many of you would board a (Boeing) 707 which, despite two hours of preventive maintenance *every* day, had a probability amounting to certainty that it would require airborne maintenance at least once between midnight on succeeding Sundays?

"Why do you expect so much more reliability with an airplane than with a computer? They aren't any more expensive. They are not kept in a special environment. It is just as intolerable to allow the collection of gadgets we call a computer to admit of unreliability as it is to allow the collection of devices we call an airplane to admit of unreliability. So to repeat myself, I expect from you simply perfection."

The complete text of this talk has been required reading in at least one system design organization, and this talk is known to have substantially influenced the design of several computers in the reliability area.

FAIL-SOFT SYSTEMS Users say that their most vital need is for computer systems that continue in operation even though one component has failed—what are called fail-soft systems. The priority of this need grows out of the transition from purely batch processing in the 1960s and early 1970s to increasingly interactive operation—including transaction, time-sharing, and real-time—which is widespread now and will be even more so in the 1980s. System failure in batch operation has relatively little impact on users if it can be corrected in one or two hours. However, system failure in an interactive environment has a devastating impact on users. Because of increasing dependence of users on their dp systems, the importance of fail-soft systems is becoming paramount—it is becoming increasingly true that if the dp system stops, the organization also stops.

Technology to achieve fail-soft systems has been available for some time, and has found widespread application within military systems. Now, this same technology is being adopted by the commercial world. The techniques include redundancy, which means that there are two or more of every system element, so that if one fails the system can still operate. Another technique is automatic reconfiguration of remaining system elements in case of a failure of any one element. For those failures which are transient in nature, it is important to have automatic system recovery so that the system can resume full operation without destroying the integrity of the data. At the level of the hardware, hardware error correction codes are becoming standard in main storage. Instruction retry is also becoming standard in processors.

Perhaps no other single characteristic of computer systems has caused

more grief to dp operations managers than that of a system failure. Everyone acknowledges that physical systems do fail, and yet devastation of operations results too often from system failure. At best, a system failure stretches out response time to users; at worst, it can corrupt data vital to company operation, bringing the entire organization to a halt. Even as important as system reliability is to operations, it remains a little understood topic, seemingly viewed by many as tedious or of little practical value. Because of the subject's current importance, every dp manager should be aware of the basics of system reliability. Further, it is going to become even more critical for future dp systems than it is for present systems.

Computer salesmen do not like to talk about system failure rates or down time because it is a negative topic that does not contribute to the solution of the customer's problem. In contrast, engineers love to talk about failure rates because failures are problems, and engineers make their living by solving problems. Perhaps for this reason, the early computer users planned on 5 hours mean time between failures (MTBF) based on conversations with engineers, got 10 hours MTBF, and were very successful in their applications. Later computer users sometimes planned on 500 hours MTBF, got 50 hours, and ended up with colossal disasters which could not support the needs of the organization. The results at the operational level are much different between planning on 500 hours MTBF and getting 50, than planning on 50 hours and getting 50 hours.

A true case study in which the author was involved might give some insight as to how things can go wrong from a reliability standpoint.

A system had been purchased and installed for a critical application involving interactive query and update of a logistics information system, and

high availability was of the utmost importance. The system, which was designed and configured to fit the users' budget, had a single processor and 10 mass storage devices, all of which had to be operational for the system to work. The media on the mass storage was nonremovable. Dumping a single mass storage device to tape to allow maintenance without endangering the data base, and then reloading, took 4 hours. The system had to be operational 20 hours per day to meet the user's needs. Normal system preventive maintenance took 2 hours per day.

The design MTBF for the mass storage devices was 500 hours; however, the achieved MTBF was only 250 hours.

$$\text{Availability} = (0.98)^{10} \approx 0.80$$

The other system components, including software, brought the total system availability down to about 0.76.

If the above problems were not enough, the designers of the system did not believe in error detection circuits, and the system often ran several hours in a fault condition generating garbage in its master file, with no one the wiser. About this time the user was climbing the walls and writing nasty (but very well documented and supported) letters to the president of the computer supplier. Clearly heroic measures were called for.

The attack on the problem was multipronged, because every subsystem had to be raised to the highest possible availability. However, the focus of the attention clearly had to be the mass storage subsystem. Factory personnel were brought in who refurbished the mass storage devices on a rotational basis, having furnished a spare for system use. The operating margins were widened to the maximum possible extent by the use of selected and matched components, and very careful tuning. As a result, the MTBF of the mass storage devices was raised from 250 hours to 1,250 hours, or 2.5 times the design goal. System availability rose slowly to about 0.96, the customer was overjoyed, and the systems are still in use as of this writing.

The development of reliable systems is becoming more difficult from a computer design point of view. At the same time that users are properly demanding more reliable systems to meet the needs of interactive operation, they are also demanding much larger and more complex systems to cope with the increased functional and communications requirements of the applications. It can easily be shown that the

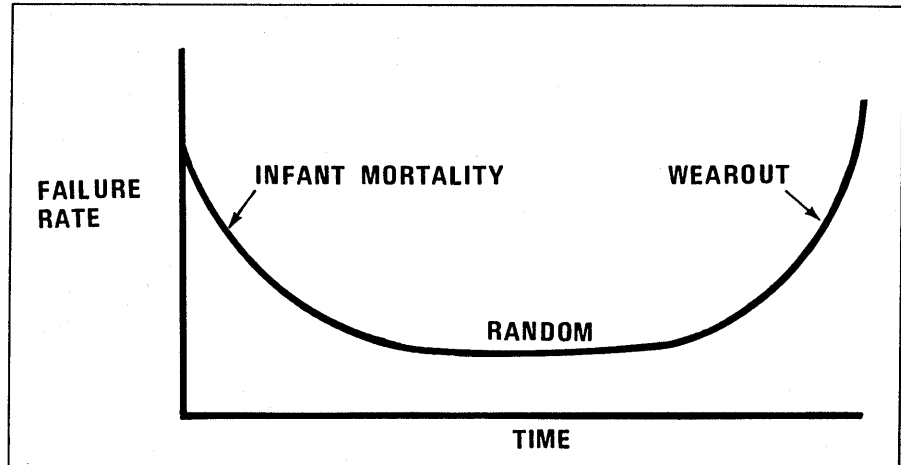


Fig. 1. The failure rate of components follows the "bathtub curve." They experience a high failure rate in infancy due to manufacturing defects, and then a relatively low failure rate during their normal lifetime.

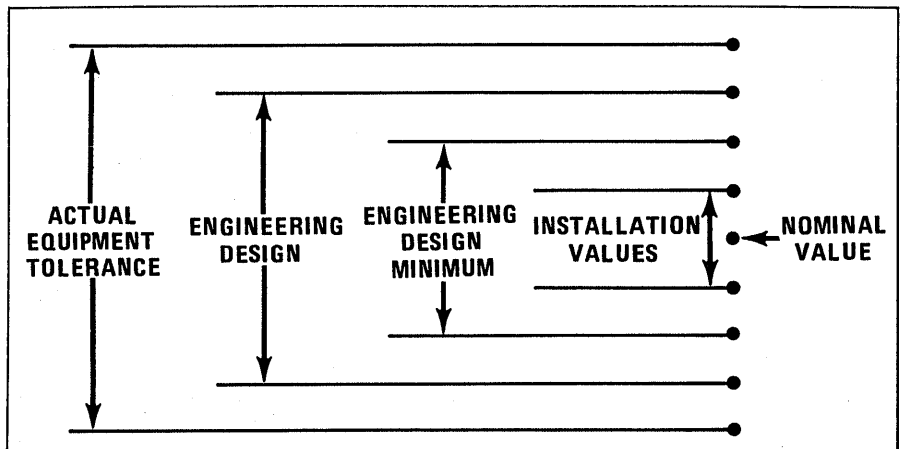


Fig. 2. Engineering designs usually allow for a greater tolerance than that expected to be necessary in an installation, and the equipment is usually somewhat more tolerant than the design calls for. Thus, the environment theoretically should never give trouble; but the real world doesn't always go by the theory.

larger a nonredundant system becomes, the less reliable it becomes, and a sufficiently large system will never run long enough to give useful service. Fortunately, by the use of redundancy, system reliability can be significantly improved in spite of increased complexity.

Both the computer system manufacturer and the computer system user must contribute to system reliability. The manufacturer can supply tools to

Dr. Champine's feature has been adapted from his book, *Computer Technology Impact on Management*, which is being published this month by North Holland Publishing Co., Amsterdam (292 pp., approx. \$27 U.S.) Permission to reprint it here is gratefully acknowledged.

improve system reliability, such as multiprocessing/reconfiguration, error correction in storage, instruction retry, maintenance processor, mass storage retry, and software recovery from hardware failure.

The user, however, also must provide for adequate system availability at the application level through appropriate methods of system implementation, such as audit trail, before/after looks, roll-back, file recovery, and data base recovery.

A very wide variation in system reliability is observed in the field. A "typical" large scale computer system will crash (require an unplanned restart) somewhere between once per day and once per week, and may be unavailable 2% to 5% of the scheduled oper-

The principal environmental factor affecting reliability is the power supply.

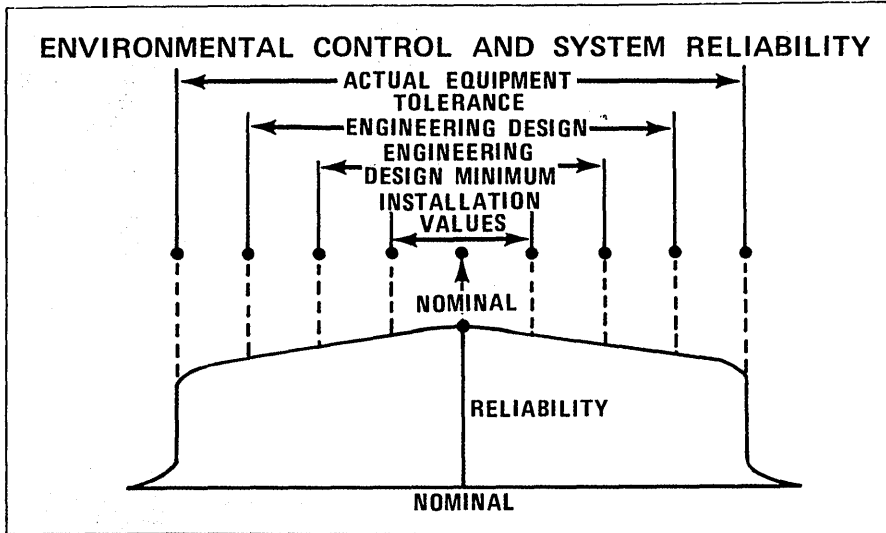


Fig. 3 When the actual operating point approaches the actual equipment tolerance limit, reliability falls off catastrophically.

ating time. And yet, a large and well known time sharing service company using standard product hardware has a long term down time average of about 0.5%. The difference is due almost entirely to user management dedication to achieving high availability (and considerable yelling at the customer engineers when reliability goals are not met).

For a system to be reliable, the reliability must be designed in at the most primitive electrical, magnetic, and software level, and it must be carefully preserved at all levels of design. For this reason, the following discussion of reliability begins at the basic level with components, and then progresses upward through the more complex areas of hardware systems, effect of environment on reliability, software recovery from system errors, and software systems. Concepts will be illustrated by example rather than by complex mathematics.

COMPONENT RELIABILITY

All hardware systems begin with components, including transistors, resistors, wires, integrated circuits, diodes, and connectors; consequently, failures are at this component level. Each of these components ultimately will fail to perform its desired function, because of time-dependent parameter changes. These changes can be sudden (microseconds) or at an almost undetectably slow drift (years). In the case of slow drift, the point at which failure occurs depends to a large extent on the design: if the design is tolerant of parameter

changes the time to failure will be much later than otherwise.

If the discussion is confined to catastrophic failures, experience has shown that a collection of large numbers of one kind of component will exhibit a failure rate shown in Fig. 1. This failure rate profile, known as the "bathtub curve" for obvious reasons, exhibits a high failure rate early in the component life as the components with manufacturing defects fail, and then a relatively low failure rate during the normal life of the component. The failure rate then rises as end of life is reached and wear-out or parameter-drift mechanisms predominate.

It is an economic fact of life that it is much cheaper for the manufacturer (and also for a user) to fix system failures in a factory before it is shipped, rather than at a customer location. For this reason, components normally undergo "burn in" before shipment, to get beyond the high failure rate early in the component life. Another technique used to eliminate marginal components in the factory is temperature cycling during operation.

Each type of component is normally assigned a failure rate value to be used in estimating system failure rates. For example, a typical integrated circuit used in a processor might have a failure rate of 10^{-7} failures per hour. This means that a collection of 10,000 circuits of this type for a typical large scale processor would have an aggregate failure rate of 10^{-3} failures per hour, or a mean time between failure of 1,000 hours, which again is typical for a large scale processor.

THE ENVIRONMENT

The electrical and thermal environment of computer system installations can play a major role in hardware reliability. A low cost installation which uses marginal power distribution, marginal chilled air flow, and which mixes power and signal cables haphazardly under a false floor can seriously degrade or even totally disable a computer system. Conversely, even a well-designed and adequately funded installation can also have problems as the following case history illustrates:

A large scale computer system was purchased and installed in a large Japanese industrial corporation. Although this product had performed well in other locations, the reliability in this installation was terrible, averaging only about six hours MTBF. The installation was well planned and executed, and subsequent reviews failed to identify any weak areas. Measurements of the computer equipment also showed adequate operating margins in all areas. Finally, experts from the manufacturer's engineering organization were called in to try to solve the problem. By this time there was the usual finger-pointing going on with each responsible organization saying the problem was somewhere else.

The manufacturer's engineer began running a series of exhaustive tests in the evening, and immediately noticed an interesting phenomenon. As long as he watched the system, it ran perfectly, but if he left the room to get coffee or something to read, the system would have failed by the time he returned. This phenomenon was reasonably repeatable, so the engineer began to see how far he could go from the computer before the system would fail. He began by sneaking out of the computer room to go for coffee but no matter how quietly he left, the system would stop before he got back. Next, he tried making a big show of leaving the computer room, making sure the system could both hear and see him leave. Then he would hide just outside the computer room a few seconds, and then spring back into the room trying to catch the system in the act of failing by this tactic. Finally, the engineer began strolling farther and farther down the hall, then racing back to see if the system had failed, but it never had unless he went downstairs to his office or the coffee machine.

Finally, it was discovered that the ground of the motor on the elevator was tied to the electrical ground

of the computer, but this connection was not shown on the building engineering prints. Every time the engineer took the elevator to the coffee room or his office, the electrical transient induced by the elevator motor caused a fault in the system.

As suggested by this story, the principal environmental factor affecting computer reliability is the main electrical supply. The power companies disclaim any responsibility to provide well-regulated, noise-free power. The quality of power supplied to all users has degraded slowly over the last decade, not just with the well known brownouts, but also in the level of noise in the power system. Computer systems are often specified to tolerate a 10% voltage deviation in the supply. Yet a recent survey taken by an industry group found that a typical computer power source had 56 incidents per month where electrical noise transients exceeded this limit. Noise transients of 50%, caused by the switching of large inductive loads, were not uncommon. Fortunately, computer systems are designed to accommodate power variations substantially in excess of this specification. However, computer installations requiring high reliability often use motor alternators and uninterruptible power supplies to reduce system outages due to power problems.

All electrical equipment is designed for a nominal operation point, for example 208 volts, with a given tolerance for installation variance around the nominal point, such as plus or minus 10%. To assure that the tolerance published for installation values can in fact be accommodated, engineering design minimums are established which provide wider tolerance than the installation values. The actual engineering design is somewhat more tolerant than the minimums, and the actual hardware is somewhat more tolerant than the design. This cascading of tolerances is shown schematically in Fig. 2.

With all of these equipment tolerances, it would seem on a theoretical basis that environmental conditions should never give trouble. But in actual practice many problems arise which compromise the tolerance of the system, including out-of-tolerance components, manufacturing flaws, and design errors. But the major causes are environmental parameters being out of tolerance and incorrect installation. The reason for this is that each system is tested in the factory to the design minimum tolerances, which are broader than the installation values; this eliminates most, although not necessarily all, mar-

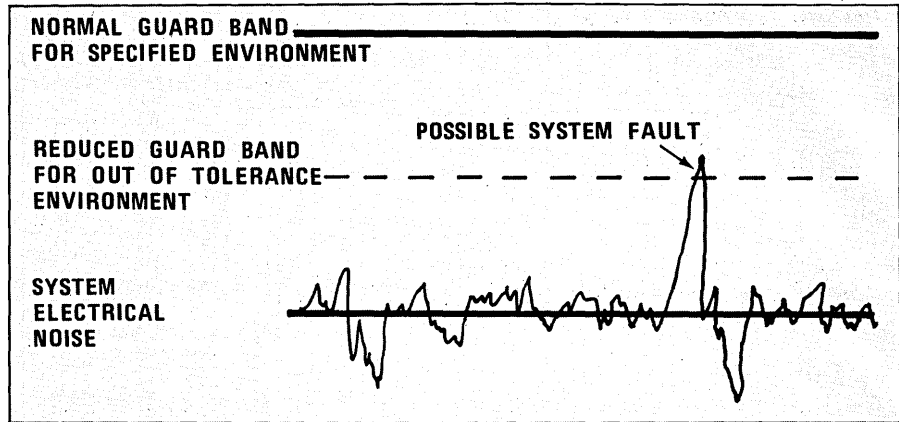


Fig. 4. When the actual operating point deviates from the point at which the equipment was designed to operate, there's less of a buffer against ever-present "noise" and failure becomes more likely.

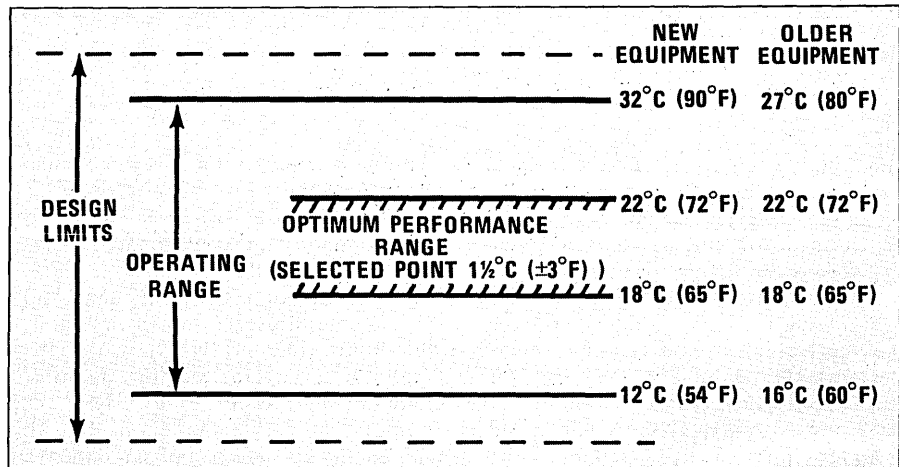


Fig. 5. Just as for electrical power, specifications for operating temperature allow for some latitude. System reliability is lower outside the normal range though, again just as it is for power variance.

ginal components, manufacturing flaws, and design errors.

Even though installation variation data is published, and systems will indeed run at the extremes of the tolerances and more, for example 228 volts instead of 208, the best reliability is obtained at the nominal point. As the actual operating point deviates more and more from the nominal, reliability slowly but steadily degrades even within the allowable installation tolerance as shown in Fig. 3. When the actual operating point exceeds the engineering design point and approaches the actual equipment tolerance, reliability falls catastrophically.

The reason for this is diagrammed in Fig. 4. When the operating point is at the nominal value, the normal guard band exists against system noise. As the operating point deviates from nominal, the guard band is steadily reduced and the system becomes

increasingly susceptible to noise, and therefore less reliable.

The problem of power line variation can be improved greatly by various techniques. A motor-alternator can be used to smooth out high frequency noise. A tapped transformer can be used to compensate for brownout conditions. The problem of power outages can be alleviated greatly, often at moderate cost, by obtaining a supply from two different power generating plants, supplied over two different sets of lines. Finally, for the highest reliability level, uninterruptible power sources are available that will supply power for durations of minutes from batteries and indefinitely from backup diesel generators.

Although the above discussion has considered electrical parameters, the same principles hold for thermal parameters. Fig. 5 shows a typical specification for temperature which calls for an

A sufficiently large system will never run long enough to do useful work.

operating point anywhere in the 18°C to 22°C (65°F to 72°F) range. The best results are obtained by selecting a temperature within this range and restricting temperature excursions to ±1.5°C (±3°F). The equipment will operate, with reduced reliability, within the range 12°C to 32°C (54°F to 90°F) and beyond.

When a nominal operating point is not published, it is important to keep the system at a constant operational value, for example in temperature. The reason for this is that normal maintenance activity tends to "tune" a system to its existing environment, and this then becomes its nominal operating point for best reliability.

SYSTEM RELIABILITY

At this point it is necessary to introduce two more terms and two relations. The terms are: Mean time to repair (MTTR) and Availability (A). Mean time to repair is, for any system component, exactly what the name implies, with the proviso that it must include rerun and data base recovery time. Availability is defined by the relation:

$$A = \frac{MTBF}{MTBF + MTTR}$$

and is the fraction of the time the component is operational. These definitions are too crude to satisfy the expert, but are adequate for our purposes here.

Availability can also be defined at the system level using the same relation, where MTBF becomes the time to any failure which by definition stops the system from completing its objective. The availability A of the system, can be computed as the product of the availabilities of each of the components A_i necessary for operation as follows:

$$A_{(system)} = \pi(A_i)$$

where A_i are the availabilities of the individual system components.

In order to have a reliable system, each component in the system, including processor, input/output, disks, printers, and terminals must individually be reliable. As an example of this, assume that the system is composed of 20 components, each of which is 99% available. If the system works only if all components work, then the availability of the system is:

$$(0.99)^{20} \approx 0.80$$

A system with 80% availability is not acceptable for most data processing applications. As the number of components increases, the availability becomes even worse, so a sufficiently large system will never run long enough to

produce useful work.

A medium to large computer system has more than 20 components, but fortunately the availability of each component is almost always higher than 0.99. The values in Table 1 are typical of MTBF values for components of a large scale system.

A typical mean time to repair is one hour if maintenance personnel and spares are on site. Otherwise travel time of up to four hours should be added. However, in the case of tape units and disk units with removable media, the "time to repair" is the time to move the media to a new drive. This can be less than one minute if the operator is alert.

SYSTEM INTEGRITY

Now that the likelihood of a system failure has been both admitted and quantified, it is appropriate to preach a short sermon on system integrity. This is not to question the system's morals, but to raise the issue of the fidelity of the data coming from the system relative to inputs and programs. It is forgivable for a system to fail and cause an error in data; but it is not forgivable for a system to fail and cause an error in data without any indication. Fortunately, most failures become apparent rather quickly because the system stops or does something irrational. But it is not unknown for a failure to occur in which the machine continues to run and generate erroneous data with no indication. In one personal experience, a failure in an on-line inventory control system caused erroneous information to be written into an important data base for more than five hours before the malfunction was discovered. The data base recovery from the audit trail and subsequent rerun time took 24 hours in addition to the five unproductive hours generating bad data.

The point is that data whose integrity is questionable is worthless. Therefore an absolutely essential characteristic of a system is comprehensive error detection. Comprehensive error detection is the foundation of all high availability systems because it triggers the recovery mechanism; without comprehensive error detection a system is worthless. End of sermon.

Systems of today have adequate error detection in main storage and mass storage through the use of error correction codes. Error detection is also adequate in the I/O and data path areas through the use of parity. But there are many systems where the processors do not have adequate error detection because it has been expensive. Fortunately, because of the reduction in cost

TYPICAL MTBF FOR LARGE SCALE SYSTEMS

Components	MTBF (hours)
Central processor with I/O	1,000
Main storage (10 million bytes)	4,000
Disk unit	2,500
Controller	3,000
High speed printer	300
Crt terminal	3,000
Tape drive	1,000

Table 1. These are typical values for the Mean Time Between Failures figures of today's equipment. Since the numbers are large, the availability of each component is almost always over 99%.

of logic, it is becoming economically attractive to duplicate the processor and execute each instruction twice in parallel; if the answers match it may be safely assumed there has been no error. Systems using this approach can approach 100% error detection capability.

SYSTEM MAINTAINABILITY

The current approach to system maintenance for a large scale system, is to run it until it fails, then use on-site maintenance personnel to repair it while it is down, and then continue. The environment is changing in two areas which will make this approach less and less viable in the future.

As mentioned at the outset, a large scale computer system typically fails at a rate between once per day and once per week. The causes for the "crashes" are generally divided equally among: (1) hardware, (2) software, and (3) "other" and "unknown."

The "other" category includes operator error and environmental problems. The time to recover from the failure can range from 10 minutes for a warm-start reboot, to one hour for on-site maintenance repair of a hardware problem, to five or more hours for hardware repair by off-site maintenance personnel or for particularly difficult problems. Unfortunately, it is not altogether unknown for a system to be down for days with a particularly vexing problem.

There is an increasing number of applications, primarily interactive, where system failures once per day or even once per week are not acceptable.

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There are almost no applications where a system outage of several days is tolerable.

The cost of on-site maintenance personnel has risen to the point where on-site maintenance is no longer economically sound except on the very largest systems. To put it on a quantitative basis, the cost per man hour of on-site maintenance increased 400% from 1965 to 1977. Except for on-line preventive maintenance of electro-mechanical equipment, the maintenance personnel mostly wait for system failures. Meanwhile, they forget their training in the repair of the electronic equipment, and when a failure occurs, the proper diagnostic procedure must be relearned.

Several measures are being taken to solve these problems simultaneously, primarily based on using increased amounts of hardware. To improve system reliability, the additional hardware is used to provide redundant systems, such that there are two or more of every component in the system. If one component fails, the rest continue in operation, so the system continues in operation, although with possibly degraded performance. More about this later.

In the case of controlling maintenance cost, the principal approach is to substitute increasingly lower cost hardware for increasingly high cost maintenance personnel. The substitution takes several forms. Additional, redundant hardware is configured into the system so that, in the event of failure, the system can continue to operate until the maintenance personnel arrive, either on an on-call basis (typically four hour response time) or even a scheduled preventive maintenance call (typically monthly).

If a system had two processors and one failed, the on-call emergency maintenance would likely be used. If a bit failed in a main storage unit with error correction code, the failure might be allowed to remain for months until enough failures had accumulated to warrant replacement during a preventive maintenance visit. The reason this is possible is that the error correction codes in use can correct single bit errors in a single word and detect double-bit errors in a single word. Storage units are designed to prevent (or at least minimize) a single hardware failure from causing multiple bits to fail in the same word. Thus, a rather large number of bit failures can be allowed to accumulate in a storage module before the probability of two bits failing in the same word becomes appreciable.

Another approach to using extra hardware to reduce maintenance labor

cost is the use of the maintenance processor. When the host system fails, the maintenance processor can diagnose the failure much more quickly and accurately than can the maintenance man, and it does not make mistakes in procedures or forget training. The maintenance processor can read all and set many of the flip-flops in the processor, thus providing much better diagnostic capability than the old hardwired, flashing-lights consoles. It can do anything a maintenance man can do, including running the system in single-step mode, inserting data, and taking snapshots of registers—all much more quickly and accurately and under software control. Where maintenance personnel involvement is required, data can be presented to him in easy-to-understand form, without resorting to complex tables and drawings. It is entirely possible that the maintenance processor could simply type out which cards to change so that operators, and not maintenance personnel, could perform most maintenance.

REMOTE MAINTENANCE

A maintenance methodology largely made feasible by the maintenance processor subsystem is the remote maintenance approach. In this approach, a computer at a manufacturer's location is used to diagnose problems in a computer at a customer location through telephone lines if the local maintenance personnel cannot localize the problem. The objective of remote maintenance, which has been in use since 1975, is to bring expert assistance to bear on maintenance problems as quickly as possible to avert extended down time. This expert assistance takes the form of:

- down-line loading and execution of special test routines
- special dump analysis
- access to data bases of system problems with solutions
- interactive remote diagnosis by factory experts

Remote maintenance also benefits the manufacturer by reducing travel time and making better utilization of experts.

REDUNDANT SYSTEMS

The concept of the redundant system has already been introduced—a system which has two or more of every component such that if one component fails the other components can continue in operation. Redundant systems have been developed and used for many years by the defense and aerospace industries to provide high reliability systems. The

basic technology is relatively well known although research continues in this area.

Only two forms of redundant systems have been used in any numbers; these are standby systems and multiprocessor systems. Both systems continue in widespread use today. In the standby system approach, a complete second system is installed to provide service if the primary system has any malfunction. An example of this is an airline passenger reservation system. If the primary system fails, operation is switched to a secondary system which shares the communication complex and mass storage. When the primary system is operational, the secondary system is used for batch so it is not wasted. In other applications, the secondary computer simply idles until it is needed.

In the multiprocessor approach, a backup system is not used. Instead, a single system is used which has two or more of every system component, including processors, main storage modules, I/O units, and peripherals. Automatic reconfiguration capability is provided so that if a component fails (a processor for example), that component is configured out of the system, and the system continues in operation with degraded performance. Whether this degraded performance is acceptable depends on the application, as shown in the following example:

An interactive medical information query system is being designed which must have very high availability and fast response to transactions. It is determined that a one second response time is necessary 90% of the time, but a two second response time is acceptable 10% of the time. Assume that the system is designed as a multiprocessor, with two processors being adequate to provide the performance necessary to achieve a one second response time. If one processor fails, the remaining one is still able to provide the two second response time required. Only if both processors failed within one repair time would the system be down.

Redundant systems can provide dramatic improvements in system availability. Assume that a large scale processor has an availability of 0.98. If a two processor system were used to obtain the required level of performance, each processor had an availability of 0.98, and degraded performance to one processor were acceptable 10% of the time, an availability of 0.96 would result.

Notice that the availability of *full* performance actually declines for a two processor system. However, the probability of having 0.5 or more perfor-

It is becoming increasingly true that if the dp system stops, the organization stops.

mance rises from 0.98 to 0.9999 and the probability of a complete system failure is reduced from 2% to a negligible value.

If the two second response time were never acceptable, a multiprocessor would have to be configured with three processors, so that if one fails, the one second response time could still be attained.

SOFTWARE RECOVERY FROM HARDWARE ERRORS

Software recovery from hardware errors takes

many forms, including:

- correcting or rereading erroneous data from a mass storage device;
- generating duplex files or data, so that if one file is lost, the system can continue with the other;
- taking system components that have failed off-line;
- error log generation;
- fault diagnostics;
- taking checkpoint dumps to provide a restart point for a run without starting over at the beginning;
- generating an audit trail to be able to rerun or back out transactions, and
- recovery of a data base after an equipment malfunction.

The last area, recovery of a data base after an equipment malfunction, requires additional discussion, because it represents both a growing opportunity and a growing burden to user management. In earlier times, each user application was freestanding and had its own private files or data base, used in a batch mode. If the run failed due to a software bug or equipment malfunction, the run could be done over with nothing lost but the rerun time. The next step was to go to a data base management system, still in batch mode, where a single data base serviced many application programs. Although this solved many problems by eliminating redundancy and providing complete information in one place via a simple interface, it created problems by making the entire organization dependent on the integrity of the one data base. However, if the data base were compromised, it could still be recovered by batch techniques without much impact to the organization. Now, many applications use data base management software in a transaction environment, which compounds the recovery problems further.

Modern data base management systems are really quite good with respect to recovery after mainframe errors. In fact, the recovery techniques

SOFTWARE RELIABILITY PARAMETERS	
Parameter	Characteristic Value
Average number of initial program errors	1 per 100 lines of source
Average manpower to identify each error (after failure)	2 man-hours
Average manpower to correct an error	6 man-hours
Average computer time to fix an error	2 hours
Average number of errors per new system software release	1,000
Average fraction of errors due to programming mistakes	$\frac{1}{2}$

Table 2. These are typical values for parameters linked to software reliability. The last one is very interesting. It suggests that only half of all software errors come from programming mistakes; thus, no amount of emphasis on improved programming techniques can cure as many as half of the errors in programs.

specify the whole approach to the design of the generalized data base management software more than any other single constraint. For example, it is possible to specify in the schema (data base format definition) that snapshots of all changed records be made; both before and after the change. It is also typical that an audit trail be made of all transactions, and that periodic dumps be taken to establish restart points. If a mainframe error takes place, an automatic part of the restart procedure will recover the data base to just before the malfunction with no involvement on the part of the user.

The vulnerability arises when (1) mass storage media (disk packs) are damaged by operator error or equipment malfunction, or (2) the data base is compromised by software bugs. Although this is a problem in batch, it is much more of a problem in a transaction environment. The recovery process is complex, and must be performed by an expert, preferably the data base administrator. He must work closely with the operations people to recover the data base by coordinating a recovery point dump, the audit trail, and the user program (if batch). Of course, the data base is unavailable during this time and no transactions can be handled. This problem can be expected to become more severe as data systems become larger and more complex.

One approach to greatly ease recovery in the case of mass storage failure is the capability to generate duplexed files. If a file is designated as being duplexed, the system will automatically create two copies. In case of an update, the system will automatically update both copies. In case of an

inquiry, the system will determine which file copy is most quickly accessible, and then access that copy. The files need not be on the same media; one could be on a disk with the other on tape.

SOFTWARE RELIABILITY

Software is like wine—it improves with age. This is true of software functionality, but

it is especially true of software reliability. Like hardware, software exhibits an early high failure rate which goes down as time on the system accumulates, failures are encountered, and errors are fixed. Unlike hardware, software does *not* exhibit an increase in failure rate due to wearout. However, software does exhibit obsolescence which makes it less and less useful as time progresses. This obsolescence, which it has been suggested gives software a half-life of about two to three years, may be the software analog of hardware wearout.

Although the technology of software reliability is in its infancy and trails far behind hardware, semiquantitative parameters may be of interest to help size the problem. Some of these are shown in Table 2.

These parameters are self-explanatory, except perhaps the last one. This parameter shows that about one-half of all software errors result from incorrect programming. The other half result from incomplete or incorrect understanding of the applications requirements. This is important because it indicates that no amount of attention to the programming process can eliminate even as much as half the errors; therefore equal attention to the application is required.

The item missing from the above

One programmer was found to have tested a single program 56 times in one day.

list is the one which is most interesting, most elusive, and largest in cost—it is the cost of causing or triggering the failures. Indeed, if the only cost were to diagnose and correct errors, the 1,000 errors per new system software release could be corrected for 8,000 man-hours and everyone would release perfect system software. The fact is that exhaustive approaches to testing are impossible because of the many combinations of environments possible; so testing must take the form of trials or sampling, with a relatively small set of environments. The early failures in software are very easy to stimulate. But as the more obvious errors are found and eliminated, the cost of testing to trigger each error rises very rapidly.

Indeed, there is a point beyond which it is almost useless for the implementers of the software to continue testing because of their inability to reproduce an operational environment. This is much more true of system software than of tailored applications software because system software must work in a much more generalized environment where less is known about individual applications.

To circumvent this problem, testing is normally done in several stages. The first stage of testing is done at the module level by the implementing programmer. Then the modules are integrated to form a system, and the system, or alpha, testing is done, also by the implementers. Then the software is given to several "friendly users" who are willing to use the software in an operational environment and report problems—the so-called beta test. Finally, the software is released to all users and corrections are issued against it as problems are reported.

An industry rule of thumb is that each level of testing removes 90% of the existing errors. Starting with the 1% initial error rate mentioned above, and applying the four levels of testing from module through release, this 90% rule of thumb suggests that there should remain an error rate of one per million instructions. If these were encountered at random, a medium sized system executing one million instructions per second would crash once per second. This does not happen, of course, because the remaining errors are far from random; having been eliminated from the commonly encountered environments and code sequences, the errors remain in seldom used code or seldom encountered environments.

As proof of this, it is well known that systems used in a very limited environment (so called "grooved" systems)

can achieve a very high degree of reliability if appropriate effort is expended. This system software reliability of a grooved system can reach several hundred or even thousands of hours mean time between failures. Conversely, multiple environment software systems tend to have lower reliability. This multiple environment can also include a highly variable load; it is not unknown for heavy system loads to cause software failure, always at the least convenient time.

Redundancy, a principal way to improve hardware reliability, has not been successfully applied in the software area. Because of the deterministic nature of software failures, a given set of inputs which causes one copy of a software module to fail will also cause another copy to fail. The basic approach to developing reliable software is the same as it always has been—generate the code and then "test out" as many errors as possible. It has long been recognized that this is not a very satisfactory approach.

Chief programmer teams, structured programming, and top down design have all been advanced as ways of increasing software reliability as well as programmer productivity. Design review walkthroughs by independent personnel and egoless programming have also been suggested. Proof-of-correctness approaches are not to the point where they are usable on real programs. Although no one of these techniques can be considered a breakthrough in improving software reliability, each is making a contribution in that direction. Progress toward more reliable software is clearly being made because of the increased attention in this area.

In at least one area, new programming techniques may have caused regression in software quality and reliability. On-line programming, where a programmer sits at a video terminal to generate code and then runs a test against it, makes it so easy to "let the machine do it" that sloppy programming can result in an undisciplined management environment. In one site that monitors programmer activity, it was found that one programmer used 152 compile-and-execute sessions at the terminal to debug a straightforward 50 line FORTRAN program. Another programmer was found to have tested a single program 56 times in one day. Before computers were so easily accessible, programmers would perform desk debugging, which often turned up errors of a subtle nature rather easily which now must be found

by extensive and expensive testing.

The question management must answer is the following: is reliability improving fast enough to meet near term system needs? System complexity is also increasing, so there appears to be no general answer to this question. It must be answered in the context of each application, based on guidelines listed below.

FUTURE SYSTEMS RELIABILITY

Systems of the future are going to be substantially more complex than systems of today, and because of this, reliability of systems in the future is going to be even more important and more difficult to obtain than it is today.

Even while reliable operation becomes more difficult to obtain, the required level of reliability/availability is going to increase significantly. A system which is used for batch operation can get along with a down time of 6% (94% available). A typical time-sharing system can only tolerate about one-third as much down time without user dissatisfaction, giving a down time of 2% or a system availability of 98%. But a system used for time-critical transactions should be twice as good as a time-sharing system, with a down time of no more than 1% or an availability of 99%.

The following hypothetical example shows the problem in system availability that can arise in more complex systems:

The Gadget Manufacturing Co. has 10 locations (combined factory, warehouse, sales office) that build, inventory, and ship a wide variety of gadgets. Any location can accept an order for any type of gadget, although not all locations build all kinds of gadgets. Each location inventories only what it builds, but sometimes these inventories are exhausted.

When an order is received for a gadget not in inventory, an internal order is sent to the nearest location building this device. When all (or at least most) of the items for an order are received, the order is filled and shipped. However, due to internal order delays and inventory outages, this system is very slow.

Each of the locations has a free-standing, on-line order processing system which has experienced an availability of 99%. A management decision is made to integrate all 10 locations into a single distributed system to speed operation considerably to meet competition. The system is designed and implemented, and works beautifully on a



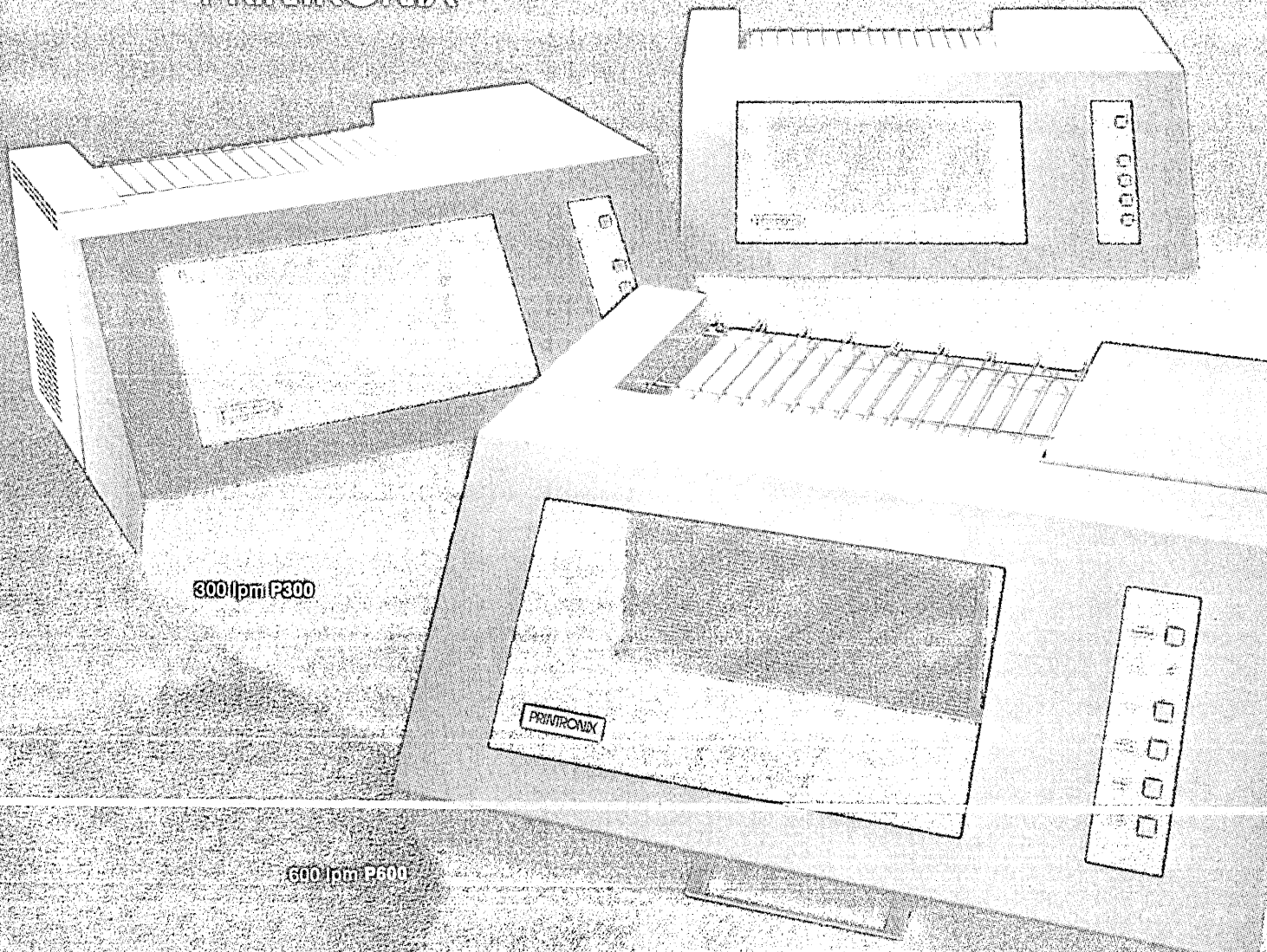
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Is reliability improving fast enough to meet near term system needs? Maybe.

functional basis. However, reliability is a major problem because all 10 sites must be operational for the system to work, and at least one site is down quite often.

An outside consultant is called in to solve the problem. After listening to the problem, he calculates the availability of the entire system on the back of an envelope

$$\text{System Availability} = (0.99)^{10} \approx 0.90$$

"There is no way," he states, "that this system can be reliable enough to be useful without major improvements. The reliability of each node must be substantially upgraded through the use of

APPORTIONMENT OF NET SYSTEM AVAILABILITY BUDGET

Component	Availability	Down
Hardware	0.993	0.0067
Software	0.993	0.0067
Other	0.993	0.0067
Total	0.980	0.0200

Table 3. If the major system components each have an individual availability of 0.993 (equivalent to being down less than 7 hours every 1,000), the system still is likely to be down 2 hours of every 100.

HARDWARE COMPONENT AVAILABILITY ALLOCATION

Hardware Component	Availability	Down
Processor and I/O	0.9984	0.0016
Main storage	0.9984	0.0016
Mass storage	0.9984	0.0016
Peripherals	0.9984	0.0016
Total	0.9933	0.0067

Table 4. To achieve the 0.993 availability of the hardware component, the availability of each individual hardware subcomponent must be far better than 0.993.

redundant techniques, and the system in general must be made fail-soft so the failure of one or two nodes will not stop the rest of the system."

This is done by duplexing certain critical equipment and files at each site, and providing the ability to use alternate sites or to queue orders to a particular site if that site is unavailable. Thus, this hypothetical problem is solved satisfactorily.

A system with 95% availability (i.e., down 30 minutes every 10 hours) is probably unusable for anything but local batch. A more realistic absolute minimum system might be 98%. This net system availability might typically be equally apportioned to the major system components as shown in Table 3, where each component must have an availability of 0.993.

If the hardware component were subdivided into subcomponents, each with an equal share of the availability budget, the result would be as shown in Table 4, with each component having an availability of 0.9984.

The minimum acceptable reliability for a processor and I/O becomes, then, one hour down time (a typical processor mean time to repair) every 600 hours of operation. In actual practice, processors usually approach 1,000

hours mean time between failure. However, consider a situation where 10 disk drives are available, and all 10 are required for operation. The availability requirement for each disk becomes 0.99984, or one hour down time for 6,000 hours of operation, an objective which cannot be met by present day equipment. However, if an 11th disk drive were provided so that the repair time would be reduced from one hour to three minutes (the time to move a disk pack) the mean time between failure requirements of the disk drive is reduced to 300 hours, a goal which can be easily exceeded.

If a higher reliability system were desired, where the minimum acceptable availability were raised to 0.99, the hardware availability budget for this example would become 0.9967, or one hour down time for every 300 hours of operation. Now the processor reliability requirement becomes 0.9992, or one hour down every 1,250 hours. At this point the adequacy of the reliability for a single processor becomes marginal, and a second redundant processor should be used. The availability A of a several processor complex, one of which must be operational, is given by the formula:

$$A = 1 - \pi(1 - A_i)$$

where A_i is the availability of each individual processor. Assuming a two processor complex with each having an availability of 0.999, the availability of the complex is 0.999999, or less than one minute down time every 10,000 hours, increased by redundancy from the one hour down per 1,000 hours. Thus, redundancy is a very powerful tool for increasing availability.

Although availability is greatly improved by redundancy, all is not beautiful. One processor will be down every 500 hours on the average, degrading system performance by approximately half and requiring a maintenance call. If on-call maintenance were used instead of on-site maintenance, with a mean time to repair of five hours (four hours travel plus one hour repair) the availability would still be 0.99997. However, the degraded performance would now exist five hours out of every 500, or 1% of the time.

It should be noted that a main storage module with error correction code (a form of redundancy), even as large as 10 million bytes, has a mean time between failure of about 4,000 hours. Thus, it easily exceeds the requirements for a system availability of 0.99 by a factor of three. The other serious limiting factor is software. *

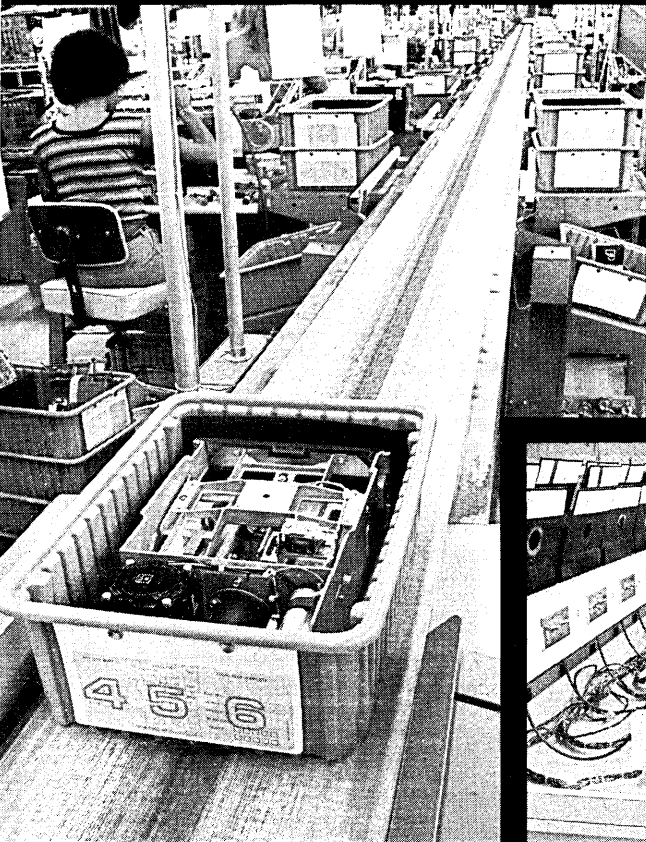
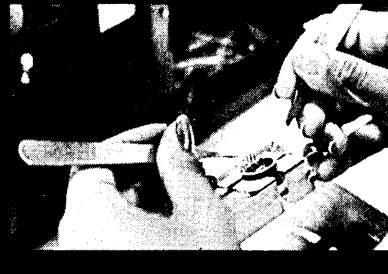
GEORGE A. CHAMPINE



Dr. Champine is the director of advanced systems for large scale commercial computer systems at Sperry Univac. In this position he is responsible for the

technical planning, design and analysis of systems beyond those currently committed to production. He is also responsible for design and management of large special projects using commercial equipment. In his 20 years with Sperry Univac, he has held several technical and managerial positions in the software and system design fields. His most recent prior position was senior staff consultant, where he was responsible for managing the advanced technology program for large scale computer systems.

Dr. Champine is also an adjunct Professor at the Univ. of Minnesota, where he teaches courses in analysis of information systems and engineering project management.



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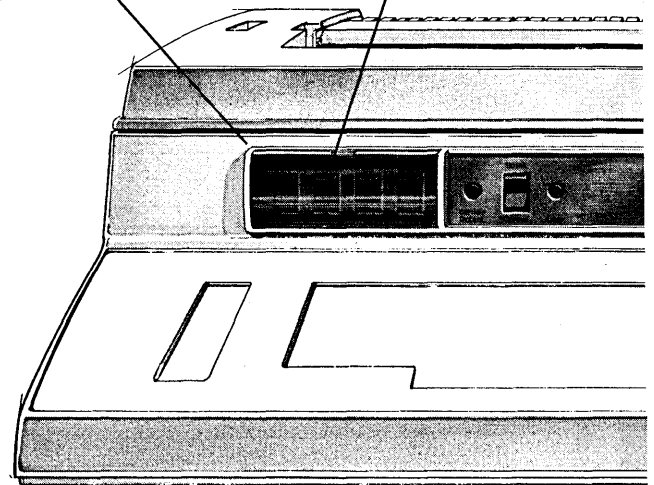
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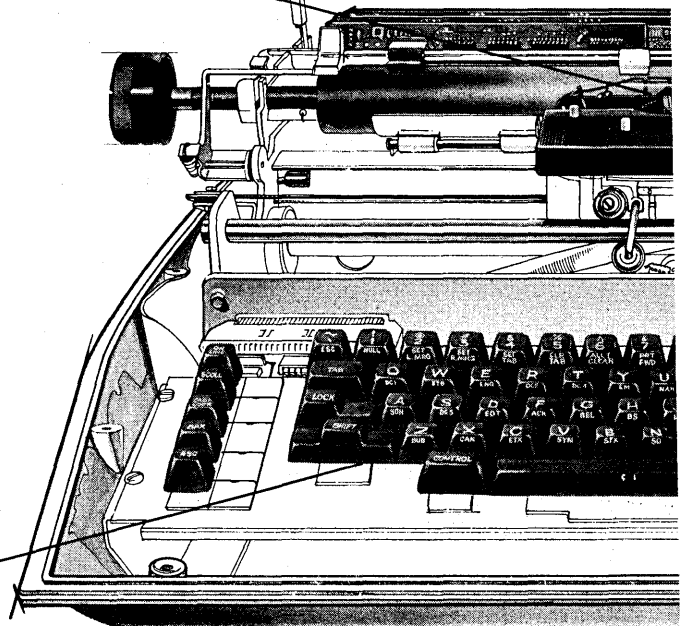
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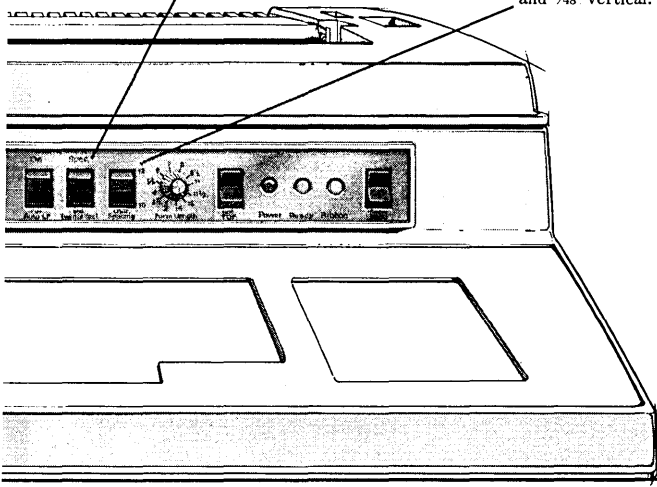
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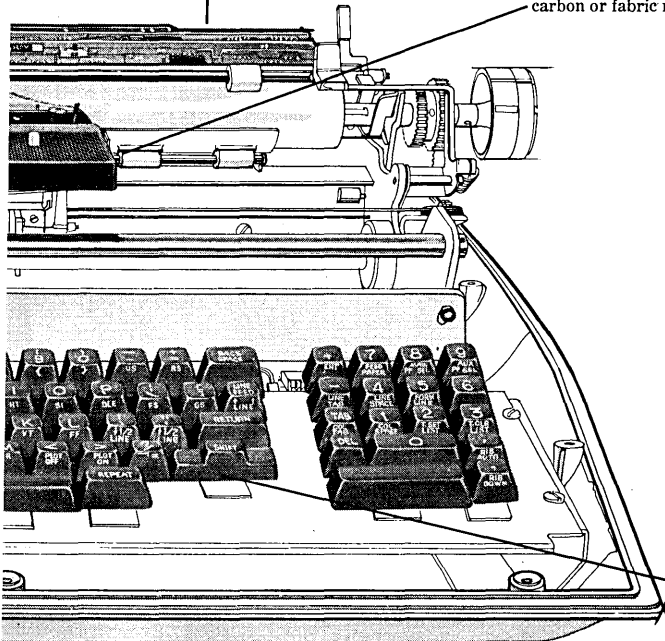
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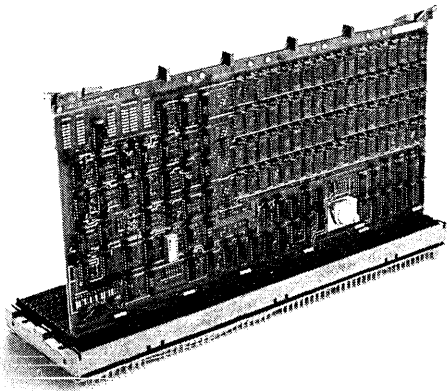
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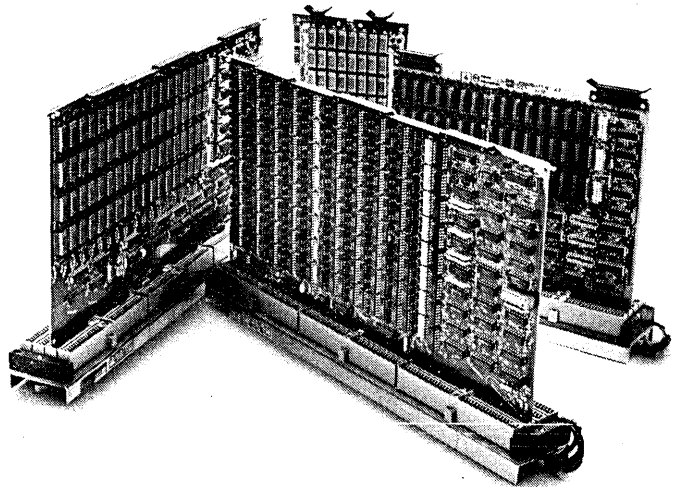
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A THEORY FOR SOFTWARE RELIABILITY

by Michael G. Walker

Exaggerated claims are being made for structured programming, top-down design, stepwise refinement, chief programmer teams, and other software development techniques. Articles containing the claims have two commonalities. First, they are anecdotal and portray the results of a single experience: "All Indians walk single file. At least the one I saw did." Second, they present no rationale. Why does the proposed programming technique work? Why should it work in other environments?

To put these claims into perspective, a theory of the management of software production is needed. The following theory provides a rationale. It attempts not only to explain how some programming techniques increase reliability, but also why identical techniques fail in similar environments.

However, the theory is radical. It holds that changes in techniques are *marginal* to production improvements, and that organizational structure, and therefore the management of structure, are the cardinal factors.

Theorem: Organizational structure is the prime determinant in producing reliable software.

Corollary 1: Noise is the measure of software reliability.

Corollary 2: Organizational structure provides noise filtration.

Corollary 3: Structural demands increase with software complexity.

The theorem and corollaries demand some definition of terms, and it turns out that the most appropriate definitions come from three different fields. The primary contributors are a sociologist, James D. Thompson (*Organizations in Action*, McGraw Hill, New York, 1967); an engineer, Glenford J. Myers (*Software Reliability*, John Wiley & Sons, New York, 1976); and a communications theorist, J.R. Pierce (*Symbols, Signals and Noise*, Harper & Row, New York, 1961).

Structure: This definition comes from Thompson and refers to the patterning and differentiation of internal relationships within an organization.

Reliable Software: This comes from Myers and refers to a probability.

Software reliability is the probability that software will execute correctly over a period of time, weighted against the cost of each error.

Noise: This comes from Pierce with an assist from Myers. According to Pierce, noise is any undesired disturbance in a system. Myers refers to software errors as software systems results that users do not reasonably expect. Therefore, noise is a disturbance in a software system, either an omission or commission, which users do not reasonably expect.

Software Complexity: This comes from Myers and refers to both the quality and the quantity of the relationships among the components of a software system. Myers contends that software complexity can be minimized by independence, hierarchy, and making connections apparent.

Reliable software is the desired outcome of software system development. The reliability of a software system is determined by the absence of noise. Noise filtration then is a primary aim in the production of software systems; and the management of noise filtration is the most significant task in producing reliable software.

Why then is structure the prime determinant in noise-free software? Why not simply write noise-free code? The interrelationships of three factors, tech-

nological complexity, communications costs, and information translation, must be addressed before the question can be understood. Again, these terms can best be understood in an interdisciplinary context.

Thompson tells us that all technologies involve specialization. And the more complex a technology is, the more specialized are its components. (See Fig. 1.) These specialized and interrelated components must be coordinated. Thompson has devised a relationship between interdependence and coordination. (See Table 1.) He has found that the costs of coordinating these specialized components increase with the specialization of the components, according to a curve much like that of Fig. 1. These coordination costs are primarily costs of communication. Therefore, the costs of coordination are a function of technical complexity.

Thompson observed another interesting phenomenon. Communications costs can be reduced by grouping interdependent components, by managing structure. Those organizational components which are more interdependent need more communication. Any grouping which facilitates communications reduces communications costs and also reduces noise.

Myers tells us that the nexus of software production is information translation. (See Table 2.) Production of software is the translation of a problem into various intermediate solutions until a detailed set of instructions is produced. Translation points occur wherever the media and hierarchy of information change. Myers also tells us that the single major cause of software errors is translation noise.

When a typical system's production effort is pictured as in Table 2, we can see the progression of information translation. Objectives to requirements, requirements to design, and design to code are a bare minimum of steps. Each step is an instance of data translation from one medium and hierarchy to another. The medium of the objectives document leads to the medium of the specifications document. As each successive translation is made, communication is necessary. The more effective the

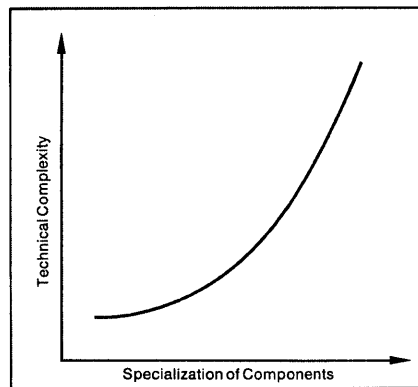


Fig. 1. As technical complexity increases, so does the specialization of a system's components. As technical complexity and specialization increase, so does the cost of project coordination.

Managing software system production is a search for effective structures.

communication, the more reliable the software is likely to be.

As software becomes more complex there are more interrelationships to translate. Therefore, more burden is placed upon effective communications. And as Thompson has shown, structure is the vehicle for controlling communications. The need to manage structure thus increases if communications are to be effective.

What can we say specifically about structure? What kinds of structures improve communications? Thompson says that the technology dictates the appropriate communications type and the appropriate structural type; that is, that different types of technology require different structures to coordinate communications. The most complex types of technology require the most flexible coordinating structures. Such technologies are characterized by the transmission of new information during the process. Each component impacts and is affected by all other components. High technology thus requires a most flexible interactive structure, a structure which changes as the information flow changes.

The management of this type of structure, then, is the primary task in producing reliable software. This management requires an understanding of the software production process and an ability to adapt to its demands.

THE TRADITIONAL VS. THE NEW

Managing software system production thus becomes a search for effective structures. The problem is one of finding a structure which is in tune with a given technology. Software production occurs in a complex technical environment, an environment characterized by constantly changing user demands. It is an uncertain environment—uncertain concerning language tools and hardware capabilities. Finally, it is an environment characterized by inadequate management devices. It is not surprising that the search for appropriate organizational structures has been difficult and often disappointing. It is also not surprising that the production of software is such an arduous and expensive task.

The traditional structure for managing software production was borrowed from engineering and rests upon several assumptions. (See Fig. 2.) It assumes that production can be segregated on the basis of occupational groups and sequenced by developmental phases: first phase analyze, second phase code, third phase test, and finally implement. Therefore, traditional structure groups analysts together, coders

INTERDEPENDENCE OF COMPONENTS VS. TECHNIQUE NEEDED TO COORDINATE COMPONENTS

Interdependency	Coordination Technique
Simplest (static environment; little communication)	Simplest techniques (static standards)
More advanced (anticipated changes; more communication)	Advanced techniques (plans for change)
Most advanced (constantly changing environment; communication must flow with changes)	Radically adaptive (changeable organizational structures; structure a function of technical demands)

Table 1. Fixed organizational structures employing straightforward control techniques may be adequate for the development of simple software products. At the other extreme, no fixed structure may be adequate to control the development of highly sophisticated software.

SOFTWARE PRODUCTION CYCLE IN TERMS OF INFORMATION MEDIA AND INFORMATION HIERARCHY

Translation Phase	Information Media	Information Hierarchy
Systems concept	Objectives document	Broad overview
General design	Design specifications	Requirements
Detailed design	Systems components	Natural language studies
Program code	Programming language	Computer language structures

Table 2. Noise occurs when information translation between project phases doesn't go right. Cutting down on that noise is the most significant task in software production.

together, and testers together. Traditional structure attempts to control the translation of information between groups employing standardized documentation.

The traditional structure works well in a relatively static and certain environment. If users' needs don't change constantly and if hardware and software tools are "known" then standardized documents can successfully filter translation noise. However, as software systems become more sophisticated, the environment becomes more dynamic. Control by documentation is no longer responsive. The traditional groupings do not work. The history of sophisticated software projects of the late '60s and early '70s reveals, in overruns, the problems of traditional structure.

Structured programming has been explored as an alternative. However, structured programming is essential-

ly only a coding technique. Its utility is primarily within the coding phase. Structured programming is an attempt to write programs for people, not for machines. Such techniques are extremely welcome and provide an excellent tool for communications. However, the total development cycle is not affected. Structured programming can and has been incorporated into traditional structures, and has improved the communications within them. However, structured programming does not operate as a filter at all translation points. In those environments in which noise is introduced in the design stages, structured programming will not ensure reliability.

Design technologies have also been investigated. Structured design, composite design, stepwise refinement and top-down design are examples. These design technologies are attempts to facilitate design communications just

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CIRCLE 68 ON READER CARD



The history of sophisticated software projects in the late 1960s and early 1970s reveals the problems of our traditional structure.

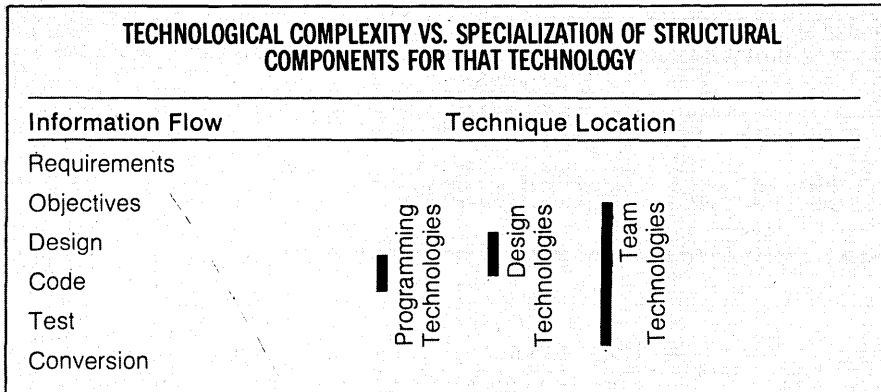


Fig. 2. The new programming and design technologies work well within project steps, but don't help to eliminate faulty translation between steps. So far, the team techniques are the only ones which aid there.

as structured programming facilitates coding communications. Design technologies cover the general and detailed design stages and thus impact more translation points than structured programming. These design technologies can also be incorporated into the traditional structure. However, the total development cycle is not impacted by

these design technologies either. Effective management of noise filtration over the entire development cycle is still not accomplished.

Team technologies are attempts to restructure the complete development cycle. Chief programmer teams, egoless programming teams, and specialist teams are variations of the technique.

The total developmental cycle is conceived as a continuous process. As many developmental phases as possible are completed by the same team. Therefore, translation point communication is intrateam communication, and intrateam walkthroughs are able to provide valuable translation point noise filtration.

If, as this theory proposes, the production of reliable software is a problem in noise filtration, and the management of this filtration depends upon discovering successful organizational structure, then team techniques seem the most innovative method of dealing with noise over the total production process. Therefore, the team structure should be a vital component in the managing of software production.

IN THE END

It should be obvious why the newer programming technologies differ in their effectiveness. Most of these new technologies apply to intramedia tasks. They radically improve the process of software production up to translation points. However, only those structures which filter noise at translation points can be expected to radically improve software reliability. Techniques can and do help. Structure, however, is the prime determinant.

Organizations that manage structure to reduce communications costs will also produce more reliable software. This software will be less prone to the noise introduced at translation points, noise which stems from software complexity. Therefore, as software becomes more complex, the management of structure will take on ever greater significance for organizations applying computer technology. *

MICHAEL G. WALKER



Dr. Walker is currently a senior computer scientist at Computer Sciences Corp., where he is responsible for formulating software engineering

policy for the Systems Div. His last post was as a senior systems analyst for the U.S. Congress House of Representatives. Prior to that assignment, he had eight years of dp experience working for Auerbach Associates, North American Rockwell, Informatics, and the U.S. Army.

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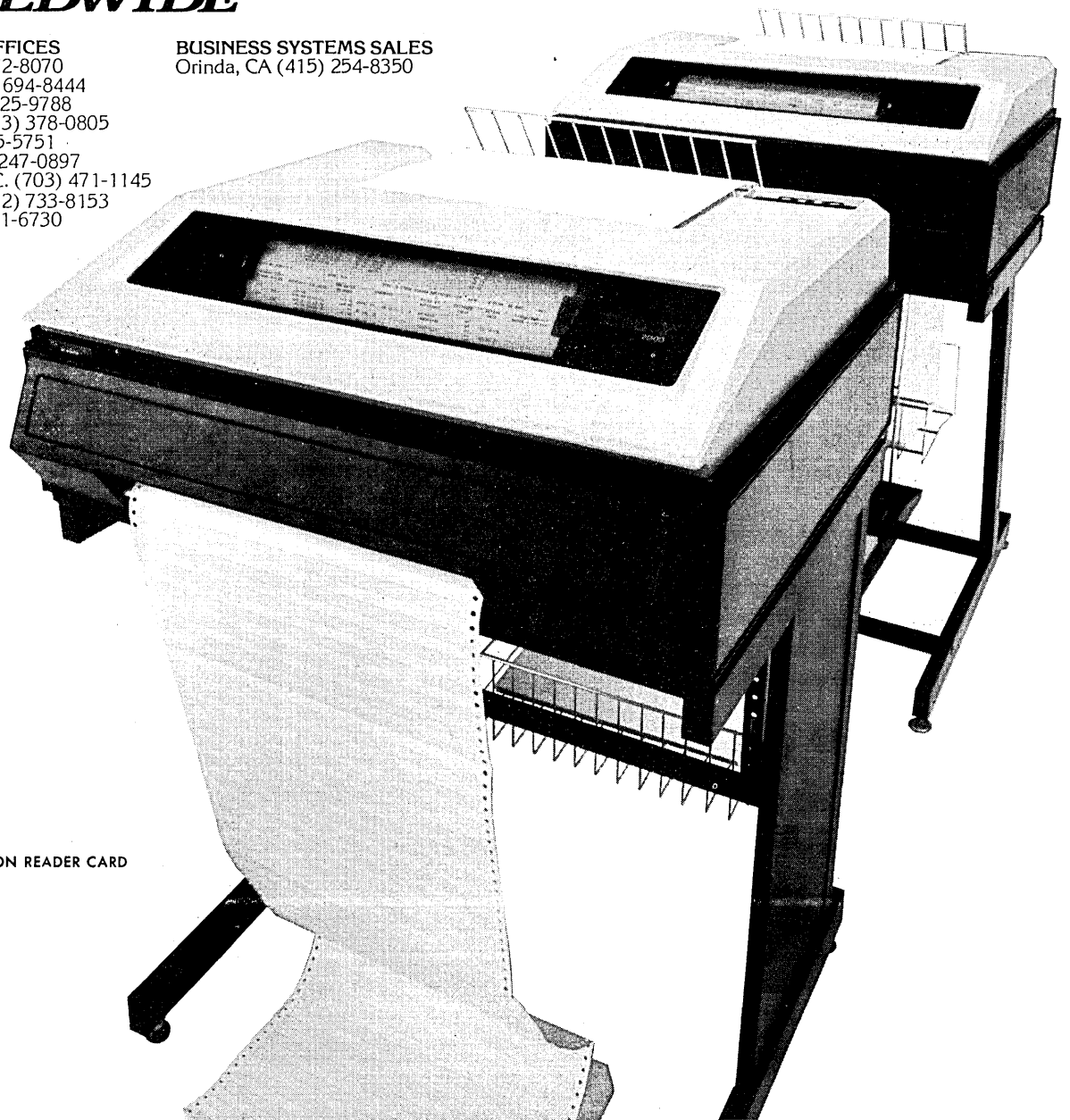
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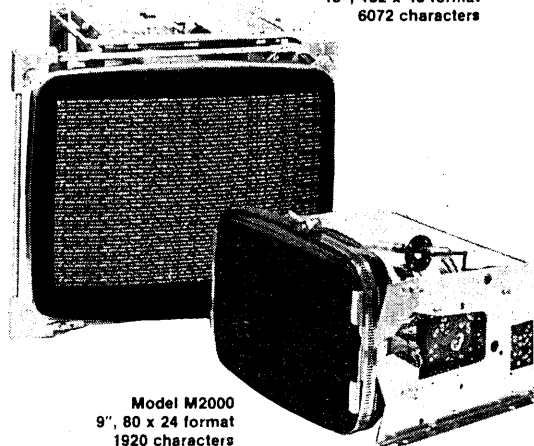
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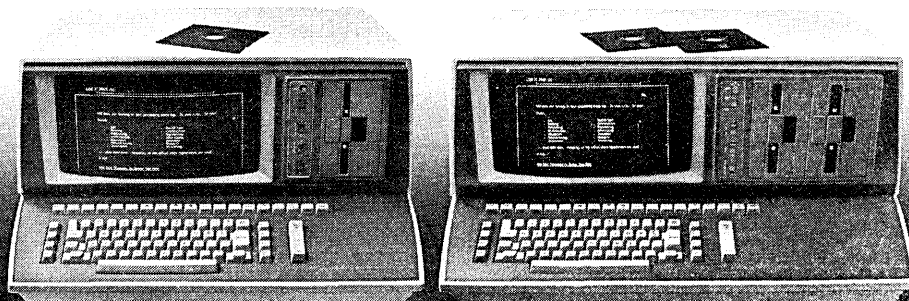
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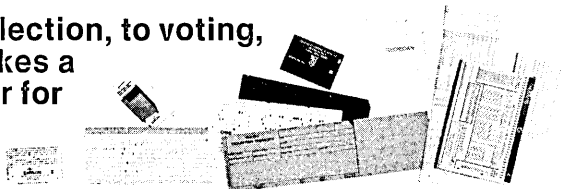
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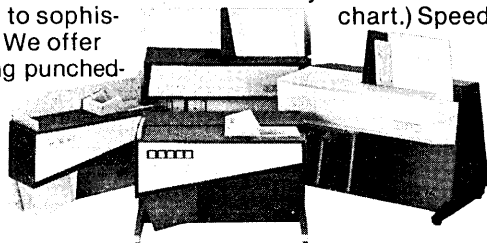
Pick a color, any color . . . We are exceedingly proud of the mark-sense reading mechanism used by these readers. Recent studies show it to be one of the most capable on the market. In the current color chart of OCR inks published by Sinclair and Valentine, for example, 46 different manufacturers of readers are listed in relation to the sensitivity of their readers to 36 different colors. Only three manufacturers are shown to make equipment insensitive to all colors, and PDI is one of them! In our mind, and we hope yours, this proves that our capability exceeds that of most of the "traditional leaders."

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head models that read both. (Those mark-sense readers, by the way, read *any* color card, see adjacent story on Sinclair and Valentine color chart.) Speeds range from 150 to 600 cards per minute. Configurations include table-mounted models and rack-mounted models. Reliability is second to none!

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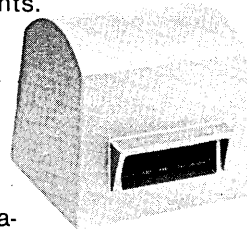
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We are speaking of an all-weather reader PDI makes for a major oil company as part of a new terminal-automation/information system.



This new automated bulk-terminal (ABT) system was recently described in NATIONAL PETROLEUM NEWS (NPN). The article points out that the oil company looked far and wide (over 40 models) before finding a reader that met their spec of a Class 1, Group D, UL rating for a hazardous area. They found it at PDI.

In addition to its capability for operating safely in hazardous atmospheres, this new card/badge reader had to be weather proof because it is installed outdoors at bulk terminal sites. Among its other unique capabilities is the fact that dirt on the card will not affect reader operation and a forget-me-not feature that makes it impossible for the truck driver to leave his card in the mechanism.

For a reprint of the NPN article, circle the number below.

Circle Number 102 on Reader Service Card



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The techniques are the important part, and they are based on some important observations.

EXPRESS TESTING

by Lawrence H. Cooke, Jr.

Does your installation suffer from the "lack of test time" syndrome? A rather painless cure is available to most third generation computer installations; even companies that are in the main very sophisticated in testing methods may benefit. The techniques have been proven in the field and are quite practical. Using them in our installation achieved the following results in a three year gestation period:

- 600% increase in tests per programmer with resources held constant
- 80% decrease in average turnaround time
- programmer complaints about test time disappeared
- operational costs remained constant

Nor did the results require "Buck Rogers" technology to achieve.

The setting in which these gains were realized (Midlantic Bank, West Orange, N.J.) was a dynamic one. This IBM shop, with a 370/158 and 370/145, was converted from DOS to OS during the period. It used VM/370 and CMS interactive facilities for part of the conversion, and presently uses ROSCOE and Librarian (both from Applied Data Research) under OS/VS1.

These products and this hardware are not essential to attain the benefits described. Any third generation hardware with disk or drum secondary storage may be used. Display terminals, though they will augment the benefits, are not strictly required either.

MODIFYING PROGRAMMER BEHAVIOR

The techniques are the important part, and they are based on some straightforward observations, such as that programmers spend the bulk of their time testing. In studies of many installations, a 20% design period, 30% coding period, and 50% testing period is typical—in spite of advanced programming techniques. Although the numbers may vary in any particular shop, testing is always a major time consumer. Fig. 1 illustrates the relationships we have found to hold between test turnaround time and delivery of a finished product.

The point of the figure is to illus-

trate what we all intuitively feel: that adding a few hours to the average turnaround figure can result in weeks or months of delay in product delivery. Thus even modest gains in turnaround speed promise big returns in throughput.

Not surprisingly, it is impossible to achieve productivity gains without changing something. Express testing, our name for the set of techniques we use, is achieved through modifying programmer behavior.

It turns out that most shops have only *one* reason for inefficiency in testing: there are too many manual steps in the test stream that render the power of the computer ineffective. For example, each time a test program calls for a tape mount, a human must notice the event, locate the tape, mount it, perhaps label it, later remove it and return it to storage. Relative to the speed of the machine, even agile operators move slowly. Multiprogramming may improve the machine's productivity, but it merely compounds the turnaround problem by giving the operator more such messages to respond to.

Some shops overcome this operator bottleneck by permitting the programmers to be present when jobs run. Perhaps this is a throwback to earlier times, or a tradition. But programmers, it has been found, move at the same relative speed as operators. Further, they interfere with the operator and with each other, and get little programming done while in the machine room.

Stage one in our conversion to better test techniques involved eliminating the manual steps. Doing this required that the data the program needs must already be *resident* in secondary storage. Admittedly, this goes against the grain of those users who feel that only "important" or "nontransient" data ought to be afforded disk space. A more practical argument might be that an installation cannot afford to use its limited disk resource for test data, but we have found that not more resources but fewer are needed. After more than three years of growth, about 5% of our available disk space is dedicated to programmer test data, down from 12% when the prior method of allocating live packs for testing prevailed. More important, operators are not required to initiate the use of test data, nor are they

even aware of its use; and that has made a vast difference.

Establishing Express testing required the following procedures be implemented more or less simultaneously: (1) compressing test files to manageable size, (2) placing them on-line, and (3) providing immediate access to them.

Like many organizations, ours had to be weaned from the "more is better" attitude about test data. Forced creation of minifiles achieved the necessary selection for us; their data was pulled from larger files both on a logical basis and as the result of random sampling.

File sizes before compression were on the order of 50,000 to 100,000 records, with typical transaction volumes of 2,000 to 5,000 per run. After compression, minifiles ranged from 500 to 2,000 records, using 100 to 200 transactions per test iteration.

Many test runs were reduced from over an hour to less than three minutes. This ratio was even greater for system tests. Our applications systems, such as Savings, Demand Deposit Accounting (DDA), Installment Loan, etc., involve hundreds of programs. Testing one of them might involve testing a stream of 10 to 50 programs and the execution of 10,000 or more lines of COBOL or assembler code.

So long as we performed the logical and random selection properly, the same code was executed, but only a few times each test rather than thousands of times. This accounted for about a 95% reduction in test execution time using minifiles over previous full file tests.

Test output produced all the expected files and reports, but at greatly reduced volume. For example, a DDA report that would normally display the status of 70,000 accounts at 40 branches, produced a report for 500 accounts at 4 branches. Consequently, report output would be reduced from 1,500 pages to 20 pages, but it would still list all the essential control breaks and totals.

Acceptance of the new scheme of things was not swift. Both users and programmers resisted the move to the condensed test files. Users feared that vital data would be lost. Programmers tended to resist reviewing the data and selecting relevant samples. Human

For reasons unrelated to testing, our dynamic environment continued to change.

nature being what it is, they were so busy producing that they had little time for selecting. However, innovators moved to Express testing. Their turnaround time improved, and word spread.

User acceptance came when the early minitests turned up more bugs than former complete runs of systems did. Errors that once appeared in the third box of output now stood out like sore thumbs. Error conditions that had existed for years were now detected. Further, as bugs appeared, the conditions which caused them were added to the minitests and saved on-line for the next test of that job. Hence each release proved out more and more of the system and added to its robustness. Our users now demand minitesting as a prerequisite for systems acceptance.

Putting those test files on-line met resistance too, but a survey found that:

- Many applications tests required multiple tape and disk volumes.
- Time dependencies caused volumes to be reserved when requested for testing.
- Operators couldn't always find the files and thus had to cancel tests.
- As mentioned, mounting files and responding to messages took place at operator speeds instead of cpu speeds.

Migration to on-line test volumes took management scheduling in the early stages. In some cases, especially where live files had been used for tests, a program to perform that migration was required. But in the end of this period, we found that all our test data would fit on a single 3330 Mod I drive—about 5% of our space at the time—once data compression was performed.

How is the space managed? Gross space is mapped out to applications based on relative sizes; some systems take a few tracks and others require several cylinders. Within the gross allocations, project leaders manage the space. Some systems have room for an initial testing condition and up to five iterations that are constantly modified by program cycle testing. Space usage and purging requires some review, for even dormant applications may need some testing. An annual purge of really dead test data has been adequate to fix our 1978 needs at about half a 3330 Mod II drive, still 5% of capacity, three years into the project.

Immediate access to test files was the most difficult facility to establish.

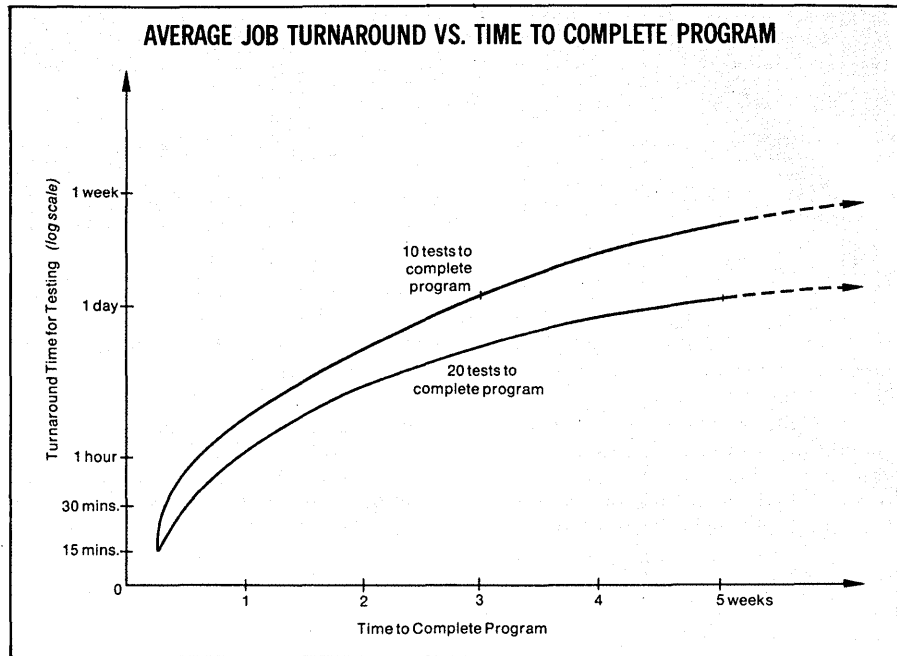


Fig. 1. With very short turnaround time, usually anything under 30 minutes, there's little time to think between runs. With long turnaround times, say one test per day, outside variables like vacation and sick leave have disproportionately great impact on progress. When jobs take more than a day to turnaround, the programmer forgets what he did for the last run.

This implies immediate action on test runs, and resources were at a premium when we began. Initially, no resources were available exclusively for programmer use. Instead of dedicating scarce resources, data center management agreed to handle Express jobs on a priority basis.

Even in the batch operation we began with, Express testing shortened our average test turnaround time from 27 hours (weekends figured in the average) to 16, cut most programmer-present runs, and about doubled the number of tests programmers ran per week. Still not an ideal environment for program development, things were getting better. In fact they were better than the turnaround numbers indicate—since programmers rushed to get one more job submitted before a week-end and these 48-hour turnarounds biased the results.

ON-LINE EXECUTION LOOP

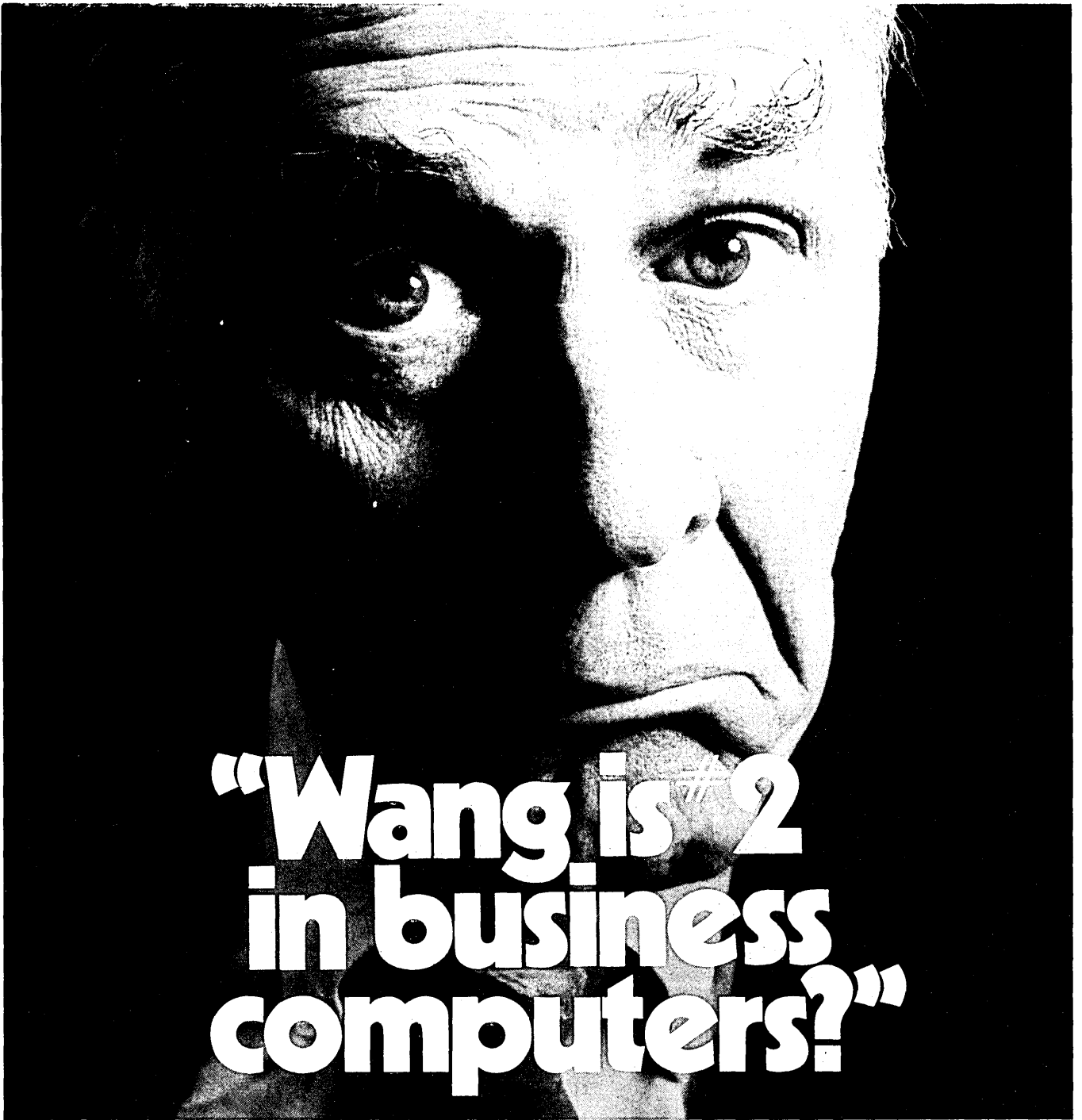
Stage two of the improvement involved going on-line, not an unusual move but not a panacea either. As a byproduct of the DOS to OS conversion, on-line operation was provided through the transition tool, IBM's Conversational Monitor System (CMS). Initially, there were only two crt's (for a staff of 30-35 programmers) for testing. On top of that, there was insufficient storage on the test machine to actually execute the test jobs composed; they had to be shifted under operator control to our other cpu.

Even under this restrictive environment, tests per programmer doubled again and average turnaround decreased to 13 hours as programmers queued test runs through the crt's. By then we primarily used OS, and the CLASS parameter allowed us to schedule the crt-submitted jobs ahead of others.

For reasons unrelated to testing, our dynamic environment continued to change. We converted from VM/370 to native OS. Since CMS runs only under VM/370, it had to go. We replaced it with ROSCOE (a keyboard-initiated remote job entry utility), partly because we were already using ADR's Librarian (a source program maintenance utility), with which ROSCOE works well. (Again, the particular products are not key to the benefits.)

Fortunately, the shift from tapes to disks for test files allowed us to release some tape drives and part of the savings was reinvested in more crt's. Now we have one for about every six programmers, and output per programmer—measured in test turnarounds or in output delivered—has again doubled.

Stage three in our test conversion, we find, is a step many shops oddly do not take. ROSCOE provides a feature (MSGCLASS=0) which routes output back to the programmer's crt. Instead of stopping at the half-step of initiating jobs through the crt and then having the line printer output return later, we eliminated the manual steps in the output and found that this does as much to improve service as eliminating



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manual intervention in job input had.

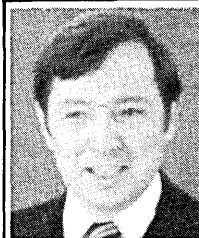
Test turnaround fell from the previous 13-hour cycle for on-line initiated jobs to slightly over three hours. Programmers now view output at their convenience and schedule their time around the two remaining variables: cpu time to process runs and programmer time to think.

After experiencing less than one-a-day turnaround, three hour turnaround seems like heaven. We have found that it is adequate, and that we now take testing for granted much as we do main storage in the virtual machine environment. Testing hasn't disappeared by a long shot. We still need detailed, on-line tests, volume tests, simulated and live parallels, and other special cases. But these events are now specially scheduled and occupy only a small fraction of our total testing activity.

We don't believe that three hour turnaround is everyone's design goal. That isn't the point. What we learned is that it takes a combination of things—minitest files, data compression, on-line job composition, on-line job initiation, *and* on-line output—to achieve good turnaround. We were simply in a unique position to see how much each of these contributes individually.

Installations which apply them all will see *correspondingly* sharp drops in their turnaround times. And that's the real point. ❄

LAWRENCE H. COOKE, Jr.



Mr. Cooke is assistant vice president and manager of technical support for Midlantic National Bank, West Orange, N.J. His previous

assignment there was as manager of systems and programming. He began his dp career in 1963 at IBM, directing the development of a compiler for the 7080. From there he went to Computer Applications, Inc. as a technical programmer and project manager. In 1969 he joined the Federal Reserve Bank of New York, where his projects included the design of an international balance of payments data base and the development of the Research Analysis Language (RAL) used by economists in the federal government, at the U.S. Treasury, and at the International Monetary Fund.

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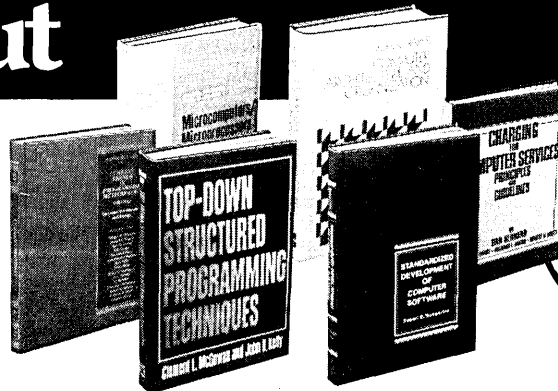
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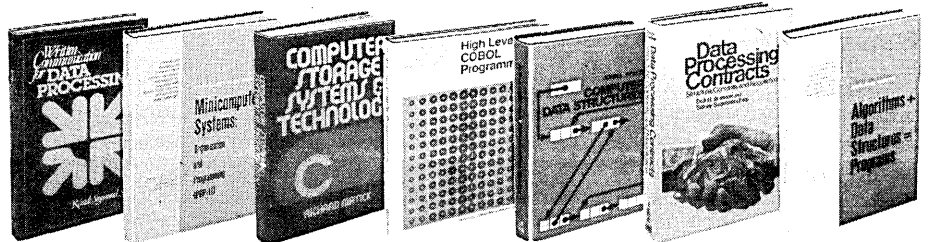
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There is still an absolute and desperate need for user involvement with a central staff. It's called "standards."

"DISTRIBUTED" DOESN'T MEAN "RANDOM"

by Ken Falor

Because minicomputers have miniprices, and often implement applications quickly and painlessly, little attention is given to their widespread implementation in a company or organization until after the fact. Then certain difficult intersystem problems can arise that could have been easily handled had planning entered the process at an early stage.

For example, the whole process of system requirements analysis and vendor evaluation may be repeated countless times, with little information passed on for the next evaluation. A myriad of operating systems, programming languages, file and data structures may result in a corporate Babel of incompatibilities.

This is the general state of affairs today. However, many organizations recognize that the use of minis will grow, and that the sooner these problems are dealt with the better, not only for the corporate interest but for the benefit of individual users as well.

There is little to be gained by attempting to reestablish strong central control and outlaw minicomputers. Minicomputers are a technological advance with many real and honest advantages in terms of price/performance and in ease of implementation and use. There is no going back without making the organization suffer.

Besides, one manager's anarchy may be another's democracy, rightfully delegated. The increasing tendency of business and governmental organizations to establish profit centers and similar independently accountable enti-

ties also results in more autonomy for managers—especially when it comes to getting local computer power for a price lower than possible with the traditional centralized approach.

However, there is still an absolute and desperate need for user involvement with a central staff. This need is for effective standards.

As central staffs have worked through the process of standardizing the data environment, they have found that this is a way to have their cake and eat it too. By establishing effective standards and providing consultation for minicomputer implementation, they are able to report to top management that more information problems are being solved faster, and solved within a coherent framework which benefits the organization's long term interests.

At the same time, they are able to relieve themselves of the actual burdens of design, implementation, and maintenance. Information systems managers find they spend less time as big-machine tenders and more time as managers. In short, they move from being systems managers to being information managers, and become more involved in the end concerns of their top management.

HARDWARE AND SOFTWARE

One of the first and most obvious opportunities for standardization is with the basic hardware and software. The goals are transferability, compatibility, and backup, as well as minimization of time and money wasted on repeated systems evaluation.

Most companies establish some standards regarding vendors and operating systems. With vendors, this will vary from recommending a single supplier to allowing a choice from a long list of suppliers developed by eliminating those which are completely unsuited for the principal application area (such as those which offer no COBOL), or lack required geographical support capability, or with problems of similar scope.

Some companies will even establish a standard list of specific equipment models and operating systems. Two considerations in doing this are the systems' continued long term growth, and migration possibilities. It is vital that a company acquire systems which will be enhanced, improved, and supported by the vendors for many years to come, and that when new systems are developed, migration opportunities are also provided by the vendor.

Standard peripheral devices may also be specified. Of particular importance are the disks. Not only can especially reliable models be recommended, but restricting the range of models makes it possible to move a disk pack from one machine to another in an emergency.

One frequently bypassed area of standardization is programming languages. The advent of more high level languages on minicomputers makes it possible to establish language standards in the same way as for large computers. FORTRAN for scientific and engineering work and COBOL or BASIC for all commercial and transaction processing work are common stand-



/malt

The central point for justifying standardization is often data communications.

ards. Exceptions are allowed for time-critical work (such as sensor-based real time applications or data communications) where assembly language is required, and for transaction processing forms design languages, where implementation advantages are great but no industry standards yet exist.

It is also possible to establish "safe" subsets of FORTRAN and COBOL that work on virtually all minicomputers. The advantage here is not just program transferability, but *programmer* transferability. In other words, a centralized and effective training program can be established, central consulting services can be provided, widely useful applications and utilities routines can be distributed throughout the company or organization, and a programmer can work on another person's programs with fewer learning problems.

Note that standardization of hardware and software can expand career opportunities within an organization. A programmer can more readily move horizontally or geographically, and opportunities exist to move upwards to larger or more critical facilities.

Obviously, all this also has an important impact on maintenance and service considerations. Internal skills can be built up much more rapidly for only one or two basic types of hardware and operating systems. Having many installations of the same vendor's equipment can frequently justify increased support from that vendor, even for remote locations. And while it is unwise to make a single operating system or language do the work of both sensor-based and business processing, it is wise to avoid the almost random selection that sometimes takes place. Standardization here means fewer problems keeping everyone current on the latest releases of these systems, and improved familiarity with their idiosyncracies.

Another benefit of central standardization is the wide applicability of purchased application and utility software packages. Few facilities would ever standardize for this reason alone, but many would enjoy such side benefits once standardization has been established for other reasons.

Finally, the likelihood of quantity discounts from minicomputer manufacturers cannot be overlooked. With the growth in the use of minis that many large organizations are experiencing, we can quickly find ourselves talking in terms of a \$ million in savings.

STANDARDIZING DATA The most urgent aspect of *design* standardization deals with data fields and files. While it seems too much to hope for any ready compatibility of file structures between minicomputers of different manufacturers, it is perfectly reasonable to ensure compatibility between models made by the same manufacturer.

File compatibility really lies on two levels. One is the underlying structure which the programmer does not see, at least not until he attempts to use the file on another piece of equipment. This concerns the on-disk structure, tape formatting, and data type characteristics.

Usually the only solution to this is to require that a universal tape format is available, so that tapes can be generated and read on any machine. Most minicomputer manufacturers offer one.

The second level is that under the control of the programmer. This again breaks down into two parts, the most important of which is the data field specification. Most companies looking into this problem take a kind of manual data base approach. That is, they issue an extensive standard list of fields, specifying field size, type (packed vs. zoned decimal), and implied decimal place. It is also advantageous to establish standard field names or naming conventions to further improve the ability of programmers who are unfamiliar with a particular program to change or maintain it.

The other part of the file compatibility problem is the question of standard record types. This question is usually relatively straightforward, and results in agreements regarding fixed vs. variable length records and where to put the record identifier in multiple record files. A more difficult question is how to deal with relative or hash-calculated access techniques. This can be resolved by providing some standard and widely-accepted algorithms or fixed routines. If chaining is involved, the pointer fields may be specified as following the record type field, and logical vs. physical pointers may be favored.

Probably equally important to the standardization of fields and files is the need to find some mechanism that simply informs the central staff of what kind of data is being stored and maintained on the many minicomputers in all parts of the organization. Using this mechanism, the central operation can locate the data that top management needs.

This mechanism may also provide an opportunity to review the security requirements of data. In one respect, the security hazard is greater with minicomputers, but in another, it is smaller. If an outsider (or self-motivated insider) penetrates the system, more complete access to programs and data is possible without detection, but a far more limited set is available compared to the successful penetration of a central site.

The only solution for the security problem is the establishment of some security standards (such as separation of personnel, customer name, or account name from the rest of the file) for specified types of data, possibly encryption of very sensitive data, and periodic audits of the type that have been standard for many years throughout the business world.

DATA COMMUNICATIONS

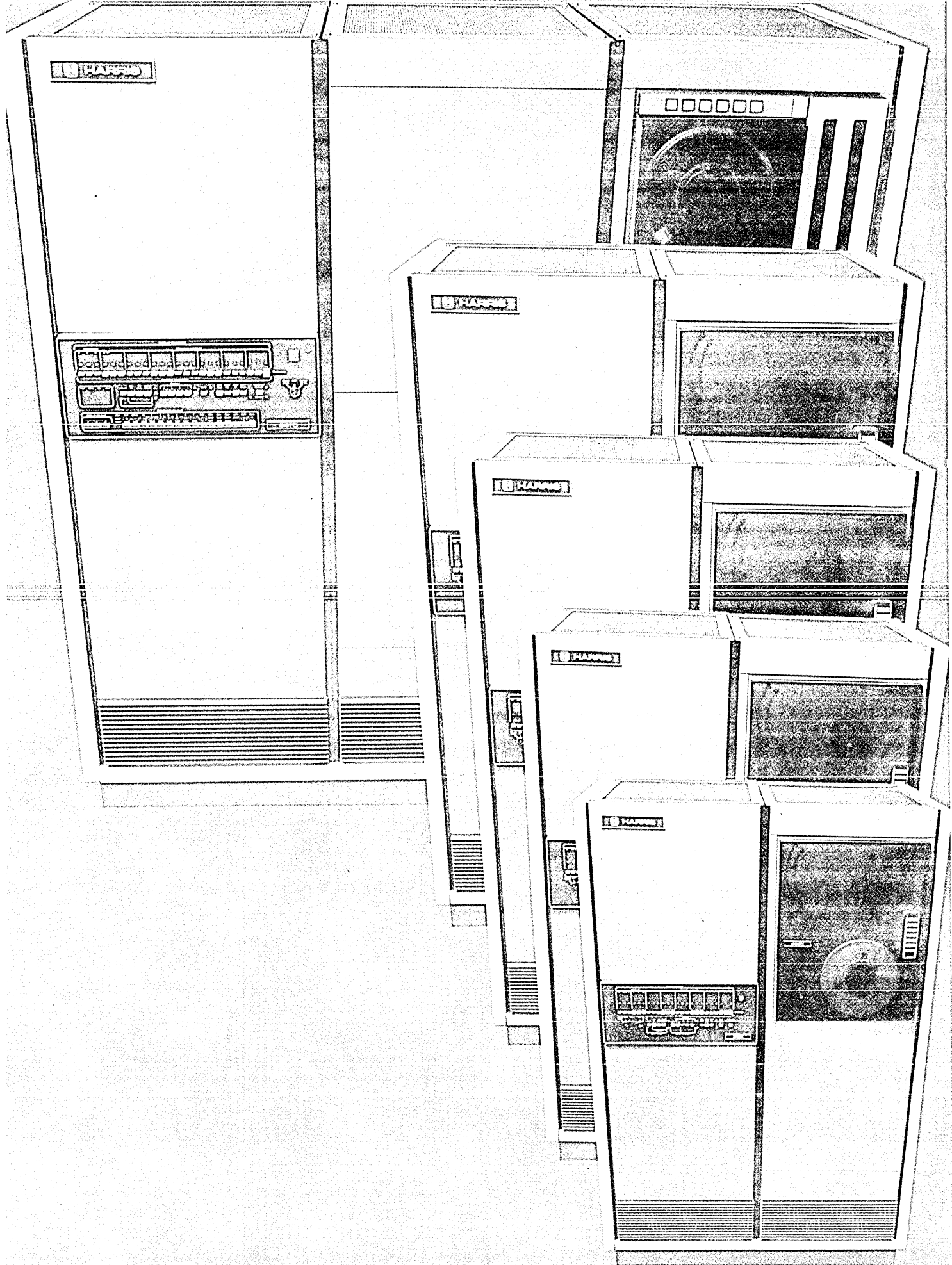
The most urgent area of standardization, and often the central point upon which the justification of all standardization may depend, is intersystem data communication.

One reason that generalized data communications implementations often turn out to be much more difficult than they appear is that they must not only handle lines and manage protocols, but must also repair all the incompatibilities between operating systems, program calls and linkages, file and data types. In a multivendor environment, these incompatibilities may be correspondingly multiplied.

The standards selected must be amenable to implementation on all the computers which communicate with one another. This may be done through adoption of a generalized or universal protocol, or a customized subset, or through emulating a de facto standard such as the ones used for IBM 2780 or 3270 terminals.

The data communications task can range in complexity from the providing of a universal tape or floppy disk format for physically carrying or mailing data from one system to another, to a simple two-node line transfer mechanism based on some widely used protocol, to managing a multinode network employing specialized front-end processors, leased lines, satellites, and a full-time staff of communications specialists.

The particular standardization of the data communications task selected will vary depending on the volume of communications, time sensitivity of data, the direction of transfer (mini to mini vs. host to mini), the number of



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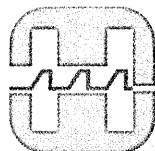
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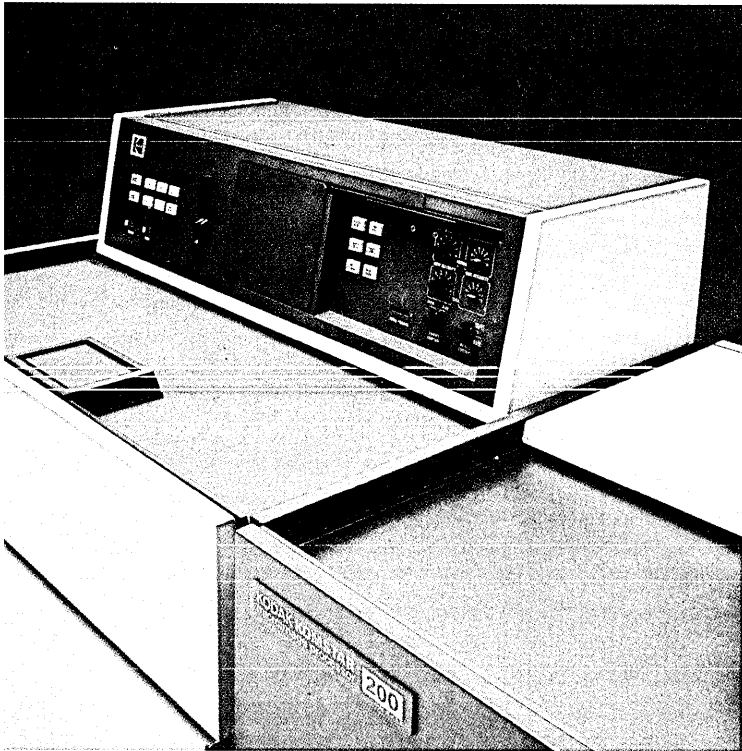
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As though controlled by Pavlovian conditioning, computer people religiously accepted the commandment against ever writing machine-dependent code again.

THIRD GENERATION MYOPIA

by R. Edward Mitchell, Jr.

The origin and history of a disease that has reached epidemic proportions among the ranks of computer professionals, threatening their vision and judgment!

If you look around very carefully you may notice a curious discontinuity in the thought processes of many of your acquaintances in the system design and programming profession. This particular aberration manifests itself in a phenomenal inability to correlate and associate the data processing capabilities of a given computer with a given applica-

tion. Instead, the afflicted persons have only the lesser ability to correlate the capabilities of a given computer *programmed in a certain language* with a given application.

Having unearthed no previous name for the affliction, this writer has chosen the term *Third Generation Myopia*, or simply TGM, for the purposes of this discussion. The origins and causes of TGM lie camouflaged by time somewhere back in the formative years of the computer programming profession.

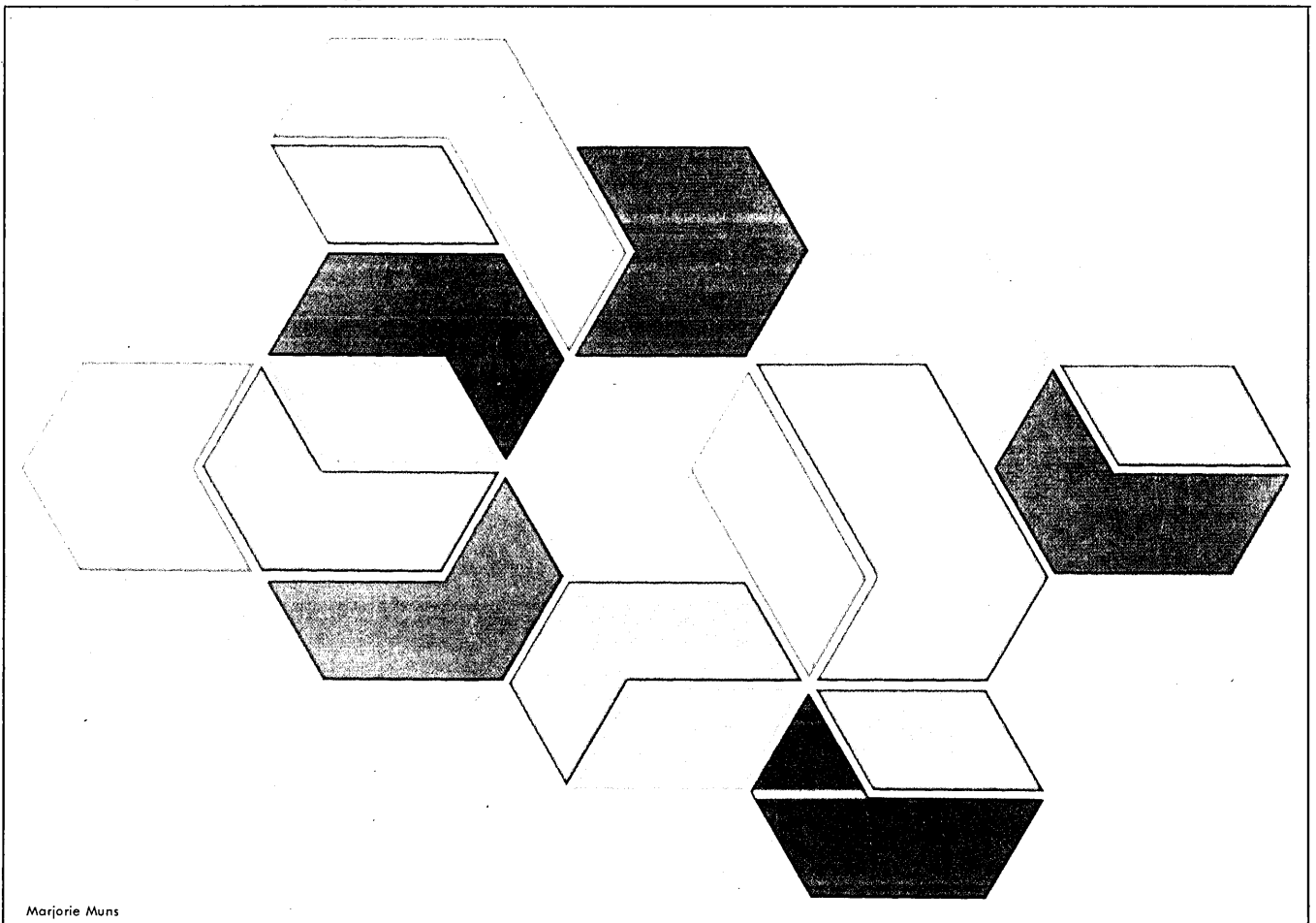
BACK IN HISTORY

Two decades ago computing machines were still in their "first generation." Most of the machines of that era were less powerful

than many of our pocket calculators today. However, even though computers of that time were slow by present standards, the first generation machines gave us all the tools we needed for learning and defining a new science and profession known as *computer programming*.

Then in the late '50s, after several rumor-laden years of waiting, IBM rang up the curtain on what we now call the second generation of computers. The new machines were transistorized, more compact, and faster. Storage space was comparatively vast, composed of tiny ferrite doughnuts. Peripheral devices were cleverly engineered with fewer moving parts that, when they did move, moved many times faster than before.

The instruction sets were some of



Marjorie Muns

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CIRCLE 120 ON READER CARD

Good data processing management ensures that good quality code is produced; good quality code is practically immortal.

the most interesting and most significant features of the new breed. Earlier programmers could only LOAD and STORE the Accumulator, with most other operations being merely variations on the same theme. Now there were variable-length operands, memory-to-memory operations, edit commands, and many other new capabilities that expanded programming horizons.

As the second generation developed, the analysts, managers, directors of computing, and assorted experts collectively arrived at a fateful realization. As if their minds were webbed together by direct mind-link they universally surveyed the scene of clattering printers, spinning tape drives, and thousands of programmers furiously coding Autocoder in thousands of cubicles, and said to themselves, "This is it!" We have arrived and this is *The Way*.

The rest of the story is well known. This collective decision and the resultant commitments made by data processors everywhere set the stage for a huge, multi-\$billion Horror Show that was to unfold in yet the next generation of computing machines. Because, as the wraps came off the third generation systems, it was immediately apparent that something had somehow gone awry. The new machines were good, very good. And they were very, very different. So different and so much better, in fact, that it took a while for data processors to see the trap into which they had fallen.

THIRD GENERATION HORRORS

All of the programming and development that went into second generation hardware was horribly and unalterably wrong. Not only wrong but so far out, so alien from the right way (as manifested by third generation hardware) that much of the old software could not even be converted to the new machines.

Corporate officers, who had become comfortable in the knowledge that computer programs, once written, continued to work forever, now saw tangible assets disappear like wisps of smoke. Heads rolled, reputations were tarnished, careers were ruined, and the boards of corporations asked penetrating questions of their computer people for which there were no satisfactory answers.

"You call yourselves professionals?" echoed across countless conference rooms. "How could you have been so stupid?"

The overreaction was predictable

and understandable. As though controlled by Pavlovian conditioning, computer people profoundly and religiously accepted the commandment that thou shall never write machine-dependent code again. This new law became reinforced in the minds of data processors, business managers, government contract officers, and through time has even pervaded the highest levels of commerce and government. As a natural consequence, many executive officers and presiding bodies have chosen to overstep their competence and knowledge of the subject by decreeing that only high level compiler languages may be used henceforth on the computers under their control. Suggestions that more efficient code might be necessary in certain cases are regarded as heresy.

Many large companies now have corporate policies that forbid any programming languages other than certain specified high level compiler languages. Many agencies of the U.S. government specifically forbid the use of assembler level programming.

Partly as the result of this, there are tens of thousands of computer programs alive and running in corporate and government computer centers today using many, many times as much computing resources as is necessary to perform their intended functions.

As a brief case in point, an expert programming consultant was asked to solve a particularly elusive bug in a large text processing program written in COBOL. After some examination it appeared that certain of the COBOL monitor routines were occasionally running amok causing the program to fail. Since a fix for the monitor routines might take months to obtain from the vendor, the programmer recommended recoding the program in ALC.

The recoding and testing was completed in a few days by using the original COBOL as detailed programming specifications. Not only did the ALC program work flawlessly, but in the process of transliterating the code into ALC, the programmer discovered a subtle error in the original COBOL. That error turned out to be the source of the alleged failure in the monitor routines.

The client was naturally happy to have the software in service. However, the most significant by-product of this exercise turned out to be an astounding drop in the processing cost from \$200 to about \$30 for an average sized file using the new ALC program. Since the program periodically received very heavy usage, this change had a bene-

ficial effect on the overall project budget.

As another example, a large electric utility company with a heavy commitment in data processing has instituted a policy endorsed by its board of directors that only COBOL and FORTRAN may be used for programming within their computer installation. This policy was probably fostered by a very expensive and bitter conversion experience from second generation hardware. To write a program in assembler, the analyst or programmer must secure specific, hard to get permission in each individual case. Exemptions are so difficult to obtain that almost no in-house programmers ever try. Moreover, only COBOL and FORTRAN programmers are hired as permanent staff.

In this company's computer operations, most applications are, in fact, best suited to compiler languages. However, a number of large, unwieldy and very costly to run systems have been written with sinuous streams of obfuscated high level code that could have been written as fast, lean modules at the assembler level. It is those systems, some of which see heavy usage during the prime shift, that are chiefly responsible for this company's inordinately heavy demands on an already overloaded system.

From a hardware configuration point of view, their computer has plenty of horsepower to handle the data processing load at hand. But saddled with years of accumulated compiler programs, many of which are performing functions much better suited to a low level language, the system is loaded past its limit for satisfactory batch turnaround and terminal response time. Management, of course, had the normal and expected reaction: next year's dp budget has been substantially increased and a larger computer is now on order.

DEBUNKING THE MYTHS

One of the strongest fears voiced by sufferers of TGM is the same fear that started TGM in the first place: that someday the machine's instruction set will no longer be supported! And as an attempt to avoid another Horror Show, they voluntarily elect to saddle themselves, their companies, and their successors with years of accumulation of compiler code.

For IBM 360/370 users, at least, this is probably an unreasonable fear. Already there are many hardware manufacturers offering competitive

Building a

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Karl Dowd, Vice President/Data Processing
Michigan Mutual Insurance Co.
Detroit, Michigan



00130 IOM *19 1304 131

00000 JOB *4:A

00321 A&Y *26 1402 140
1467 1470 147

00213 KEYUT *23 1410 141

02336 KPAUSX *135 1748 175

00641 EFFMO *44 279 2E
2791

00653 EFFYH *46 288 28

01562 ERNFLD *98 1574 155

01630 EXPIRE *105 996 99

03632 FILEDATE *213 1962 245

01571 FIRST *100

01574 FIRST1 *101

04467 FLAG *266 2982 300
3131 3147 315

03271 FORM1A *178 1072 107
1162 1166 117

02532 FSTENT *134 1733 174

03671 INDKEY *220 1950 196
2463 2465 246
2512 2513 251
2586 2587 258
2700 2701 270
2755 2756 275

00130 IOM *19 1304 131

00000 JOB *4:A

00321 A&Y *26 1402 140
1467 1470 147

00213 KEYUT *23 1410 141

02336 KPAUSX *135 1748 175

Detroit-based Michigan Mutual Insurance Co. is a major supplier of multiple line casualty and property insurance services. The 66-year old company is perhaps best known for its pioneering efforts in worker's compensation insurance but for many years it has also written other casualty and property insurance lines. The company has about 250,000 insurance policies in force. In 1977 the company generated sales of over \$180 million working with a network of branch and regional sales offices that extend to nearly 50 cities in 13 states.

Linking these scattered offices together with an IBM 360/65 unit in the Detroit headquarters of Michigan Mutual is an advanced computer/communications network based upon Datapoint DATASHARE systems located in home and regional field offices. These DATA-SHARE systems provide both communications linkage to the central mainframe in Detroit and

computer power for satellite Datapoint 3600 workstations which are located in regional and field offices.

Currently the Michigan Mutual network utilizes six DATASHARE systems based on Datapoint 5500 processors located in as many cities. Each of these processors service in turn up to eight Datapoint 3600 workstations. These workstations are located in field office cities and connected via telephone to the regional office, or located in the regional office near the processor. At least one terminal in each office is equipped with its own terminal printer.

"That's a big plus with the Datapoint units," said Mr. Dowd. "The 3600 workstations in our branch offices needn't depend on a centralized batch printer, which gives us a lot more flexibility." Each 5500 processor also utilizes twin 20 million character disk drive units which allow important policy information to be stored locally. "We will return about 75% of our master file to be stored on local disk storage units," said Mr. Dowd.

"By returning an appropriate portion of our master file data to the local host storage units," said Dowd, "There's no need to resort to central computer storage for over 90% of field office-generated inquiries and file look-ups. Hence, without incurring long distance communications costs, the field offices can give a lot faster customer service. This has proven to be a big plus especially in working with independent agents who are not used to that kind of convenience.

Other benefits

"The Datapoint units enable us to make just one-time entry of data in our field offices for a multitude of subsequent applications," said Mr. Dowd. "In addition, the on-site computer power represented by the Datapoint processors enables us to off-load work from our central IBM unit and lets our field offices handle locally much of our claims adjustment and policy issuance activities without involving the home office. We process about 700,000 policy transactions and handle about 130,000 claims annually, which

gives you some idea of the work load. At night when telephone rates are lowest the home office 5500's automatically 'poll' the processors in the field for summary information. This arrangement alone enables us to realize substantial savings in data communications costs and allows us to avoid almost all the uncertainty and time lags we experienced in mailing source documents to the home office."

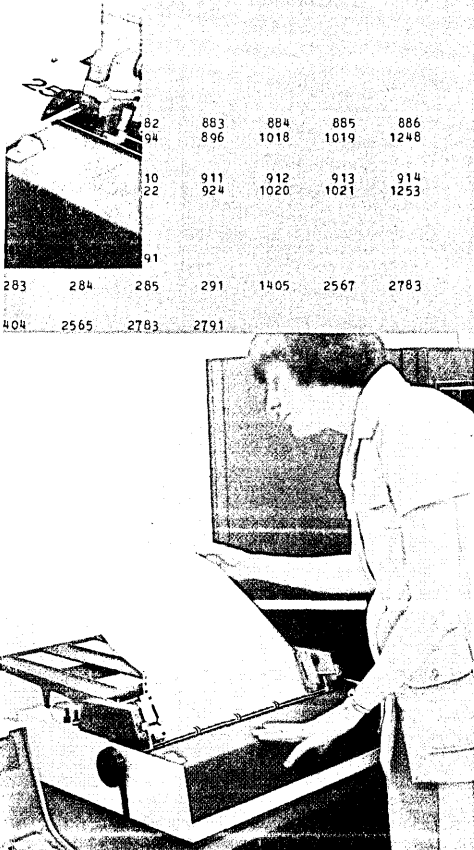
Making the most of the mainframe

Dowd is especially proud of the cost/effectiveness of the IBM 360/65 system, an older system although recently installed at Michigan Mutual. "It's an old-line 'Fleetwood' system," noted Dowd, "with more than ample power for our needs. With our dispersed processing network and the ability of the Datapoint processors to handle growing workloads in our field office, we should be able to handle our volume for the foreseeable future in a very cost/effective manner. For some of our field offices where workload warrants, we may install low-cost units such as the Datapoint 1500 which can participate directly in our overall network and provide much greater on-site processing power. We have also installed in our home office a full Datapoint ARC™ system with DCIO (Direct Channel Interface Option) which adds both more horsepower and more convenience to our network."

Michigan Mutual has made dispersed processing pay off big, and so can your company. For information on how to create a cost/effective computer network based on advanced Datapoint processor systems and peripherals, contact the nearest Datapoint sales office or write or call Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284, (512) 699-7059.

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Some applications call for programming a language, others for programming a computer.

cpu's to process the 360/370 instruction set. Were IBM to completely abandon that instruction set in a new series of processors (albeit unthinkable in terms of good business sense), many other suppliers stand ready to supply the already established market. In any event, the machinery and software to process the 360/370 instruction set will be available at least into the next century. Admittedly, the instruction sets of other manufacturers have a much less certain future.

Another therapeutic exercise which might help alleviate some of the paranoia produced by TGM is recognition of the quality and permanence associated with the 360/370 instruction set. Upon questioning a number of competent, broadly experienced programmers, I have found that most agree that the 360/370 instruction set is the best all-around *data processing* repertoire of any commercially available machine.

Another myth has to do with cost. The cost of developing a program with the different languages depends largely on the application and, naturally, on the skills of the programmer(s). However, given an approximately equal skill level among the programmers of COBOL, FORTRAN and ALC in an installation, some valid generalizations and cost comparisons can be made. For example, a heavy mathematical application with many long formulas and math functions can be developed faster and cheaper in FORTRAN; while the same program in ALC might run a little faster, the savings would probably be minimal and would never pay for the added development costs.

A small, special purpose module for generating reports might be most easily developed in COBOL and could present a number of lengthy chores in ALC or FORTRAN. Again, any savings in execution costs might as well be ignored.

A program with many data transformations, bit and byte manipulations, character scans and string searches and so forth is generally much simpler to do in ALC whereas the same problem becomes circuitous in the high level languages.

Then there's the conversion myth. Well written and well documented assembler code is fully translatable, sometimes more so than compiler code. Most of the rigors of conversion from second to third generation hardware were caused by poor programming standards and practices. During that period, many programmers delib-

erately wrote complicated, exotic code, possibly as a manifestation of their competence and intimacy with the hardware.

Now that our profession has matured somewhat, good programming is recognized as having the additional qualities of clarity, straightforwardness, functional modularity, and maintainability. Good data processing management ensures that good quality code is produced; good quality code is practically immortal.

In an organization where program development is an on-going and vital part of the operation, programming methods and efficiency are areas that demand careful attention. Streamlined procedures, consistent adherence to standards, and attention to the development of good programming tools continue to pay dividends year after year. The development of programming tools is an area where sufferers of TGM are often denied, since compiler level languages do not offer much in the way of tool-building capabilities.

Most assembler level languages, however, provide macro processing capabilities. The macroinstruction represents one of the best means for building effective programming tools. These tools are as important to the professional computer programmer as a trowel and spirit level are to the brick-layer.

My experience has shown that a good ALC programmer with a well developed toolbox of macros will often outperform a compiler-language programmer nearly two to one in day to day applications. Despite popular misconceptions (around TGM-infected installations) and depending on the application, of course, some assembler programs are up for service in approximately 60% of the time and cost of what a compiler language implementation would be. For complicated data manipulation tasks we find the gap widens even further. Therefore, time and cost are not necessarily a reason for disqualifying assembler language for most applications.

THE NOT-SO-PROFESSIONAL

Be wary of professional data processors who discount and reject assembler level languages across the board for sundry and often vague reasons. In nearly all cases, such persons do not really know assembler languages nor how the computer instruction set actually functions. TGM pro-

vides a convenient camouflage to cover their ignorance and lack of technical depth.

Some applications call for programming a language, others for programming a computer. As a technical manager make sure you know who on your staff is a computer programmer and who is a language programmer. Encourage your language programmers to learn how your computer works and begin using assembler occasionally when the situation calls for it. Work on developing or acquiring good programming tools and promote their use in your organization. A good macro library developed for a specific line of business can have a tremendous effect on lowering cost, ensuring timely delivery and improving the reliability of programs.

If you are an officer or administrator of a computer based operation, be sure your technical management is competent and has *all* the skills necessary to do a professional job. If your managers tell you the organization needs a larger computer, try to find out just how efficiently you are using the present one.

The most effective cure to the problem of spreading TGM is realizing there is nothing inherently wrong or bad about assembler programming. For many applications assembler programs may well be the best all around solution.* A professional data processor should have no prejudices or biases about any programming language. Rather, the language should be chosen based on the application and situation.

*

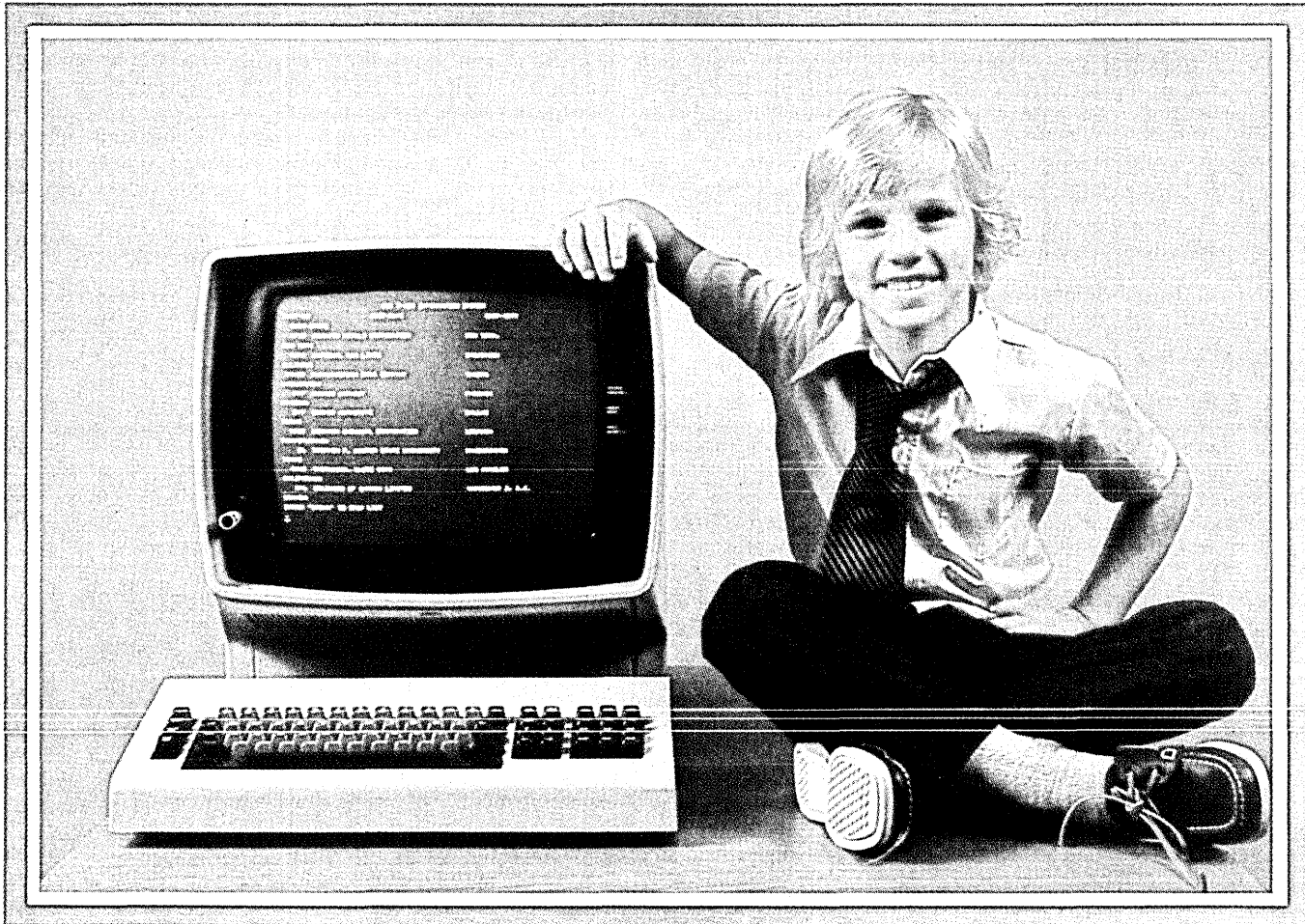
R. EDWARD MITCHELL, JR.



Mr. Mitchell is presently a senior consultant with Martin Marietta Data Systems in Bethesda, Md. He is a cofounder and was president of U.S. Robots, Inc.,

also in Bethesda, and for eight years made his living as a consultant specializing in computer information systems and advanced programming methods. He first began writing programs as a field technician for early second generation machines.

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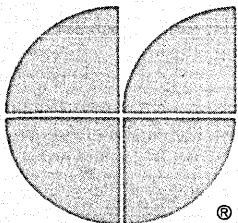
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Managers frequently find themselves pushing the limits of their department's abilities to adapt—and not knowing what the limits are.

GAUGING THE IMPACT OF CHANGE

by Joseph R. Matthews
and Robert J. Smith

Change is an integral part of an organization's life as well as of an individual's. Be it a new market opportunity, technological breakthrough, management reorganization, or government regulation and compliance procedure, change is an everyday occurrence. Some

There is nothing permanent except change.

Heraclitus

changes are unavoidable; others are sought. Some come down as mandates; others sneak in before they are recognized.

Data processing managers are somewhat unusual in the amount of change they experience. Theirs is one of the most volatile fields to begin with, but in addition they must cope with changes in other parts of the organization as well as in their own. They frequently find themselves pushing the limits of their department's abilities to adapt—and yet may have no idea what those limits are.

We contend that each data processing department has a tolerance level for the amount of change it can accommodate without serious disruption of its performance, and that the manner in which change is planned and managed determines the quality of dp services delivered.

Data processing has never been a static function. There have been frequent conversions of hardware and software, for example, all along. Thus the manager has always had two major re-

sponsibilities: keeping the system operational and managing change.

The conflict between the two responsibilities is apparent. The first is based on steady state assumptions while the second is based on altering those steady states. And while the majority of lessons learned by the manager both through education and experience focus on the steady state side, people are left to fend for themselves in learning to manage change.

Work groups are really quite delicate mechanisms balanced within a patterned network of pressures. Each of the major subcomponents—the task, organizational structure, people, and technology—are interrelated. A change in one will impact all the others. Further, any change in the kinds of tasks, form of technology, reporting relationships, and personalities may have a stressful and

disruptive (but perhaps unanticipated) impact on the overall performance of the work group.

Thus for example, a change in operating systems (technology) may

Knowledge is change—and accelerating knowledge acquisition, fueling the great engine of technology—means accelerating change.

Alvin Toffler

require new skills (tasks) leading to the need to hire new individuals with experience in the new operating system (people). Then new links must be formed within the social networks, and new formal and informal rules must evolve. This alters roles for the members of the work group. These changes do consume resources, including tangible ones and the intangible psychic and social energies

THE COMPUTING READJUSTMENT SCALE	
EVENT	VALUE
Hardware & Software	
1. A change in generation of machine (same vendor)	<u>500</u>
2. A change of CPU vendors, switching from one vendor to another	_____
3. A change in the number of CPU's	_____
4. A change in size of CPU, a significant upgrading	_____
5. Switching peripheral equipment vendors	_____
6. Installing a new type of peripheral equipment (e.g., CRT's, key-to-disk)	_____
	⋮

Fig. 1. Among other questions, the survey instrument asked respondents to weight kinds of changes in dp against a standard of 500 for a conversion from one generation to another in the same manufacturer's line.

spent adjusting to new roles, relationships, and routines.

Experienced data processing managers are sensitive to these stresses and have developed over time an intuitive ability to assess the time and effort required for a work group to readjust to the stress resulting from major changes. Managers with "battle scars" recognize the limits of the group's adaptability and the consequences for reduced system performance if these limits are exceeded. These managers would be hard pressed, however, to make explicit their intuitive insights and the subtle distinctions between the various types of change events.

Managers have learned their change readjustment estimating skills only after some bitter and perhaps costly experiences. Further, there is seldom any assurance that a once-successful estimator will continue to be successful. It appears that a tool for formalizing the collected wisdom and experience of many managers would be helpful. Our Computing Readjustment Scale (CRS) is designed to fill this need.

By "Computing Readjustment" we mean to represent the variety of factors necessary to cope with changes in current computing practices. Examples of readjustment include: planning and scheduling the proposed change, reallocating personnel, hiring new personnel, meeting time constraints, bringing in outside experts, using vendor service personnel, working overtime, etc.

BUILDING THE SCALE

The necessary data to develop the Computing Readjustment Scale was provided by 120 survey respondents. (Table 1 provides data concerning their characteristics.) Each was asked to compare the readjustment necessary to successfully cope with individual changes against the readjustment represented by converting from one computer generation to another within the same vendor's line. The generation conversion was assigned an arbitrary value of 500 on the questionnaire. Respondents were asked to weight other changes, such as a change in the number or size of cpu's, against that standard. (See Fig. 1.) The resulting scale is a first step in trying to bring a greater degree of predictability and reliability in estimates of the resources necessary to successfully implement a particular change. Fig. 2 presents our Computing Readjustment

Change of cpu vendors	100	
	73	Implementation of data base management system
Change in relationships between computer installations, such as centralization	65	
	61	Change from batch to on-line system
Change in operating system	47	
	43	High turnover of systems analysts
Software support discontinued by the vendor	38	
	37	High turnover of applications programmers
Change in key systems programmers	37	
	37	Changing demands placed on the system by users
Change in development priorities for a major new system	36	
	36	Changes in dp department location
Change in top dp management	36	
	35	Change in generation of machine (from same vendor)
Addition of a major application	34	
	34	Moving cpu to another location
Acquiring and installing an application from a similar organization	33	
	31	Adding a new (to the site) programming language
Acquiring and installing an application from a cpu manufacturer	30	
	28	Acquiring and installing an application from a software house
Change in the organizational structure of the dp department	27	
	27	Change in the organization's top executive officer
Change in reporting requirements imposed by a higher authority	27	
	24	Change in demand for peak processing
Change in number of cpu's	24	
	22	Installing new types of peripherals
Switching peripheral vendors	22	
	21	Significant upgrading of cpu size
Changing the number of shifts the computer is operational	20	
	18	New release of an operating system
High turnover of data entry personnel	18	

Fig. 2. The Computing Readjustment Scale represents the collective experience of the 120 respondents. Users may wish to compile their own index, but this one at least passes some common sense tests.

Changes in technology require the most difficult readjustments.

Scale. This figure contains the magnitude of the computing change events on a scale of 0-100 (the mean score of each event divided by the value of the one event with the largest mean value).

The scale is intuitively attractive because it provides a relatively easy to understand index for a variety of diverse changes involving hardware and software, structure, personnel, and operations. In addition, the relative ranking of the seriousness of the various change events appears to pass the test of "common sense"; that is, for instance, a change of cpu vendors or the implementation of a data base management system is much more problematic and requires considerably more readjustment effort than the adoption of a new programming language and this shows up in the index numbers. The significance of the scale is that it provides a ratio of the likely readjustment necessary to accommodate a particular change. (At present we assume, but have no basis on which to judge, that the scale is linear rather than curvilinear or exponential.)

Notice that the group of change events that are technology-based pose serious readjustment problems that should not be underestimated. Consider the top 16 change events, as shown in Table 2. The magnitudes of the computing readjustment scores for Technology are almost twice the scores of either People, Tasks, or Structure. While changes in technology are often couched in terms of positive benefits to the organization, the impacts in terms of required readjustment are significant. In addition, changes in Technology are likely to cause additional adjusting changes in the areas of People, Tasks, and Structure.

It may well be that managers will want to determine their own ratings for the change events presented here. That makes good sense, as installations and people differ in their reactions to change. The distilled experience represented in the index numbers we've compiled will at least aid in the process of developing a personal scale.

PUTTING IT TO WORK Once created, the Computing Readjustment Scale may be used in a number of ways, as the following few uses illustrate.

How do your personal experiences compare with the Computing Readjustment Scale?

Recollect your experiences in coping with various change events and

CHARACTERISTICS OF RESPONDENTS

Type of Organization	%	Computing Environment	%
Banking/credit	8%	Batch only	3%
Dp services	3%	Batch, multiprogramming	9%
Education	1%	Batch & on-line	22%
Gov't, local	21%	On-line, multiprogramming	66%
Gov't, state & fed.	6%		
Health	3%	Respondent	%
Insurance	7%	Provider of dp service	86%
Manufacturing	27%	User of dp service	4%
Petroleum	4%	Other	10%
Public utilities	7%		
Trade, wholesale & retail	3%	Average Years of Experience	
Transportation	3%	In present position	4.2 years
Other	7%	With this organization	8.9 years
		In data processing	13.7 years
Number of Employees	%		
1 - 49	3%		
50 - 99	3%		
100 - 249	11%		
250 - 499	15%		
500 - 999	16%		
1,000 - 1,999	17%		
Over 1,999	35%		

Other organizational data: the mean machine size, measured by main memory, was over 1MB; 54% had dbms.

Other respondent data: 95% male, average age was 43, 78% have at least one degree.

Table 1. The survey sample was spread over many industries and organization sizes, but definitely was biased toward the experienced dp services provider in a large, sophisticated shop.

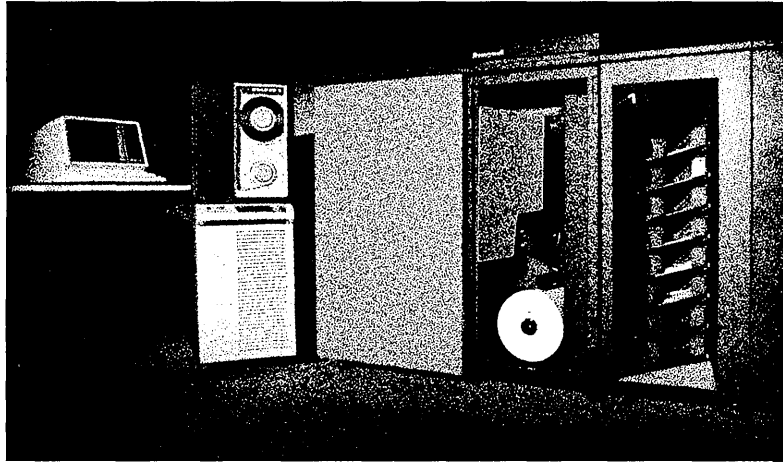
LOOKING AT THE TOP 16

CRS RANK	PEOPLE	CRS VALUE
6	High turnover of systems analysts	43
8	High turnover among applications programmers	37
9	Change in key systems programmers	37
	TASKS	
7	Software support discontinued by vendor	38
10	Change in demands placed on system by users	37
11	Change in development priorities	36
15	Adding a major new application	34
	TECHNOLOGY	
1	Change of cpu vendors	100
2	Implementing a data base management system	73
4	Change from batch to on-line system	61
5	Change in operating systems	47
14	Change in generation of cpu (same vendor)	35
	STRUCTURE	
3	Change in relationships between computer installations, such as centralization	65
12	Change in dp department location	36
13	Change in top dp management	36
16	Moving cpu to another location	34

Table 2. Changes in technology have a more dramatic effect on dp, overall, than do any other changes. Note that a "change in relationships between computer installations, such as centralization," which is listed under "Structure," may also involve a change in technology. It too is ranked very high in impact.

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The manager figured that installing a new forecasting application was about as difficult as installing a new operating system release. He was wrong.

compare them to the scale. Are you reasonably close to the scale? If you are not very close to the rankings in the scale, not to worry. Some of the change events had a great deal of variations in the values assigned by the respondents (for example, change events Number 1, 2, 3, 4, 6, 7, 8 and 11 all had standard deviations in excess of 10 on the original scale which used 500 as a base). This suggests that some differences may spring from using

cpu's from different manufacturers, from the experience and capabilities of the dp manager, and from different management strategies. The other change events had reasonably small standard deviations. Were the sample size increased dramatically, the positioning of some of the change events might move a bit but we would not anticipate major shifts in position.

Are there benefits to preparing

baseline cost data for my organization?

For a recent project, ascertain with some degree of certainty the actual dollar and other intangible costs involved in implementing that change. It will then be possible to predict future costs of planned projects using this baseline data. Are the planned projects resources roughly proportional to the change event's position on the Computing Readjustment Scale? If not, then a review of the project might be in order to discover if overlooked areas might contribute to a schedule delay or cost overrun.

Is an average CRS score of use to my organization?

Compute your organization's CRS cumulative score for each of the past three to five years. Examine each year to see if all of the changes made were implemented on time and within budget. For those years that there were overruns, assuming a relatively high CRS score, perhaps your organization exceeded its change tolerance. Now you will be in a position to determine the current year's CRS score; it may suggest whether your current change activities are likely to face unexpected problems and serious delays.

Are there any uses of the CRS that may aid in staffing the data processing department?

Planned change events can be reviewed for their likely personnel requirements. The CRS score for each of these planned changes could be reviewed to determine whether they are in rough agreement in terms of total resources necessary to implement the changes, based on benchmark data established earlier. When compared to current and projected staff levels, this review may signal the need for contract personnel for peak periods or specific skill requirements necessary to successfully implement a planned change.

Could the CRS be used to control or schedule change in the data processing department?

Yes. Planned and known future change events could have their CRS score determined. Once known, this information could be used to review the implementation schedule of change events to determine whether some of the periods with high CRS scores might be adjusted or rescheduled to smooth out the high points of readjustments.

Are there any management uses for the CRS?

Several uses of the CRS come to mind concerning the management of the data processing department. These include using the CRS score as a basis of determining whether too much or too

Sola "Ultra-Regulation": Plug it in where you need it most.

Brownouts, transients and line noise can cause electronic office equipment to malfunction; drop digits, lose memory, and suffer inefficient operation. Field service people may tell you to install a dedicated line. Still others will suggest an ultra-isolation transformer. But both of these are expensive and inflexible compared with Sola's Mini and Micro/Minicomputer Regulators with "Ultra-Regulation" — complete protection for your electronics.

Sola's "Ultra-Regulators" do everything a dedicated line or an ultra-isolation transformer does and more. They eliminate transients and provide complete isolation from line surges. The resulting waveshape contains less

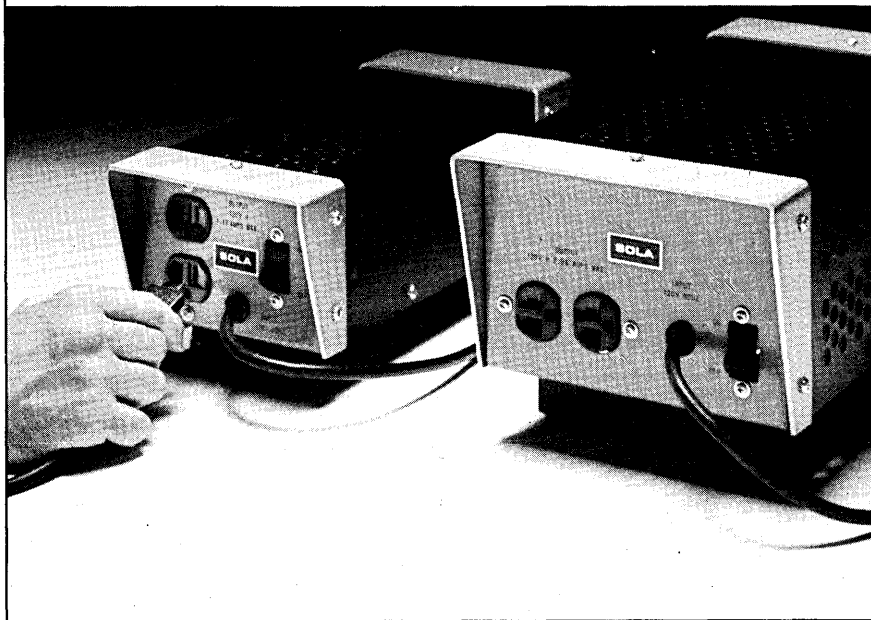
than 3% harmonic distortion. What's more, each unit is portable. You can plug it in where it's needed most at any given moment. And it's UL listed.

Sola Micro/Minicomputer Regulators provide better than 120 db common mode noise rejection; 60 db transverse mode noise rejection, as well as reliable brownout protection. Output remains within NEMA voltage specification of $\pm 5\%$ for input voltages as low as 65% of nominal.

Before you invest in ultra-isolation or a dedicated line, investigate Sola's Mini and Micro/Minicomputer Regulators — in stock for immediate shipment through your local Sola stocking distributor. Call or write for free literature.



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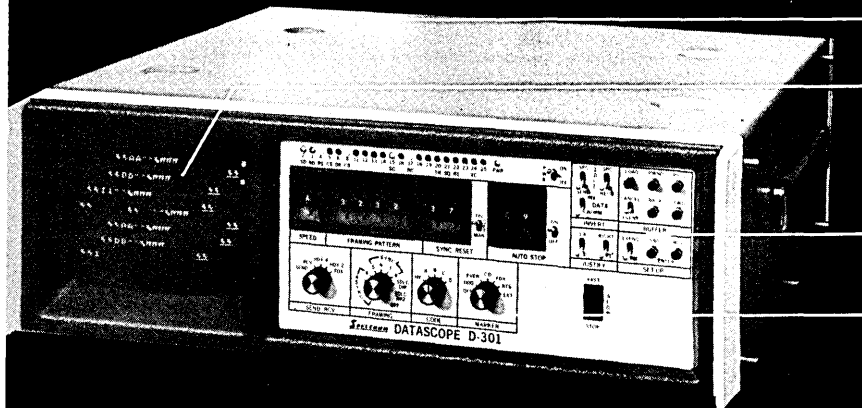


CIRCLE 196 ON READER CARD

Data Communications Problems? Meet The Portable Problem Solver

Spectron D-301 DATASCOPE

The Field Service Standard For Network Hardware and Software Monitoring



The fully microprocessor-based D-301 is designed for portability. It's a 5½" high x 16" wide x 17" deep, brief case size, and weighs only 25 lbs. It has a built-in ease and simplicity of operation, as do all DATASCOPIES.

The time-correlated full-duplex CRT display allows maximum monitoring flexibility. Send and receive data are separately (and simultaneously) controlled for speed, language (i.e., HEX, ASCII, EBCDIC), synchronization, and number of bits per character.

The D-301 captures full duplex data at speeds up to 72,000 bits per second and stores it in its large 262,000 bit buffer for replay under operator control. A search feature with Auto-Stop (up to 4 selected characters) permits the rapid scanning of the entire buffer contents.

The D-301 provides for switch-selectable full duplex, half duplex and simplex operation; SDLC, Synchronous, Asynchronous, and Isochronous transmission; and 5, 6, 7, or 8 level codes. Right or left character justification, bit inversion and character reversal are independently controllable for each side. Complete interface breakout and L.E.D. display.

The DATASCOPE is the window into your communications network which shows every character sent or received. Hidden errors become visible; complex problems become solvable.

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Exceptionally Capable
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TWX: 710-897-1359
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CIRCLE 131 ON READER CARD

Anticipating changes that follow other changes.

little resources are being budgeted to implement a particular change. If there are several alternatives that involve different change events to solve a particular problem, the CRS score for each change event could be used as *one measure* of the likely impacts implicit with each alternative. In addition, the CRS could be used as a means of anticipating changes that will likely follow the introduction or implementation of any other change. These aftershocks can require substantial readjustment by the data processing department just as the aftershocks of minor earthquakes often inflict serious damage to an area already softened up by a major quake.

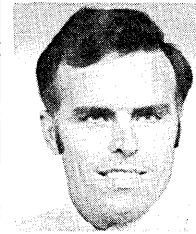
Several data processing managers expressed interest in using the CRS as one reference tool in planning the necessary resources to implement a particular change. One manager, in particular, felt that he should reconsider and review an estimate of the resources for a planned change. Two weeks prior to seeing the CRS, this manager had installed a new release of an operating system, which has a value of 18 on the CRS. Now the manager was planning to install a new budget forecasting application borrowed from a "sister" organization. The

manager had planned to use the same amount of resources for implementing this new application. This new change event ranks considerably higher on the CRS scale, however, with a value of 33. Realizing this, the manager decided to carefully reexamine the project estimates and to check the experiences of some of his counterparts. He found he'd overlooked some programming and had to increase the resources allocated for installing the new application.

A Computing Readjustment Scale provides a rationale for assessing the relative impact of a specific change, at least in broad terms. Using one, manager and systems personnel can review the number and sequence of changes scheduled for their installations to determine whether too much is being attempted in too short a period. Further, that use of the scale should improve its utility by tuning the index numbers to fit a given environment.

Whether the user accepts the index numbers compiled here from 120 persons' experiences or derives a new set from his own experience, he will have one more tool for managing change. And unlike most others, this one improves with age. *

J.R. MATTHEWS



Mr. Matthews is managing director of J. Matthews and Associates, a Cypress, California consulting firm.

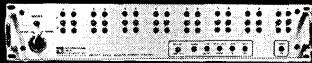
Formerly he was associated with the URBIS Project being conducted by the Public Research Organization at the Univ. of California at Irvine. He also has been a programmer and systems analyst.

R.J. SMITH



Mr. Smith is an associate professor of management in the School of Business Admin., California State Univ., Long Beach. He has been involved in the development of information systems for public and private organizations, and teaches Management Information Systems.

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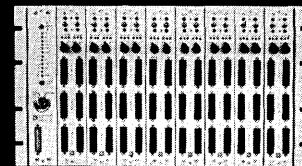
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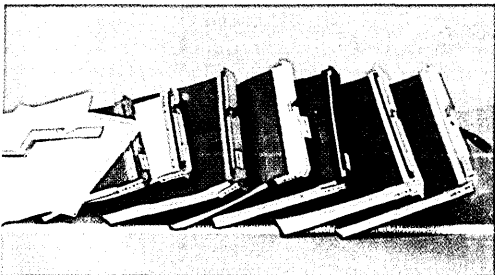
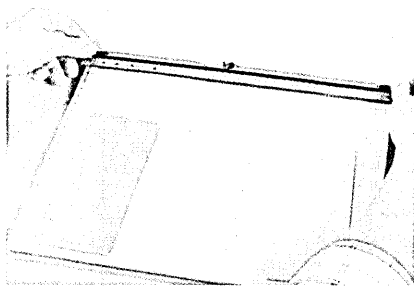
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CIRCLE 163 ON READER CARD

how DOCU-MATE™ and the structured filing concept improve systems and programming productivity

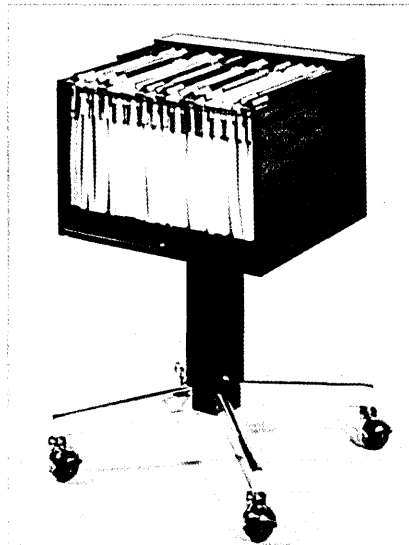
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Conference and exposition for information management people will begin to set some records of its own in Chicago, Oct. 16-19.

INFO 78: CATCHING UP WITH THE NCC

by Tom McCusker, Senior Editor

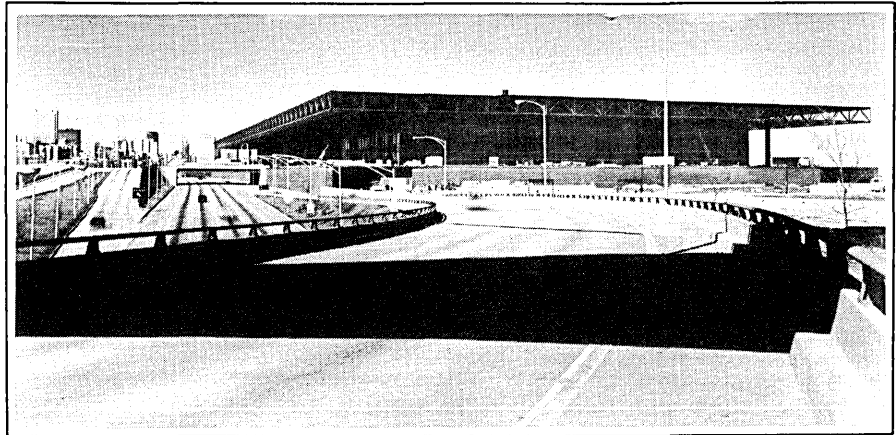
It isn't quite a National Computer Conference with its 350 exhibitors and attendance of 57,000. But Info 78, the Information Management Exposition and Conference, which opens in Chicago Oct. 16 for a four-day run, is beginning to set some records of its own. For the first time in its five years, Info 78 has every major mainframe company, except Control Data, as an exhibitor. It has just about every minicomputer manufacturer in the show, with the exception of Digital Equipment Corp. (and Data General, which won't be exhibiting this year even though it's been in previous Info shows—explaining that it's re-directing its show activity to an ambitious schedule of its own road shows).

Some 60 firms are exhibiting in Info for the first time and 38 companies who exhibited in last year's event in New York City have increased their exhibit space by a total of 11,000 sq. ft. Its 150 exhibitors in last year's show in New York have increased to about 200 this year and the 44,000 sq. ft. of exhibit space has soared to 70,000 sq. ft. this year in Chicago's huge McCormick Place. "And that space," says Richard Wolcott of the show management firm of Clapp & Poliak which puts on Info shows, "is the very same amount of space that the National Computer Conference occupied during its first run in New York in 1973."

Attendance, which last year reached 15,000, was expected to be about the same this year. But two months before the show was to open, about half of the exhibitors already had ordered 120,000 admission tickets to send to customers. So the turnout, as with the NCC in Anaheim last June, is anyone's guess.

REPLACEMENT FOR THE JOINT CONFERENCES

The Information Management Exposition and Conference was started in the Fall of 1974 as a sort of replacement to the semiannual Spring and Fall Joint



Info 78's home this year is huge McCormick Place in Chicago, Oct. 16-19.

Computer Conferences, which in 1973 were consolidated into a single summer show. But its organizers took a different approach to the conference program by directing its content to management aspects rather than to technical approaches. The program for its first conference was put together by the American Management Assn.

It has pretty much stuck to this format, even though Clapp & Poliak's Wolcott still worries about the interests of his attendees. "A lawyer came up to me once and complained the content of the conference wasn't technical enough," Wolcott said. "And he was a lawyer!"

Theme for this year's conference is "strategic planning in the information age," which the sponsors say was selected to convey the need for a corporate strategy in gathering, storing, retrieving, and disseminating information. And there are plenty of sessions directed to technical subjects in order to please the estimated 2,500 persons who attend the conference part of the Info event.

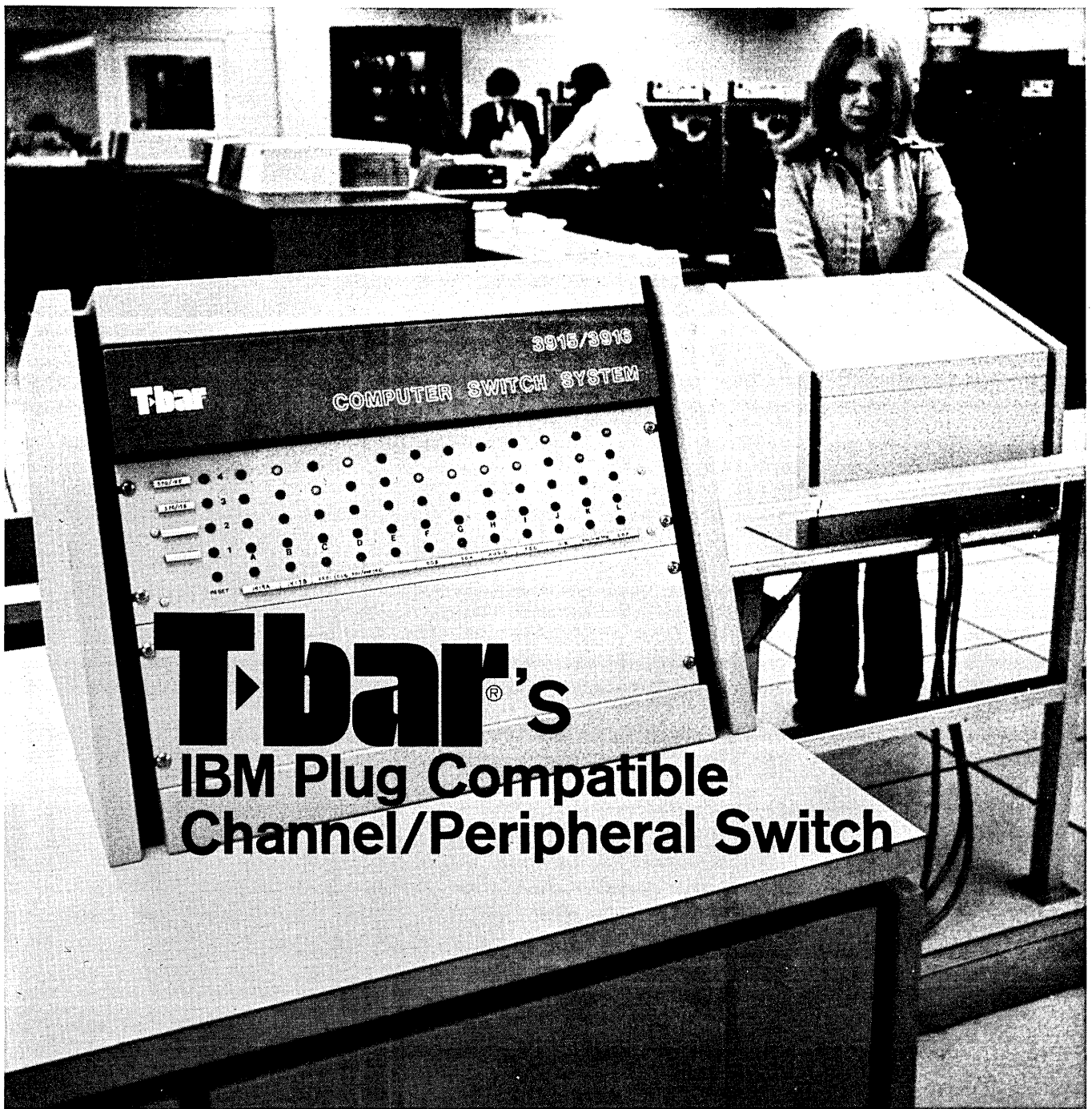
For instance, Howard Anderson of the Cambridge consulting firm, The Yankee Group, will describe the telephone company's Advanced Communications Service in a session on Oct. 16; and Steven M. Farber, of Boeing Computer Services, will talk about communications technology alternatives in a

session on Oct. 17. There is a session on Oct. 18 discussing how to manage the proliferation of minicomputers, featuring two users and a marketing man from minicomputer manufacturer Data General. Another session on Oct. 18 will be directed to exploring ways to improve the productivity of software development.

The conference is broken down into three principal sections covering Information Management, Information Technology, and Office Automation.

In addition to these, smaller groups of sessions will be directed to applications in specific areas of interest, such as the use of information management in manufacturing, banking, corporate financial, insurance, and hospitals.

And there will be keynote speakers. At an opening session on Monday, Oct. 16, William J. Mueller, vice chairman of the accounting firm of Arthur Anderson & Co., Chicago, will speak on "Crossroads in Information Management." Mueller's message is that executive management now must be able to use advanced management techniques brought about by technology. He talks of computer based methods for capital budgeting, productivity analysis, risk assessment and what-if modeling. "Hitherto impractical to implement, they're now available for planning and



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Show and exposition have been drawing about 15,000 and exhibit space has increased considerably to 70,000 sq. ft. from about 44,000 sq. ft. last year in New York's Coliseum.

decision-making because of the great advances in computer technology and data communications.”

So, Mueller says, information systems managers not only have the opportunity to introduce these tech-

niques to their executive management, but they will also need to integrate their own system planning with strategic corporate plans and develop relationships with other corporate executives. He says traditional dp management now has a

much broader role in a company.

A second keynoter, William E. Reidy, executive vice president-technical services with Kraft, Inc., Glenview, Ill., will talk about new problems facing the dp manager in a highly complex environment. In a speech entitled “New Opportunities for the DP Manager,” Reidy will offer some guidelines for the information manager to follow in applying new technologies to the processing and utilization of information in his organization.

OFFICE OF THE FUTURE

The third keynoter, Vincent Byrne, director of management and administrative sciences with Xerox in Stamford, Conn., will discuss the office of the future in a talk entitled “The ‘1980 Office’—a View from the Top.” He’ll discuss how management can plan, coordinate, and use the new technologies in automating offices within the next decade. Byrne will talk about how data processing, word processing, and data communications will be merged, and what will be the impact on multioffice operations and office organization.

Although the conference organizers say they have trouble defining “information management” precisely because the concept expands with the development of new technologies, they say its scope at present includes: data processing, word processing, data communications, dictation systems, micrographics, electronic mail, duplicating, telephone systems, records storage and retrieval, and office automation. And they say the emphasis at the show and conference is not on technology but on applications. “The purpose is to demonstrate how executives can make their operations more productive by improving existing information systems; or creating new ones,” the show organizers say.

Some titles of sessions in the dp section of the conference indicate how they’ve implemented the planning theme: Information Systems Planning for the 1980 Corporate Environment; Project Management Techniques and Standards for EDP; Long Range Planning for Data Communications; Human Resource Management to Increase Productivity; Capacity Planning—A Necessary Component of DP Management; Managing the Proliferation of Minicomputers; Improving Productivity in Software Development; Planning for Disaster Recovery; Planning for the EDP Audit; Preparing the Feasibility Study for a New Application; Planning for the Merging Trends in Computer Architecture; Interactive Graphics—

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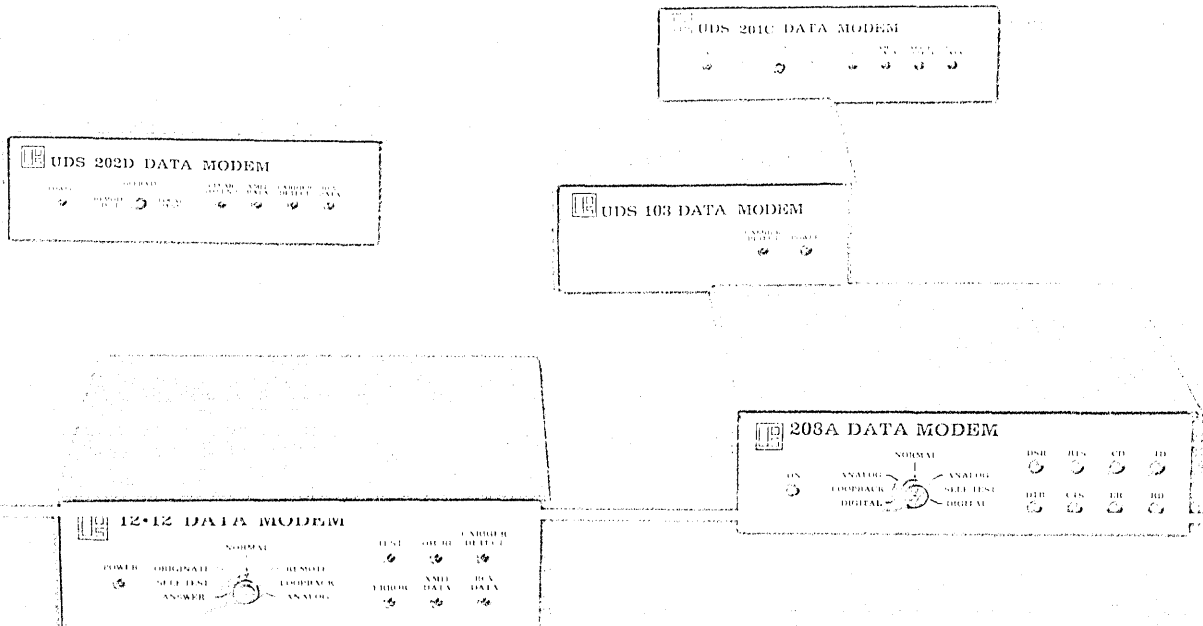
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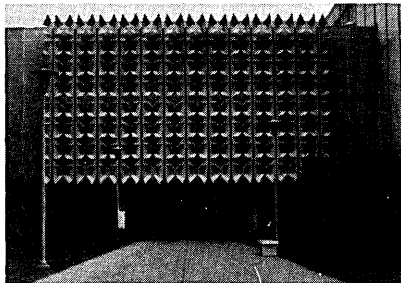
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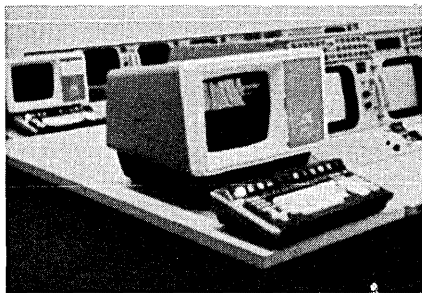


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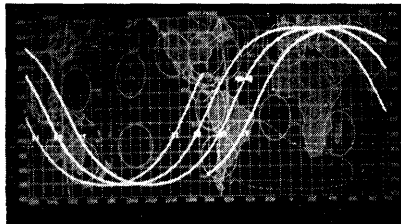
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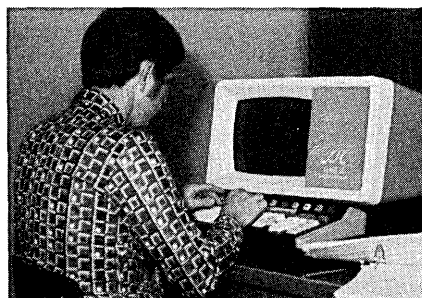
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A complete program can be obtained from Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017.

REGISTRATION INFORMATION

A variety of registration fees are available: attendance for the four full days, Oct. 16-19, is priced at \$225. One day at the conference is \$80 and a half day is \$45. If you're only attending the exhibits, the registration fee is \$5. Persons receiving tickets from exhibitors will be charged \$1.

Among the 70 first-time exhibitors in this year's conference are: IBM's Data Processing Div.; Dictaphone Corp.; A. B. Dick; Texas Instruments; Automatic Data Processing; Consolidated Computers International; Infoton; Compugraphics; Jacquard Systems; Quantor Corp.; DatagraphiX; and Nanodata. Hewlett-Packard Corp., which hasn't exhibited at NCC for two years, will exhibit at Info 78. NCR Corp., which last year had a 300 ft. booth, this year has expanded to 1,500 ft.

Wolcott, who expects a turnout of about 15,000 to the show, but would be happy with 14,000, says the huge turnout of exhibitors is due in part to good economic times in the industry, but also to the fact that Info has come of age. "They recognize us now as a viable exposition with an attendance made up of the right people," he said.

Clapp & Poliak is a huge international show management firm. While Info 78 is small compared with its Plant Engineering Show with 800 exhibitors and its Design Engineering show with about 500 exhibitors, Info is growing and for the first time this year will be running in the black. But Wolcott says all anticipated profits will be poured into attendance promotion. "It's growing, but it's far from gaining the stature we have in mind," Wolcott said.

The exposition will be held on the street level floor of McCormick Place, and two other shows are being held at the same time on the lower level—an industrial construction show and a premiums show—which Wolcott thinks might also be visited by attendees. *

CIRCLE 187 ON READER CARD

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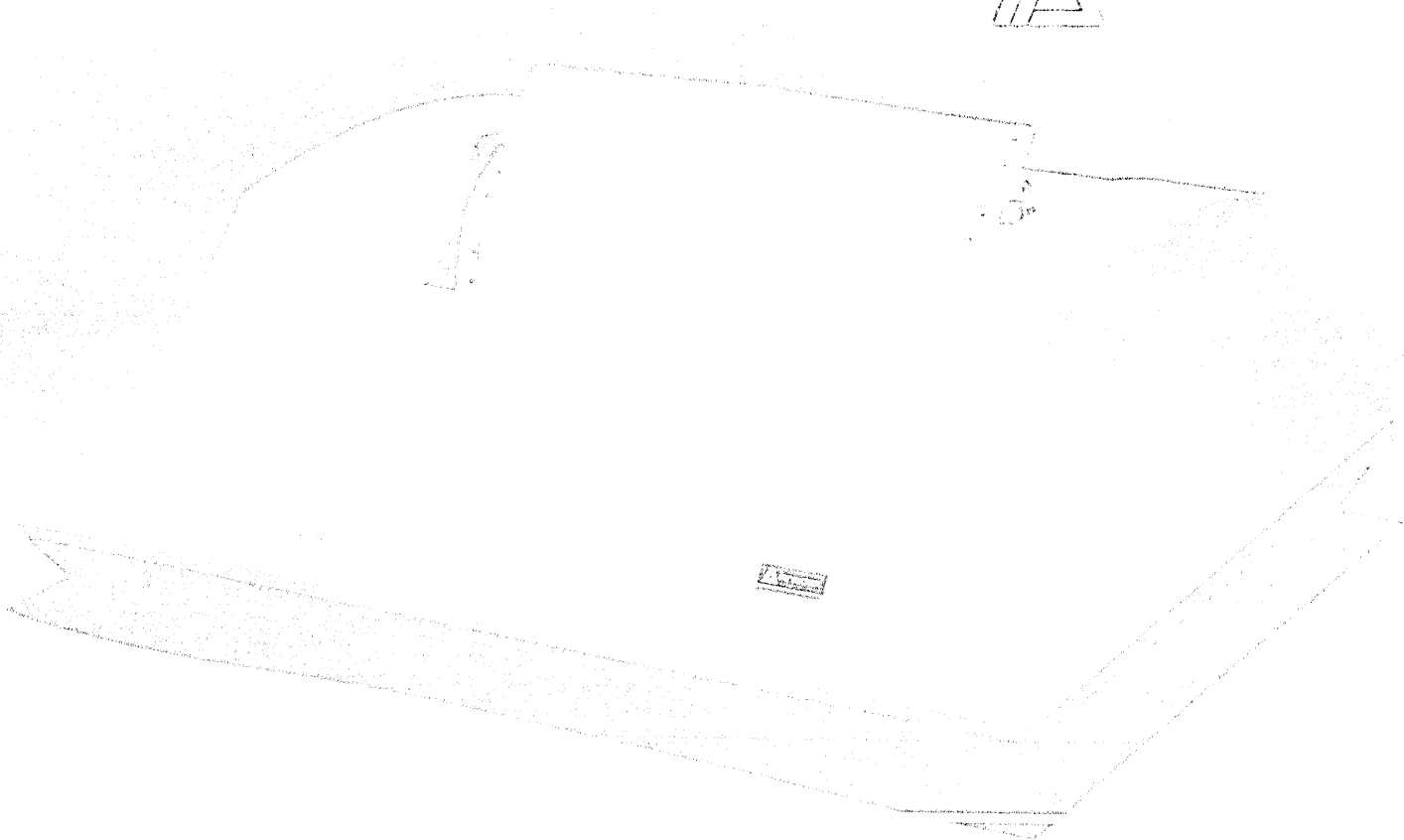
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CIRCLE 32 ON READER CARD

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THE INTERNATIONAL SERVICES INDUSTRY IN CONFLICT

by Ralph Emmett, European Editor

The little micro cast a giant shadow over the first-ever World Computing Services Industry conference held in Barcelona, Spain. It emerged as a tool to divide the 600-plus attendees from all sectors of the global services community into two warring camps. It stood throughout the three day event as an insurmountable barrier to the assembly's quest for a common language and aim.

And finally, it opened the door for control of this fledgling industry to be taken out of the hands of the service companies that have so painstakingly built it up.

The keynote speaker and head of the U.S. service bureau ADP, Frank Lautenberg, talked of "doom-sayers" who claim that the services industry is just a "coincidence of circumstance" and a "bridge" between old and expensive computer resources and new low cost devices. "Are we to be obsoleted by a massive outpouring of devices dedicated to services required by our customers? . . . Is this first world conference a prelude or a finale?" he asked.

Lautenberg's answer was: "Probably not a finale." He said that the outcome depends not on the forces of technology, but on the skills, resourcefulness, and sense of opportunity of the services community.

His theme—which set the tone for the whole event—was that the role of technology is overemphasized. "What counts is service at the right price," he stressed. Other service bureau pundits took up this banner by claiming that some software houses left the end user "out" in their desire to be "engaged" with the manufacturers.

This attack led to charges from software company representatives that Lautenberg "and his kind" were afraid of

the microprocessor suppliers.

Most vocal of these delegates was Alex d'Agapeyeff, head of the U.K.-based software group, CAP/PPP, who thrust a four-inch wafer of silicon under the noses of the packed assembly and told them that the market for it and its offspring in desktop computers would "dwarf" anything that had gone before. He warned his colleagues of the dangers of being complacent about the micro:

"Instead of peddling time on expensive and obsolete machines the service industry should be learning how to exploit the opportunities provided by the micro," he said.

A contingent of Swedish service bureau representatives talked of the strong competition between the software and service bureau industries. L.H. Schwieler from Datema AB, Sweden, said the service bureau industry had always welcomed new hardware developments in the past. Why should it see them as a threat now?

Schwieler said that service bureaus had looked with alarm at the growth in tailored on-site minis and micros offered on a turnkey basis by the software houses. In an effort to compete,

ADP and others are now offering stand-alone systems at the user's site. But users are getting a "wrong understanding of the situation because we price our minis and micros in the software house way," he said.

Schwieler went on to say that he couldn't understand why bureaus had been lulled into talking about hardware costs at all because they are "low" and "not really relevant in our business method of offering a complete service."

Richard Crandall, simultaneously ADAPSO and COMSHARE president, supported this by saying that only 15% to 25% of the revenues of computer service companies were tied up in hardware costs, according to a recent ADAPSO survey. He noted that in some packaged applications, such as income tax preparation, hardware costs amounted to only 8% of total revenues. "Furthermore," he added, "the central processor itself typically represents only 25% to 33% of the cost of the total computer."

"Thus, major changes in main-frame price/performance resulting from the introduction of LSI circuits would only impact less than one-fourth of 25% of a computer service firm's operating



Delegates from 25 countries—including India, Israel, Japan, New Zealand, Australia, and South Africa as well as Europe and the U.S.—met to find a common ground, but had great difficulty coming to agreement.

Successful service firms are growing at twice the rate of leading mainframers.

performance," Crandall said.

Bearing these facts in mind the Swedish bureau contingent stressed there was no reason for not using the "standard service bureau method" of charging per transaction—independent of whether the hardware is a micro, mini, large scale computer, or any combination.

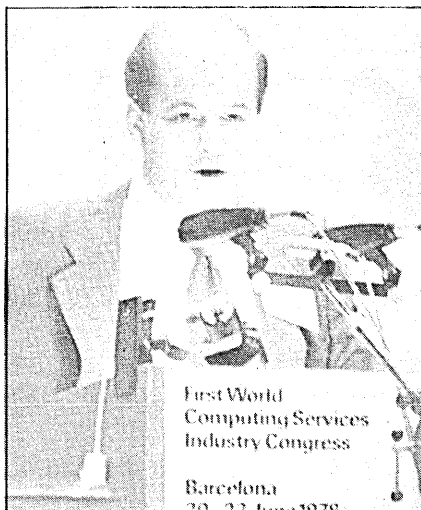
They envisioned the growth of the "dp center" approach to combine the best elements of both service bureau and software house approaches in a more nearly "total solution." In this scenario application languages would reside on large scale computers in these centers. Centralized development for a large number of minis and micros was described as the only administrative way of keeping maintenance costs down.

BOOM TIME FOR SERVICES

Having noted the impressive growth of the services industry to its present

\$13 billion market and 500,000-person workforce level, Lautenberg asked his audience: "We have the critical mass needed to assure our continuity in some form. What will that form be?"

Figures offered by Lautenberg showed that successful computer service firms are growing at twice the rate of



Alex d'Agapeyeff: "Instead of peddling time on obsolete machines, the industry should learn how to exploit the micro."

leading mainframers. Much of this growth comes from the private data network resource concept which "bleeds" traffic (and hence revenue) from the carriers' public facilities.

Lautenberg claimed that the revenues for a group of 10 publicly traded, independent, U.S.-based com-

puter service companies had grown at an average rate of 26% during the last five years. He claimed that net profit after tax for the same 10 concerns had grown at an even more spectacular 37% a year. During the same time span the six largest U.S. mainframe manufacturers increased revenues an average of only 13% and after tax income 15%. Further, New York analysts say that the mainframe business cannot expect to grow at more than 11% to 12% per annum over the next five years, whereas services should grow at some 20% or so.

"Those who successfully package a manufactured item and add value to it can grow at a rate in excess of that for the naked item," the ADP chief explained. He cited the example of the airlines, which he said had grown almost 2.5 times faster than aircraft manufacturers.

These forecasts brought a smile to the faces of this unusual Barcelona gathering of entrepreneurs, opportunists, and proponents of the "value-added world" slogan. But each of the faces from the 25 countries—including places as far flung as India, Israel, Japan, New Zealand, Australia, and South Africa—expressed a different angle, while Lautenberg was calling for the need for a "common mission" as an aid to survival.

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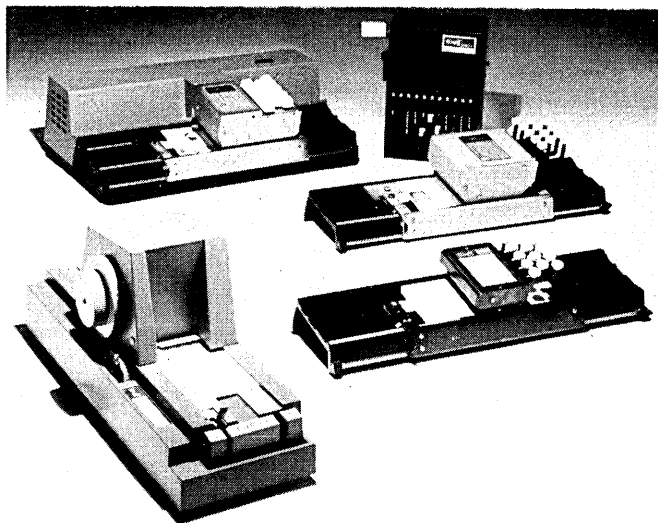
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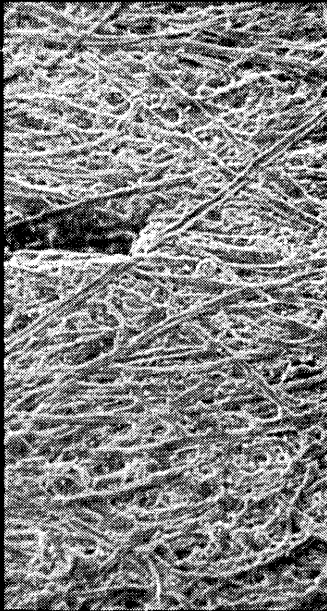
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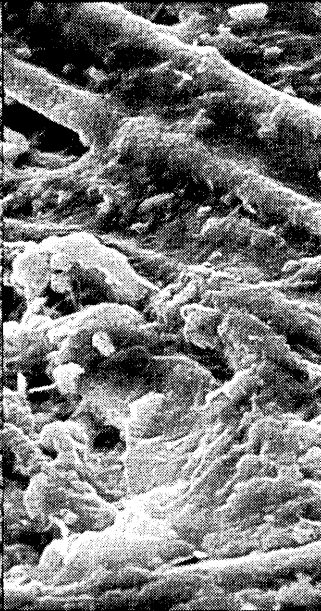
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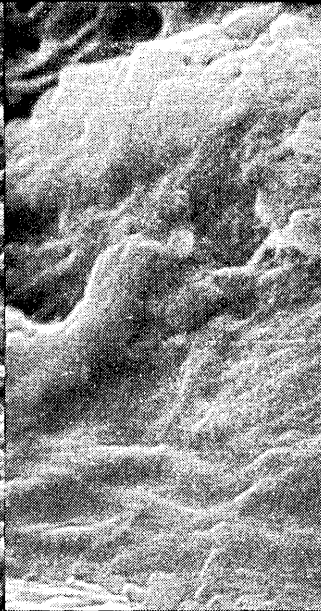
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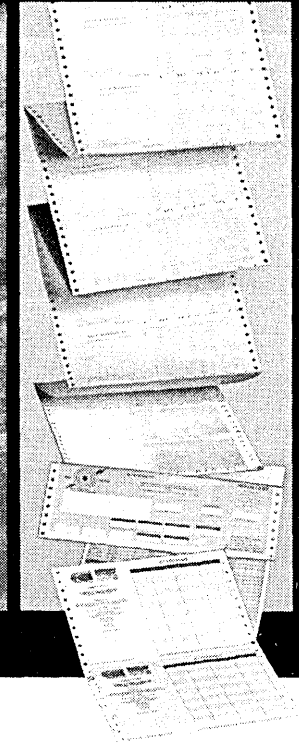
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THE HEAVYWEIGHT CONTENDERS

The British Post Office also looked hard at the "value-added" philosophy in the light of its own manufactured items: its millions of dollars worth of buried telephone cable . . . "gold in the ground" . . . and came up with Viewdata. "Viewdata" has now become a generic term for a domestic service in the home or office whereby vast computer data bases are spewed on-line via the telephone network to ordinary (if slightly converted) tv sets. The U.S. Post Office has sold the software for its system, which it calls Prestel, to both the German and Dutch Post, Telephone and Telegraph agencies (PTT's) and other sales to European telecommunication authorities are in the pipe. Later this year the British PTT will demonstrate how the system can be extended to embrace minis, micros, and other small business systems by the distribution of programs.

In the immediate future the first tentative links between these Viewdata networks will take place and the whole will give what d'Agapeyeff described as a "tremendous thrust for office automation." But as the PTT's can enter the value-added services business at will with their existing network monopoly, the

whole will also act as a tremendous freeze-out to the (currently) dominant U.S.-based network service bureau in Europe which try to offer competitive services.

Many delegates worried that the communications carriers, with their protected status, would force out many services suppliers (and that those which were not trampled by the communications monopolies would be run over by IBM). Among them were the Control Data Corp. representatives, who said that unlike the PTT's, "who are subsidized and can afford to run at a loss if necessary," CDC's shareholders didn't like red balance sheets.

Another fear among the Americans is that a linked Viewdata setup on a Pan-European (or even international) scale would act as a magnet to lure away their life-blood data base and information providers who would see greater revenue opportunities with the PTT's.

The conference chairman, Alan Benjamin, director-general of the U.K. Computing Services Assn. (CSA), was referring directly to these PTT's moves when he warned delegates that control of the services sector "could be taken out of our hands." Benjamin has been at the center of a fierce lobby to get the union

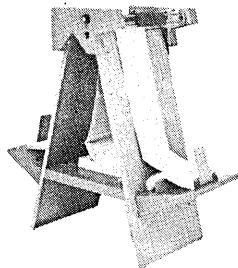
of PTT's (CEPT) to define its communications monopoly in clear terms and ensure that its involvement in services is up-front and allows service companies to compete on equal terms.

Another familiar complaint, this time from one official from the Spanish packet-switched network, CTNE, was a clear delineation of where dp ends and data communications begins. The dp monopoly and the telecommunications monopoly (in the form of European PTT's) have already met head-on on the question of data network standards—and so far IBM has given way. Having forced IBM to toe the line on its land network standard, X. 25, the PTT's—particularly the French—are expecting IBM to attack again, this time from the sky via satellites. At stake is control of the automated office of tomorrow—the largest potential market for services.

As this gigantic confrontation begins to take shape, the Spanish arena for its early expression was perhaps appropriate. More than a few of the 600-plus delegates were beginning to visualize the PTT's playing matador to the IBM bull.

Whether the late-June Barcelona meeting was "prelude" or "finale," it's likely that the next time the curtain goes up that contest will be on center stage. *

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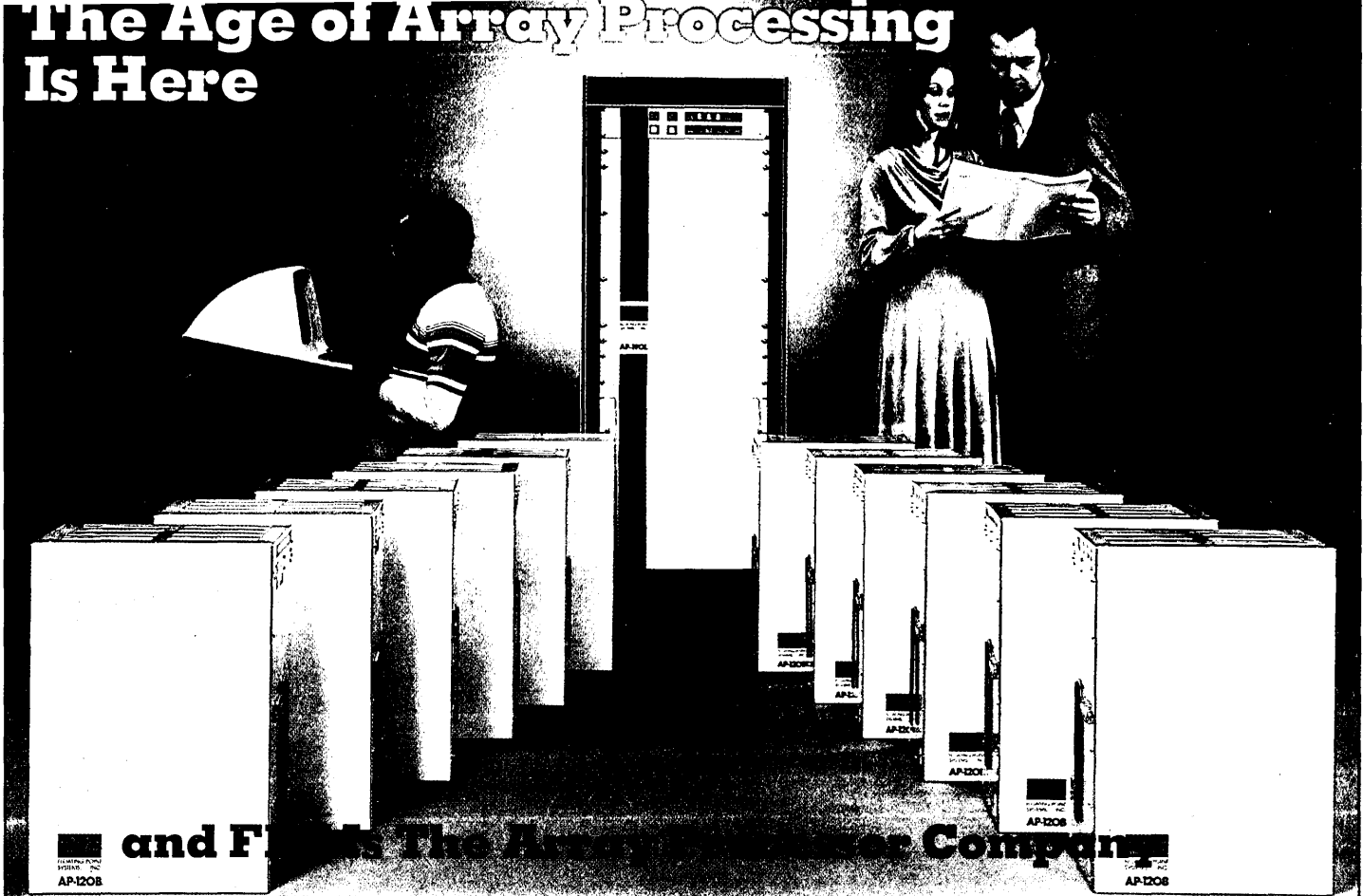
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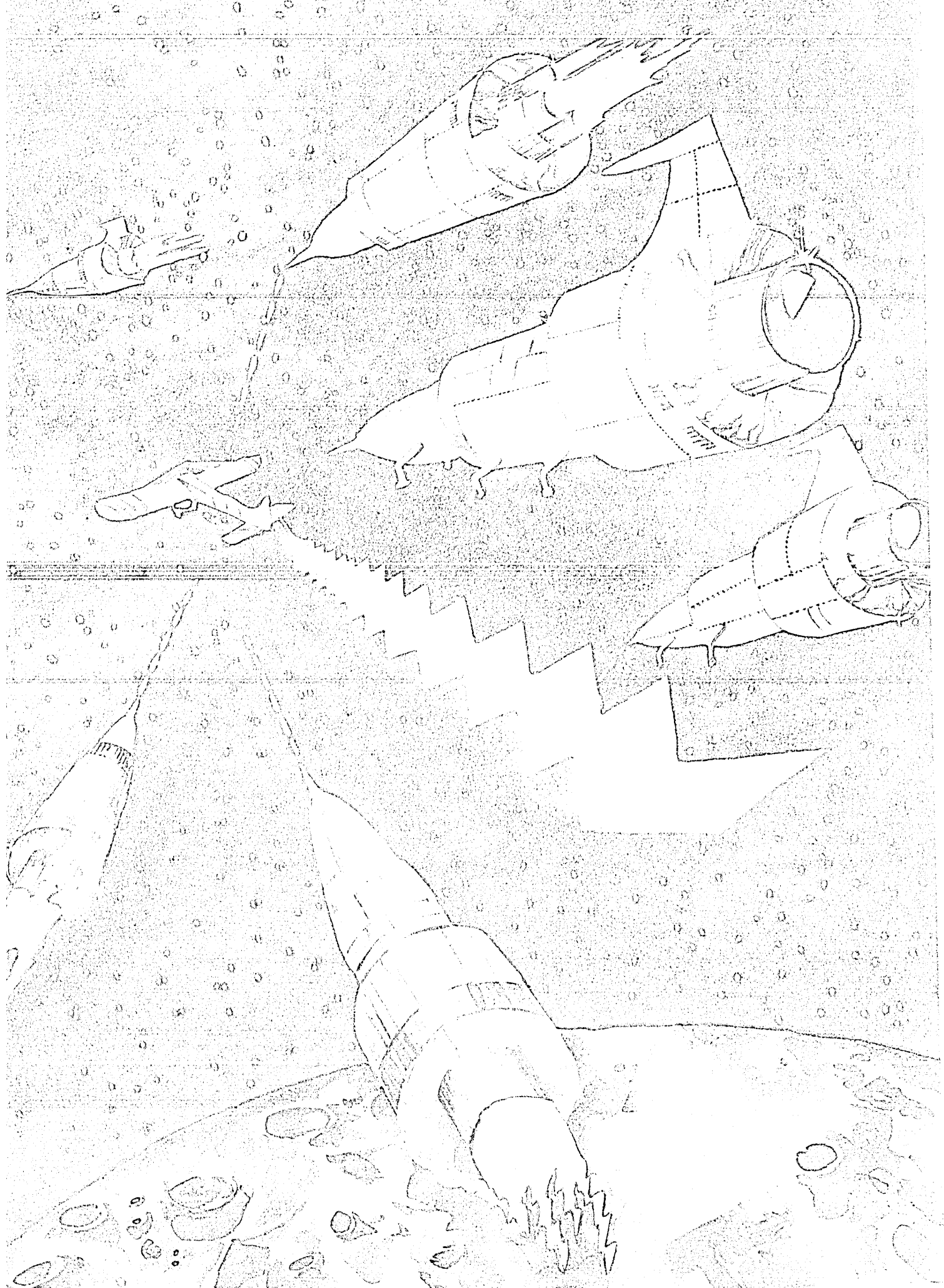
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DATAMATION 9/78



Central site printing will be reduced significantly by 1982, and will virtually disappear by 1988. Remote sites will drop printers too, where they can.

DON'T BET ON PAPER OUTPUT

by Tim Tyler

Since their birth in the 1940s, computer systems have produced ever increasing quantities of paper output, and it is commonly assumed that the trend will continue. This view is supported by many forecasts based on widely accepted market research techniques. However, such techniques are not appropriate for predicting the impact of new technology, and those who rely on them are forever exposed to unpleasant surprises.

The use of punch cards provides an interesting example of how forecasts go wrong. Fig. 1 (see page 268) plots worldwide tab card shipments from 1965 through 1975. From 1965 through 1969, shipments rose steadily and prompted correlations to be established with the installed computer base, the number of installed keypunches, the volume of business transactions, and the gross national product. Production of nearly 700,000 tons of card stock was predicted for 1975.

Unfortunately (for the card manufacturers anyway), the correlations all turned out to be nonsense. Shipments peaked at 559,000 tons in 1969 and dropped to a plateau around 500,000 tons in the early '70s—where they remained in 1975, 30% below the earlier prediction.

The projections were updated in 1975 by several leading market research firms. It was predicted there would be gradual erosion in the punch card market of 3.3% per year through 1980. What really happened was that shipments dropped 23.6% that year, and management of paper companies got another of those unpleasant surprises.

Today's projections for the domestic use of continuous forms for computer output say that forms shipments will increase in value from \$1.2 billion in 1976 to \$3.7 billion in 1988. However, computer and communica-

tions technologies are currently making the substitution of electronic media for paper not only possible, but necessary, just as they did for punch cards. The potential significance of this change is not understood by either the general public or by those closely associated with computer/communications technology. Those big projections for 1988 are dead wrong. To appreciate why, it is necessary to look closely at dp spending.

A relatively stable relationship has been established between personnel costs and other data processing costs. It is roughly as follows:

Personnel costs	45%
Hardware, services & supplies	55%

For the expenses over which dp management has direct control, the ratio stated above has been surprisingly consistent. Further, the dynamics of dp budgets have been (and will continue to be) within the two broad areas and not between them.

An analysis of hardware, communications and supplies budgets (among large dp users) reveals the trends and projections illustrated in Table 1.

The cost distributions are not intended to be precise (although they are within published ranges). They are presented to describe cost trends from the viewpoint of data processing management, and their specific purpose is to illustrate dp management's priorities. The following general statements can be made about the budget table (see reference numbers on the table):

1. Central processors are becoming a relatively less important expense.
2. Mass storage (disk, tape, etc.) at central (or host) sites will remain relatively stable as a percentage of hardware budgets, but this does not include secondary storage associated with minicomputer and intelligent terminal sys-

tems. (Storage is growing more rapidly than any other item but it is migrating out from the central site as distributed processing is implemented.)

3. Minicomputers will continue to assume increasing importance but the actual processors will sell for "microprocessor prices." The relative increase is due primarily to storage associated with the systems.

4. Data entry equipment, unit record equipment, and printers will either disappear or lose their identity by 1988. Unit record installations had virtually disappeared by 1977. Key-punches and standalone data entry systems will be replaced by multifunction terminals by 1988 as data is captured at the point of transaction. Printers will not be primarily associated with central sites but will have become associated with minicomputer or intelligent terminal systems.

5. Terminals and communications hardware will continue to have more substantial processing capability. This category will represent the largest single item in the budget by 1988. Practically all hardcopy output will be generated at this level of the processing hierarchy.

6. Supplies are assumed to remain relatively constant as a percentage of budget in order to determine what the impact will be from the point of view of data processing users.

7. Data communications will continue to grow as a percentage of total data processing expenditures.

The following is the rationale for what has occurred and is projected to occur with dp budgets:

In 1965 the data processing function was centralized within major organizational entities. Centralized computer hardware represented nearly 75% of the budget (other than personnel). It is easy to understand the priority given to new hardware and its associated systems software by dp managers.

There are expenses and problems to "distribute".

Alternate data entry equipment became available in the mid-1960s (key-to-tape). Since a significant portion of the personnel budget was associated with data entry (and personnel costs were increasing), this problem was also addressed, with the result that punch card usage peaked in 1969. The expense of data entry equipment was contained and it shrank to 11% of the dp budget by 1977.

The shift to "on-line" systems was primarily because of dissatisfaction with service from centralized computer departments. After multiprogramming operating systems were developed, the primary systems response bottleneck became printing and distribution of output. Users were willing to pay for better response and by 1977 centralized computer facilities represented less than 50% of the dp budget (again excluding personnel).

This distribution of costs within dp budgets has also resulted in a complex pattern of expense distribution between centralized dp budgets and those of end users. Hardware, communications, supplies, and personnel expenses are not budgeted in a uniform manner. This has resulted in less centralized control of budgets and substantial confusion. This trend will continue as distributed processing extends to smaller organizational entities and to the office environment.

GOING DISTRIBUTED

Regardless of how threatened data processing management feels by decentralization of control, there are certain expenses and problems they would as soon "distribute" to the end users:

- high response applications development
- ad hoc reporting requirements
- data entry functions
- physical preparation and distribution of output
- responsibility for sensitive data bases

Therefore, contrary to popular opinion, informed data processing management has several reasons for wanting to see certain responsibilities distributed. Distributed processing also obscures the cost of data processing expense, and this can be a definite advantage since general management has become somewhat disenchanted with dp achievements to date.

To understand the dp manager's point of view, it is necessary to examine how the costs of data processing are recovered from end users.

Normally the facilities which are

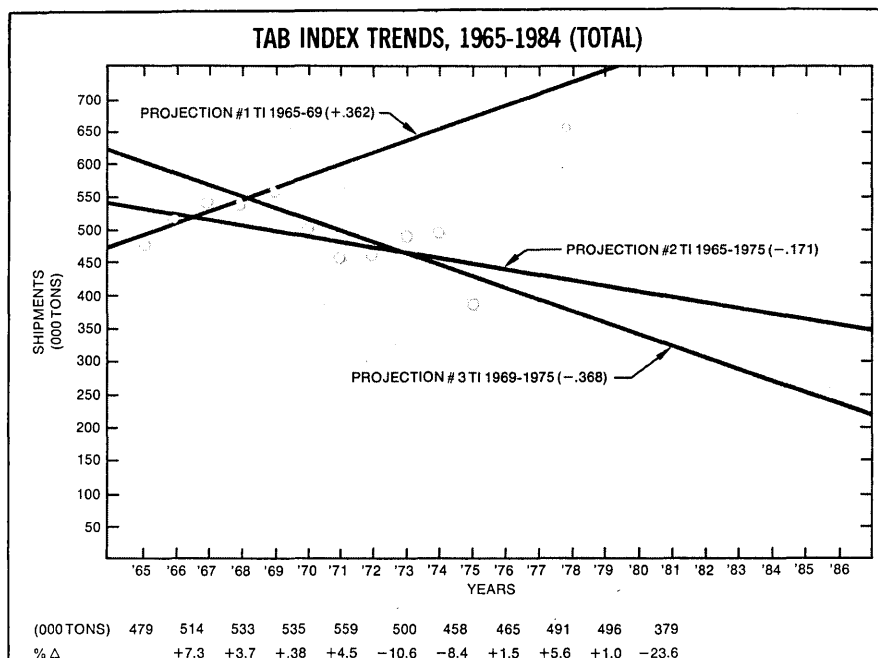


Fig. 1. The punch card industry is an excellent example of projections which have gone sour because of new developments in computers and data communications. Even after a huge, unexpected drop in sales in 1970 and 1971, the industry thought it recognized a plateau in 1972, 1973, and 1974. Actual sales for 1975 fell off the plots again.

HARDWARE, COMMUNICATIONS AND SUPPLIES BUDGET

	1965	1977	1982	1988
1. Central processors & main memory	41%	23%	20%	15%
2. Peripherals & mass storage	32%	20%	20%	20%
3. Minicomputer systems	—	7%	12%	15%
4. Data entry, unit record & printers	17%	11%	5%	—
5. Terminals & communications hardware	—	19%	21%	25%
6. Supplies (paper & magnetic media)	10%	10%	10%	10%
7. Data communications services	—	10%	12%	15%
	100%	100%	100%	100%

Table 1. By now, the falling budgetary importance of central processors and main memory is no surprise. Nor is the rising importance of minicomputers. What may come as a shock is how quickly printers are expected to follow the path of EAM equipment. Note that the Supplies percentage has been **assumed** to remain constant in order to isolate what is happening in other categories.

shared by multiple users are accounted for by use of a billing algorithm which attempts to allocate cost based on resource utilization. Algorithms vary significantly but normally account for cpu cycles, I/O activity, priorities, etc. Supplies and personnel expenses associated with the computer center are normally recovered indirectly in the algorithm rates.

Dedicated resources (communications lines, disk, etc.) are usually billed separately.

Remote expenses (minicomputers, terminals, personnel, supplies) are considered the user's responsibility whether he pays directly or is billed through the center.

Service functions which can be easily accounted for, such as data entry, are also billed directly to end users.

For obvious reasons, the pressure on the dp manager is to reduce the charges to end users. This pressure comes from both general management and end users. In 1978, the easiest and most effective way to lower data center costs would be to cut back on central site printing.

For example, a large scale computer (IBM 370/168 class) will produce approximately 3,000,000 pages of output per month. This will result in the following approximate costs (assuming here an IBM 3211 or 1403-N1 printer):

	Monthly Costs/	Costs	Page
Printer rentals	\$15,000		0.5c
Supplies & forms	30,000		1.0c
Handling	45,000		1.5c
Total printing expense	\$90,000		3.0c

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



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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!

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YES, I'm interested in keeping static away from my terminal with VELOSTAT conductive floor mats.

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Data Processing Management is becoming aware of a problem that systems programmers have long known existed — the trials of MVS.

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improve the performance of the MVS system. That capability successfully eliminates the costly guesswork in systems tuning.

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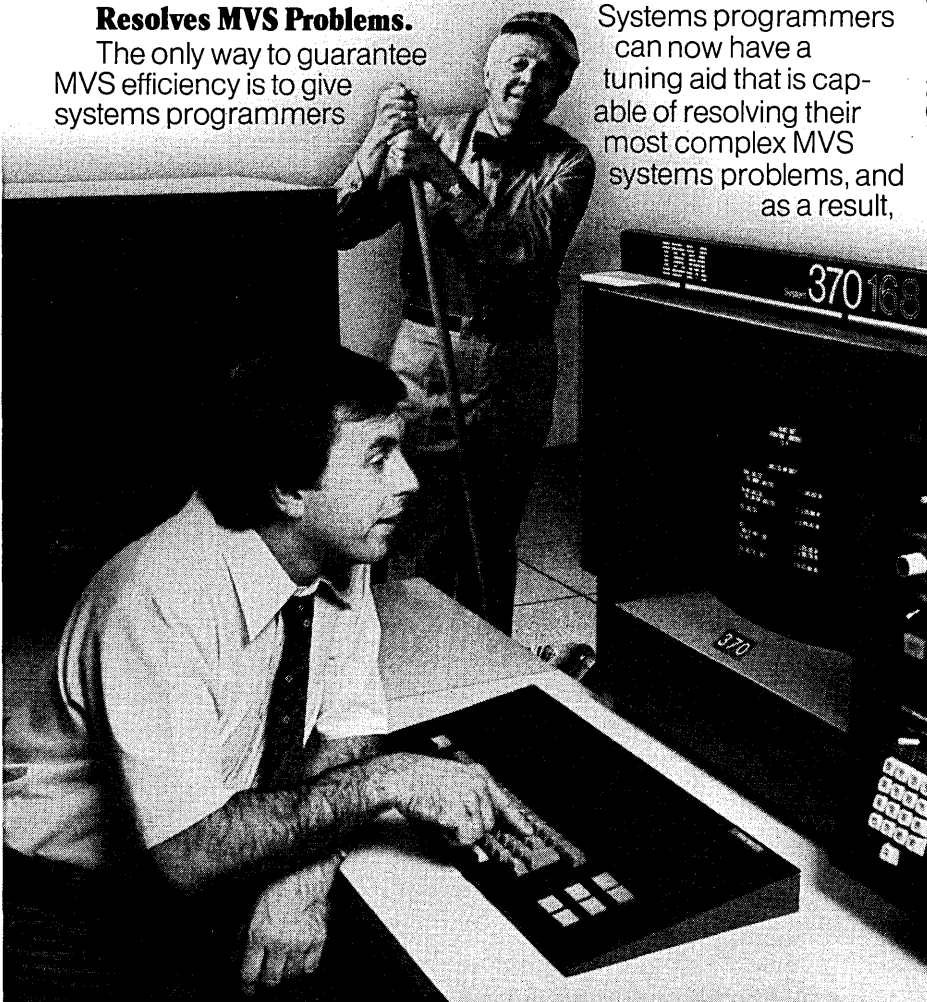
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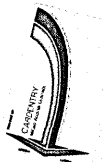
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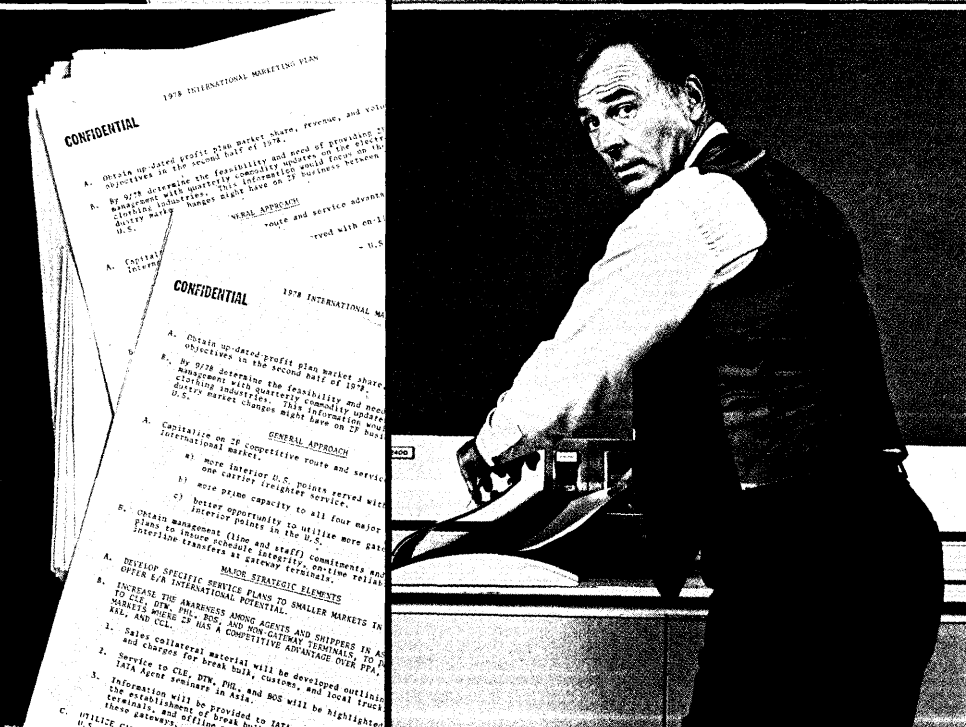
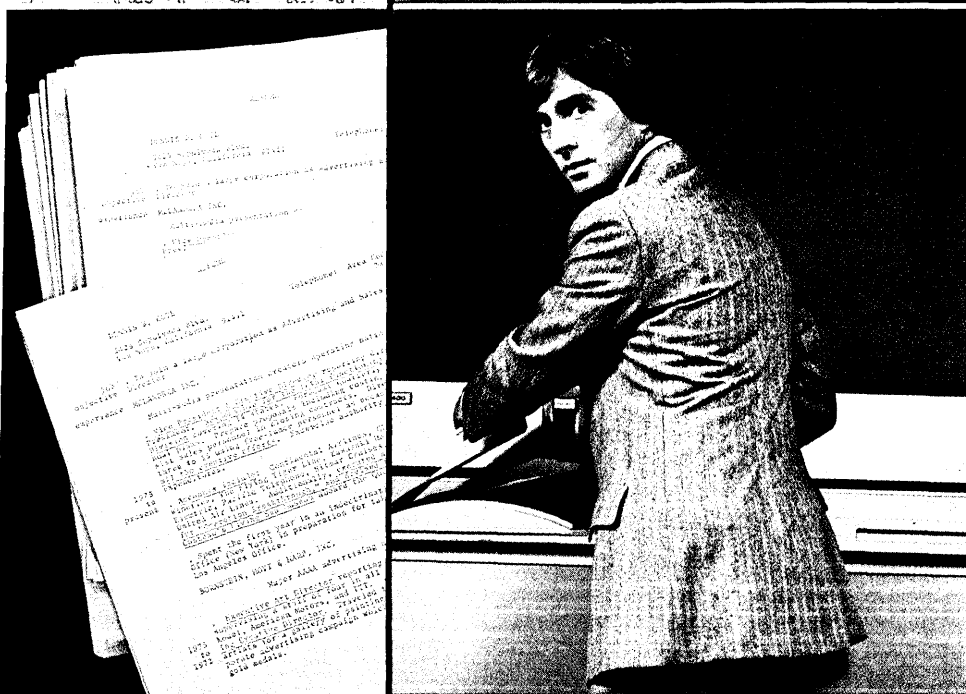
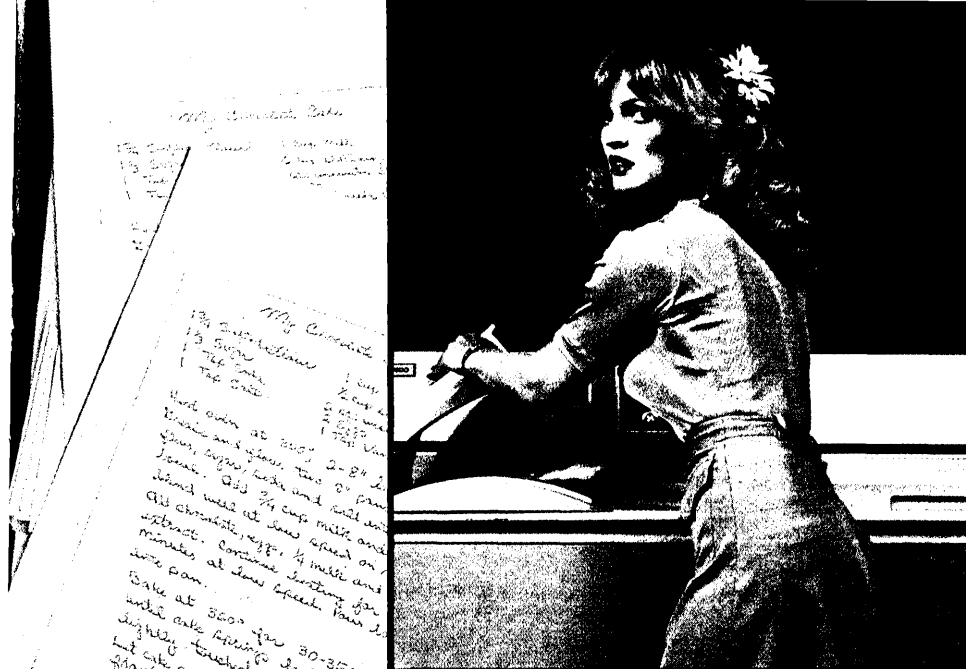


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CIRCLE 146 ON READER CARD



Users of distributed processing, small business, and word processing systems will find 60% of their costs are related to paper output.

These numbers are conservative and dp management knows they will increase as costs of paper and personnel continue to rise. The total cost of running a large central site (hardware, software, personnel, space, power, light supplies, etc.) which must be recovered under the billing algorithm will be approximately \$330,000 per month. This means the dp manager has the potential for transferring 20% to 30% of his total accountable costs directly to end user control by distributing the printing to user sites (local or remote). This has numerous advantages:

1. It will lower the amount he must recover under the billing algorithm.
2. It will remove the most critical bottleneck in responsiveness from his direct control. (Printing and distribution of reports is the major factor in turnaround time.)
3. It is a straightforward solution to an immediate problem which can be easily accomplished with today's hardware and software without significant conversion effort.
4. For really heavy print loads which cannot be conveniently or economically transferred to user control with 1978 technology, there is always Computer Output Microfilm. It has been estimated that 30% to 40% of current computer paper output lends itself to COM. The dp manager at a large installation could cut his total printing production costs by approximately 25% through its use.

Under any circumstance, large central site volume printing *must* receive immediate attention from responsible dp management, and the answer to high print volumes is not faster printers. For example, the savings achieved by newer high speed printers in the case cited above would be as follows:

	Printer, Supplies & Handling (Cost for 3 Million Pages)
Case cited (using IBM 3211 or 1403-N1)	\$90,000
IBM 3800	\$81,000
Honeywell Page Printer	\$75,000

Savings of 10% to 15% do not prompt most dp managers to change, and that is especially true when more attractive alternatives are available.

Therefore, we expect that large central site printing will be reduced significantly before 1982 and will virtually disappear by 1988. The mere distribution of printing obviously does not

eliminate paper, and it may actually increase some costs. (For example, printers and direct operational costs may increase in a less efficient distributed environment if the same volumes are maintained.) However, it is probable that these costs will be obscured by their transfer from dp budgets to user budgets, and the increase may be completely offset by decreased distribution costs.

Incidentally, the most important result of distributed printing will be to make end users aware of the true cost of printed output.

DISTRIBUTED PROCESSING—1982

By 1982, end users will have responsibility for a substantial portion of the data processing function. Data entry (including editing) and printing will have been distributed, and these basic functions currently represent in excess of 50% of commercial data processing costs.

The following facts will become apparent concerning printed output:

1. Printers are the most expensive component associated with mini-computer and intelligent terminal operation.
2. Printers are noisy and not suitable for many end user environments.
3. Paper itself is expensive.
4. Paper handling costs are substantial.

At this point, it is important to note that these observations will become apparent to first-time users of electronic technology (including word processing and small business systems) as well as to those who have previously purchased services from centralized dp departments.

There is an interesting case study of end user rejection of obviously expensive (and obsolete) technology on the IBM System/3. The designers felt the first-time user would obviously want a card oriented machine. After all, from unit record shops, 650s and 1401s, mighty commercial computer installations have grown. Those with an interest in punch cards (paper manufacturers, card converters, and IBM) projected new life for punch cards. Fortunately, the first-time user of System/3 was not necessarily card oriented—but cost oriented. He could not understand the logic of keypunching and feeding cards through a card reader when he could key in his data directly through a terminal. That was the beginning and end of the great card revival.

When the end user analyzes the cost of his distributed system in 1982, he will discover the following:

- A processor, 20MB to 30MB of storage, and four crt terminals will be available for \$20K.
- A printer of reasonable speed and quality to continue today's paper report-oriented environment will cost \$10,000 (200 lpm to 300 lpm).
- The printer will be the least reliable component in the system and will cost the most for maintenance.
- The operational cost of printing will be between \$1,000 and \$2,000 per month (assuming the use of paper for information display and storage is continued).
- The printer will be the limiting factor on responsiveness, and if scheduling becomes a problem, a full-time operator may be required, adding to the expense.
- The monthly costs of 1982's print oriented systems will break down as follows:

	300 lpm Mainframe	Printer
Hardware (including maintenance)	\$600	\$300
Software	600	—
Supplies*	—	600
Handling (paper)	—	900
	<u>\$1,200</u>	<u>\$1,800</u>

* Assume 40,000 impressions (pages or documents) per month.

Approximately 60% of the data processing expense will be directly associated with paper output. In addition, the printer will be the least reliable component of the system, the major response bottleneck, and require the most human attention. Good systems design will dictate the elimination of paper wherever practical.

WHERE THE PAPER GOES

To estimate how much paper can be eliminated, it is necessary to understand where the paper goes. This obviously varies tremendously across both computer installations and industries. Table 2 shows a generalized distribution.

The data processing function itself is one of the biggest users of paper, and programmers are notorious for generating the greatest volume for the least



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use. Most of this usage can (and will) eventually be eliminated.

Paper which is used to communicate outside an enterprise is the most difficult to eliminate (communications to customers, vendors, government, etc.). However, there is one feature of this paper output which will encourage its elimination—most of it is used to evoke a response which must be converted to electronic media. This chain of media conversion (paper-to-electronic to paper-to-electronic, etc.) as transactions are processed is unbelievably expensive and is adding untold \$ billions to what consumers pay for goods and services.

Internal production represents 50% of the paper used, based on the generalized model. This is obviously a significant variable in the overall equation, and the specific uses (applications) are practically infinite. However, it is possible to characterize these paper uses in a more general fashion. Fundamentally, internal reports fall into three categories: (1) operational reports directly associated with an enterprise's basic functions and requiring some action; (2) management reports which may or may not prompt action but which are used for accounting, control and planning; and (3) archival data storage which seldom prompts action but is required for some reason (legal, policy, or backup).

Once placed in these categories, the possibilities of media replacement becomes more readily apparent.

ALTERNATIVES AND RISKS

The cost analysis indicated that paper will tend to increase as a percentage of total data processing costs. There is also a more significant hidden cost which was not mentioned: timeliness. While it is difficult to quantify the value of timely information, it is possible to define specific situations which demonstrate substantial risks if timely information is *not* available.

The risk in certain competitive situations is apparent. If a vendor cannot supply goods or service upon demand, he loses the business. Reservations systems are an excellent example of how immediate information must be available in order to be competitive. Paper listings of airplane loadings and available hotel accommodations are no longer satisfactory in terms of being able to distribute operational information or service the customer.

Consumer goods of all kinds must be available upon demand or the customer will find another source. Inventory information cannot be distributed rapidly enough using paper media.

Government services are too costly to dispense using paper com-

GENERAL DISTRIBUTION OF COMPUTER GENERATED PAPER OUTPUT

Type of Usage	1978 % of total paper output	Possibility of decreasing paper output—1982
Computer center operations	7.5%	High
Program development & maintenance	17.5%	High
Production—internal to the firm	50.0%	Varies
Production—external to the firm	25.0%	Low

Table 2. Paper used internally by the dp department, especially the high volumes churned through by programmers, may be easy to replace with electronic media. Most difficult to convert will be the paper used to communicate with businesses, customers, and agencies outside the firm.

munications. A recent study in Wisconsin showed that case workers who previously handled only two cases per day could handle six to eight using distributed processing. Personnel cost savings of 60% to 75% cannot be ignored by responsible government organizations, and fiscally irresponsible government is rapidly becoming the number one issue for the American public. The classic "paper pushers" are coming under increasing attack.

Government reporting requirements are a tremendous burden on both private enterprise, individual citizens and other governmental entities. Whether or not these "requirements" are justified can be disputed, but the cost must be reduced under any circumstance. Just as the census bureau collected more data than it could process in 1890, the federal government can make use of much data currently being collected only at tremendous conversion costs from paper to electronic media.

Data processing management which does not recognize the true cost of paper and the enterprise's requirements for responsiveness will soon find systems design responsibility being distributed to end users (along with willing vendors). Continuing with "business as usual" will result in the dp function becoming custodial in nature; instead, dp should exert leadership.

PREDICTIONS FOR 1982

By 1982 we expect to see the following systems design and implementation fundamentals:

No new systems will be designed which include the classic cycle of source document—keypunch—punch card—computer—error listing—user—source document (correction)—keypunch, etc. Thus, not only will cards be eliminated but so will a substantial amount of paper flow.

The majority of programs will be developed and tested on-line using crt's

rather than hardcopy terminals.

New operational systems will be designed to eliminate paper at the work station (factory floor, sales location, point-of-transaction).

New management systems will be designed to minimize reporting by eliminating voluminous listings of data. Fundamental analysis will be built into the reporting structure, because management will demand it and because the facilities will be available to make such reporting rather simple. Ad hoc reporting will make many voluminous reports now kept in file cabinets or desk drawers unnecessary. (However, most management reports will still be paper.)

New systems incorporating voluminous archival storage will make much increased use of COM as cost spreads become even more significant.

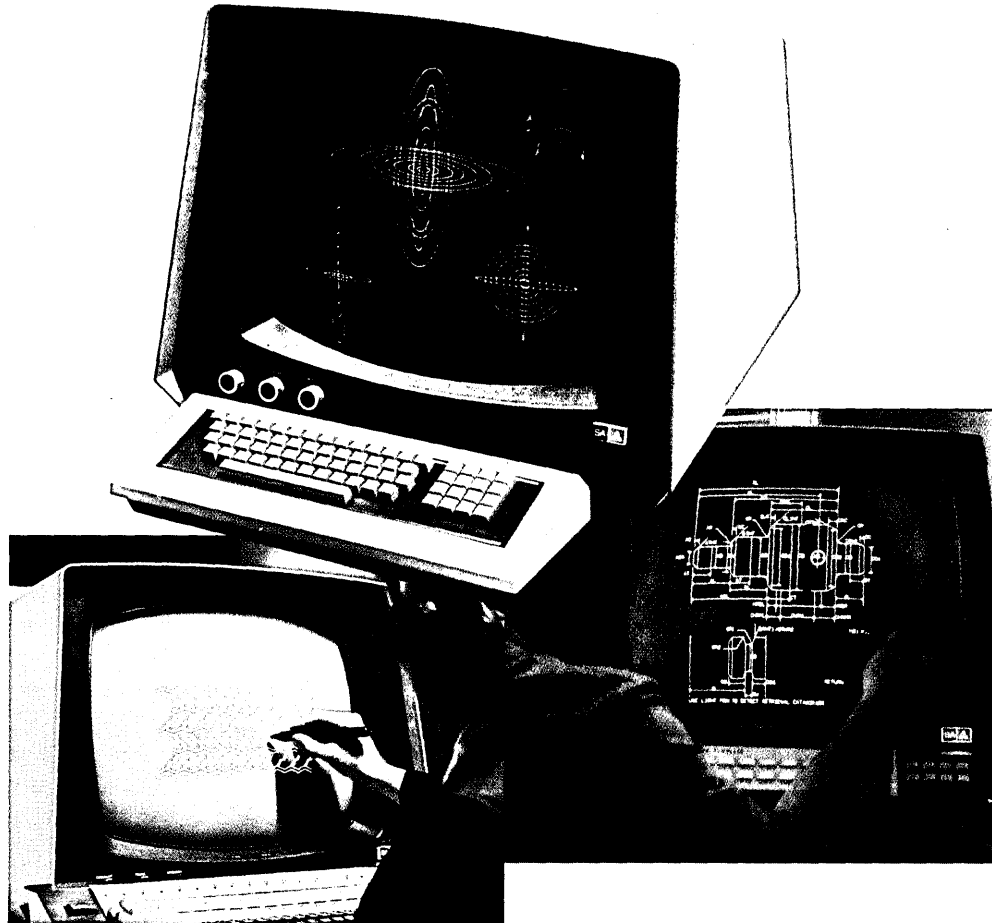
Interorganizational reporting (and transactions) will trend more toward substitution of electronic for paper media, especially in financial transactions. However, paper will still be the prime medium for reporting.

Communications between business or government and individuals will remain very much as it is today, except for an increasing trend toward consolidating financial transactions. (New banking services will include more consolidated billing and payments, such as for utilities and services. A first class stamp will probably be over 20¢ by 1982, and this cost alone will justify consolidation.)

AND FOR 1988

Most of the above developments will relate to the implementation of *new* systems and many old (and obsolete) systems will still exist and continue to grow through 1982. However, by 1988 sufficient cost pressure will have been exerted through major communications and computer technological developments in the early 1980s to justify conversion of old systems. Systems design projections for 1988 are as follows:

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Thomas F. Crabtree, Jr. (right) is Data Processing Manager of Pier 1 Imports, Inc., a national chain of import stores. Donald Cormier is Data Processing Operations Manager.



Dp managers who do not recognize the true costs will lose their responsibility for systems design.

A high proportion of "systems development" will be the responsibility of the end user, who will not be concerned at all with program listings or memory dumps.

Most operational systems will be based on information retrieval rather than reporting. (Data capture at the source is implicit in operational systems.)

Management will be part of the end user population and will satisfy a high percentage of its information requirements without recourse to programmers (and today's reporting facilities). Paper will be used to record plans and answers, not data for analysis.

The weening of management from paper dependency will be speeded by integration of office systems and communications with data processing. In addition, both upper and middle management will have grown up living with computer and communication technology—most of them from college days.

New systems requiring archival storage will find electronic storage cheaper than paper and much more convenient than COM. Electronic transmission will be cheap enough to shift and maintain the archival store on either a centralized or distributed basis.

Electronic communications will be substituted for most paper reporting and communications (including mail) in all new commercial systems. For those who do not have the resources to implement such systems, communications services will be available to permit inter-company communications. These services will be cheaper than maintaining the old "paper mills."

New systems developed by government will encourage electronic communications with the business and financial communities, and will dictate electronic reporting from other governmental entities (state and local).

Communications between business or government and individuals will continue to be paper oriented, but electronic facilities for transaction processing will go "public" through financial institutions, utilities, service bureaus, and perhaps through the U.S. Postal Service (regular first class postal rates will exceed 30¢). Individuals will be able to have terminal access for bill paying, income tax assistance, and information retrieval through the organizations mentioned above. In fact, home terminals (even if only the Touch-Tone phone) and computer systems will be able to connect to both public and private networks for the purposes mentioned above.

However, even though home computers may be a multi-\$ billion industry in 1988, they still will be available to a relatively small percentage of the population. This does *not* mean systems designers should ignore this possibility because the real impact will occur in the early 1990s.

Of the terminals and home computers installed, many will be related to part time (or full time) work from the home. Many of the "workers" from home will be directly associated with the computer/communications industries (programming systems designers, etc.).

The cost and performance characteristics of electronic media, the demands of operating management, and the pressure on dp management to produce, all point toward the replacement of paper oriented systems on a relatively rapid basis. The impact on actual paper usage obviously depends on how rapidly existing systems are replaced. And this in turn depends to a large degree on the interconnection (tight or loose) of existing systems. While such impacts are difficult to predict, the most important fact is clear—*paper usage is not going to follow traditional patterns and keep growing indefinitely.* Busi-

ness, government and individuals cannot afford it! *

Mr. Tyler's feature has been adapted from "Electronic Versus Paper Media," a 90-page report authored by him for SBS Publishing, 4320 Stevens Creek Blvd., San Jose, CA 95129. The report includes forecasts for cost trends and markets related to business forms, and is priced at \$600.

TIM TYLER



Mr. Tyler is an independent consultant in computing and communications, based in Mountain View, Calif. He was formerly a vice president of Singer Information Services Co., responsible for systems and programming personnel and computer operations. Previously with IBM and Southern Railway, he was involved in systems evaluation, and the management of systems personnel.

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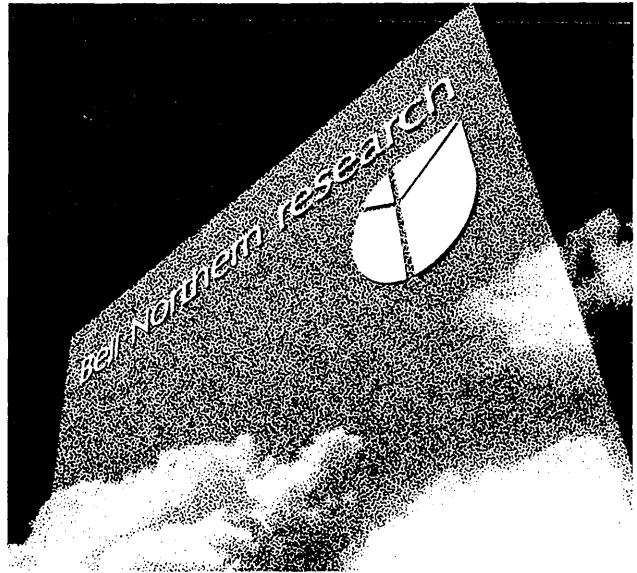
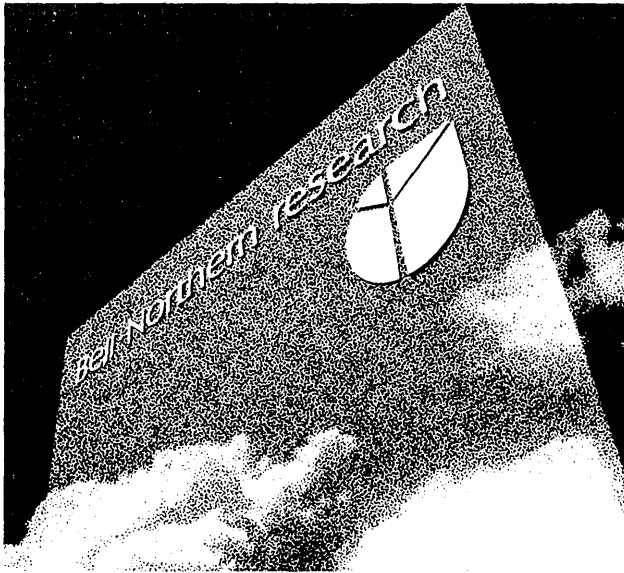
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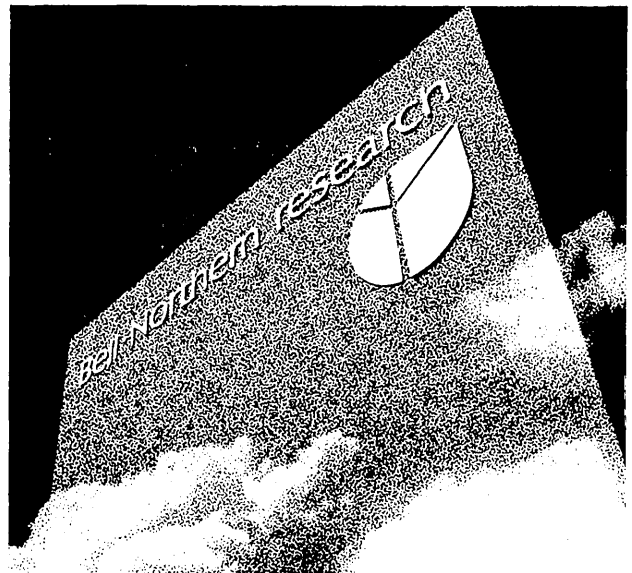
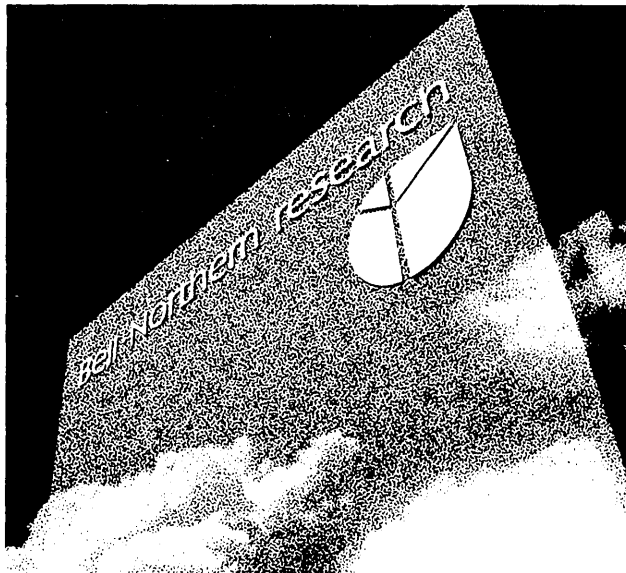
- Work involves enhancement and maintenance of switching and data network software such as compilers, assemblers, various data base systems and/or special utility packages. Implementation is on an IBM 370 using PL-1 and IBM assembler. (SU-01)

Database Systems

- Database design and application software development. Candidates must have the ability to carry through software development from system analysis to software implementation and installation in a user environment. Knowledge of structured programming, top-down design and good documentation principles is required. (DB-01)

Advanced Operating System Design and Development

Design and implement real-time operating systems for voice switching applications as well as for business and data communication systems. Experience in the design, implementation or maintenance of at least one operating system is required, and exposure to real-time applications and data base design is highly desirable. (OS-01)



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Software Systems Development

- Systems programmer to become involved with functional analysis and software system design on a real-time computer system. Design areas include system startup, initialization, processor fault resolution, reconfiguration of control subsystems and diagnostics for processor subsystems. (SS-01)
- Systems programmer to work on the implementation of a disk file system as part of a disk operating system development team. This work will extend into a study of the general communication problems involved in tightly coupled, message-driven computer networks. (SS-02)
- System programmers to join a group involved in the design and implementation of telephone central office data services. Past experience in operating systems design, data base management or disk file management will be applied to the specification and realization of page oriented document storage and retrieval systems. (SS-03)
- Work at the fore-front of Software Engineering technology. Assist in the development of software design languages and methodologies, data-capture graphics systems, design databases and computer-aided design systems applied to software development. In-depth experience of systems software development and/or experience in any of the above is required. (SS-04)

Computer Services Development

- Participate in the development of electronic mail and messaging systems. This group designs facilities for composing, editing, sending, receiving, forwarding and distributing messages. Required skills include: high-level language programming, systems design experience, and an understanding of time-sharing and interactive computing. (CS-01)
- Participate in the development of high speed communication network systems for distributed computing applications. Required skills include: assembler level programming, high-level languages, data communications experience, and knowledge of packet switching and communication protocols. (CS-02)
- Systems programmer to support and enhance the VM/370 operating system on a 370/168. Install IBM system level changes, isolate and solve software programs in CP, CMS

and RSCS. Enhance these system components to add new functions, improve performance and increase security. Experience requirements include at least one year of systems programming with an IBM Virtual Storage operating system, a good understanding of IBM system 370 architecture and experience with IBM assembler. (CS-03)

- Programmer/analyst to support DEC PDP-11/70 computer systems. Responsibilities will include system generations, problem diagnosis, correction and enhancements to the operating systems to provide improved performance, new functions, increased security and better user interface. DEC system software experience is a must. (CS-04)
- Programmer/analyst to design and develop corporate Management Information Systems. Demonstrated ability in areas of systems analysis and design, advanced programming and data base design is necessary. (CS-05)
- Evaluate all aspects of computing technology as applicable to the corporate computing plan. Familiarity with state-of-the-art computing technology as offered by the major minicomputer and main frame manufactures, and experience in HW/SW system evaluation are absolute requirements. Knowledge of communications, storage subsystems, test equipment and terminal technology is desirable. (CS-06)
- Programmer experienced in software performance techniques to work in the areas of application program efficiency, performance tools, software usage statistics and new software evaluation. Experience should also include IBM assembler, at least one high level language and knowledge of OS, VS or CMS operating systems. (CS-07)

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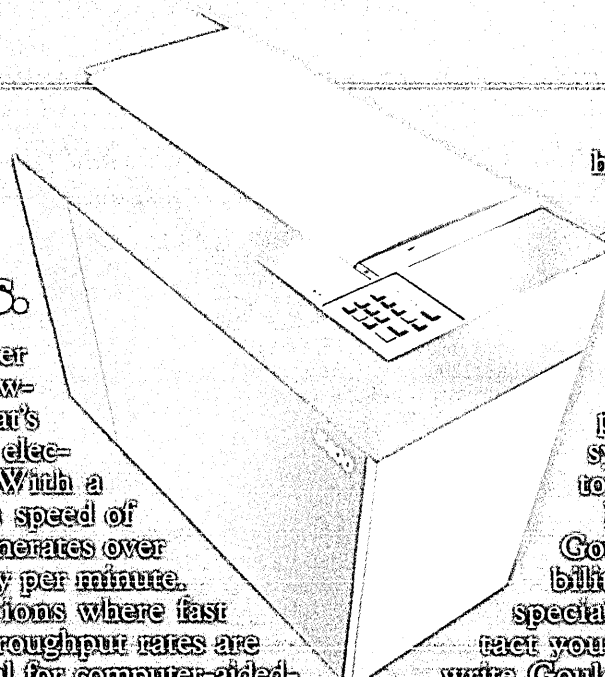
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Gould's 5400 printer/plotter will produce an E-sized drawing in 13.5 seconds. That's faster than any competing electrostatic printer/plotter. With a paper width of 36" and a speed of 3.25"/second, the 5400 generates over 48 square feet of hardcopy per minute.

Designed for applications where fast turn-around and high throughput rates are important, the 5400 is ideal for computer-aided design, seismic data plotting, and business graphic applications such as PERT/CPM, Gantt, and others.

Gould's patented negative-pressure, closed loop toning system ensures high contrast dry



hardcopy even at the maximum plotting speed of the 5400. Print resolution is 100 dots per inch, horizontal and vertical. In addition, a staggered image head produces overlapping dots for high contrast images. A user-oriented control panel features a unique LED system for continuously monitoring paper supply.

For additional information on Gould 5400 printer/plotter capabilities, software, interfaces and special application packages contact your Gould representative. Or write Gould Inc., Instruments Division, 3631 Perkins Avenue, Cleveland, Ohio 44114 (216) 361-3315. For brochure call toll free: (800) 325-6400, ext 77. In Missouri: (800) 324-6600.



GOULD

HARDWARE

OFF-LINE

Rockwell International's Electronic Systems Group has delivered a prototype Solid State Data Recorder to NASA's Langley Research Center. The unit uses bubble memory, and has PPS-8 microprocessors for read and write control. Designed to have a one megabit capacity, the recorder can record one to four serial channels, or an eight-bit parallel channel. The prototype contains only 12.5% of the unit's designed memory capacity, and will be studied to see how improvements over mechanically driven recorders can be made.

Texas Instruments also has something new in bubble memories: a 1/4-megabit chip, the TIB0303. The chip will be available for prototyping at the end of this year, with a price of \$500. TI also announced that its 92K-bit bubble chip has entered volume production, with availability 6 weeks ARO. It's priced at \$100 in lots of 100.

Pacific Southwest Airlines (PSA), a California intrastate air carrier, has installed an automated, credit card reading, ticket vending machine at San Diego's Lindbergh Field. The unit, built by Cubic Western Data, can issue one-way or roundtrip tickets to any of PSA's destinations, with the bill issued against any of six mag-stripped credit cards.

One-day delivery of first class mail? That's what the Danes hope to ensure with the installation of 10 CDC System 17s to control the sorting and routing of the nearly 2.9-million pieces handled by their central sorting office in Copenhagen.

In the first two years of marketing, IBM sold nearly 5,000 5100s with a total value of \$90-million. Sales of the recently introduced 5110, with floppy disks, will be limited only by production capacity, according to a Venture Development Corp. study, "Desktop Computer Markets." H-P, Wang, and Tektronix will be the other major forces, but "IBM can be expected to assume the lead in sales."

PORTABLE DATA ENTRY TERMINAL

If the telephone in this photograph looks unfamiliar, it's because both the phone and the Memoport 8 portable data entry terminal to its right are of European design. Intended for use by the proverbial traveling salesman, and anyone else whose job calls for on-site data collection, the Memoport 8 has 2KB of semiconductor memory, organized as 168 lines of 12-digit entries. Editing functions are provided from the keyboard. When the operator wishes to send the

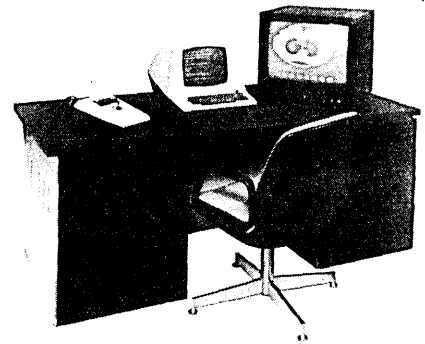


unit's memory contents to the host computer, he dials the host, puts the Memoport's acoustic coupler on the phone, and hits the transmit key. Transmission to the central site occurs at 600bps. The receiving end is controlled by a mini-computer, which checks the validity of the transmission and confirms correct reception with an audible signal. The Memoport 8 sells for \$1,000; the central site mini-based receiver sells for \$12,000 to \$40,000 depending on capabilities desired. MEMO-TEL INC., New York, N.Y.

FOR DATA CIRCLE 384 ON READER CARD

GRAPHICS SYSTEM

A family of standalone imaging and graphics system, the RM-3000 series, handles color, gray-scale, and black and white displays. Based on DEC's LSI-11 and this vendor's RM-9000 or RM-9500 display controllers, the 3000 Independent Display System (IDS) can be configured to process data stored on floppy disks, rigid disks, mag tape, or in a host computer connected via a telecommunications link. Customers can select a variety of resolutions ranging from 256 elements by 256 lines to 640 elements by 512 lines. The 3000 IDS can support multiple workstations, as well as joysticks and other peripherals. Users can perform display



operations with a set of macro instructions supplied for the display controller's Z-80 microprocessor, and they can program the LSI-11 in macro assembler, FORTRAN IV, or BASIC. A FORTRAN Imaging and Plot Package is offered, as source code, to those wishing to purchase it. A basic RM-3000 IDS, consisting of a 64KB LSI-11, floating point arithmetic, RT-11 software license, dual floppies, RM-9000 or RM-9500 series display controller, and a desk console, sells for \$18,200. The user will also need to select a monitor to fit the application at hand. Oem discounts are offered. RAMTEK CORP., Sunnyvale, Calif.

FOR DATA CIRCLE 385 ON READER CARD

TAPE CONTROLLER

The TC-150 is an embedded magnetic tape controller for use with DEC's LSI-11 series. Providing both phase encoding (PE) and NRZ recording modes, the unit allows mixing of seven- and nine-track transports in any combination of up to eight units. It can be used with any transport having an "industry standard" interface, such as units produced by Pertec, Kennedy, Tandberg, and others. Tape units operating at speeds ranging from 12.5ips to 125ips are supported. The TC-150 is software compatible with any system capable of supporting DEC's TM-11. The TC-150 sells for \$3,500, including cabling for the first tape unit. WESTERN PERIPHERALS, Anaheim, Calif.

FOR DATA CIRCLE 386 ON READER CARD

WORD PROCESSING

This vendor has increased its potential market with the introduction of an entry-level crt-based word processing system expected to compete with elec-

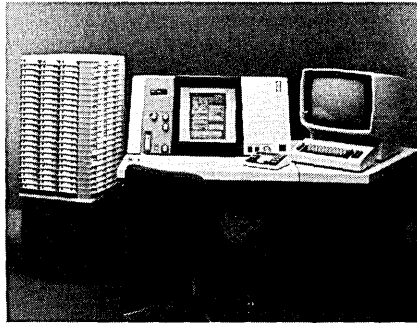


tronic memory typewriters. The System 5 consists of two standalone models, both of which can be upgraded into the vendor's larger Systems 20, 25, or 30. The System 5 Model I includes crt and keyboard, diskette storage, and provision for connection of a single printer. With a 40cps daisywheel printer (introduced at the same time as the System 5), the model I sells for \$9,900. The model II has additional operator features, such as a glossary. With a 40cps printer, it sells for \$11,900. Both models offer media compatibility with the vendor's larger systems. WANG LABORATORIES, INC., Lowell, Mass.

FOR DATA CIRCLE 387 ON READER CARD

SMART MICROFILM RETRIEVAL

The microprocessor-based IMT-100 and IMT-150 intelligent microimage retrieval terminals can operate in a standalone mode, or on-line to a wide range of host computers. The IMT-100 is a reader only, while the IMT-150 is both a reader and a dry-paper printer. In the on-line mode, the host can send the terminal a block of image addresses, and the unit's microprocessor will handle retrieval without subsequent help from the host. In the standalone mode, an operator can specify which frames to fetch. The units also can remember the location of a frame for subsequent references—useful when an



index frame may be needed frequently.

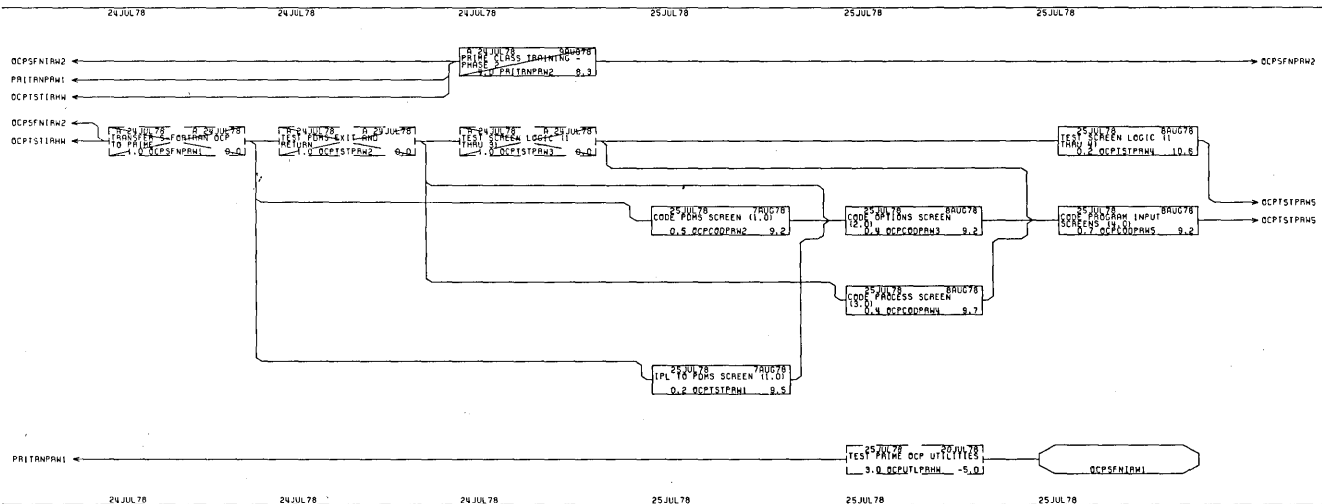
Both units can communicate synchronously or asynchronously using

ASCII or EBCDIC characters. The units can be switched to be compatible with IBM 3277 display terminal protocols, or asynchronous data transmissions at standard rates ranging from 50bps to 9600bps. Both RS232 and 20mA current loop interfaces can be used. The IMT-100 sells for \$8,855, while the IMT-150 goes for \$9,955. EASTMAN KODAK CO., Rochester, N.Y.

FOR DATA CIRCLE 388 ON READER CARD

VIDEO INTERFACE BOARDS

The CRT-2000 and CRT-3000 are 16-line by 64-character video interface boards that communicate with digital devices (computers, ASCII encoded keyboards) via a parallel TTL interface. The boards generate video output signals compatible with monitors using RS170 inputs. The boards have 1K-characters of RAM and a PROM-driven character generator. Cursor functions, foreground/background video, protected fields, and automatic scrolling are standard. The CRT-3000 offers one additional feature not found in the CRT-2000: it has a "screen read" feature that allows random access reading of any character position on the screen. In singles, the CRT-2000 sells for \$149.95, the CRT-3000 comes in ten bucks higher at \$159.95. NUCLEONIC PRODUCTS CO.,



PROJECT MANAGEMENT

After ten years of selling EZPERT, a graphic output package for use with a variety of project management packages running on large mainframes, this vendor has taken the step into the turnkey system market. The Vision system combines EZPERT's capabilities with management software for planning, scheduling, monitoring, and controlling projects. The vendor hopes this turnkey approach will reach smaller firms, particularly those that don't have a computer capable of running EZPERT and one of the many project management packages offered for mainframes. Installing a Vision system should allow smaller firms

to compete with large outfits for government contracts stipulating detailed management reporting.

The system's management software encompasses planning and control of cost, schedule, and resources. Integrated reporting and financial accounting also are included. Graphic outputs include networks, Gantt barcharts, X-Y graphics, task charts, and logic networks.

The Vision family comprises three members: Vision 1000 (with deliveries targeted for next March), Vision 3000, and Vision 7000. The latter two are planned, but completion dates have yet to be set. Vision 7000 is intended to satis-

fy the Dept. of Defense's instruction 7000.2, which specifies a wide range of detailed reporting capabilities that a contractor must possess to be considered for certain government contracts.

Vision systems are implemented on Prime computer systems. Vision 1000 consists of a Prime 300, 12MB (6MB removable, 6MB fixed) of disk, terminal, Printronix 300 lpm dot-matrix line printer (with graphics capabilities), and, of course, the software to make it all work. The system will sell for roughly \$100,000. A Versatec electrostatic plotter will be offered as an option. SYSTONETICS, INC., Anaheim, Calif.

FOR DATA CIRCLE 383 ON READER CARD

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HARDWARE

Canoga Park, Calif.

FOR DATA CIRCLE 389 ON READER CARD

MICROCOMPUTER MEMORY

While the manufacturer says its RAM III memory boards are specifically intended for use in its VDP line of desktop computers, the boards' S-100 bus interface should allow use in a variety of microcomputers. Available in 32KB and 64KB capacities, the dynamic memories include on-board refresh circuitry. Refreshing is said to be synchronized with the cpu's timing, occurring when the cpu is not accessing memory. The boards have an average access time of 375nsec, and a cycle time of 500nsec. The 32KB board retails for \$895; the 64KB board is \$1,695. IMSAI MANUFACTURING CORP., San Leandro, Calif.

FOR DATA CIRCLE 390 ON READER CARD

CONTROL INTERFACE

For control applications, the RS-16-1 can drive 16 medium-power loads, such as small dc motors or relays, and sense 16 switch contacts or TTL inputs. The controller attaches to a microcomputer via an eight-bit parallel I/O port. Output lines can be individually set or cleared by programs issuing I/O commands. Relay, switch, and logic connections to the RS-16-1 are made through a single removable connector, which leads to an interesting troubleshooting scheme. If the unit fails, the user can plug in a special connector which wires the unit's output into its input. Then a diagnostic BASIC program exercises the unit, identifying the part or parts which have failed. The RS-16-1 sells for \$229, including an installation guide and sample BASIC programs. COOPER COMPUTING, Clayton, Mo.

FOR DATA CIRCLE 391 ON READER CARD

MINIFLOPPY SUBSYSTEM

The FDS-100 Minifile is an intelligent minifloppy disk subsystem with a file management system in firmware. Of the four models in the family, two are intended to interface to instruments, and the remaining two sport computer interfaces. The file management system handles file creation and deletion, directory maintenance, diskette formatting, and file repacking. Three of the four models have integral keyboards for issuing commands to the file management system, while the fourth accepts ASCII command strings from its host. The FDS-100 Minifile model S, intended for program loading and data storage, is commanded by the host via an RS232C, RS422, RS423, or current loop interface. Model 11K is intended as a paper tape replacement for PDP-11's. As such, it is software compatible with the PC-11 reader; it also has a front panel command keyboard.

The model SK, intended for instrumentation applications, shares the features of the model S, except it takes its commands from a front panel keyboard. Model GK has an IEEE-488 instrument interface capable of functioning as listener or talker. Model 11K sells for \$1,795; the remaining three each are priced at \$1,595. Oem discounts are offered. GRECO & ULRICH COMPUTER PRODUCTS, San Diego, Calif.

FOR DATA CIRCLE 392 ON READER CARD

PDP-11 MEMORY

The PM-S1164A packs 128KB of memory on a hex board, along with the circuitry for parity generation and checking. It's a direct replacement for DEC's MS11-JP memory board, and its associated M7850 parity controller. The PM-S1164A lists at \$4,045, and quantity discounts are offered. Depopulated boards with 32KB, 64KB, and 96KB capacities also are available. PLESSEY PERIPHERAL SYSTEMS, Irvine, Calif.

FOR DATA CIRCLE 393 ON READER CARD

COMMUNICATIONS CONTROLLER

The DCU/200 is a programmable communications controller for use with Novas and Eclipses. Occupying the middle tier of a cpu/controller/multiplexor hierarchy, the DCU/200 handles character I/O processing, improving the host's efficiency by allowing it to use message-oriented I/O. The DCU/200 has 4K-words of 400nsec memory, and the capability of accessing the host's memory (beyond the 4K local address space). The single-board controller occupies one slot in the host and interfaces to the host's DMA channel. A host can support up to four DCU/200s. Each DCU,

in turn, can have as many as 16 multiplexors connected to it. The multiplexors can be either 8- or 16-channel asynchronous units, or 2-channel synchronous units. The DCU is supported by software for asynchronous, synchronous, and bisync protocols; it can be programmed for other protocols as needed. Three host operating systems—AOS, RDOS, and RTOS—provide support for the DCU/200. DCU/200s sell for \$3,900, in unit quantity. DATA GENERAL CORP., Westboro, Mass.

FOR DATA CIRCLE 394 ON READER CARD

FLOPPY CONTROLLER

Oem's and end-users of LSI-11 and LSI-11/2 microcomputers can use the FDI-L11 to control up to four full size and three mini-floppy drives simultaneously. The floppy disk controller also contains a PROM-based bootstrap which can load an operating system from diskette at power-up. The FDI-L11 handles single- or double-sided drives from the Shugart SA800/850 and SA400/450 families (or equivalent). It is said to handle all soft-sectored formats with 16 bytes to 4KB per sector. Data transfers are via direct memory access; a DMA control is included in the FDI-L11. A single controller sells for \$945, with quantity discounts offered. COMPUTER TECHNOLOGY, Oakland, Calif.

FOR DATA CIRCLE 395 ON READER CARD

CRT TERMINAL

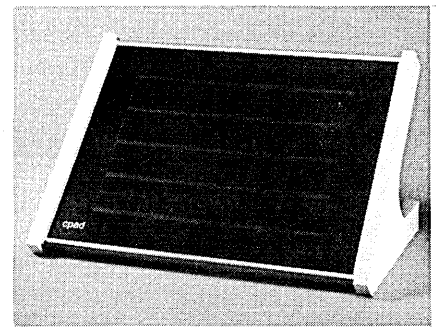
The TVI-912 crt terminal should appeal to economy-minded terminal shoppers. At \$749 for one, dropping to \$595 for 5 to 49, and \$550 for 50 to 99, the TVI-912 should find favor with users needing a full function crt at a reasonable price.

HARDWARE SPOTLIGHT

INTERFACE PANEL

The C-Pad, a microprocessor-based touch-operated I/O device, looks like a nicely engineered man/machine interface, especially when the human side of the equation is heavily weighted with semiskilled and unskilled operators. The vendor says it sees the process control field as a major market; we suspect the C-Pad will find acceptance with current and potential users of touch-sensitive crt's, and crt/light pen combinations.

The unit consists of 20 touch-operated switches, associated with 20 eight-character alphanumeric displays. It has an additional 40-character single line display (sans switch) for outputting longer messages. The LED displays can represent 64 ASCII characters (the upper case alphabet, 10 digits, 28 symbols) and a cursor. The keys generate single-character ASCII codes when touched and, after a one second delay, each key will



repeat its code at 0.1-sec intervals as long as the key is held. Communications between the C-Pad and the computer can be full- or half-duplex at data rates of 1200bps, 2400bps, 4800bps, or 9600bps. Interfacing may be RS232 or 20mA current loop. A single C-Pad sells for \$1,950; quantity discounts are available. CONTROL TECHNOLOGY + ENGINEERING CORP., Mountain View, Calif.

FOR DATA CIRCLE 382 ON READER CARD

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HARDWARE

The microprocessor-based terminal displays 24 lines of 80 characters (from the 96-character ASCII set) on its 12-inch diagonal screen. The unit has an addressable cursor, tabs, high- and low-intensity characters, and inverse video. On the communications side, the TVI-912



can operate in half- or full-duplex mode, with switch-selectable parity. Transmission can be either character-at-a-time or block mode, at speeds ranging from 75bps to 19,200bps. Interfacing can be RS232 and 20mA current loop. TELEVIDEO, INC., Santa Clara, Calif.
FOR DATA CIRCLE 396 ON READER CARD

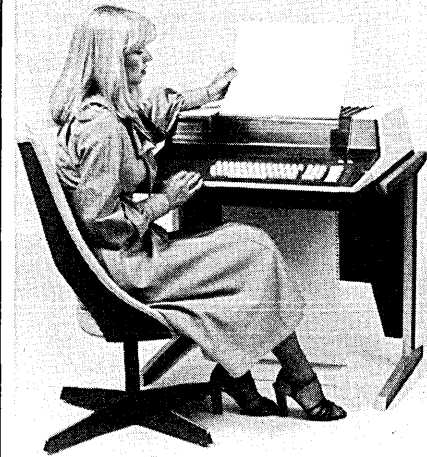
VIDEO TERMINAL BOARD

The VideoTerm, Model VT-103A, provides I/O control between microcomputers using the Multibus architecture, raster scan displays, and eight-bit keyboards. Intended for use with microcomputer systems from Intel, National Semiconductor, and other manufacturers using the Multibus, the VT-103A generates 9x7 dot matrix characters from the 96-character ASCII set. The board contains its own refresh memory for 16 lines of 64 characters. An eight-bit keyboard port is included. Two video outputs are provided: composite RS420, and direct drive. A single VT-103A, including cursor control logic, sells for \$495; quantity discounts are offered. DATAcube SMK INC., Reading, Mass.
FOR DATA CIRCLE 398 ON READER CARD

PRINTER/TERMINAL

It's not such a big step, still it's interesting to note that this computer company, which started out making crt terminals 10 years ago, has just introduced its first KSR printer/terminals. Built around the existing Freedom printer line, the new terminal offerings are available in 80cps and 160cps versions. The upper/lower case ASCII dot-matrix printing terminals can print lines of up to 132 characters.

An integral bipolar processor optimizes bidirectional printing, and provides last-character visibility by spacing over whenever the print mechanism is idle. The terminals sport dual, separately controlled paper paths (with optional forms tractors), and RS232 interfaces. A choice



of keyboards also is offered. The 160cps model 3552 sells for \$4,895; the 80cps model 3551 is \$4,395. On a three-year lease the two go for \$165 and \$150 per month respectively; maintenance is \$55 and \$40 per month. DATAPOINT CORP., San Antonio, Texas.
FOR DATA CIRCLE 397 ON READER CARD

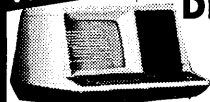
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MINICOMPUTER

The Able family of 16-bit minicomputers has four members, differing only in standard equipment, number of chassis slots, and power supply capacity. The family uses MSI technology as opposed to LSI, due to reliability and cost considerations. The asynchronous cpu has 16 registers and is said to execute in-



structions in an average of 200nsec to 300nsec.

The family's common operating system, dubbed XPL, is a real-time operating system designed to aid in composition, editing, and compiling programs. It includes a three-pass optimizing compiler for a PL/1 subset.

The Able/20, designed for running compiled programs, consists of a

10-slot chassis, terminal interface card, real-time clock, 4KB of memory (expandable to 32KB), and a single drive minifloppy. It sells for \$4,826. The Able/40, the smallest member of the family that can be used for program development, has a 15-slot chassis, 32KB of memory, and dual minifloppies. Its price is \$7,750. Able/60 is an Able/40, with eight-inch floppies in place of the 40's minifloppies. It sells for \$9,500. The 21-slot Able/80 includes four special purpose interfaces: a 16-line, 12-bit A/D converter, a timer with usec resolution, a 32-bit TTL I/O interface, and a Hand Operated Processor which provides direct I/O access. The Able/80 goes for \$9,865. Oem discounts range from 10% on two units to 40% on 100 units. NEW ENGLAND DIGITAL CORP., Norwich, Vermont.

FOR DATA CIRCLE 399 ON READER CARD

80-COLUMN IMPACT PRINTER

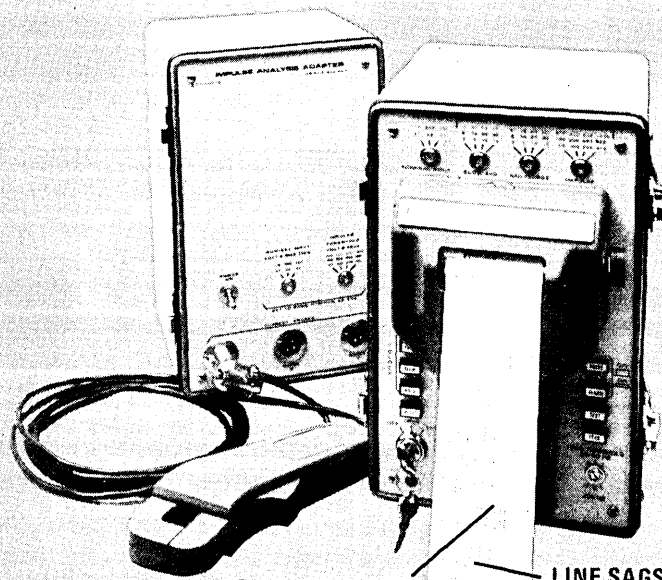
Eighty columns, 84 lpm, 96 ASCII character impact printing, and an RS232 interface in a \$845 (quantity one) package? That's the DP-8010, one of three members of the DP-8000 family of printers. The 8020 and 8040 differ in interfaces, with the first having current loop interfacing and sharing the 8010's price, the latter having a parallel interface and a \$795, quantity one, price tag. All three are controlled by a microprocessor, and have 256 character buffers. The two serial interfaced units accept data at standard rates from 110bps to 9600bps; the parallel interfaced DP-8040 accepts data at up to 1,000 characters per second. The family uses a dot matrix print head rated at 100-million characters. Sprocket-fed paper can enter through either the bottom or the rear of the printer. Availability is slated for November. Distribution channels will consist primarily of oem's and distributors. ANADEX, INC., Chatsworth, Calif.

FOR DATA CIRCLE 407 ON READER CARD

FLOPPY DRIVE

The FDD 100-8 series of 8-inch diskette drives feature Shugart-compatibility, 85% parts commonality between single and dual-head drives, and double density recording without extra prewrite compensation circuits. The units also have IBM compatibility, and can read or write 3740-formatted diskettes. Single density FDD 100-8s can record up to 400KB per diskette; double-density capacity is 800KB. Options include a door interlock, hard sector detection, and write protection. Available to oem's, single quantity prices start at \$580. SIEMENS CORP., OEM Div., Anaheim, Calif.

FOR DATA CIRCLE 400 ON READER CARD



SLOW-AVERAGE
LINE CHANGES

DC OUTPUT AVG,
SAG/SURGE, TRANSIENTS

LINE SAGS & SURGES

LINE TRANSIENTS
NUMBER AND
AMPLITUDE

IMPULSE AREA
(VOLT-SECONDS)

and now... The Final Diagnostic Data!

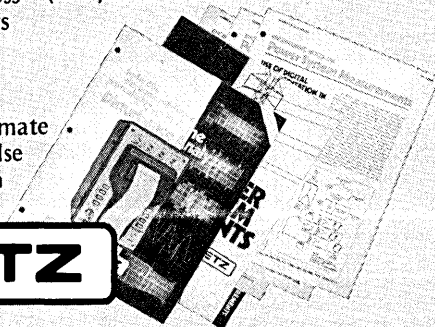
Two years ago, we brought you the first microprocessor-based line-disturbance analyzer (Series 606) — a breakthrough design that monitored and recorded sags, surges, slow-average drifts, and impulses on AC power lines. It changed the entire computer-maintenance picture, from guessing to *knowing*. You made it the world leader in line-quality assurance. Thousands are in daily service.

Last year, we brought you a new design (Series 616), extending your diagnostic capability to monitoring both AC power input and DC power outputs, so that you could analyze the effectiveness of system power-supply regulators and filters. Once more, it swept the industry.

AND NOW we've created the ultimate diagnostic tool: a family of Impulse Analysis Adaptors that work with

Series 606 Disturbance Analyzers to give you *accurate, quantitative* measurements of *severity* of the most disturbing (and elusive) of all line disturbances: *transient impulses*. Now you can measure, classify, and print records of such disturbances, expressed in terms of *volt-seconds* (energy content) of the transient impulse.

For complete technical data on these brand-new Series 6000 Adaptors, and the Series 600 Power Line Disturbance Analyzers themselves, plus valuable application notes, use the inquiry number, or call or write: Dranetz Engineering Labs., Inc. 2385 South Clinton Avenue South Plainfield, N.J. 07080 (201) 755-7080



DRANETZ

SOFTWARE

UPDATES

We recently saw a demonstration of what was to us a rather surprising piece of personal computer software: a stock quotation service. Using an Apple II personal computer, and software developed by Apple, users can access the Dow Jones' Stock Quote Reporter Service via a phone link. Users get 15-minute delayed quotes on the stocks of their choice. Portfolio evaluation and access to the Dow Jones data base of news stories about the companies are in the works. The demo, held at The Computer Store in Santa Monica, was so impressive that one of the dozen or so guests, who happened to be a stock broker, was last seen sitting at the cashier's desk ordering his own system.

The SPSS and SCSS users group, ISSUE, is having a membership drive. The independent group says it "has the autonomy needed to express its members' concerns while maintaining close communication with SPSS Inc." The group picks up its mail at P.O. Box 8224, Chicago, IL 60680.

New York City is about to begin teaching math to third through eighth graders with the help of microfiche projectors from Kodak, and learning materials prepared by Educational Testing Service. Students in Manhattan's Upper West Side will answer diagnostic questions, progressing to more difficult material if they answer the questions correctly. Teachers will be able to spend time individually with students having trouble.

The Society for Worldwide Interbank Financial Telecommunications, SWIFT, officially accepted General Automation's interface device software. SWIFT now owns the package and has full responsibility for its maintenance.

PET ACCOUNTING

Personal Ledger is a double entry book-keeping system for owners of the Commodore PET. It has provisions for budgeting, and keeping records of income, expenses (both deductible and nondeductible), assets, and liabilities. As many as 50 accounts can be defined, with names and budgets specified by the user. Data are read from cassette prior to entering transactions, and rewritten to cassette after all transactions have been entered. If the user has a printer, the package can print income statements and balance sheets, as well as an audit trail of transactions. Supplied on cassette, Personal Ledger comes with a manual, program listing, and sample data. It sells for \$20. CHANNEL DATA SYSTEMS, Goleta, Calif.

FOR DATA CIRCLE 352 ON READER CARD

PROPERTY MANAGEMENT

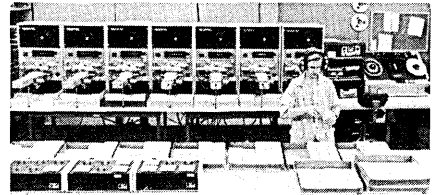
Firms involved in real estate and property management may be interested in this package written for the IBM System/32. It's an accounting package emphasizing property management. The package was developed by a real estate firm, which has been using it for better than six months to manage better than 1,400 commercial and residential units.

The system is divided into four subsystems: cash receipts, cash disbursements, general ledger, and property management. Input comes from the keyboard, and the input routines are designed for use by nontechnical personnel. Both closing and on-demand reports are provided. Closing reports include the usual accounting reports, such as profit and loss broken out by branch and division. A rent roll, with renter data, a receipts statement, and a monthly operating statement summarizing all activity for each project are additional closing reports. Of the on-demand reports, perhaps the three most important are the availability report on units, cash receipts and disbursement statements, and a delinquency report which includes the tenant's payment history and phone number. The package carries a price tag of \$8,000, which includes five days of on-site installation and training (though the customer also

must pay transportation costs for the vendors personnel). The package carries a one year guarantee. J. ALVIN HAWBAKER ASSOCIATES, State College, Penn.
FOR DATA CIRCLE 353 ON READER CARD

MICRO SOFTWARE DUPLICATION

Here's a service that should help aspiring microcomputer software moguls: cassette program duplication for the TRS-80 and PET markets. Why is it limited to only those two machines? The vendor explains it's a matter of quality control. It has these two machines on hand, and uses them in the duplication process. Here's how it works: the software author provides the company with a cassette to be duped. The company loads the cassette into the appropriate personal computer, then dumps the program onto



a 1/4-inch master tape. Then they use the master tape to generate the production run. And you don't have to place a big order to use the service: they'll accept an order for as few as 100 copies. For 100 copies, the price is \$1 per cassette, which includes media, Norelco-style box, unaffixed blank labels, and shipping the entire batch to any one location in the continental U.S. Turnaround on an order this size is said to be seven days. Larger volumes cost less per copy, and may take a little longer to fill (say 30 days for 100,000). MICROSETTE CO., Sunnyvale, Calif.

FOR DATA CIRCLE 354 ON READER CARD

OPTIMIZATION MODEL

The Space Shuttle Spares Optimization Model, as the name implies, was developed to predict the number of spares needed in the space shuttle project, and to help prepare budget forecasts. It also performs risk analysis on the spare stocking strategy generated. Coming down to Earth, it looks like the kind of

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

Additional features and functions include:

- Supported under both IMS DB/DC and TSO
- Full support of IMS/VS secondary indexing
- Open-ended computation facilities
- Ability to SORT display output
- Complete security through password protection
- Comprehensive log of all session and run statistics
- Unlimited data base concatenation and referencing
- Optional usage of qualified SSA's

In summary, ASI/INQUIRY represents the state-of-the-art product in an IMS/DC or TSO-supported environment. Contact us and learn why organizations such as *Hughes Aircraft, Standard Oil of Indiana, Hydro-Quebec* and *EXXON* are processing queries like "What if . . ." and obtaining a return on their investment many times over.



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(213) 542-4381

SOFTWARE

thing manufacturers and dealers might use to keep their parts inventories adequate, but not overly large. Written in FORTRAN IV, the program runs as a batch job on 360s and 370s running OS. It requires roughly 400KB of main memory. The documentation can be had for \$8. The program itself, which the distributor calls MSC-18015, sells for \$140. COMPUTER SOFTWARE MANAGEMENT AND INFORMATION CENTER (COSMIC), Athens, Georgia.

FOR DATA CIRCLE 355 ON READER CARD

M6800 COBOL

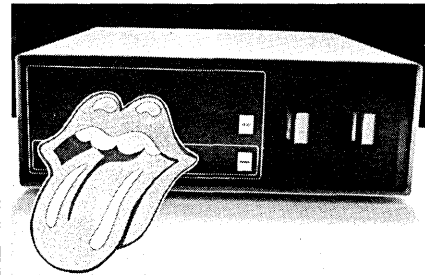
Oem's developing business applications on M6800-based microcomputers should be happy to learn of the M6800 resident COBOL compiler. It's said to handle all of the 1974 level one COBOL constructs, plus a handful from higher levels, including the COMPUTE and SEARCH verbs, nested IF's, and complex logical conditions. It runs on the Exorciser Development System, when equipped with 32KB of memory, floppy disk system, and terminal. Compilation is said to procede at 500 statements per minute. The compiler has a license fee of \$1,195. MOTOROLA SEMICONDUCTOR PRODUCTS, INC., Phoenix, Ariz.

FOR DATA CIRCLE 356 ON READER CARD

SOFTWARE SPOTLIGHT

SPEECH SYNTHESIS

The Votrax line of speech synthesizers and the Computalker speech synthesizer both can make your computer talk. Unfortunately, neither can speak directly from English text. Someone, or something, has to translate the words to be spoken into codes specifying the phonemes (in linguistics, the smallest unit of speech; the sounds which, when combined, form spoken language). Well, Anglophone is an 8080 assembly language program that does the trick. The program is based on research published by the Navy Research Lab in Washington, which claims 97% accuracy in translating text into phonemes. That doesn't mean word accuracy; words with two pronunciations (such as "read": should it be "red" or "reed"?) cause problems. The vendor says you can work around this problem by spelling ambiguous words phonetically. Or, you could go in and



hand code those words the software can't handle. With a Votrax VS6, we're told Anglophone works in real time. There's a several second delay when using the Computalker, as additional processing is required. The Anglophone package needs 8KB of memory, and includes both source and object code on paper tape or cassette. A 120-page user's manual is included in the \$100 price. UPPER CASE BOOKS, Champaign, Ill.

FOR DATA CIRCLE 351 ON READER CARD

TEXT PROCESSING

This vendor has added software for creating, storing, and editing documents on its System 45 (aka 9845) desktop computer. The user can enter and store text on the computer, and subsequently

alter, organize, or update any of the material. Features include automatic search with replacement, and the repetition or movement of blocks of text. The software takes advantage of the System 45's function keys, which are defined to initiate hyphenation, line insertion,

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If you're one of those bright data processing people who has developed a sound software package, you've probably struggled with different methods of getting it to the marketplace.

We know what you've been going through. We're an established computer software company with a proven track record of bringing products to the marketplace and supporting them once they are sold.

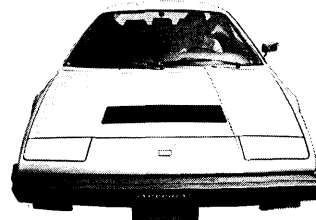
Now we're looking for additional systems-oriented software to add to our line.

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Drop us a note today and we'll get back to you immediately to see if there's a way we can both benefit from your expertise.



Box S-9-1
Datamation
35 Mason Street
Greenwich, Conn. 06830

margin placement, and text additions. The System 45 also can store as many as 45 pages of single spaced text on one of its miniature 3M-type cassettes. The Text Processing software sells for \$300. HEWLETT-PACKARD CO., Palo Alto, Calif. **FOR DATA CIRCLE 357 ON READER CARD**

DATA SECURITY

IBM has brought out its latest release of RACF (Resource Access Control Facility), said to be more convenient to use as a system-wide access control because it now "is easier to use with other programs." Release 3 can spread control information among storage devices, providing multiple paths and improved access to needed data. IMS/VS now can get extended security support via RACF. When used with IMS/VS, RACF allows storage of user authorization information in main memory, increasing performance. A merge/split facility can expand or reduce the number of RACF data sets. Simultaneous update and backup of RACF data sets now is possible. More than one user ID now can be maintained in a single address space. RACF Release 3 runs under OS/VS2 MVS, and is available now for \$500 per month. INTERNATIONAL BUSINESS MACHINES CORP., White Plains, N.Y. **FOR DATA CIRCLE 358 ON READER CARD**

MICROCOMPUTER COBOL

This vendor now offers COBOL for its Z-80-based microcomputer systems. Based on ANSI standard X3.23-1974, this COBOL includes all Level 1 features for the nucleus, and then some. Sequential, relative, and indexed file handling are



included, as are table handling, library, and interprogram communication capabilities. Level 2 options supported include the verbs STRING, UNSTRING, COMPUTE, SEARCH, and PERFORM. Abbreviated and compound conditions, and condition names also may be used. Data may be written to diskette in packed

decimal format, saving mass memory space. A batch style debug utility is included. COBOL is offered on two media: minidiskette (model FDC-S) or 8-inch diskette (model FDC-L). It sells for \$95. CROMEMCO, INC., Mountain View, Calif. **FOR DATA CIRCLE 359 ON READER CARD**

INTERACTIVE JOB SUBMISSION

Users of this vendor's BASIC time-sharing system for 370s can interactively build source program files (in the language of their choice) and use the Interactive Job Submission (IJS) subsystem to submit these files as jobs to the Power/VS spooler. Output can be retrieved via IJS. A text editor aids program creation, and allows retrieval of selected portions of the output. Users can include canned JCL with their submissions, via IJS's Power/VS SLI procedure support. Security facilities protect users from each other and allow the system supervisor to specify what kinds of jobs each user may submit. IJS runs as a subsystem of the vendor's BASIC/TPC. Educational users get a 25% price break, and can license BASIC/TPC for \$300 per month, and get IJS for an additional \$100 per month. Trial licenses are offered. CBM, Lansing, N.Y. * **FOR DATA CIRCLE 361 ON READER CARD**

Controls Division

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CIRCLE 206 ON READER CARD

PERSONAL COMPUTING

THE SOFTWARE VACUUM

In personal computing we've seen hardware companies named Parasitic Engineering, Smoke Signal Broadcasting, and Thinker Toys. We've seen computer stores named Kentucky Fried Computers, The Computer Deli, and Itty Bitty Machine Company. Computer names include PET, Gnat, Apple, and No Name. Now we shouldn't be too surprised at the newly emerging software companies with names like PET Food, Speakeasy Software, The Software Works, and The Hustlers.

These clever names do little to indicate the seriousness of personal computing software issues. The hardware now is in reasonable shape for both the home and business markets. The systems software—including simple operating systems and programming languages—is available. Both home and business markets now are limited by the need for application software.

Some applications software is available. In the small business area, software falls primarily into two categories: standard and specialized. Among the standard packages are: general ledger, inventory, word processing, and data base management. A number of companies offer these. Among the more specialized packages are: medical professional billing, statistical analysis, rental locator service, rent accounts, sales order processing, and medical billing. Typically, each of these is offered by one company for one computer. Prices vary widely. For example, one general ledger package is advertised for \$35; another for \$995.

Still we have only barely started to produce the software needed to realize the promise of the personal computer. We need programs for every small business. We need consumer software collections as vast as our present stereo record collections.

Where will we get the low-cost mass-produced application software to go with low-cost computers? Will it come from the manufacturers? Will it come from the computer stores? Will we create an ad hoc structure of systems houses, consultants and software companies as did the minicomputer industry? Will book and magazine publishers get even further into the software business? Will a software distribution business analogous to the publishing business emerge? Will programming be easy enough that the user can do it?

Let's take a look at the manufacturers. The personal computing hardware manufacturers are just like their predecessors that manufactured larger computers—they just want to produce iron. They definitely don't want to be in the application software business.

Will personal computers go the way of minicomputers with software being produced by an ad hoc assortment of systems houses, consultants, and software companies?

The current rumor in the industry is that all the major manufacturers of business personal computing hardware are looking for or developing basic business applications such as accounting packages and word processing packages. Although we probably can expect some basic business applications software from the manufacturers, they will certainly not get into the specialized lower volume business applications such as packages for personnel agencies or savings and loan companies.

Now let's look at computer stores. Computer stores are in a prime position to produce software because they are in touch with the customers and their needs.

There are several examples of computer stores that have developed application software. For example, COMPAL, a computer store in Studio City, California, has produced a word processing package, an accounting package, and a real estate investing package. My store, the Micro Store in Richardson, Texas, offers a word processing package and a package for a

savings and loan company. The Computer Mart of New Jersey in Iselin, New Jersey, offers a personnel agency package. Although there have been isolated instances where stores have produced their own software, most computer stores agree that they don't want to get into the software business either.

What does that leave? Will personal computers go the way of minicomputers with software being produced by an ad hoc assortment of systems houses, consultants, and software companies? Possibly. A number of consultants and software companies are emerging. The most successful of these is probably Michael Shrayner Software in Glendale, California. Michael Shrayner markets a word processing package called the Electric Pencil II. The Electric Pencil II runs on more than 50 different hardware configurations. It is sold primarily through computer stores. The cost of the Electric Pencil ranges from \$100 to \$175 depending on the configuration. Another company called Structured Systems Group offers a general ledger package, a sorting package, and an accounts receivable package. The Software Works, Inc. offers a mailing list program called the Mail Room and an inventory program.

What is the role of the publisher in filling the software vacuum? Most of the personal computing magazines publish program listings. *BYTE* has experimented with distributing software on the printed page as bar codes which requires a simple ocr wand to read it into the computer. This is a very inexpensive means of reproducing software; however, it requires that all computers have the wand attachment. *Interface Age* magazine has experimented with distributing software by inserting in each issue a floppy ROM, a 33 $\frac{1}{3}$ rpm record much like the records that came on cereal boxes. *Interface Age* has proposed a standard for recording software in this format. *Creative Computing* and *Kilobaud* both recently went into the software distribution business. Both advertise that they will pay royalties on contributed programs and will sell the programs on cassette tapes for the Radio Shack and Commodore PET computers at a very low cost, typically

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PERSONAL COMPUTING

under \$10. *CURSOR* magazine is actually a monthly cassette tape containing programs for the Commodore PET. Twelve issues are available for \$24. A magazine called *The Software Exchange* has offered to publish paid classified advertisements for both needed software and for for-sale software—the idea being to match the producer with the consumer.

An enterprising company called Micro Systems Services in Orange Park, Florida, advertised a Dial-a-Program service on a toll-free number. The strategy was to transmit programs for a Radio Shack TRS-80 over the telephone receiving it using a standard telephone pickup connection to an audio cassette recorder. The service was discontinued after they discovered they couldn't transmit the programs reliably. The company is now offering software through a publication called *Dump*

The strategy was to transmit programs for a Radio Shack TRS-80 over the telephone . . .

magazine which includes a 33 $\frac{1}{3}$ rpm record similar to that pioneered by *Interface Age* magazine.

Some software appears in book form. For example, Scientific Research in Key Biscayne, Florida, offers seven books (ranging in price from \$9.95 to \$49.95) containing listings of BASIC programs. Among the programs are personal bookkeeping, games, programs for math and engineering, programs for plotting and statistics as well as a chess program. Another book publisher, Osborne and Associates, has a book called "Payroll with Cost Accounting" which contains complete documentation as well as the source program listings for a payroll package. Adam Osborne says his company sells more than 1,000 copies of this book per month. Scientific Research and Osborne and Associates take opposite approaches to the problem of software theft. Scientific Research has had such problems with copying that they are offering a reward leading to the arrest and conviction of anyone reproducing their software in any form (book, diskettes, paper tape, cassettes, records, etc.). Osborne and Associates, on the other hand, offers the software free and allows reproduction of it. Once a magnetic recording of the software has been made by keying it manually from the book, the software can be copied, given away, sold, etc. If a person doesn't desire to manually key the programs himself, he can purchase the magnetic media for any of several machine configurations. Adam Osborne says that he can afford to give

New Jersey to the customer in Texas books. In his opinion, for every software package given away, several books are sold. His books are protected by copyright, therefore, his investment is safe. Giving away the software in order to sell books is certainly a novel approach. Will software become a loss-leader for the publishing company? Will the software be the razor and the books the blade?

A software listing in a book or a magazine is a software kit. You have to put it together by keying it into the machine and debugging it. In my opinion, the software in a book is a stopgap measure and the market for these books will diminish when the real assembled software is available. Just as the market for hardware kits has diminished now that low-cost fully assembled computers are available, software kits too will have a limited life.

Can the user (businessman or consumer) do his own programming? Although the business user could learn to write BASIC programs, it is unlikely that most will want to learn programming and systems analysis to the extent necessary to implement small business systems. Most business users will want to buy packaged software that may require customization by a consultant. On the home front, there is an upper limit of about one million people who would be willing to learn to program as programming languages stand today. If home computers are to be sold to more people than this in the near future, then a very large number of package programs will be needed. In the long range future, most people probably will program in languages very different from those we know today.

Now let us summarize the present state of affairs in personal computing software. Some software has been produced by manufacturers, computer stores, consultants, and software companies. In general, the software has not been made widely available. How do we get the personnel agency package developed by a computer store in

away the software because it sells the who wants to run it on a different machine?

Figure 1 shows a possible structure for a mass market software industry. This industry structure is based on the concept of the software distribution company. The software distribution company works much like a publishing company or a music distribution company. A program is produced by a programmer just as a manuscript is produced by an author. The software distribution company evaluates the program, maps out a business plan, makes the program into a product, markets and distributes the program and provides after-the-sale support to both the retailer and the end user. The programmer receives a royalty on sales.

The first task of the software distribution company is to evaluate programs that are presented to it. The evaluation of a submitted program involves determining the potential market for the application as well as estimating the cost of turning the program into a product.

After the initial evaluation phase, a business plan must be prepared for the program product. The market must be identified and sized. The cost of making the program into a product and marketing the product must be estimated. A price must be determined for the program. The product must be evaluated against competitive products. Earnings over time must be estimated and a contract must be negotiated with the author.

Making a program into a product may require completely rewriting a program or may simply involve cleaning up the existing program. The program must be thoroughly tested. End-user documentation and documentation for the retailer must be written. Packaging for the product must be designed. It may be that conversion to other computers is required.

Marketing a program product is one of the most important tasks of the distributor. First, the buyer must be

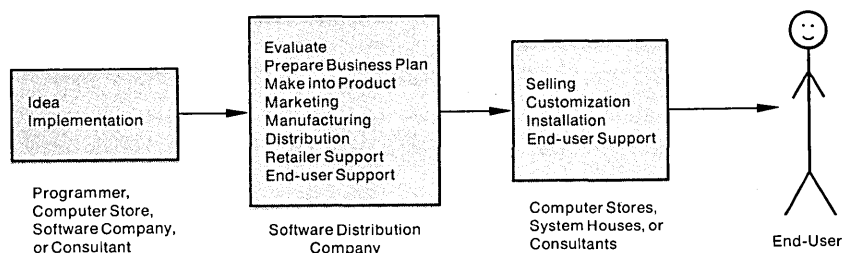


Fig. 1. Key to this industry structure is the concept of a software distribution company. Working much like a publishing company or a music distribution company, the software distribution company turns the programmers "manuscript"—his program—into a fully supported product.

This conference is being organised for representatives from commerce, industry and government, who have a vital interest in the costs and conditions of international data communications.

Data regulation in the form of privacy legislation either exists or is imminent in most European countries. Also the Third World is becoming increasingly sensitive about dependence upon US based computer systems.

The upsurge in transnational data traffic is causing considerable alarm and several international organisations are now working on regulatory plans. Barriers to computerised data crossing national boundaries are being erected in the name of privacy, data security, sovereignty, or to protect domestic data processing.

The problems are with us now even though there is as yet comparatively little awareness of them. One thing is certain, they will not go away, they will only proliferate. This conference will analyse the problems you are facing and provide you with information invaluable for the planning of future international activities.

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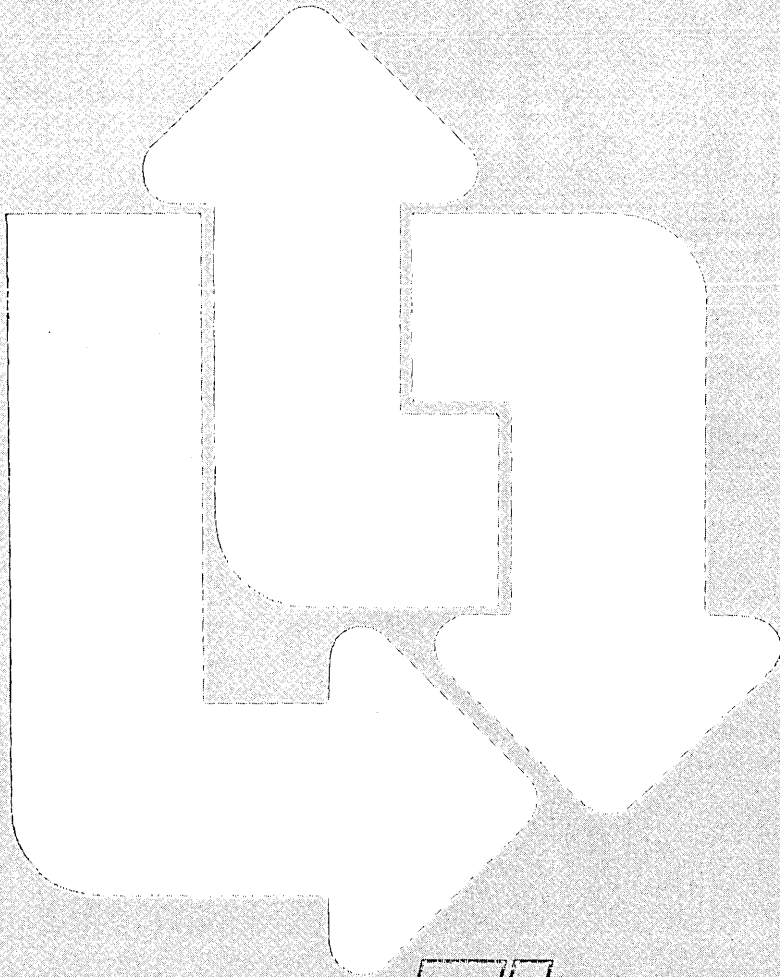
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identified and the advertising program planned ads must be designed and placed. Direct mail to computer stores, systems houses and consultants may be useful to identify dealers for the program product. Trade show demonstrations may attract both dealers and end-users. Seminars might be given for both dealers and end-users. Dealer visits may be necessary. Shared advertising or direct mail to end-users with retailers may be desirable.

The manufacturing process is relatively simple for software. If the media is disk or tape, only a simple copying process is required. If the media is a read only memory in a cartridge, some assembly may be required. In any case, copies must be tested to determine that a correct copy has been made.

Actual distribution involves accepting and shipping orders and doing all the necessary record keeping. This involves determining various discounts to retailers based on volume, serial numbering the copies in order to help prevent theft, recording the number of copies shipped in order to pay the producer of the software the proper royalty, and invoicing the dealer.

Supporting the retailer is one of the most important functions of the

Supporting the retailer is one of the most important functions of the software distribution company.

software distribution company. Retailer support will require educating the retailer in demonstrating the software package by visiting the retailer periodically and providing seminars. Constant telephone help must be available. The retailer must be promptly notified of any error or change in the software, probably via a newsletter.

Even though the retailer will provide a significant amount of end-user support, the software distribution company also must provide some end-user support. Each user will be registered with a unique number. The number will entitle the user to a certain amount of telephone support and a newsletter which keeps the user updated on problems in the software or new releases. This may be paid for by a software maintenance contract. For a user willing to pay for on-site support and possibly customization of the software, it should be provided by the distribution company.

The software distribution company really makes sense. First, let's look at it from the point of view of the producer of the software. It gives the producer a wider market, it removes the continuing commitment to support the

software product, and it provides the producer with a continuing income. The producer can count on the well-known name of the software distribution company to help market his product. A producer of software might have some objections to the concept of a software distribution company. He might naively believe that he will want to perform the distribution job and keep all the profits for himself. He might also prefer the independence and complete control that he has over his software product as long as he owns it entirely. Although the author of the software need not give up to the distribution company his right to continue marketing his own product in his own territory, he might feel that he is diluting potential future territory by giving the distribution company the right to also sell the software in territories out of the producer's primary area.

From the computer retailer's point of view, the software distribution company offers many advantages. The primary reason the retailer needs the software distribution company is the impossible evaluation and selection problem facing him without it. In fact, now when a retailer looks at the marketplace and scans the magazines for advertised software and sees six different accounts receivable programs advertised, he has absolutely no idea which one to stake his future on. He certainly does not have the time to buy and evaluate every package. Further, he cannot afford to risk the chance that an unknown company might not provide the level of support required. The retailer would risk being stuck with supporting the product himself if he sold it to a customer and later found that continuing support was not available from the producer.

Many problems face the software distribution company. There is the question of whether or not the present copyright laws are sufficient to protect mass distributed software. There is the present state of the hardware market in which no one machine is clearly dominant, therefore, there are no standards for languages and software recording media. Until such standards exist, it will be necessary for a software distribution company to support a software product for a wide range of machines, languages, and media.

Is the software distribution company the answer to the software vacuum? Maybe. Time will tell. *



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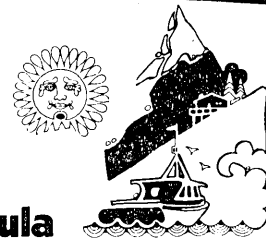
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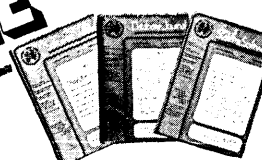
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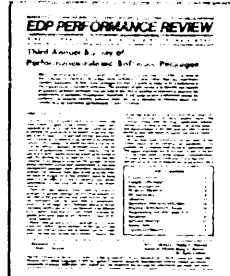
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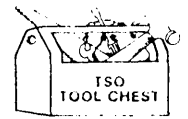
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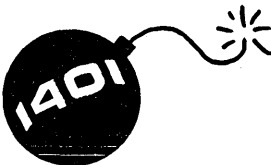
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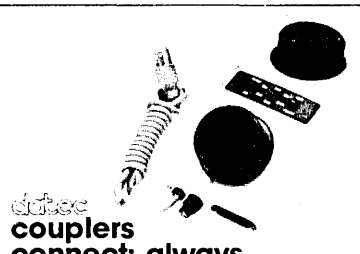
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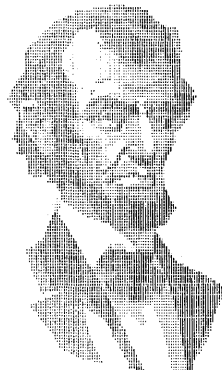
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BOOKS

STANDARDIZED DEVELOPMENT OF COMPUTER SOFTWARE

by Robert C. Tausworthe

This book lies somewhere between a gem and a pain. A gem because of its breadth in covering what to expect on a software development project from the structured programming viewpoint—but a constant frustration because it is liberally sprinkled with references to actual standards in chapters and appendices not yet published.

The volume has an interesting history: It was first produced at Jet Propulsion Laboratory as an actual standard to be used on a large missile project. (I did see a few chapters at the time that were circulating about the "old boy" circuit in the aerospace industry and was interested because SDC was doing something of the same thing at the time.) It was later given an official government printing (putting it in the public domain). Prentice-Hall got hold of a copy and, impressed, arranged for its publication, complete with dangling references to unavailable material. Actually, the author says that JPL plans to publish appendices this summer; hopefully, Prentice-Hall will pick that up, too, and we will have a complete work.

Substantively *Standardized Development* covers just about every aspect of software development, showing how top-down structured programming impacts each development phase. The early theoretical development covers such salient features as the developmental cycle, program structure and conceptual hierarchies, and principles of program documentation. Performance or functional analysis and specification, the first developmental phase, is covered in a general fashion. No particular point is made of any particular approach to analysis, top-down or otherwise, but the feeling is there. We are warned to look for real needs and to differentiate between functional requirements and program definition, but there is little emphasis on trade-offs or other analytic devices except information flow diagrams. The standard here is a specification standard rather than an analytic standard.

The program design section does

get into the top-down rules, modularization principles, and alternative design considerations. Treatment of these rules is not deep, and design rules are placed in the context of the whole process rather than being the whole of design as some advocates seem to believe. Again, specification is an indigenous part of design; a fair amount of space is devoted to presentation techniques, module classification, and criteria for establishing levels of abstraction.

Chapters are devoted to both real-time and non-real-time programs. Standard control structures and Mills' mathematical proof of program correctness of "proper programs" dominate non-real-time. Multiprogram considerations, resource trade-offs, and similar strictures receive attention for real-time programs. Quite a bit of space is devoted to techniques for rendering non-proper programs proper, and several of the issues of structured programming—abnormal terminations, concurrency handling, and program efficiency—are also examined.

At this point, two tools—structured programming languages and decision tables—are covered. A language is proposed which is built upon existing language structures and hence is missing some of the more esoteric features of a proper structured programming language. It's tied to existing data structures, for instance. In short, a practical preprocessor to be used on a software project, as it undoubtedly was.

Tausworthe strongly supports the notion of concurrent design, code, and test offered by structured programming and points out various approaches to these. However, his chapter on verification and validation (reviews, audits, and tests) is rather weak. He develops some expressions of confidence limits for verification and looks at proofs of correctness techniques, but does little toward developing a full-fledged testing program or even a quality assurance program. Test documentation is covered, but not as wholeheartedly as specifications are.

The last chapter deals with management. Tausworthe's ideas for programmer teams for large projects, programming support libraries, and project

administration are expounded, all good structured programming approaches. However, as an old hand at software systems management, I'd say his standards for configuration management and change control are inadequate. He doesn't show how to take full advantage of programming support libraries for management purposes. Still, software management is a broad subject and cannot be covered in the depth one might like and kept in balance with the rest of the book. Some insights are offered, if not the whole ball of wax.

In general, this book offers one of the best overviews to come along of structured programming principles applied to the whole software development process. While other books may develop specific techniques in greater depth, this is usually at the expense of other notions. This book has a fairly balanced presentation, not deep, but certainly good guidance. If the "standards" volume is published to augment this "methods" volume, *Standardized Development* could well be a standard reference on a lot of shelves. Prentice-Hall, N.Y. (1977, 379 pp., \$19.95).

—N.E. Willmorth

STANDARDS AND PROCEDURES FOR THE DATA BASE ADMINISTRATION FUNCTIONS

by Robert M. Curtice

This handbook is a checklist of standards and procedures that should be developed and implemented by any shop using DBMS or data dictionary software. The checklist is presented in such a manner that it is independent of hardware and software specifics. Actual standards, of course, are dependent on the specifics of a hardware/software configuration, so standards are presented in the following manner: "Online transaction processing modules should not exceed X bytes in storage requirements."

The handbook is organized in great detail. Three principal sections are presented: Data Base Design and Development, Data Base Programming, and Data Administration. Most of the key standards that one is likely to consider are

covered in this book. For example, under Data Base Programming, program limits, selection criteria, sorting, statistics, etc., are covered. The author does not hesitate to make specific recommendations when his experience has resulted in a conclusion which is generally applicable. For example, "Use of sorted chains. When relationships are to be maintained by the DBMS in a specified order, update becomes more expensive. Sorted chains should not be specified unless the guidelines are met."

An extensive list of references is provided in an unusual and useful fashion: They are listed at the immediate conclusion of each section where their use may be warranted.

This book could be very important to DBMS implementers. If there is any most commonplace failure in the data base world, it is the implementation of systems which are not data independent and in which, because no management control has been exercised, a DBMS is simply used as another access method. Following the guidelines in this handbook will go a great length toward preventing that from happening to you.

The book is not a text nor could it be easily converted to such. It is not an expository writeup. It is a good, practical, detailed list of standards that should be implemented by users of DBMS software and, therefore, is strongly recommended for such organizations. Arthur D. Little, Inc., Cambridge, Mass. (1978, 71 pp., \$25).

—George Schussel

THE RISE OF SYSTEMS THEORY: AN IDEOLOGICAL ANALYSIS
by Robert Lilienfeld

The premise of this book is that a number of disciplines have emerged in the 20th century that can be classified under the general heading of "systems thinking" and that these originally separate disciplines have converged in philosophy, goals, principles of exposition, and results. On the whole, the author is unhappy with these developments, and the purpose of the book is to argue the case against systems theory.

Part I is an overview of those disciplines that use systems techniques. These include cybernetics, information theory, statistical communications theory, artificial intelligence, operations research, game theory, systems analysis, and large-scale simulation. While sparse and incomplete, this overview does serve to acquaint the reader with the main thrusts of the various disciplines and to see the common threads, in terms of both technique and philosophy, that tie them together. This part serves to demonstrate that the systems disciplines represent what is basically one unified approach and way of

thinking; differences are not intrinsic but are based on the specific features of narrow problems. Unifying principles include: viewing objects of study as systems of interrelated variables with an "outside" and an "inside," a hierarchical approach to problem statement and solution, the use of models, and the quantification of aspects of interest and the use of sophisticated mathematical techniques on the quantized variables.

Having established the subject to be discussed, the author attacks system theory on two levels. First, he asserts that the societal claims of systems advocates have not been met. He cites a number of examples of government-funded contracts that have come to nothing or done actual harm. The well-documented criticisms of *The Limits to Growth* are also cited. He concludes by asserting that no substantive theoretical or even "applied"



sociological, political, or economic problems has been resolved by the elaboration of systems theory.

The second level of criticism has to do with the implications of systems philosophy with respect to how our society is organized. He fears that systems philosophy promotes bureaucracy, meritocracy, and authoritarianism. Individual responsibility and freedom is gradually handed over to increasingly unified and centralized social institutions that are justified by and dependent upon the systems experts.

Because it forces the reader to think of the larger implications and utility of a particular corner of modern science and technology, this is a useful and challenging book. John Wiley & Sons, N.Y. (1978, 292 pp., \$19.95).

—Dr. William Stallings

THE PROGRAMMER'S ANSI COBOL REFERENCE MANUAL
by Donald A. Sordillo

This unusual book is destined to be an invaluable reference tool for many—not only for working programmers, but for those involved in planning and sales activities dealing with COBOL applications.

The book is organized alphabetically, with a chapter for each letter except X and Y, and consequently there is neither a table of contents nor an index. The reader can look up any reserved word or concept (such as "logical operations") and find not only the official definitions of the desired subject, but well written examples, with many useful diagrams and tables. And perhaps the most useful aspect of Sordillo's approach to the material is his inclusion of excellent cross-references to related concepts so that, unlike the official ANS X3.23-1974 COBOL standard publication, the reader can attain a meaningful understanding of the implications and interrelationships of every element of the language without drowning in a sea of wordy legalisms.

An important dimension to the book is its emphasis on differences between the predecessor (1968) standard and the current one—making this book useful to anyone involved in conversion of older COBOL programs. (A summary of "68 COBOL" appears in Chapter S.) And there is much to recommend the book to those responsible for management of software houses or to computer manufacturers that implement COBOL compilers and may need to upgrade rusty COBOL familiarity. There is even a 20-page section on structured programming, and a single appendix giving the general formats of all language constructs.

In any effort to make sense of so much material, errors can creep into the final product in spite of the most diligent human efforts; the list below is sufficiently small to not represent a serious detraction from the book's quality:

Page 214: "Level 49 cannot be a qualifier" is incorrect since it can serve as a qualifier of a condition-name (level 88 entry).

Page 273: The list of prohibited characters in the CURRENCY SIGN entry is incomplete.

Page 273: It is asserted that ELSE is no longer permitted in IF; the correct wording is that OTHERWISE is no longer permitted.

One addition might be useful in a future edition of this reference book: an appendix concerned with the federal COBOL standard, delineating the four subsets (low, low intermediate, high intermediate, and high) defined in FIPS Publication 21-1. Prentice-Hall, N.Y. (1978, 378 pp., \$22.50).

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REPORTS AND REFERENCES

DISTRIBUTED PROCESSING MANAGEMENT

Booz, Allen and Hamilton, using their consulting experience and the help of a user panel, have surveyed what they consider four of the hottest "hot buttons" facing management today: the technology of distributed processing, human resource problems associated with distributed processing, IBM copies (plug-compatible processors), and inter-organizational networks. The findings, based on a business group meeting of the consultants and panelists, are presented in a 53-page booklet "EDP Hot Buttons," Vol. V, No. 3 of the FAIM Technology Reports series. \$25. FAIM TECHNICAL PRODUCTS, INC., P.O. Box 1013, Melville, NY 11746.

ELECTRONIC MAIL

Electronic Message Systems: The Technological, Market and Regulatory Prospects is a 328-page study prepared for the Federal Communications Commission by Kalba Bowen Associates and the MIT Center for Policy Alternatives. It begins by defining a new acronym for us, EMS—for Electronic Message Systems—which covers terminal to terminal messages which otherwise would have been sent by phone or relegated to the depths of the Postal Service.

Product information is provided (this part comes from interviews with 50 manufacturers), along with a review of the literature (in both bibliographic and abstract form), and analysis prepared by the study team. \$30, prepaid, to KALBA BOWEN ASSOCIATES, INC., 12 Arrow St., Cambridge, MA 02138.

SERIES/1 PRODUCTS

A report from SBS Publishing looks at non-IBM suppliers of Series/1 products, including profiles of vendors (nearly 40 are covered by the analysis), a section on various ways the Series/1 can be used to off-load mainframes, and a discussion of maintenance alternatives. The 250-page report predicts a \$3.5 billion market for Series/1 products by 1982—\$2 billion of software and \$1.5 billion for add-on peripherals.

Non-IBM Suppliers of Series/1 Products, priced at \$350, is available from SBS Publishing, 4320 Stevens Creek Blvd., Suite 190, San Jose, CA 95129 (408) 243-8121.

TWO NEW IN-DEPTH IRD REPORTS

The market for nonimpact printers will double to over \$1 billion by 1988, while the cost of lasers will be reduced to below \$20 each in the same timeframe.

These are the conclusions of International Resource Development, Inc., a market research and management consulting firm that publishes comprehensive studies of equipment markets and technology.

The latest two studies, *Non-Impact Printers* and *Lasers in Reprographics and Communications* provide a good summary introduction to the respective industries. Each report includes an overview discussion of the technology, detailed description of available equipment and the manufacturers, and analysis of the current and future markets. Each study is based in part on interviews with some of the firms themselves; *Non-Impact Printers* includes the results of a 40-firm survey in which the companies reveal their attitudes and plans to purchase. For *Lasers . . .*, over 100 suppliers and users were interviewed. Each report is approximately 200 pp. *Lasers . . .* sells for \$895. *Non-Impact Printers* is \$795. INTERNATIONAL RESOURCE DEVELOPMENT INC., 125 Elm St., New Canaan, CT 06840.

THE OFFICE OF THE FUTURE

What is an automated office, anyhow? It means more than just buying a word processor and throwing out your old manual typewriters, according to the introduction of *Automated Office Solutions*. The new Datapro report sees it as the "gathering point for certain technologies, techniques, and functions normally scattered far and wide in non-automated offices."

These technologies, techniques, and functions are defined and divided into five sections in the two-volume monthly updated reference set as Input, Process, Storage, Output, and Distribution. Each section discusses solutions with regard to available technology with emphasis on personnel and management considerations.

Unlike the technology reports for which Datapro is so well known, which report on individual pieces of equipment and software, this series is a management guide with reports such as "How to Get a Good Consultant" and "How to Conduct a Word Processing Feasibility Study." Although the price tag of \$230 is a little steep for someone with a casual interest, the manager with ongoing office management responsibility would find the service a handy reference. DATAPRO RESEARCH CORP., 1085 Underwood Blvd., Delran, NJ 08075.

ACS IMPACT

The Yankee Group's recent study on the Bell Data Network focuses on its impact on the user, the dp industry, and the communications industry. The anal-

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waukee, Minneapolis, New York, Philadelphia, Pittsburgh, and Washington, DC)

■ AN/UJK-7 OR AN/UJK-20

(Opportunities in New England, New Jersey Shore, Norfolk/Newport News, Virginia, San Diego, California and Washington, D.C.)

■ Intel 8080 or other Microprocessors (These positions in the Houston and Philadelphia areas)



CIRCLE 204 ON READER CARD

ysis includes exploration of AT&T's motivations, acceptance by various kinds of users, and future markets. The report will be updated four times during the year. \$690. THE YANKEE GROUP, Harvard Square, P.O. Box 43, Cambridge, MA 02138 (617) 868-6139.

DOWN-TO-EARTH SATELLITE RESULTS

Satellite Business System's report on Project Prelude is now available, at no charge. The project provided the first linkup of business equipment with high-speed satellite communications capability on an end user's premises. Some objectives of the experiment were: to determine user requirements, assess new applications, and bring together state-of-the-art equipment for evaluation and testing in a realistic business environment. The SBS report uses results from questionnaires filled out by over 1,000 people present at the 52 Project Prelude sessions.

According to the study, teleconferencing is an acceptable, and even in some cases preferable, alternative to regular conferences. The main reason cited for this was time saved in travel and decision making, with cost saving found to be a secondary factor.

40% of the responders, who had previously had little or no familiarity with facsimile communications, said they would use it five times a week or more if it were available. Asked "If you had a terminal and information storage and retrieval capacity would you want to personally operate the terminal?" approximately one fourth of the responders said yes.

A copy of the *Project Prelude Evaluation Report* is available from SBS PUBLIC AFFAIRS DEPT., 8003 Westpark Drive, McLean, VA 22102 (703) 827-2057.

LSI

The increasing tendency of semiconductor manufacturers to obtain large portions of their technological services from outside vendors has resulted in there being so many of these vendors and in such diversity that it is possible to subcontract all the steps in designing and building an LSI device.

A 185-page report from Anderson/Bogert, a high-technology consulting firm, entitled *Vertical Dis-Integration*, outlines factors to consider when thinking "do or buy" and provides information on potential vendors and methods of working with them.

The report, at \$475, is being distributed by ELECTRONICS TREND PUBLICATIONS, 10050 N. Wolfe Rd., S.W. #3, Suite 200, Cupertino, CA 95050.

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Vacationing near us this summer? A brief visit to NCR can be an eye opener. So if you're going to be in our area, plan to stop by. Contact us in advance for a technical interview.



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- Interactive Processing
- Data Base Design
- Performance Measurement & Analysis
- Configuration Management
- File Access Methods
- Operating System Development
- Compiler Design/Development
- Firmware Development
- Diagnostic Programming
- Test Systems Development
- Software Quality Assurance
- MICR Proof Of Deposit Software
- Systems Architecture

Immediate Openings— Hardware areas:

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- MICR/OCR/OMR Engineering
- Memory Device Engineering
- Logic Design Engineering
- Components Engineering
- Systems Architecture
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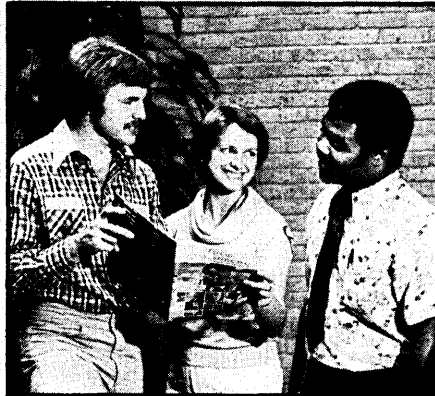
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dimensional seismic data gathering and processing, an exclusive approach to petroleum exploration

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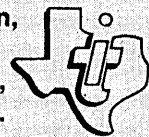
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CIRCLE 219 ON READER CARD

VENDOR LITERATURE

MODEMS

The Special Offer Division of this well-known modem-maker has published a 24-page catalog of factory tested and warranted used equipment available for purchase or lease at reduced rates. In addition to describing modems (from 2400bps to 9600bps), the catalog lists accessories, such as test sets, solid state buffers, and registered connecting devices. The original price is given with each unit's reduced price for the purpose of comparison. Maintenance terms are explained and a maintenance agreement is included, along with a lease agreement and a sales order form. RACAL-MILGO INFORMATION SYSTEMS, INC., Miami, Fla.

FOR COPY CIRCLE 365 ON READER CARD

IMAGE ANALYSIS

The Magiscan Image Analysis System is the topic of an eight-page, illustrated brochure. Photographs, schematics, and text detail applications of the system. A section entitled "how it works" uses a schematic and text to describe the steps from image acquisition to image output; the discussion covers digitizing the image, processing, amendment, and measurement. One page is devoted to the introduction of the three user programming languages, then each lan-

Magiscan Image Analysis Systems



guage is given its own page for a more detailed treatment. JOYCE-LOEBL, Woburn, Mass.

FOR COPY CIRCLE 377 ON READER CARD

BUSINESS SYSTEMS

A 12-page, illustrated brochure describes this vendor's model 700 and 800 business systems. A single page overview covers the company, its software, hardware, and services. Two pages are devoted to a discussion of the business environments these systems fit into. In a

more detailed, three-page discussion the vendor examines its software offerings, including its transaction controller, screen formatting, data input validation, telecommunications control, operating system, file system, and utility packages. Hardware also gets a three-page treatment, with descriptions of both systems in their smallest and largest configurations. Processors, crt's, disks, and other peripherals are described. The booklet concludes with the details on service offerings, and a final statement on the company. INTERDATA DIV., Perkin-Elmer Corp., Oceanport, N.J.

FOR COPY CIRCLE 366 ON READER CARD

CALCULATORS

An eight-page, four-color brochure describes the three scientific members of this vendor's recently announced E-Series of pocket calculators. After a one-page overview of the three units, each is treated in detail on its own two-page spread. Each is pictured, and text describes its functions. The manuals and accessories supplied with each calculator also are listed. Physical specifications and the limited warranty common to all three are described on the closing page. HEWLETT-PACKARD CO., Palo Alto, Calif.

FOR COPY CIRCLE 371 ON READER CARD

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CIRCLE 202 ON READER CARD

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MIS DIRECTOR to \$35,000. Int'l. natural resources client seeks degreed self starter w/5-10 yrs exp in financial & mg systems. Will assume corporate-wide mgmt. resp. & have staff reporting. Southeast location. Refer RM.

MGR. DATA BASE-PHOENIX to \$32,000. "Fortune 500" firm seeks indiv. to direct file access methods for multi-development units. Req's degree, 5-10 yrs hvy tech bkgr, effective communicator. Excellent growth potential in a low cost-of-living area. Refer RS.

EDP AUDITORS to \$26,500. "Fortune 500" firm, due to continued growth, currently has opportunity available for sev. EDP auditors w/2+ yrs exp. Past system/programming bkgrd preferred. Full career benefits. Refer JS.

SYSTEMS ANALYSTS, \$19,000-\$25,000. DC/VA area. Rapid expansion creates openings w/20 leading financial inst. Prefer COBOL, large scale IBM. Accounting, banking or insurance exp. a plus. Refer DM.

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COURSES

DATACOMM SOFTWARE DESIGN

Software design for remote batch, message switching, time-sharing, transaction processing, packet switching, and distributed systems will be covered at both the applications and operating system levels. Classroom and workshop sessions both will be provided. Oct. 11-13 and Feb. 28-March 2 (1979) in Washington, D.C. Fee: \$430. Contact: Martha Augustin, Continuing Engineering Education, George Washington University, Washington, DC 20052 (800) 424-9773 or (202) 676-6106.

MINICOMPUTER APPLICATIONS

The course will attempt to cover the hidden costs of software, experiences in applying minis to business functions, the technical knowledge required to use minis well, evaluation of mini vendors, considerations of user company management and politics, software, implementation, and more. \$490. Oct. 9-11 in Dallas and Nov. 20-22 in New York. Contact: Claire Summer, American Management Associations, 135 W. 50th St., New York, NY 10020 (212) 586-8100.

SOFTWARE PHYSICS & CAPACITY MANAGEMENT

For those responsible for computer measurement activities for performance, workload forecasting, and equipment planning. Oct. 2-6 in Toronto, Oct. 16-20 in Minneapolis, Nov. 13-17 in Washington, D.C., and Dec. 11-15 in Phoenix. \$625 (\$375 for members of the Institute for Software Engineering). Contact: The Institute for Software Engineering, P.O. Box 637, Palo Alto, CA 94302 (415) 493-0300.

COMPUTER GRAPHICS

Carl Machower will conduct a course entitled "Knowing and Understanding Computer Graphics" in San Francisco Oct. 4-6 and in Chicago Dec. 13-15. Contact: Robert Sanzo, Frost & Sullivan, Inc., 106 Fulton St., New York NY 10038 (212) 233-1080.

DATAPRO SEMINARS

Datapro's fall course lineup includes the following subjects: Data communications (both an introductory and an advanced course are offered), data base management systems, word processing, integration of dp systems and word processing, effective computer operations management, computer performance

measurement, an introduction to data processing, organization communications for increased dp benefits and use, distributed systems, selection and use of minicomputers and small business computers, dp project management, network design, and understanding and purchasing proprietary software. \$485 (\$435 for Datapro subscribers). Contact: Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075 (800) 257-9406.

LASER BEAM INFORMATION SYSTEMS

The course will cover the application of laser technology to image and data manipulation in the forms of scanning, transmission, reproduction and control. Oct. 24-26 in Boston, Dec. 4-6 in Atlanta, and March 5-7 (1979) in Chicago. Contact: Heidi E. Kaplan, Dept. 20 NR, New York Management Center, 360 Lexington Ave., New York, NY 10017 (212) 953-7262.

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16-18. \$300. Contact: C.W. Little, Jr., Univ. of Wisconsin Extension, Dept. of Engineering, 432 North Lake St., Madison, WI 53706 (608) 262-2061.

DATA BASE COURSES

Three separate courses are offered by PDC: Planning and Initiating the Data Base System Project, to be held Oct. 16 and 17 in Los Angeles and Nov. 13 and 14 in Houston; DBMS Packages: Comparison and Selection, to be held Oct. 18 and 19 in Los Angeles and Oct. 30 and 31 in New York; Data Administration/Data Dictionary, to be held Nov. 1 and 2 in New York and Nov. 15 and 16 in Houston. Each is \$375. Contact: Ms. Cheryl Palent, Performance Development Corp., 1101 State Road, Bldg. M, Princeton, NJ 08540 (609) 921-3770.

FAST FOURIER

A course on Modern Fast Fourier Transform Theory, to include techniques and applications, will be held in San Diego Oct. 16-18. Contact: Dr. Donald J. Rauch, Evelving Technology Seminars, 3720 Jennings St., San Diego, CA 92106 (714) 224-3788.

PERIODICALS

CUSTOMER NEWSLETTER

IMSAI Manufacturing Corp. offers a bi-monthly glossy publication "to establish communication with all the people who purchased IMSAI equipment, and as the capabilities, the usefulness and the performance of our product are improved or expanded, to make that information available." *The IMSAider* welcomes articles and letters from users concerning applications, software enhancements, experience with hardware, user groups, and seminars and events. \$4, yearly. IMSAI MANUFACTURING CORP., 14860 Wicks Blvd., San Leandro, CA 94577 (415) 483-2093.

PERSONAL COMPUTING

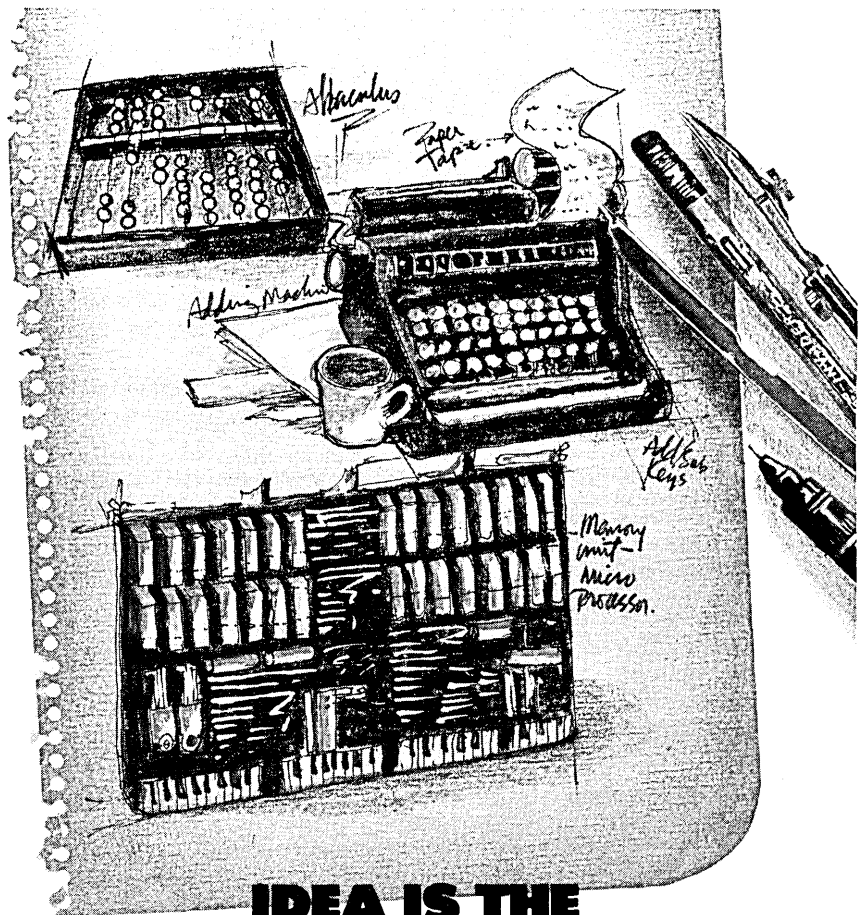
A monthly newsletter entitled *Personal Computing Industry Report* is now available. Its stated purpose is to provide reporting of observations, product announcements, market forecasts, interviews, insights, and industry analysis in a concise and relatively informal format. Regular departments will cover small business computing, semiconductor LSI, memory technology, retailing, software, peripherals, communications, trade shows, company profiles, and other areas. \$195 for a monthly subscription. VANTAGE RESEARCH, INC., 770 Welch Road, Suite 154, Palo Alto, CA 94304 (415) 965-4900.

MICROPROCESSOR NEWSLETTER

The Microprocessor Newsletter features a glossary for managers and corporate executives of "the basic terms necessary for communication with others in the field, i.e., manufacturers, engineers, etc." The newsletter provides news about micro users and makers, and features course information. Press releases about microprocessor ideas, applications and other news are solicited by the publisher. Yearly subscription is \$75. CARZO ASSOCIATES, 1210A King St., Wilmington, DE 19801.

INFORMATION TECHNOLOGY

A newsletter entitled *Impact: Information Technology* is Published by the Administrative Management Society, a nonprofit organization for professional managers, the newsletter will feature articles on the subjects of data processing, records management, reprographics, telecommunications, and word processing, with attention toward the integration of these fields. A monthly subscription is \$30. ADMINISTRATIVE MANAGEMENT SOCIETY, Maryland Road, Willow Grove, PA 19090 (215) 659-4300. *



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CIRCLE 211 ON READER CARD

SOFTWARE ENGINEERS...

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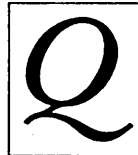
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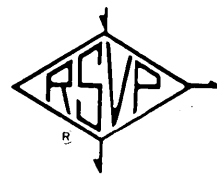
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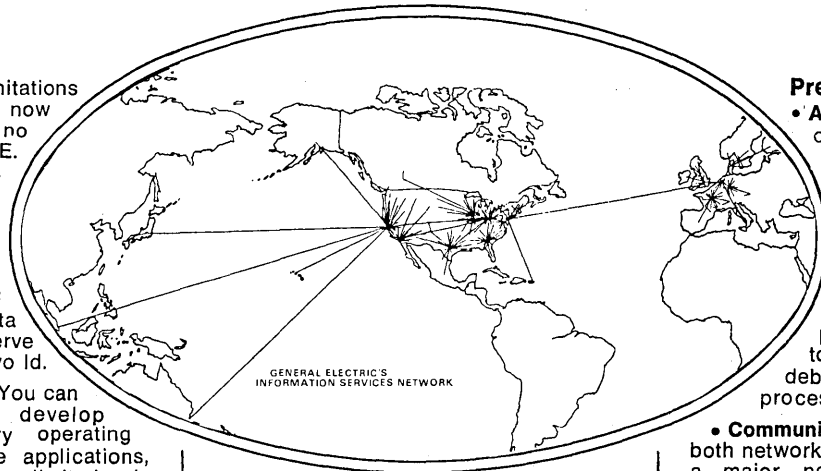
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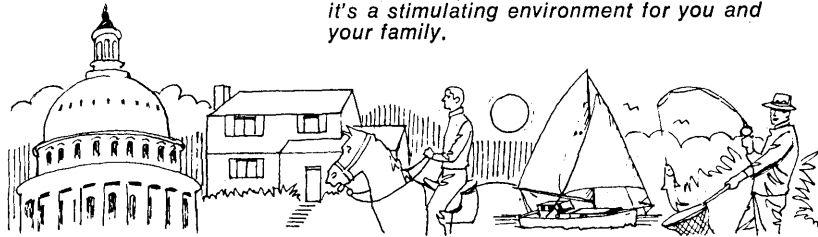
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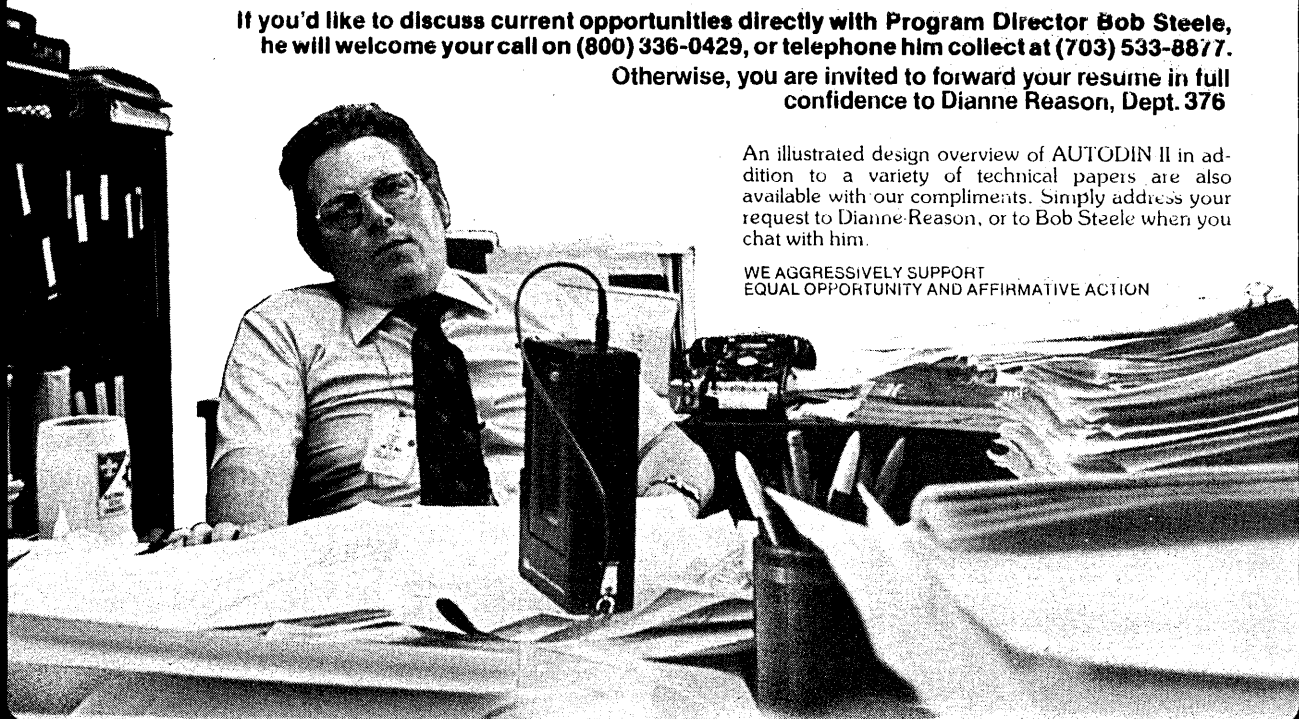
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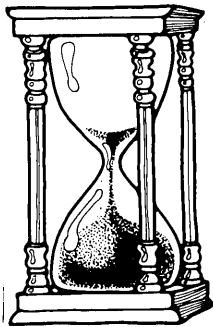
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for one, for the *use* of applications programs, while the state's tax statute expressly limits the tax to operating system programs "needed to make the computer operate." Thus applications programs are being classified as operating system programs—retroactively no less!

Usually the problem boils down to whether software is tangible or intangible. Unfortunately, the courts and taxing bodies haven't been educated to the true nature of software. Finding cards and magnetic tape to be quite tangible, they have often determined that software is open to taxation. The counterargument is already there, in the law, however; we must simply learn how to find it and how to use it.

For example, accountants, lawyers, doctors, typists, etc., all generally enjoy intangible tax exempt status for their work products. Similarly, the typed sheet of a secretary is classified as intangible and not taxable. But the same typed sheet read by a computer is classified as tangible and taxed. The input paper tape of a court reporter is generally classified as intangible, while the input paper or mag tape for a computer is classified as tangible. (However, the same computer tape used to carry output is generally classified as intangible. How's that?)

A TAX FOR EVERY OCCASION

Whether you're a seller, buyer, user, or employee the software sales tax issue affects you. However, the sales tax on software is just the beginning. Where there is a sales tax, there is a use tax. That can extend the tax into the users' laps—even a tax *within* companies on the internal services of data processors. (It's being tried.) If the tax arises under statutes authorizing a tax on tangible personal property, as in most states taxing software, the property tax man can be next. And property tax can amount to 50% of the original cost of computer software over a 10 year period.

There are various ways in which a sales tax on software can be created. It could arise through an adverse court decision or legislative lawmaking. For the most part, however, this form of taxation evolves through the rule-making authority of a state agency empowered to administer the state sales tax law. Generally, the law itself provides for the taxation of things corporeal, and the agency arbitrarily classifies software as tangible personal property without properly considering the facts.

For example, California, where it all began, has been imposing an irrational tax on data processors for several years. The reason the tax appears irrational is that the rule itself levying the tax, rule 1502, expressly and specifically exempts the product of programmers, analysts, and technical help. Many firms have fought the tax, but the cases have been kept to individual terms. Thus, up to now California has successfully prevented data processors from achieving any general administrative or judicial remedy of the problem.

On May 4th all that might have changed. After the successful completion of a similar action in New York, a California group called STAG (Sales Tax Action Group) was granted a formal, administrative, rule-making hearing by the State of California. Data processors and their attorneys, however, faltered. After less than two hours, the state was allowed to end the much-awaited hearing before all witnesses were heard. Why had the industry again failed to present a complete, favorable and appealable record before continuing private discussions?

The answer lies in a fallacious belief that deference to agency desires at the expense of due process will win special favor. In reality the acquiescence constitutes a surrender of valuable Fourteenth Amendment rights: the right to reasonable government action, the right to a rational classification under the law, and the right to judicial review.

By agreeing to terminate the hearing before its conclusion, data processors deprived themselves of any judicial review of that particular agency action they might have invoked. Meanwhile, they must continue paying taxes that are

in many cases unlawful; and by the time the tax is ruled invalid—if ever—much of the monies paid into government will have been cut off from them by the statute of limitations.

The dp industry doesn't always lose, however. Eight states have changed their classification of software to intangible and nontaxable since last year: Alabama, Florida, New Jersey, New York, Vermont, Louisiana, Minnesota, and Wisconsin. The catalyst for these actions is the 1976 Tennessee Tidwell Supreme Court decision, which is as noteworthy for its breadth as it is for its declaration of intangibility. For the first time, a state Supreme Court included all of computer input—"information and directions . . ."—in the intangible classification, not just programs.

Yet nowhere do the facts mock reason more than in Tennessee. The state's ploy of calling intangible software tangible was first introduced into law in 1977 by adding software to the definition of tangible personal property. In 1978 the law was amended by moving software into the sales tax category, purportedly for the purpose of selectively removing it from the use tax. Now software is both intangible and tangible in Tennessee at the same time, depending on whether a sales or a use tax is under consideration!

Tennessee's own legislative deliberations show the tax is flagrantly unreasonable and irrational. The deliberations of March 16, 1977 on the original bill hold clearly that software constitutes professional services, much the same as law and accounting, and that software should be accorded the same treatment under the tax law as other professions; yet despite a constitutional right to a rational classification, the legislature ignored its own findings and classified software as tangible and taxable anyway:

Senator Hamilton (sponsor of the bill): "Mr. Speaker. Members of the Senate. This bill would include computer software within the definition of tangible personal property contained in the state sales tax statutes . . . Under this bill, the sale of computer tapes and cards containing programs would be taxable. Pending any questions, Mr. Speaker, I move its passage on it."

Senator Higgs: "I find some inconsistency coming from . . . the revenue department wanting to exempt professional services from a tax . . . But software is computer programming and it is the expertise of the programmer of professional services that you're fixing to put a tax here. Now the cards and tapes so far have always been taxable. So I'm beginning to wonder what the revenue department and administration are thinking over there."

Senator Hamilton: "Well, I can tell you this, that under the recent court ruling computer tapes and stuff cannot be taxed as tangible personal property and this (the bill) in effect was supposed to remedy that situation where we actually kept in practice that which we had been practicing for years."

Senator Higgs: "Well, we've been paying sales tax on tape, bunch of tape and stuff, for as long as I've known. Even the rent of the computer is taxed. But the programming itself, which is the professional services of an individual, much the same as an attorney or an accountant or an anthropologist, ah, it comes from inside his head, he puts it down in a formula, and if we're going to tax these professional services, maybe we ought to put them all under."

Senator Hamilton: "I couldn't agree with you more on that."

Speaker of the Senate: "Is there any further discussion? . . . Take the poll. Ayes - 23. No - 4. 32 not voting. Senate Bill 224 having received constitutional majority and let it pass."

At this point, Tennessee's lawmakers have conceded software is a professional service but, inexplicably, have simultaneously classified that service as tangible.

In doing so, Tennessee has set a clear precedent for others to follow as California had done years before. Tennes-

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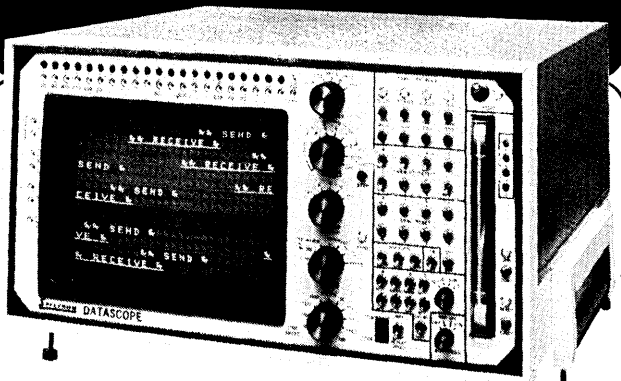
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see is teaching other states how to turn the dp industry's victories into defeats through the arbitrary redefinition of words, as California had first shown the states how to tax us under statutes authorizing a tax on tangible personal property.

My interest in software's legislative history in Tennessee is deeply rooted. It was during the time of my fight with Florida in 1976 against the \$45,000 retroactive assessment the state had levied on me (*Nova Computing Services, Inc. vs. Askeu*) that the Tennessee Tidwell decision was handed down. While the opinion was not binding on Florida, the hearing officer in my case found it persuasive. Thus, it helped tip the scales in Florida, as it has in other states since then.

FOLLOW RHODE ISLAND

A powerlessness to remedy my \$45,000 assessment except through spending \$50,000 for lawyers' fees forced me into this issue. A view of how poorly data processors are represented in such cases has kept me involved. Fortunately, that representation can be improved.

Unlike many actions to date, the Rhode Island case (*Puritan Life Insurance Co. vs. Dept. of Revenue*) shows the benefit of close cooperation between lawyers and laymen. For three days prior to the hearing in April, data processors and their counselors huddled in intensive preparation. The hard work paid off in pinpoint examination during the hearing, leading to recorded testimony which finally puts on the record a meaningful description of what software is.

The testimony hasn't led to a victory for us, yet, but when the Rhode Island case is decided it will be decided on the record, not on governmental whim. Even if the case goes against us, the record may show enough in our favor for appeal to federal courts under the Fourteenth Amendment. That's not a guaranteed win either, but at least it's another chance.

Just as the Tennessee and California examples have shown other states how to get away with levying taxes on the sale of software, the Rhode Island case shows how the dp industry can fight back—by educating the lawyers and courts, and by standing up for its rights. But to do this, the data processing industry must educate itself. It must become aware of the nature and size of the problem, and then, somehow, come to a consensus and unite on the issue. The alternative is to sit back, as we are, and watch as sales, use, and property taxes—and perhaps others—are levied on those software products which are sold to us and those which we build for our own use.


The amount of money we are talking about is substantial. It is not just 5% or 6% on top of a sale; it may amount to 50% of a product's value or more over the life of the product. That is worth fighting over.

Mr. Sherin is the president of Nova Computing Services, Inc., in Miami, and a paralegal with the law firm of Jack Large in Ft. Lauderdale. He also acts as a nonjudicial legislative advisor to the DPMA.

— Robert M. Sherin

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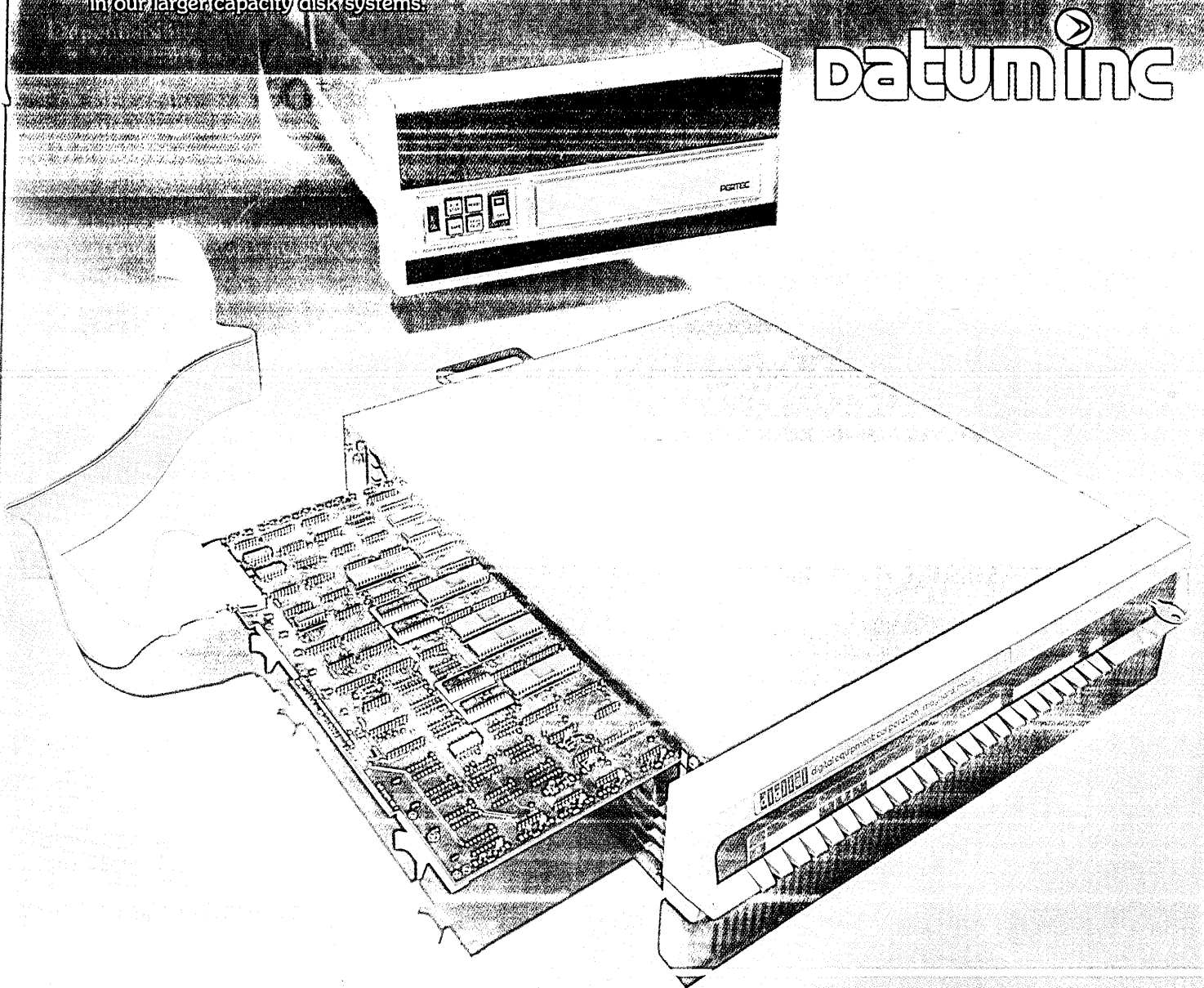
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