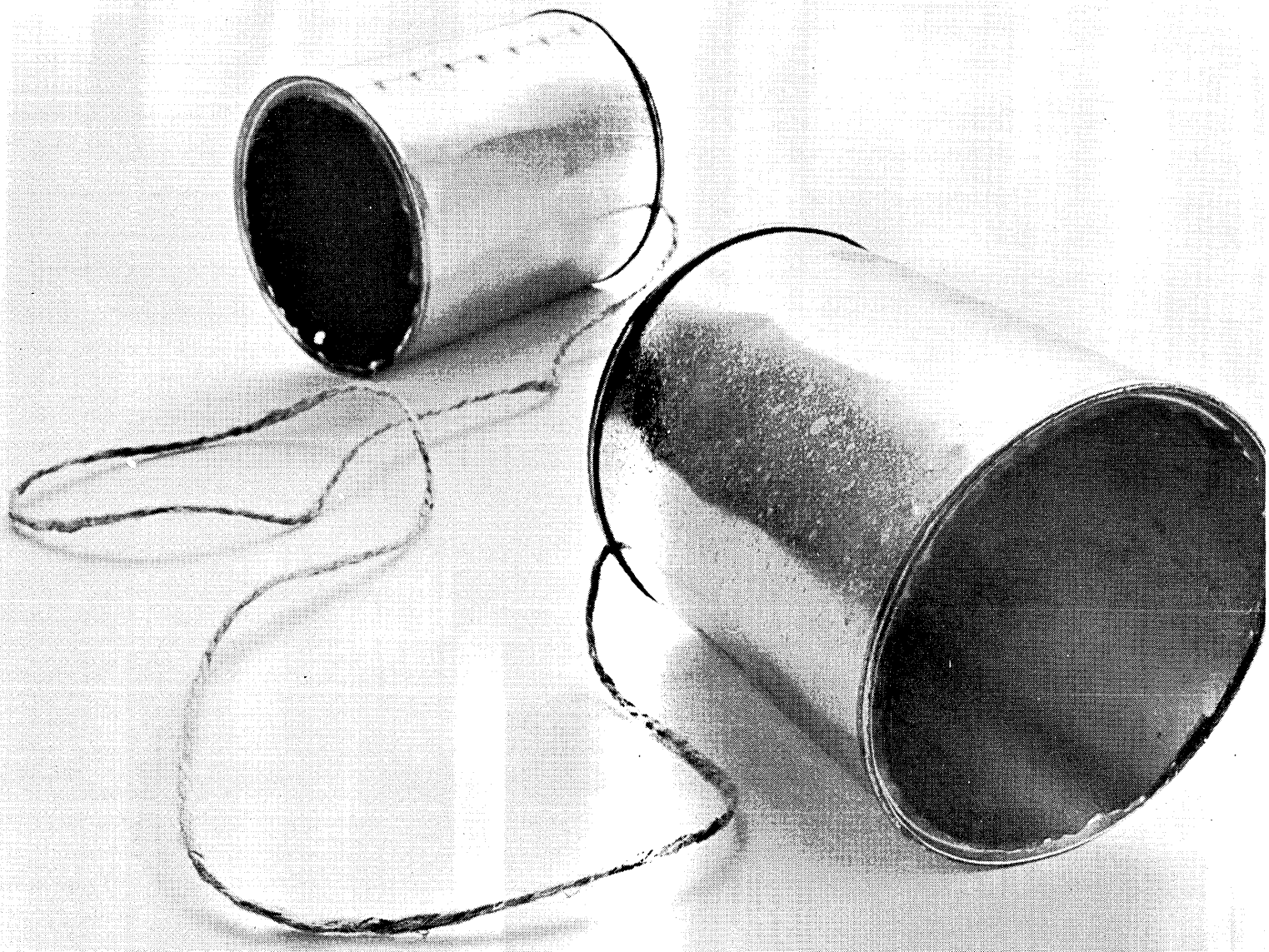
DATAMATION® 71

March 1

MANAGING THE CAMPUS COMPUTERS



If your communications problems are more complex, we've got a solution

It's Varian's 620/f-DC Data-Communications System. Remember, as a kid, when your biggest problem in tin-can communications was not letting the string touch anything? Today you're more sophisticated—and your problems more complex. We can help.

Varian's new 620/f-DC is a total data-communications system that offers economy and speed for communications networks. As a communications preprocessor, it relieves the large computer of mundane tasks by collecting data from many sources and feeding it directly and efficiently into your large computer. The 620/f-DC, as a data concentrator or message switcher, handles up to 64 data lines at higher throughputs than any other system available.

Consider all its capabilities—from speed to modularity to reducing overhead—and it becomes one of the most economical data communicators available.

Our 620/f-DC won't beat the low cost of tin-can and string, but it will make your communications dollar stretch. Write the Big Company in Small Computers.

varian data machines

The Big Company in Small Computers

U.S. Sales Offices: Downey (213-927-1371), San Diego (714-298-9292), San Francisco (415-968-9996), Calif./Washington (301-773-6770), D.C./Chicago (312-692-7184), Ill./Waltham (617-899-6072), Mass./Detroit (313-645-9950), Mich./Minneapolis (612-926-6571), Minn./Albuquerque (505-298-5570), N. Mex./New Rochelle (914-636-8118), Syracuse (315-437-6595), N.Y./Fort Washington (215-643-2355), Pa./Dallas (214-231-5145), Houston (713-781-0105), Tex. Other offices worldwide/Varian Data Machines, a Varian subsidiary, 2722 Michelson Drive, Irvine, California 92664. Telephone 714/833-2400.

CIRCLE 1 ON READER CARD

An easier keyboard for your operator... An advanced tape station for your computer

The Tally Datascribe emphasizes simple operation with your keypunch operator in mind . . . and a host of versatile data handling options for more efficient utilization of a key-to-tape recorder. If you already have key-to-tape recording and communications equipment, you'll be especially interested in Datascribe. That's because Datascribe designers took the time to reflect on the shortcomings of all the earlier key-to-tape equipment in order to build a better machine.

The keyboard is virtually identical to the conventional keypunch keyboard. Operation is so simple you can learn from the manual if you choose. For training purposes, all data is displayed in English language. Both the 7 and 9 track units are identical in operation and features.

The Datascribe system is one basic unit which, with the addition of appropriate plug-in options, can be additionally used as a remote data terminal, pooler, high speed communicator or high speed print station.

The Datascribe offers a unique and highly efficient data compression feature. In the transmission mode, one character can be used to represent many when data is identical to the preceding data or preceding record. Datascribe operates over dial up telephone lines. Both supply and take-up for full 10½" reels is standard.

And this is just the beginning. Call your nearest Tally regional office or contact us here for full details.

Tally Corporation, 8301 South 180th Street, Kent, Washington 98031. Phone (206) 251-5500.

Regional Offices:

Chicago: 33 North Addison Road, Addison, Illinois 60101 (312) 279-9200

Dallas: 2339 Inwood Plaza, Dallas, Texas 75235 (214) 521-5657

Los Angeles: 501 N. Golden Circle Drive, Santa Ana, California 92705 (714) 542-1196

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Richmond: 5404 Distributor Drive, Richmond, Virginia 23225 (703) 231-0259

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England: Tally, Ltd., Tally House, 7 Cremyll Road, Reading RG1 8NQ, Berkshire Reading 580-142

TALLY®
Vanguard Series

CIRCLE 4 ON READER CARD

SUZY'S MARRIED TO OUR AD MANAGER

(they fight a lot)

"My husband Clyde?
Oh, he's all right. Good husband, good manager — but he never wants to say *enough* about a good thing. PI's new 1217/19 customized digital recorder, for instance. That's why we have an occasional spat.

"If it were left to him, he'd just tell you the 1217/19 is synchronous and incremental, up to 1600 bpi, and features IBM compatibility, 7 or 9 channels. 'Never write too much in an ad,' he says, 'people won't read it.'

"Phooey!
You're reading this, aren't you?

"The rest of the good news (with apologies to no one): the 1217/19 also comes in 7 and 9 channels read-read, remotely selectable. It interfaces with your existing equipment, and is ideal for such uses as process control, off-line data processing, key-to-tape and tape-to-tape transfer, minicomputers, and many more.

"Every unit is easily field modified to meet new requirements — you simply choose the modular features you want. Result? A top-quality *custom* recorder at surprisingly low cost!

"If you'd like more information on the *enchanting* 1217/19, call, TWX or write Clyde or one of the other boys — Norv, Ridge or Konrad. Better yet, if you want the *full* story, call me!"

PI

PRECISION INSTRUMENT

3170 Porter Drive, Palo Alto, California 94304 ■ Phone (415) 493-2222 ■ TWX No. 910-373-1752

CIRCLE 30 ON READER CARD

DATAMATION 71®

MARCH 1, 1971
volume 17 number 5

About the Cover

As the computer intrudes, the classic structure crumbles. Roy Lichtenstein's great "Temple of Apollo" states the case with impact. Its machine-dot background contrasts with the dying colonnade reminding computer people to utilize their machines with man as well as system management in mind. The painting is reproduced here courtesy of Mr. and Mrs. Robert A. Rowan, Los Angeles.

departments

DATAMATION®

MARCH 1, 1971
volume 17 number 5
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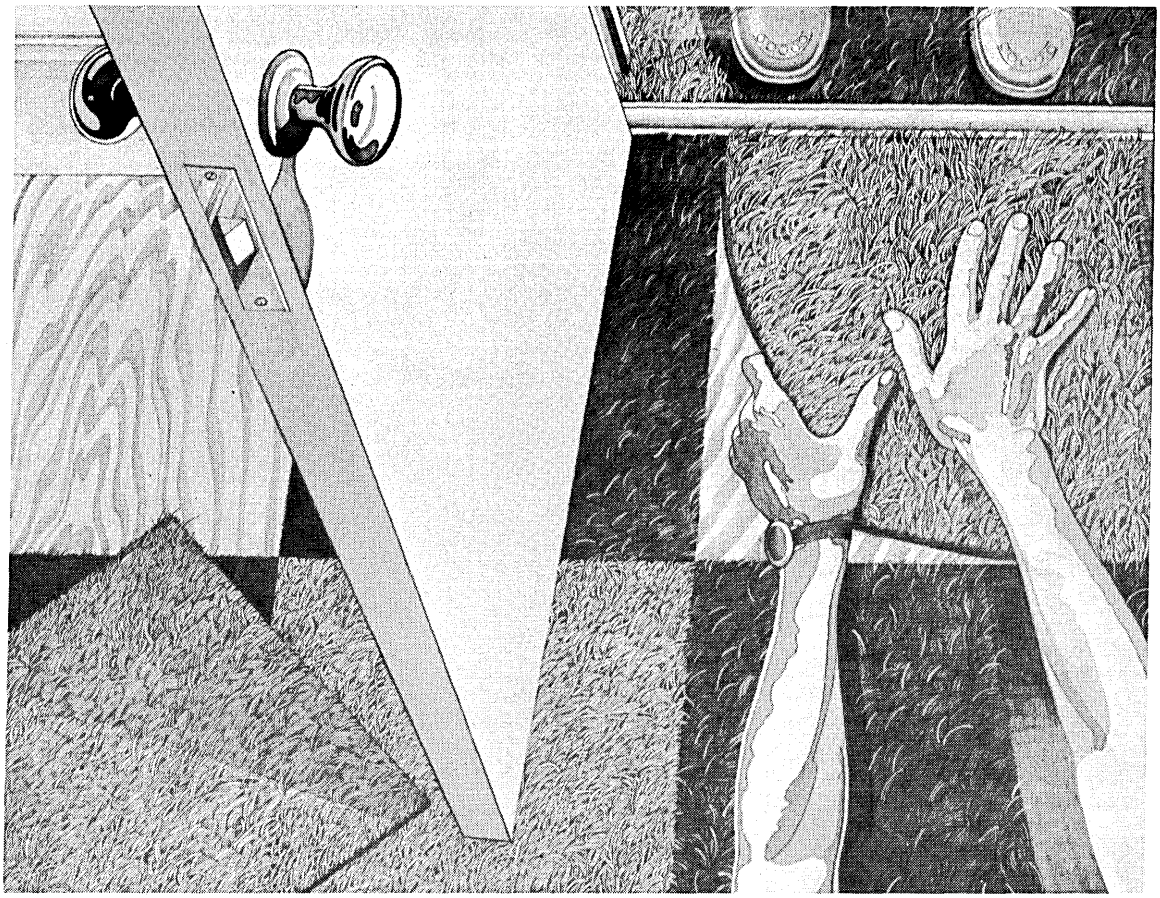
Printed by Beslow Associates, Inc.

No one beats a path through your computer room on Heugatile Carpet Squares



Light traffic area

Heavy traffic area

In the time other carpets are developing bedraggled trails of wear in the heavy traffic lanes, Heugatiles stay fresh and new—two to three times longer.

The secret is rotation. Before Heugatiles are worn by heavy traffic, you simply lift them out and easily move them to light traffic areas.

And underfloor access needn't be a headache. The one floor covering that licks this problem efficiently for computer rooms is Heugatile. Our carpet squares lock solidly in position by their own vacuum. But when you need to get to underfloor switches and control cables, up they come with no effort whatsoever. No glue, tape, tack strip or pad is needed, ever.

Noise problems? Heugatiles help silence the 'drum effect' created by vibrations from suspended floors. No static build-up either.

And you don't have to buy Heugatile. You can lease it, just as you would lease any equipment—with a service contract that guarantees continuing satisfaction. You can lease as little as 200 square yards, too.

Heugatile's special construction hides soil. Cleans easier. They're made by the most experienced manufacturer of carpet squares in the world.

Send in the coupon today for more information.

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Dept. D3–1

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Company _____

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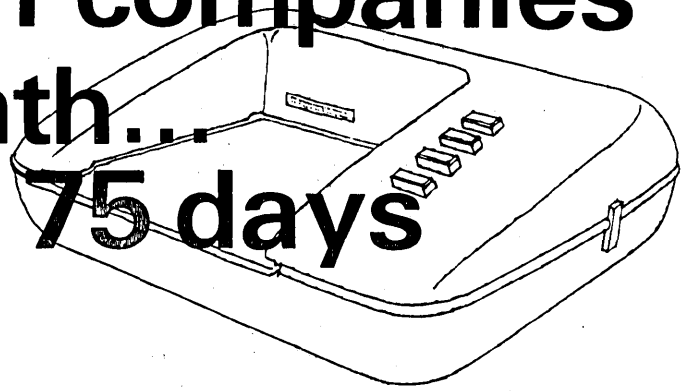
the DATAFLOW optical page reading system started working for eighteen companies this month... delivery 75 days



with the DATAFLOW system you achieve fully-integrated Optical Page Reading Capability for Data Processing Data Conversion Typesetting at a far lower cost than ever before

Eighteen companies received their DATAFLOW systems this month and put them right to work...lowering processing costs (a management consideration on any expenditure today)

call or write...in a matter of days, a datatype representative will show you how to put the DATAFLOW system to work for you—and 75 days later—the system will be wherever you designate—working.

let us hear about your particular application—or problem—now.

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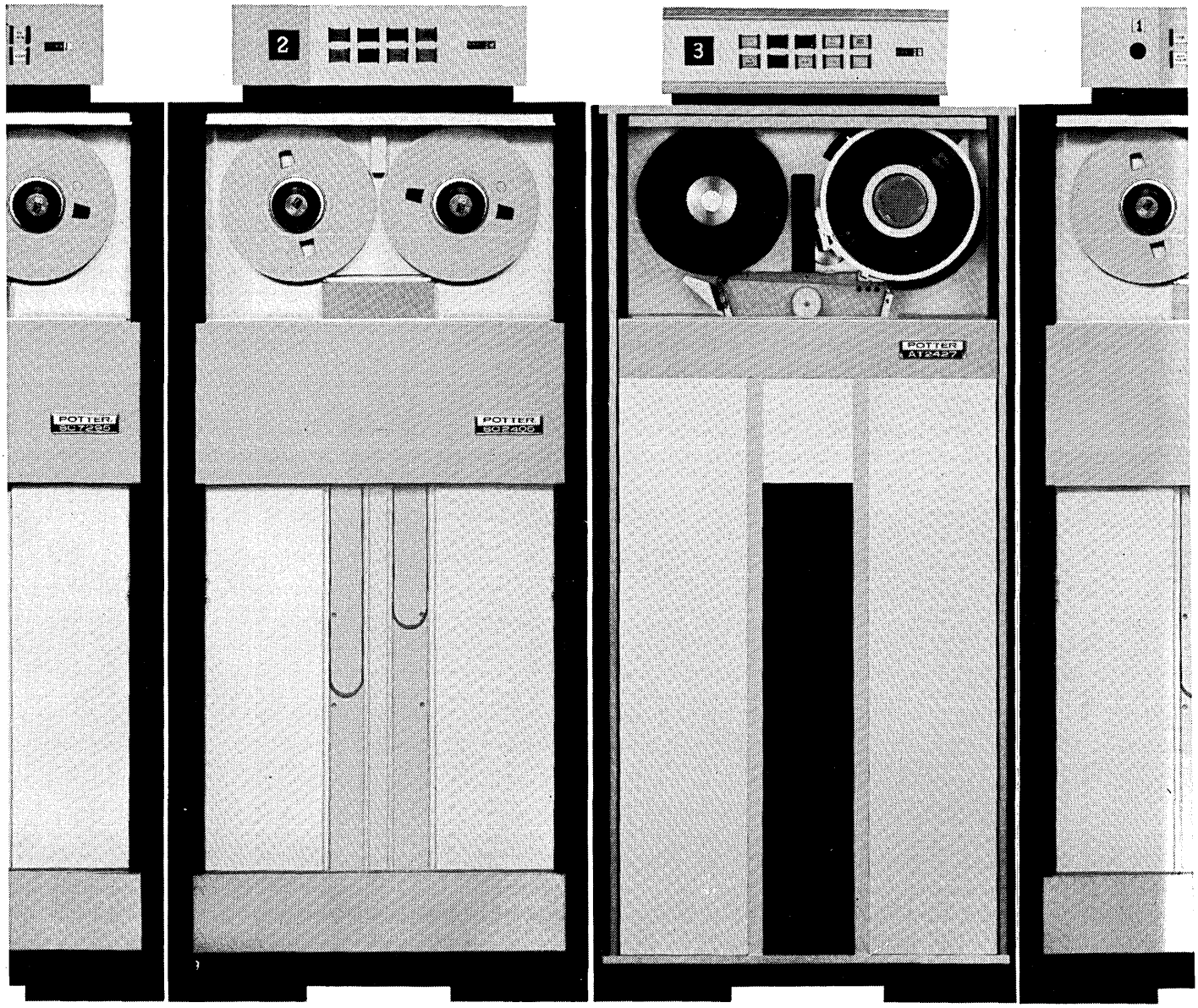
CALENDAR

DATE	EVENT/SPONSOR	LOCATION	CONTACT	COST
March 8-9	Impact of Digital Computer on Fluid Power Systems	Madison, Wis.	Univ. of Wisconsin 725 Extension Bldg. Madison, Wis. 53706	$70
March 8-10	AMA Management Systems EDP Conference	New York City	American Mgt. Assn. 135 W. 50th St. New York, N.Y. 10020	Unknown
March 9-11	ASM, AMS Business Equipment Show	Tulsa, Okla.	A. O. Oyler, BEST Box 141 Tulsa, Okla. 74102	Free admission $215, exhibitors
March 10-12	4th Annual Simulation Symposium	Tampa, Fla.	Annual Simulation Symp. P.O. Box 1155 Tampa, Fla. 33601	$85
March 22-24	Numerical Control Society's 8th Annual Conference	Anaheim, Calif.	NCS 44 Nassau St. Princeton, N.J. 08540	$95, members $125, others
March 22-24	9th Annual Symposium on Biomathematics & Computer Science in Life Sciences	Houston, Texas	Office of the Dean Univ. of Tex. Graduate School of Biomedical Scs. Houston, Texas 77025	Unknown
March 23-26	Information Industry Association 3rd Annual Meeting	Lancaster, Pa.	IIA 1025 15th St. NW Washington, D.C. 20005	$75, members $125, others $25, spouses
March 29-April 2	British Computer Society Datafair 71	London	British Computer Soc. 29 Portland Pl. London, W.1, England	Unknown
April 1-2	ACM Symposium on Information Storage & Retrieval	College Park, Md.	Dr. Jack Minker University of Maryland College Park, Md.	Unknown
April 11-13	COMPSO West	Los Angeles	Computer Expositions, Inc. 37 W. 31st St. New York, N.Y. 10018	Free preregistered $2 at door
April 14-15	ISA, IEEE Electronics & Instrumentation Conference	Cincinnati	William Meinders Husky Products, Inc. 7405 Industrial Rd. Florence, Ky. 41042	$2 registration
May 2-5	Assoc. of Business Forms Mfrs. Annual Meeting	Miami	ABFM P.O. Box 5737 Washington, D.C. 20014	Unknown
May 4-6	SID Int'l. Symposium	Philadelphia	Lewis Winner 152 W. 42nd St. New York, N.Y. 10036	Unknown
May 18-20	Spring Joint Computer Conference	Atlantic City	AFIPS 210 Summit Ave. Montvale, N.J. 07645	Preregistration $20, members $50, others
May 25-28	20th Annual Convention National Microfilm Assn.	Washington, D.C.	NMA Suite 1101 8728 Colesville Rd. Silver Spring, Md. 20910	Unknown
June 7-9	ComFor (International Computer Forum & Expo)	Chicago	ComFor 1211 W. 22nd St. Oak Brook, Ill. 60521	Unknown
June 22-25	DPMA Conference & Expo	Houston	OPMA 505 Busse Highway Park Ridge, Ill. 60068	Unknown

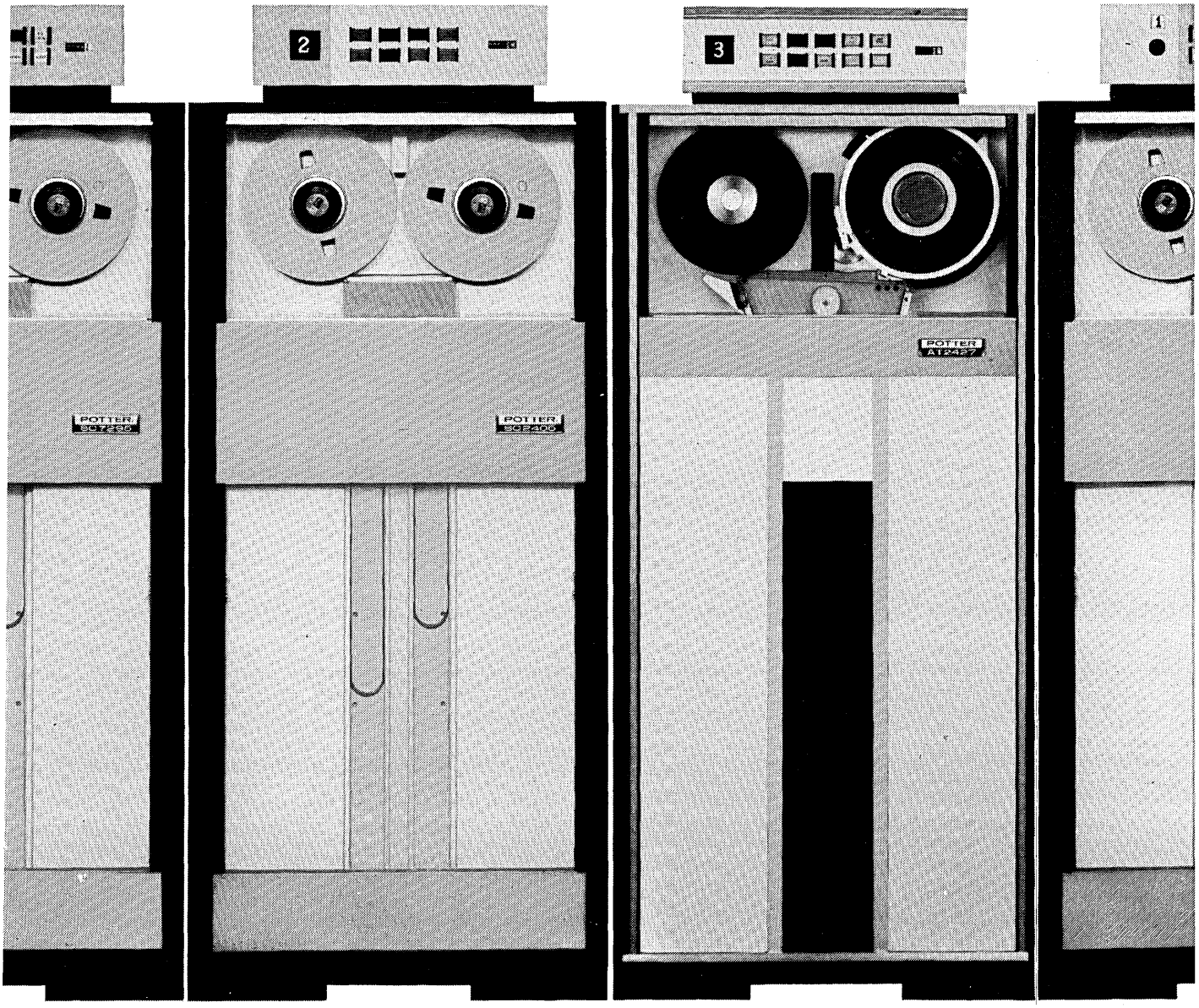
LOW PRICE IS
THE POTTER TAP
THERE'S ALSO TR



All 15 models of Potter's "plug-to-plug" Magnetic Tape Unit line are now supplied with our new Hard Coat recording head. The result is a series of tape units which can operate on IBM systems for over 2000 hours without adjustment for wear. This HARDWARE RELIABILITY insures you of better system reliability — less down-time.

Then there's Potter's DATA RELIABILITY that assures you o error-free output. Such things as single capstan drive, retractable read/write heads and automatic threading all work towarc eliminating data drop-outs and errors.

ONLY PART OF E DRIVE STORY... IPLE RELIABILITY.



Finally, there's SERVICE RELIABILITY. Potter maintains a nation-wide staff of trained field engineers to give you fast, dependable service . . . to keep your down-time to an absolute minimum . . . to keep your jobs on schedule.

There are more Potter manufactured tape drives in use on IBM systems than any other independent make. For tape drives, disk drives or data terminals, call Potter first.

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Potter. A lot more than less expensive.

Media is the tape with the lifetime guarantee*.

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Our reasoning went like this. It doesn't much matter how good a tape is if you can't get it when you need it. *After* you get it, the quality begins to matter. And the longer you have it, and the less trouble you have *with* it, the more likely that your future orders will be for Media tape.

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* With proper care and regular maintenance, Media tape is guaranteed to outlive your present computer installation.

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GKI

the first computer tape with a Lifetime Guarantee & 48-hour delivery service!

first

LETTERS

Been looking everywhere

Sir:
In the Nov. 15, 1970, issue, a book review (p. 209) appeared for a volume (*Concepts and Models in Biomathematics, Vol. 1*) which was indeed highly complimentary. Unfortunately, my name as editor was spelled with a double error (Heinnetz)—it should be Heinmets.

Since this error may lead to difficulty in identifying the book, I would appreciate your printing a correction to that effect.

F. HEINMETS
U. S. Army Natick Laboratories
Natick, Massachusetts

Fiction addiction

Sir:
Reference "EDP Professional—the Blurred Image" P. H. Dorn (Jan. 1, p. 22).

As a computer professional and a science fiction "addict," I take exception to Mr. Dorn's blanket indictment of science fiction: "Unfortunately, the science fiction addicts and popular commentators perpetuated the widely held myth that giant electronic brains control their environment. . . ."

Mr. Dorn reveals himself to have an abysmal ignorance of science fiction. Science fiction writers are not uneducated and ignorant of scientific reality; Isaac Asimov, Fred Hoyle, Clifford Simak, and Arthur Clarke are typical science fiction writers. Nor are science fiction addicts lacking in knowledge and education. Science fiction does not appeal to the ignorant and uneducated; its scientific, political, economic, and sociological concepts are too complex.

Mr. Dorn must think of science fiction as being on the level of (with apologies to Max Schulman) the "Creature that Devoured Cleveland," as he links, through guilt by association, science fiction with "television comedies, wrong bills from the neighborhood store, and magazine cartoons" in the next sentence of that paragraph.

Overall, science fiction contains few examples of the ignorance of computers and computer people about which Mr. Dorn is writing. He would do well to review his examples; his subject is relevant, and his examples should have been likewise.

J. M. PEARSON
China Lake, California

Mr. Dorn's wife assures us that he is a long-standing science fiction devotee, stays up watching the late show whenever "Destination Moon" is being rerun, travels with "Analog" in his briefcase, but thinks "The Forbin Project" is a lousy movie.

Blurredbrains

Sir:
Philip Dorn's article made for interesting reading. However, it made a basic assumption that requires further discussion. It assumed that *edp professionals* exist and this implies that there is an edp profession. I question that. A profession generally requires: 1) a rigorous body of knowledge that distinguishes it from other disciplines; 2) an effective medium of distribution of this knowledge; 3) a code of ethics; 4) a sense of professionalism; 5) criteria for certifying professionalism; 6) a definition of the purpose of the profession. I do not believe that the edp field satisfies the above. If it did, a great deal of the turmoil found in the field would be lessened. The edp field suffers from a lack, this lack being that it is not, at this time, truly a profession, but rather a hodgepodge. It has many gifted people, such as Phil (with whom I worked at Union Carbide), scientists, academicians, commercial and scientific programmers, operations personnel, etc. But it is also filled with many charlatans, incompetents and knaves. It does nothing to weed out the latter class of people. To remove the "blur," edp must become a profession.

ROBERT MANKIN
New York, New York

Venture spleen

Sir:
In an editorial in the October, 1969, issue (p. 59), you took the time and expended the effort to counsel personally the aspiring entrepreneurs in the edp industry. It was a sound, well-motivated, valuable message to those in the industry contemplating a venture on their own. Consider what damage might be done to these venturers by your story "The Viatron Venture Capital Adventure" (Dec. 15, 1970, p. 61), which is so contradictory and unsound when compared to your editorial.

American Science Associates is a venture capital investment banking group which has financed several young companies in the past two years. Because of the naivete and lack of experience in how to approach the raising of capital by most new entrepreneurs, we published a free brochure, "A Guide to Venture Capital Financing," specifically to help these new businessmen understand how to approach the financial community. Since March of this year, thousands of copies of this brochure have been distributed. That brochure was inspired by your editorial of October, 1969.

To the aspiring entrepreneur who takes Dr. Bennett seriously, both Dr. Bennett and DATAMATION have performed a disservice. The executive of a newly formed company, who has left his employer, invested his savings and those of friends and associates, and is undertaking a search for capital according to Dr. Bennett's advice, is courting disaster.

Our business is to evaluate new ideas and new companies and then provide financing for those which offer an intelligent investment opportunity. Honest, sound, forthright presentation of the business is basic to an evaluation by sources of capital. This message should be clear to all would-be entrepreneurs.

CARL W. STURSBERG, JR.
American Science Associates
New York, New York

Glad to know that at least one of our editorials was inspirational. The story in question was an item of news coverage, not editorial viewpoint.

Get his number

Sir:
The staff at Computer Corp. of America was delighted to see your story (Look Ahead, Jan. 1) on the information retrieval system which is helping the directory assistance (information) operators in Oakland,

Good news! Kodak KOM microfilmers now give you microfiche.

The microfiche you see above holds 208 pages, plus title, that were recorded from magnetic tape by the Kodak KOM-90 microfilmer in less than thirty seconds. And with remarkable clarity, thanks to the new Kodak Versaform camera.

It lets you convert tape data to 16mm, 35mm, 82.5mm, and 105mm film at 24X and 42X reduction ratios. The camera is retrofittable to KOM-90 microfilmers already installed.

Whether your application requirements call for roll, strip, fiche, or tab-card-size formats, all are possible using the Versaform camera. Couple this with one of several available computer-generated indexing systems, and you have one more reason to select Kodak for all your COM needs.

Find out more about Kodak's total COM systems responsibility. Ask your Kodak systems expert for details or write Eastman Kodak Company, Business Systems Markets Division, Dept. DP 531, Rochester, N.Y. 14650.

Kodak Microfilm Systems

CIRCLE 50 ON READER CARD

Calif. You pointed out correctly that the system covers 17 exchanges in the San Francisco area (over a million subscribers), gives virtually instantaneous answers to all sorts of complicated queries—even those containing incomplete information—and is updated very quickly. In fact, this system may well be the most advanced computerized information retrieval system running anywhere today, and we were very happy to see it get recognition in the press.

Unfortunately, you failed to mention one important point: The software for the system was designed and implemented by Computer Corp. of America.

THOMAS MARILL, *President*
Computer Corp. of America
Cambridge, Massachusetts

Lemieux's vieux

Sir:
I was greatly encouraged after reading Dr. R. R. Johnson's article "Needed: A Measure For Measure" (Dec. 15, 1970, p. 22) since it was only a historical survey of computer performance measurements. My fear that Johnson's Juxtapositions were about to be added to an already ponderous pile of measures and countermeasures was unfounded. However, his conclusion that more theories of this ilk are needed cannot be commended and could be taken as a sign that even he is confused re: Adams' Charts, Arbuckle's Weights, Grosch's Law, Knight's Formulae, Schneidewind's Models, Solomon's Kernels and God knows what else!

JOSEPH H. LEMIEUX
Chelmsford, Massachusetts

Computer got loaded

Sir:
I'd like to clear up a gross misconception that one of your contributors has concerning the behavior of the onboard computer during the APOLLO 11 landing. Evidence of the misunderstanding can be found in the Jan. 1, 1971, issue in the article " . . . but the Ambivalence Lingers," by Daniel D. McCracken. In his article, he gives the following as an example of "a computer foulup": "The APOLLO 11 computer almost forced an abort of the moon landing, although nothing was actually wrong."

There definitely was something wrong. It was not the computer or its software. Due to an error in the checklist manual, the rendezvous radar switch was placed in the wrong position. This caused it to send erroneous signals to the computer. The result was that the computer was being asked to perform all of its normal functions for landing while receiving an extra load of spurious data which used up 15% of its time. The computer (or rather the software in it) was smart enough to recognize that it was being asked to perform more tasks than it should be performing. It then sent out an alarm, which meant to the astronaut, "I'm overloaded with more tasks than I should be doing at this time and I'm going to keep only the more important tasks; i.e., the ones needed for landing."

To blame the computer for the APOLLO 11 problem is like blaming the person who spots a fire and calls the fire department. Actually, the computer was programmed to do more than recognize error conditions. A complete set of recovery programs was incorporated into the software. The software's action, in this case, was to eliminate lower priority tasks and re-establish the more important ones. The computer, rather than almost forcing an abort, prevented an abort.

If the computer hadn't recognized this problem and taken recovery action, I doubt if APOLLO 11 would have been the successful moon landing it was.

MARGARET H. HAMILTON
Director of Apollo Flight Computer Programming
MIT Draper Laboratory
Cambridge, Massachusetts

Lost women

Sir:
In the past months' issues you have had numerous discussions about education for and shortages of people in the computer field. I think that several points need to be emphasized and one seems to have been omitted almost completely.

No articles emphasized the role women could potentially play in the computer world. Since there is a shortage of trained personnel, a little more effort directed toward involving women in computer work would be more than worthwhile. Many college women with general scientific degrees or liberal arts degrees can very easily be trained to do the tasks from coder to senior systems analyst. However, most of these women do not realize that they could find satisfying and challenging opportunities in edp or that companies would hire them. Once hired, women would be more likely to stay in a job. Even marriage or family raising need not eliminate these women from the working world. Part-time positions could be filled and the companies would save by not having to provide benefits for these part-time employees. An industrious woman, working from nine to two or on a flexible schedule can do a large amount of work. So let's remember the woman for edp jobs.

At the present time, edp schools are not providing the type of people needed, nor the quantity needed. Generally these schools are expensive and also time consuming for the individual who is enrolled. I think that the edp industries and organizations should warn potential students that these schools are not always what they seem to be. This warning will not be heard if it appears only in trade publications. Some type of information service (a phone number advertised on the same page as the edp schools) would be easy to establish. Individuals could be guided to reputable schools or even better, to industries with their own training programs. Perhaps, in this way, people who have turned away from the computer industry because of bad experiences with edp schools would not be lost to the field.

PAMELA A. HENLINE
Argonne, Illinois

Besmirch research

Sir:
As a further entry in the sweepstakes on who went to only magnetic tape input first, I would like to point out that the fourth Univac I system installed at New York University in June of 1953 at the Atomic Energy Commission computing facility prepared all inputs to the system on magnetic tape using the Unityper I.

HERBERT B. GOERTZEL
Rockville, Maryland ■

This is an introductory ad.

If you've never seen an ad quite like this before, it's because you've never seen products quite like this before in the United States.

While these data systems are just now being introduced in this country, they're part of the entire TEAC line of instrumentation products that have more than made their mark in business and industry around the world over the past decade.

So this debut is anything but presumptuous or precipitate. It's part of a planned program as precise and uncompromising as the products themselves.

TEAC's commitment has always been to become thoroughly involved with our customer's problems and needs before, during and after the purchase of our products. Competent field and factory service and a comprehensive parts inventory are a critical part of this philosophy.

By way of introduction, the six products shown below illustrate our point.

Newest addition to the TEAC line of data recorders is the R-70 Cassette Data Recorder which includes both FM and direct electronics and operates from either self-contained power supply or external AC/DC.

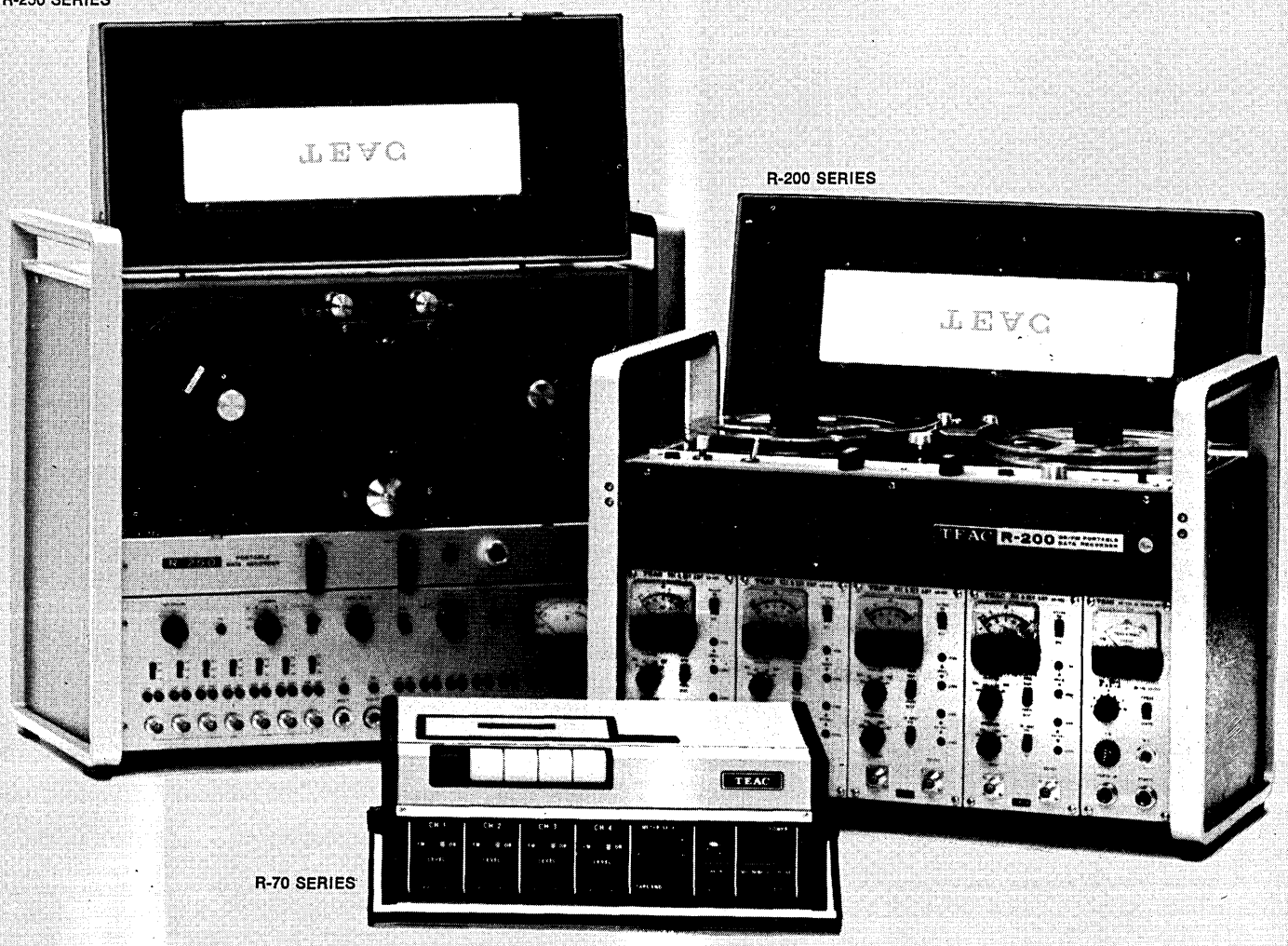
Flexibility in analog data recording is reflected in the wide variety of configurations available in the truly portable R-200 and the IRIG compatible R-250 as well as the transportable R-410 series.

The C-110 Real Time Digital Correlator and the F-100 Spectrum Analyzer team up to provide rapid signal analysis.

As we said in the beginning, this is an introductory ad. We can't hope to give all the details here or anticipate your questions.

So, if you'd like more details on the exciting world of TEAC, send for our new twelve-page, four-color brochure. Just write or call Ken Williamson, Director of Marketing, Technical Products, TEAC Corporation of America, 2000 Colorado Avenue, Santa Monica, California 90404. Telephone (213) 394-0240.

There's a good reason to go TEAC®



CIRCLE 24 ON READER CARD

B 7700 design test model

What's really new in big computer performance?

For Details, Use This Coupon

Burroughs Corporation, Dept. A
P.O. Box 418
Detroit, Michigan 48232

I want to know more about
Burroughs new B 7700!

name

company address

city state zip

job title

BURROUGHS New B 7700! It offers you:

- Thousands of data communications lines on a single central system
- Continuous processing
- Fail-soft systems design
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- Mass random storage with 2- to 10-ms accessing
- Memory phasing *plus* interleaving for new levels of performance
- 30-megabyte input/output capacity.

Burroughs B 7700 Is Really New... and Worth Knowing About.

Burroughs

LOOK AHEAD

CDC IN BUSINESS DP? A MERGER COULD HELP

Control Data reportedly has selected March 9 to announce a business-oriented computer series, using enhanced 6000 and 7000 cpus. They feature: move, compare and possibly other new instructions; extended core storage at no extra cost; a "distributive data path" that permits access to the ECS without going through the cpu; and a 10-20% increase in price/performance. A PL/I compiler will be introduced in the 4th quarter, we are told.

A source thinks the move into business dp, which already has required a multi-megabuck planning investment, is a big mistake; CDC doesn't have the marketing power to buck well-established competition. It might do it through a merger, however, and we hear this decision may be reached during the summer with RCA and NCR considered the likeliest partners. Bill Norris is said to be encouraging an increase in the exchange of visits by CDC technicians and their counterparts in the two other companies.

IBM MAY DROP 125, FILL GAP WITH S/3

A 64K version of IBM's System 3 is on the way and may be followed, we hear, with still another version with even more memory. This means that the 125 has been scrapped--at least for now--and that models of the S/3 will bridge the gap all the way to the 370/135. (One source wonders if IBM is planning virtual memory for the big S/3s as originally considered for the long-rumored 3.7).

Based on the above, a market expert feels that the 135 will be the only real concession to DOS users in the 370 line, which otherwise emphasizes OS. (Easier to move to the forthcoming NSOS system?) IBM will push as many 360/25 and 30 users to it as possible and thus collect more revenues. A 125 would probably be a direct no gain replacement; IBM's already having trouble with 360/65 users trading for 155s for no income gain.

Those with small 25s and 30s and large 20s will not have much choice for economy in the 370 line for now, unless they're able to cut over to the bigger S/3s. A source feels the recent 30% purchase price cut on the small 20s, models 1 through 4, "implies a certain family of customers IBM doesn't want to support anymore," since it urges them to ownership and remoteness from IBM. But they too could move to S/3. If all this is true, it appears IBM is firmly breaking its products into two more manageable families. The question is how and when can you grow from an S/3 to the 370? Or do you just slap on communications gear and become part of a "computer utility"?

GIVE INDEPENDENTS A PEEK, JUSTICE TELLS GSA

The Justice Department's chief trust buster, Richard McLaren, has sided with independent peripheral makers in their fight with IBM over the 370 I/O controller. In a letter to the General Services Administration (GSA), McLaren said federal rfps should specify

systems which give independents a maximum opportunity to bid. He said bidding systems manufacturers should be required to give independents the data they need to interface and GSA should, before awarding a system contract, consider peripherals substitution. GSA reportedly fears this would lead to the expense of system configuring now performed free by bidders and would force divulgence of proprietary data. But, GSA will talk to McLaren's office to "see what can be done." The Computer Peripheral Manufacturer's Association (CPMA) has won valuable support.

ROOM AT THE INN AS IBM, HIS VACATE

American Federation of Information Processing Societies (AFIPS) reports that by February, 160 exhibitors had signed for more than 600 of the 800 available booths at the Spring Joint Computer Conference, May 18-20. So there's room for more.

AFIPS is confident the Atlantic City hall will fill up. But the shocker is that the No. 1 and 2 attention-getters, Honeywell and IBM, won't be there. Honeywell is sinking the first six months' promotion funds into hawking the new 6000 line, but will be back next fall. IBM won't. New emphasis on marketing and media advertising will keep IBM out of JCCs and the IEEE, BEMA and DPMA shows in 1971. Sources say IBM's austerity drive which recently swept away THINK magazine is the major cause. RCA has ordered 15 booths up front and will feature the new model 3 virtual memory system. Other big space buyers include the newly-organized Raytheon Data Systems with 16 booths, and Friden which we hear will have a new product line to show.

RUMORS AND RAW RANDOM DATA

We hear that an academic committee in New Zealand has unanimously recommended to the government that the five universities in the country get one Burroughs 6700 each. The package deal would represent a quantum jump in computer power for New Zealand--two of the big machines, for example, would replace 1130s . . . Rumor has it that IBM will announce a 370/177 with paging hardware before summer. It will have twice the speed of the 165 . . . Raytheon is said to be considering its own attack on the 370 line, ranging in size from the 135 to the 165 . . . CompuTerminal, the San Francisco service bureau, last year placed "the largest commercial computer order ever" for 40 Burroughs B5500s valued at $60 million, of which one has been delivered. Last month it was being pressed by IBM for $20K in back rental for keypunches and other peripherals . . . We thought you'd like to know that Computer Nozzle, Inc., of Rosemead, Calif., is doing marvelously, despite the recession. It distributes gasoline pump "computers" made by Veeder Root to regulate pump prices to gas flow and adjusts to price changes. It seems when unemployment is up, people drive around in cars looking for work and using gas.

Universities were a big part of the development of computers but it's only recently that their use has affected the administrative structure

Campus Computing

Because the first computers ever built were on college and university campuses, it is easy to ignore the tremendous and very recent impact of computers on educational institutions. From an esoteric research device, the computer became first a useful tool in a number of sciences and has now emerged as a real necessity for a whole spectrum of activities in research, instruction, and administration. The computer center on today's campus is an important and busy focus of activity rivaling the library in the diversity of its users.

The computer generates information, ideas, insight, and documents. It also generates problems at a rate which is impressive even in the context of today's problem-prone campuses. Computing is an expensive and critical resource; its management requires skills which many colleges have never used before.

Administrators with responsibility for computing functions are concerned about the adequacy of their services and are anxious to know whether they are getting the most value for the dollars invested. Administrators at campuses without computers are concerned that their facilities are inadequate in a most important respect. The college president, like the head of any other organization that uses computers, must take a hard look at computing, what it does (or could do) for his institution, and what it costs.

Some figures will elucidate the situation. In the academic year 1962-63, less than $50 million was spent for computing in higher education. This money was spent by the 200 elite institutions that were then leaders in this field. Six years later, in 1968-69, the figures were more than $350 million—a six-fold increase. This expenditure purchased computing for about 1250 institutions—about half of the accredited colleges and universities in the United States.

Naturally, these computers are not evenly distributed: larger institutions are more likely to have computers than are small colleges; almost all doctorate level institutions have access to computers, while far fewer bachelor or associate level colleges do; richer colleges are more computer-prone than poorer ones, and public more than private. But as the cost of computation goes down and as the technical capability to make use of it becomes broader, even the smaller and poorer colleges are making the decision that the computer is a necessary tool of education and not merely an academic fad.

The typical college makes a considerable investment to enter the computer era. Once this agonizing decision is made, the innocent administrator may feel that the problem is solved and that he can turn his attention to other matters. Unfortunately, computers are different from centrifuges, microscopes, and libraries. Once the college community (students as well as faculty and staff) is exposed to computation and what it can do, the demand for it goes up at a faster rate than the cost of computing comes down. Over the six years cited above, the cost of computation probably decreased by a factor of 10 while the average expenditure per college actually increased by about 12%. Once computing arrives on campus, it seems to demand more and more money and constant administrative attention.

Purpose and goals

What is all this computer power used for? It is customary to distinguish research, instruction, and administrative use. The use of computers for research purposes conjures up images of data reduction in physics and engineering laboratories. Of considerable and growing importance, however, are such sophisticated applications as the simulation of political and economic systems; experiments in musicology; data file management systems for statistical analysis. A scholar or scientist who begins using the computer for isolated problems often discovers that he can do more

Management

research (and do it better and faster) than he had ever thought possible. The computer greatly expands the amount of work he can accomplish in his professional lifetime and he is no longer willing to work without it.

Since the computer has become an important tool in all kinds of activities off campus, the student preparing for these activities must become acquainted with it. If a student is going to learn the trade of doing chemistry or highway engineering or statistics, he must learn to use the computer to solve the kinds of problems chemists, engineers, and statisticians now face. If the college conscientiously attempts to train students for the work they will have to do over the next 30 years, it is hard to say that they will never need to know about computers or how to use them. In addition, some computer-aided pedagogical techniques are becoming important in college-level teaching. Simulation and games, for instance, can teach the student to understand the functioning of such complex systems as business management, economics, and social organizations more thoroughly and more graphically than any other known technique.

With swelling enrollments and more complex and expensive facilities and with ever-growing requirements for the documentation of everything, the college administrator—like administrators everywhere —finds the computer to be the only hope for keeping abreast of his job. Students may complain that the use of computers for admissions, registration, and the maintenance of records is impersonal; but the fact is that without the computer, registration lines would be longer, admissions would be slower, and the student's range of alternatives would be smaller. It is not the computer that makes the system impersonal; it is simply the growing size and complexity of our institutions which tax our ability to devise workable and humane administrative bureaucracies.

by Charles Mosmann and Einar Stefferud

Thus, at a time when money for higher education is extremely tight, the computer seems to absorb a larger and disproportionate share of the available funds. The student needs the computer for his education; the professor needs it for his research, his teaching, and his administrative duties; the administrator needs it to keep track of a large, challenging, and changing enterprise.

Managing a resource which is used by such a wide and growing spectrum of campus personnel is often more of a headache than a challenge. The president and his aides, whose background and experience may be in fields far removed from computing, soon come to realize that the computer is a new and special kind of resource on the campus. It seems to require more of them in the way of understanding, guidance, and leadership than any other kind of resource.

To avoid chaos

To bring computing onto the campus, the president may make the first commitment without knowing much about the field; he will trust experts on his faculty or from elsewhere. But he soon learns that, because of the very generality of the computer and the fact that usage is so dispersed across the campus, its availability creates conflicts which can only be resolved at the highest level: in his own office. He therefore has this choice: he can allow computing affairs to become a chaotic and inefficient jungle or he must learn something about the management of computing. Then, if he decides against chaos, he learns that there are a few established rules or principles that he can use to bring order out of chaos. The remainder of this article is an attempt to show how computing looks from the top; how the president and those around him view the problems and issues generated by the presence of computing power on the

campus.

When he first expresses real interest and concern, the president may find that his technical experts will involve him in considerations of the cost per bit of alternative memory systems or the merits of BASIC and FORTRAN IV as instructional tools. One exasperated university executive told his computer management consultant, "When you talk politics, I understand you; when you talk hardware or software, I don't!" He understood the situation very well. The president properly views computing affairs as political or organizational and never as technical. From his perspective, once the organizational and political problems are solved, the technical issues will be handled by the technical managers in the organization.

In attempting to sort out the political and organizational problems, the president's first task is to distinguish the dramatis personae. They may not wear black or white hats, but they do fall into categories with their own attitudes and particular interests. When the president understands how the people he talks to represent different interests and points of view, he will find it easier to understand what they are saying. There are on the campus *facility managers, customers,* and *users* of computing services.

The *facility manager* acts as a vendor, who offers services that he hopes will be attractive to customers. His *customers* are the academic departments and administrative offices which consume the services; they are represented by the deans, department heads, and administrative officers who agree to the commitment of funds to computing. The *users* are generally not the customers. The users are the students, professors, and administrative analysts and programmers who do work for the customers and thus interact with the staff of the computer facility which provides computer support to the customers' activities. Users tend to seek more resources without much concern for value.

Needs and objectives

Each of these groups has its own needs, objectives, and incentives and each must have a mechanism for expressing its needs and for controlling its resources. The president will make certain that his organizational mechanism enables these groups to get their jobs done and to work together toward the common, community-wide objectives that are the president's real concern.

In attempting to establish the appropriate level of his interest, the president will distinguish between policies and procedures. Just as he regards technical questions in terms of organizational issues, he will deal with procedural questions in terms of policy. Policy has to do with the establishment of rules to allocate resources among users, to resolve potential conflicts, and to allow work to flow smoothly and without crisis. Procedures have to do with the specific mechanisms users must employ to get the system to work for them. Policy is designed to make the system as a whole work for everybody; procedures embody specific applications of policy to expedite the work.

As an example, consider the question of resource allocation. Having only recently installed its first small computer, College X finds it is sufficient to establish a simple procedure for access: "If you want to use the computer, stand in line until it is free—first come, first served." This works very well for perhaps a year. By then, there are enough users to absorb all of the time and the lines grow very long and the users become impatient. Dr. A, whose research is impeded, complains that Professor B's students take too much time doing trivial and unimportant problems. B complains that the root of the problem is the comptroller, C, who insists on running his reports during the peak hours of student use. Thus the procedure for access becomes inadequate and conflicts arise that—since they involve deans and professors and comptrollers—cannot be resolved by the facility manager, the users, or the customers. They must percolate up to the president's office.

Policy decisions

When the problem becomes bad enough, the president of College X must see to the establishment of a new policy for the allocation of computer resources so that conflicts can be resolved or averted by reference to policy without the president becoming involved in crises of recrimination, hard feelings, and letters of resignation.

The new mechanism will usually involve a committee on which the major customers and the facility manager will sit. Important members of the power structure are included to aggregate sufficient power in the committee to enable it to formulate policy that will stick. The committee will work out policies which are fair to all classes of users and will encourage the best use of computing resources from the point of view of the college as a whole. They may give the facility manager authority to place time limits on jobs to be run at peak load times; they may establish a user's committee for airing grievances and discussion of mutual problems; rules may be set up for what constitutes proper student use; etc.

Within the policies set by this committee, the facility manager, who is responsible for operating the computer, can establish procedures and the different classes of users can get their work done with a minimum of friction. The facility manager is included in the committee deliberations so that he will acquire an in-depth understanding of the intention of the policies he will implement. His role is also to educate the administration about the full range of the problems of computer management; he must educate them to solve the problems rather than attempt to shield them.

One important policy area with which the president will want to become involved has to do with the products and services to be provided by the computer facility. At first glance, this question appears to be technical rather than organizational. However, the nature of computer facility products and services is so important in determining the success of computing on his campus that the president will be willing to explore these technical issues in terms of their organizational implications. He will be interested in the products of computing, not in their own terms, but in terms of the value they have to customers: research reports written, students instructed in various subjects, reports generated, payrolls processed. These are things that are of value to the customers and for which they are willing to commit funds to computing.

What kinds of computer services can the users make use of in order to generate value for the customers? It is important to note that raw computation—mere access to a computer—is important and useful to only a small segment of any college or university. For most users, more user-oriented services are required. Users need advice and assistance in designing and testing programs. Some will need special languages, libraries, and programs. It is not clear that all services need stem from one computer or that the computer needs to be on the campus. Both academic and administrative users can often purchase the services they need most economically off campus. The key concept underlying the services of the computer facility is *support:* the products and services offered must support the activities of the customers. Thus, it is an important policy matter to decide what products and services will be made available and what the customers and users can do if the services they need are not provided by the campus computing facility. Unless the president understands this and policy regulates it, unused capacity and unsatisfied customers will appear simultaneously and paradoxically.

Resource control

There is a further complexity in the relationship between the computer facility and its customers which the president must take into account to assure himself that computing really serves the objectives of the institution—and not vice versa. The divisions, departments, and offices using computers must have sufficient control over their resources if they are to be held responsible for their own functions. Otherwise they can, and will, blame their failures on agencies outside their control. This principle applies to all segments of the campus, although administrative areas bear the brunt of the arguments because the issues are more sharply drawn for the administrative offices.

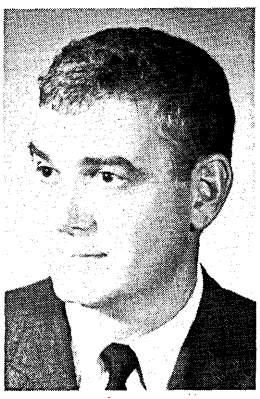
It may seem obvious that the registrar of a college or university is solely responsible for the registration function, but at any number of institutions he is dependent on a computer facility over which he has little control; he is thus not accountable for the success or failure of his own enterprise. It is not unusual for some agency outside the registrar's control to design a new registration system without involving the registrar at all; after all, he is too busy coping with current operational problems and he doesn't understand the new technology! When the system is installed and it fails to work, he handily uses the excuse which must have been invented the first day a computer was put to useful work: "Don't blame me, the computer did it!" In the meantime, while the buck is being passed, the registration function is out of control on the campus.

Administrative data processing and academic computing have often resisted consolidation for these reasons of accountability. Unless both are protected by policies which regulate control of computer use, they lose their authority over the resources needed to do their jobs and thus are forced to abdicate their responsibilities. (There are interesting discussions of this issue in the articles by Anthony Ralston and Michael Roberts in this issue.)

The manager of the computer facility will also resist any reduction of his authority as strongly as will his customers, but he must avoid becoming a scapegoat. Absolute authority entails absolute responsibility: whoever controls the resources of others will become the scapegoat for their failures. Proper organization of computing requires that the responsible parties agree to the settlement of questions of responsibility, authority, and accountability in such a way as to eliminate this buckpassing potential.

In the wider context of the president's office, where the rules and principles of computer management on campus are seen to be emerging, it is clear that computing is liable to cause significant changes in the way the institution manages itself. Computing, if seriously applied to the work of the college or university, will eventually cause profound changes in the traditionally complex way in which decisions are made and in the way in which work is done and goals are realized. The way administrative and academic work gets done changes when the computer is introduced. These changes cause shifts in the power structure which in turn require adjustments in the organization of the institution. People come to depend upon each other in new ways. The policies for computing affairs which are established lead to the emergence of new and innovative organizational forms. In this context, the president sees his job as one of guiding the long-term evolution of his institution's organizational structure to accommodate the exploitation of computing in support of the institution's real goals. ■

Dr. Mosmann is a consultant specializing in the application of computers in educational institutions. He is co-author of Computers on Campus, a book on the management of academic computing resources, published by the American Council on Education. He has a PhD from Columbia Univ. and has been active in the computer field since 1955.



Mr. Stefferud is a computer management consultant in Santa Monica, Calif. and has had contracts with the Univ. of New Mexico, the Claremont Colleges, the California State Colleges, and the Univ. of Michigan. He was previously manager of the computation center at Carnegie-Mellon Univ. and has a BS and MBA from UCLA.

An integrated computer center for administrative, academic, and research use may be the ideal, but not every university can attain it

University EDP: Get

Until quite recently at almost all large universities, the administrative data processing (adp) organization was separate from that of the academic-research computing center and was usually housed somewhere in the Business Affairs part of the structure.

Historically there were good reasons for this separation. Through the '50s and most of the '60s attempts to use common hardware, which economics necessitated at small colleges and universities, nearly always resulted in substantial friction because the hardware and software available did not allow the needs of adp on the one hand and research-academic computing on the other hand to be simultaneously satisfied. In the last few years, however, both hardware and software developments have made operation of a common hardware facility much more feasible. In addition, the realization that the differences between adp and what might be called scientific data processing are much smaller than many people previously believed, has provided some arguments in favor of merging not only the hardware but the staffs in the two areas. A number of larger universities have done this with varying results.

The purpose of this article is to discuss the pros and cons of the various alternatives now available for the organization of adp in the university.

The strongest argument in favor of separate hardware and a separate organization for administrative data processing has always been the special needs and problems of this type of operation, particularly as opposed to an academic-research computing operation. Let us look at these needs.

Tight reporting schedules which must be maintained except perhaps in face of hardware disaster is certainly one of these needs. In contrast to this, it is often claimed by the users of administrative data processing that academic-research computing centers can and do work on less tight schedules and, perhaps more importantly, on schedules which can vary substantially from day to day or week to week. Actually, however, this argument no longer has much force. In the first place the ability to service most customers with short turnaround has become the operating aim of all large academic-research computing centers. When this aim is achieved, the turnaround time is usually much less than required by normal administrative data processing service requests. More important, the priority scheduling algorithms available with most large operating systems enable data processing service requests to be satisfied on a crisis basis, if necessary.

But it may still be held that the satisfaction of crisis requests is antithetical to the operating philosophy of most academic-research computing centers and that, therefore, administrative data processing crisis needs are not likely to be serviced as well as may be desired. True enough. But one counterargument to this is that the users of administrative data processing services have often become much too accustomed to making crisis requests to the detriment of the affairs of the university. True crises are rare, very rare, and whether it be the need of the president of the university for an immediate analysis of the current endowment investments or the need of Professor X for some calculation which he must have for a paper he is delivering tomorrow, any well run computing facility should be able to service true crisis situations.

The above arguments address only the computing system, that is, hardware and software, considerations. How about the special staff needs? Is it possible to have administrative data processing system design and implementation performed by applications programmers at a central computing facility or must these programmers be under the direct supervision of the administrative clients for such data processing? This is a difficult and rather subtle question.

Let me begin by stating a belief that different solutions will be best in different situations. The issues seem to be these:

1. In many instances applications programmers work most effectively if they are supervised by those knowledgeable in the applications area, particularly if these supervisors are also familiar with the potentiali-

ties of computers for handling these applications. For this reason I have always been opposed to having large stables of scientific applications programmers at research-academic computing centers. For similar reasons there is a cogent argument for having the administrative applications programmers work for people who are knowledgeable about the applications.

2. A counterargument to this concerns the integrated nature of administrative data processing applications as opposed to the single shot, isolated nature of most scientific applications. In particular, the totality of the administrative data processing systems of a university should involve significant interaction between its two major components, the financial administration system and the student record system. If the business affairs and student affairs organizations are administratively linked, then a single administrative data processing staff working together on joint problems is feasible. But more often they are not linked and then an integrated staff means that those programmers who serve one major client work for the other major client. This almost inevitably leads to less than the best service to the client for whom no programmers work.

3. If the hardware on which the adp work is done is in one organization but the programmers are in another, morale tends to suffer. Such adp programmers feel isolated if they are divorced from the hardware. This problem can be overstressed but it should not be ignored.

Administration and adp

If high level university administrators were normally knowledgeable about computing, much of the discussion of this article would be academic (no pun intended). In such a case, any one of a number of organizational patterns would be workable. But this is not the case. Most university administrators are not only ignorant about computing but also they are typically quite nervous about it in both its adp and academic-research manifestations. On the one hand, they usually realize the necessity for adp and they often understand the growing importance of computing at all levels of the academic process. But, on the other hand, it often appears to be an endless sink for money and a source of troubles which the administration does not understand and often feels incompetent to deal with. It is, therefore, of the utmost importance that computing be organized in the most professional manner possible and in such a way that the top administration can put reasonable trust in the information it gets *about* computing on campus as well as in the computerized adp information itself.

This is no easy aim and there is no perfect solution. Directors of computing centers of all kinds are well known to be empire builders and thus to have their own axes to grind. But perhaps a more important problem is the attitude toward adp on the part of its major clients, both business and student. At too many universities, business officers, controllers, budget officers and directors of admissions have little or no understanding of the use of computers in university administration. They may know that they must use computers—at least because everyone else is doing it.

This acknowledgement of need together with the usual fear of something not entirely understood often results in a strong desire to control the operation. For then it can be hidden and the inefficiencies of use may remain unknown outside, particularly if the higher administration is also unknowledgeable and if, as is usually the case, the academic computing center personnel evince no interest at all in the adp operation. And so a common result is the classic syndrome of an IBM 360/30 or 40 computer emulating an IBM 1400 computer which in turn was emulating a tab system. The conclusion is that, in the absence of a higher administrative structure which understands computing, it is preferable to have the adp operation outside the control of its clients if institutionalized inefficiency is to be avoided. Only in this way can the top administration have some chance of hearing about computing like it is.

It All Together

by Anthony Ralston

A joint computing center

For the past three years I was the director of a computer services organization which serves, through both hardware and staff, the adp, academic and research needs of the State University of New York at Buffalo. Prior to that I had been involved only in the administration of academic-research computing centers. These three years were neither an unalloyed pleasure nor a total success. But they convinced me that such an operation is not only feasible but has several significant advantages:

1. *The hardware will often be used more efficiently.* This has two aspects. Combining all the computer resources will probably allow the installation of more powerful, flexible hardware than either an adp installation or an academic-research installation could install by itself. In computing, the whole is greater than the sum of its parts.

But, also, it may happen that a further advantage is incurred in that the hardware may be operated more efficiently than at either separate installation. For example, IBM 360/40 and 50 computers in adp installations are all too often operated without any use being made of the multiprogramming capabilities of the computer. That is, they are run like old batch processing computers on a single job at a time basis. The result is substantial inefficiency. In a combined installation such an operation is impossible if reasonable service and good turnaround is going to be provided and, therefore, much more efficient use of the hardware may be attained. It should also be noted that an adp job stream combined with a scientific job stream often enable better use to be made of the hardware than either would alone because of the input-output-bound tendencies of the former and

the computer-bound tendencies of the latter.

2. *The adp programmers will normally have to have more contact with systems programmers at a large joint installation than at a smaller adp installation where often there are no systems programmers except perhaps for one or two programmers who maintain the software system.* This contact is often painful because adp programmers and systems programmers seldom understand each other well. But it is salutary just because it develops such understanding. For the adp programmer, who all too often tries to ignore the operating system under which the applications programs are executed, contact with systems programmers may broaden his perspectives and thereby improve his performance.

3. *Separating the adp programmer administratively from his clients will usually unearth problems which heretofore were hidden.* Particularly, if the general administrative operation at the university is weak, it will no longer be possible for administrators to hide behind the facade of computer problems causing the trouble when in fact it is basic lack of competence to take advantage of computer systems which is the real problem. Of course, an inevitable concomitant of this is friction between the adp operation and its clients who may be fighting for their lives. Such conflicts can be bloody but they are necessary and, if resolved properly, surely result in a stronger university administrative operation.

Of course, these advantages are neither easily attained nor are they necessarily attainable in every case, but I am convinced they are possible and desirable.

Are there any clear disadvantages to adp in a joint adp-academic computer operation? I think there are not but there certainly are potential problems. At large, research-oriented universities the adp computing load is normally a small fraction of the academic-research load and in a joint organization it could be relegated to second class status. But this is in no sense inevitable. Its avoidance requires the right combination of a computing center management which understands and is interested in the adp problems and appropriate pressure for service from the adp clients.

Another potential problem, mentioned above, is internal friction in a joint staff between programmers who don't understand each others problems. It was mentioned above that one result of this may be to broaden the perspectives of all. But it takes sensitive, perceptive management to achieve this. Particularly, if the marriage between the adp and academic-research centers has been a shotgun affair, there may be some difficult periods in the early days of the merger. Often the quality of the two staffs will be unequal, something which cannot be changed overnight. But this type of problem is not unique to computing; it is a classical management problem. And the difficulty of solving it cannot itself be used as an excuse for not consummating the marriage.

And in conclusion . . .

The main conclusion to be drawn from the above is that, if a college or a university were today starting from scratch to build a substantial computing effort, the best organization is a joint center managing both staff and hardware for adp, academic, and research uses. Looked at in this context there are no significant disadvantages to this form of organization but there are, as indicated previously in this article, many advantages.

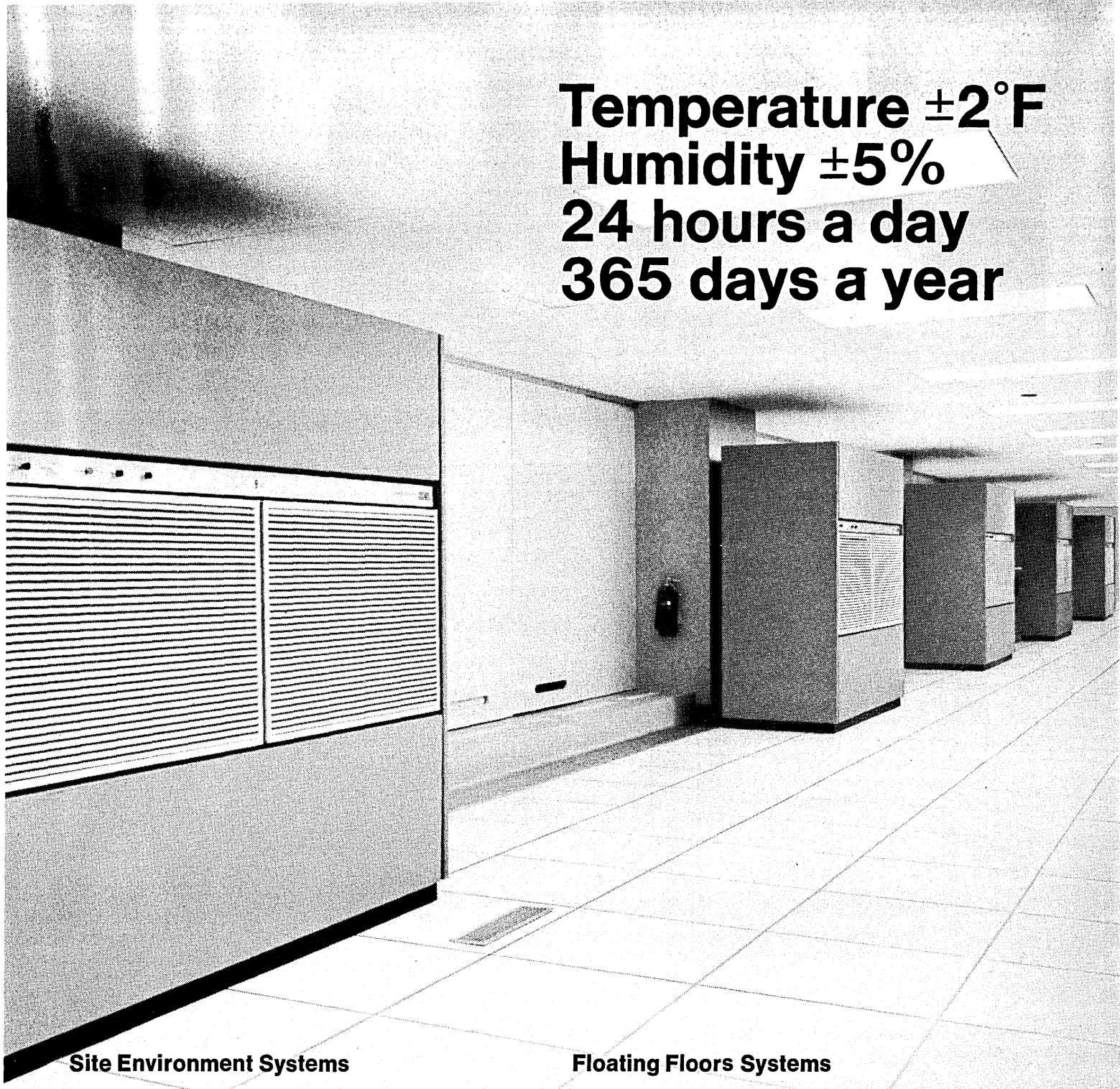
Of course, there are no colleges or universities today which have no computing effort and need to start a substantial one. Therefore, the operative question is whether or not it is worth changing existing organizational patterns to achieve such a joint center. And, naturally enough, my answer is that it depends. If the administration is satisfied that the adp operation is running smoothly and efficiently, then there is no valid excuse for fusing it with the academic-research effort. Smooth running computer operations are all too rare anywhere for theoretical considerations of organizational efficiency to justify a significant change.

But, if there are real problems with the adp operation or, at least, substantial insecurity felt by the top administration about it, then a change may be indicated. Such a change might be particularly attractive if able management exists in the academic-research computing establishment which is knowledgeable in the adp area and which can be expected to be responsive to the needs of adp. (These remarks tend to oversimplify the problem since a change of this nature may lead to deep management problems and strains in whatever organization adp is moved from.)

As a final word let me note that it is important for the success of a joint adp-academic-research computing center that it be properly fit into the overall college or university structure. Just *because* it includes components serving both the administrative and academic arms of the university, it is important that it be controlled by neither. At a large institution, the computing organization should report at a vice-presidential level but not to the administrative or academic vice president. If an executive vice president exists, this office may be the appropriate one to report to. At smaller institutions it may be desirable to have the computing organization report directly to the office of the president if not to the president himself.

In any case, since computing is a sensitive function on any campus, it is most important that no clients of computing believe the organizational framework biases the operation in favor of other clients. ■

Dr. Ralston is chairman of the Department of Computer Science at the State Univ. of New York at Buffalo where, until recently, he was also director of computer services. Previously he had been professor of mathematics and director of the Computing Center at Stevens Institute of Technology in Hoboken, N.J. He has held various design, analysis, and consultant positions with Ferranti, Ltd., IBM, Bell Laboratories, and American Cyanamid Co. He holds S.B. and PhD degrees from M.I.T.



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CIRCLE 43 ON READER CARD

Economies of scale just MAY be overrated when it comes to campus computing

A Separatist's View

I find a great deal in Anthony Ralston's article (see p. 24) with which I am in agreement, particularly the idea that the "special" characteristics of administrative data processing (adp) jobs have been oversold in the interests of separatism. I also agree with his implied statement that what the adp organization in many schools needs is a large injection of talent, and as a practical matter, this is only going to come from the academic computing area or from industry. However, I also believe he is wide of the mark on several key points that in effect vitiate much of his argument. Let me categorize my observations under four headings —hardware, software, customers and management.

Hardware

I believe that economy of scale has been oversold as a basis for making major decisions on computer configurations for general purpose computing. In a properly configured and well utilized facility, the central processor will account for 30-40% of hardware cost, and perhaps 10-15% of total cost after inclusion of programming and operations staff. The advent of LSI and other technology is continuing to provide lower unit cost of cpu operation, but this is having a smaller and smaller impact on total system costs because other costs are rising. Further, although the raw cost of machine cycles does show an exponential decline in large processors, a substantial portion of this cost advantage is lost in the millions of bytes of system code required to drive the large machines.

Rather than a continuation of the current race between hardware designers to produce cheaper cycles, and software designers to absorb them in ever more complex systems, I believe the user community would be better served by more emphasis on tailoring both hardware and software to fit logically related types of use. The use of variable microcode in the 370 series machines is an indication of the perceived need for a "tailoring" ability. In the on-line, terminal oriented systems of the future, the primary determinant of machine size is likely to be the size of data base and attendant transaction load required to serve a user community.

Taken together, these developments argue that a cautious stance should be adopted toward trying to combine all possible campus computing needs on one machine, and that consideration of the integration of facilities should be taken in a broader perspective than that of processor costs alone.

Software

There are significant differences in software requirements and preferences as between scientific and administrative systems and the staffs responsible for their development and maintenance. Given some minimum level of service, the administrative applications programmer is most anxious that the system not get in his way unnecessarily, that it be reliable and predictable, and that new versions or releases not cause production bugs or require recompilation. (One major West Coast bank was so plagued by this latter problem that it now requires a 72-hour benchmark test of every major production process prior to putting a new release in operation.)

On the other hand, the scientific programmer, and the staffs of most academic computing centers, are concerned about a continuing expansion and improvement of system services to meet constantly expanding needs for computing support from the students and faculty utilizing the facility. In league with their computing science graduate student cohorts, they frequently discover abominable code buried in the manufacturer's operating system, which they proceed to remedy with consequent gains in throughput, but also frequently at the expense of making the system and its user applications incapable of operation except on the campus machine. Although it is certainly possible for both groups to cohabitate on the same machine, there is an inherent tension in such

# of University EDP

by Michael M. Roberts

living conditions that argues for careful examination of the true savings involved.

Under this heading I would like to advance an argument for centralized management of administrative systems groups not covered by Mr. Ralston. The biggest single failing of most adp operations is bad code and poor systems design. The major contributors to such situations are inadequate training, lack of standards, and lack of supervision. It is simply not possible to maintain a professionally trained and competent systems group if its members are fragmented among various administrative offices.

The problem of developing and maintaining close liaison with administrative users can be resolved by assigning responsibility for program development and maintenance of specific application areas to a senior analyst or programmer, an arrangement that has been used for several years at my institution. This individual becomes the customer's representative in the programming group, but retains his identity as a professional and a member of an integrated systems development staff.

Problems of turnover, promotion, and training continually afflict systems managers in the best of circumstances. Attempting to provide quality support in an environment where the analysts and programmers are farmed out to individual administrative offices will bring, sooner or later, missed deadlines, inability to schedule work and resolve priority questions, and a less than optimum level of competence.

Customers

There are also significant differences in the computer support needs of administrative and academic areas. Faculty and student researchers are usually involved with project oriented work demanding a diversity of computing resources to accomplish the desired result. The greater part of the computing work done is for test and development of complex algorithmic programs which have a very short production lifetime. Machine capability is more highly treasured than machine reliability and stability, and there generally is considerable pressure for obtaining or creating locally the latest in hardware and software developments. Although not unconcerned about costs, this community primarily is working with funds supplied by outside sources on the basis of budgets containing lump sum amounts for computing service at the established rates in the campus center.

The administrative computing center, on the other hand, is generally under great pressure to provide the highest level of service for the least cost possible. Its staff is supporting one, or at most, two programming languages. The primary emphasis is on a smooth running production environment, in which considerable attention is given to rapid processing and turnaround of data for such functions as payroll, student grades, and financial reports. Cost effectiveness considerations weigh heavily in design and development of new applications, and proposals for such work embody estimates of ongoing production costs which assume stable or declining unit costs of computing over time. Further there is a need for physical security of vital files and programs which may be difficult to provide in a combined facility that by its very nature must be open to student users.

It is self-evident that support from the same computing system for academic and administrative users will require concessions by both sides, which is not to imply that there are not conditions where it will be warranted. However, the need for careful planning and the development of clearcut policy for dealing with conflicts and setting priorities must be recognized and dealt with in advance.

Management

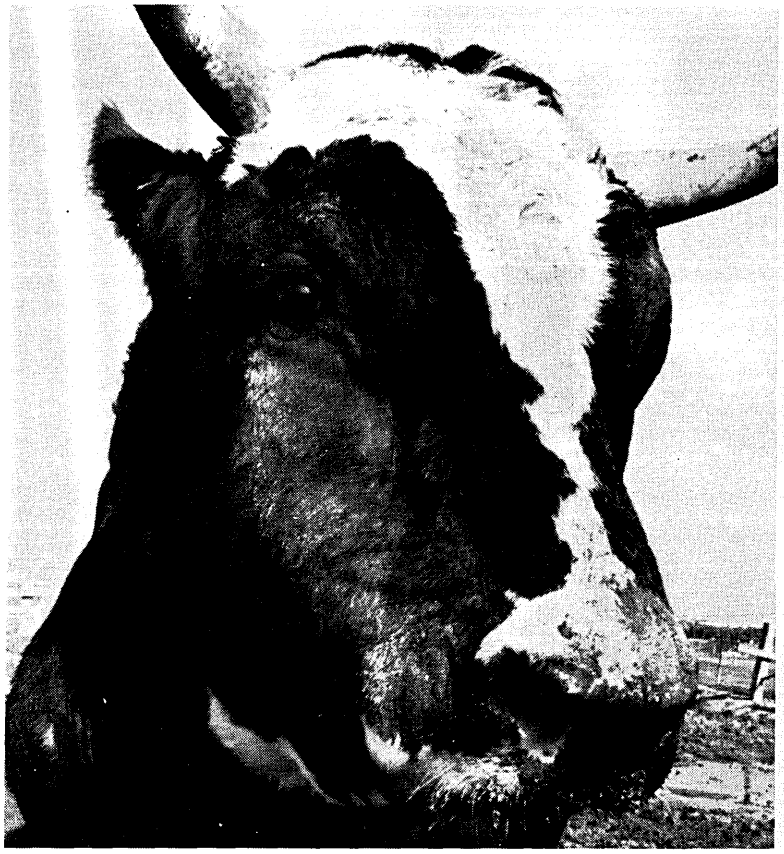
The basic problem with arguments that considerations of economy of scale and staffing dictate a combined administrative and academic computing organization is that they assume that the computing work

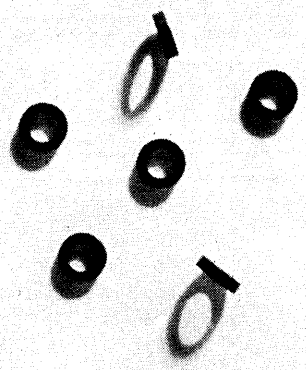
done in support of administration is separable from the functioning of the offices themselves. There is a tendency to think of the programs and processes as though they had a life of their own. Quite the contrary is true. Administrative computer processes are integral parts of the organization they serve and are, in most institutions, vital to the proper functioning of the school. Lifting responsibility for this work from administrators and assigning it to some hopefully "neutral" individual reporting high in the organization is liable to perpetuate a prevalent state of affairs where insufficiently talented administrators are evading their responsibility in this new area of technology —a force which is radically changing their working environment.

The solution to weak management in administrative areas, including computing, is not to transfer responsibility away from administration, but to strengthen the existing management, either through intensive training or involuntary turnover. In this regard, the experience of the major corporations in delegating responsibility far down in the organization and then focusing on performance may be a model to which institutions of higher education should give more attention.

There exists an urgent need for competent technical advice on computers and computer systems in every organization, but this need can be fulfilled, I believe, by the same type of staff organization that is used to deal with other specialized needs such as legal counsel and federal relations. Resolution of operational questions relating to provision of computing support to administrative functions, the costs of such service, and plans for systems development over time are managerial responsibilities which sooner or later must be addressed directly and dealt with successfully by institutional administrators. This process can be accelerated significantly if the academic community emphasizes in the operation of their own colleges and universities those principles of good management which members of the faculty involved with business administration programs have been working hard to develop and refine in recent years. Ninety-nine percent of computer problems are people problems, and can best be resolved by strong and talented management. ■

Mr. Roberts is director of administrative computing at Stanford Univ. In addition he is director of Project INFO, an advanced systems development effort of university administration sponsored by a grant from the Ford Foundation. He has served as vice chairman of the Special Interest Group on Business Data Processing of the ACM, and is currently president of the College and University Systems Exchange. He holds undergraduate and graduate degrees from Stanford Univ.





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Proposal culminates years of effort by ANSI committee

At Last: Standards for Keyboards

by Joseph P. Ancona, Stuart M. Garland, and John J. Tropsa

Over the years, there have been increased applications of data communications, data entry and data processing terminals. Some of these take the form of crt displays, teleprinters and magnetic tape systems. Although different, they have one item in common—a keyboard.

In today's environment there is a high mobility of people within companies and within industries. In order to improve throughput between man and machine, manufacturers must provide standardized interfaces. Today, and in the foreseeable future, computer terminals will use typewriter-like keyboards as the principal link between man and machine. Further, "man" as defined will range from scientist to housewife to kindergarten student.

With this expectation, keyboard standardization is imperative if we are to optimize the benefits to society.

The keyboard arrangement on almost every typewriter in use in office or home is practically identical to the first developed by Christopher Sholes in 1873. Subsequent development of telecommunication and electric typewriters maintained his basic alphanumeric arrangement. Research consistently revealed that the over-riding criterion for continued use was the millions of people already familiar (and those trained annually in schools) with this arrangement.

Codes and keyboards

Keyboards associated with more recently developed equipment have as their primary function the generation of a coded signal. During the 1960s, the inadequacy of existing codes was highlighted by the increased sophistication of data communications, the widespread use of high speed electronic computers for data processing and information interchange and the international pressures for development of a common code.

Under the sponsorship of the Business Equipment Manufacturers' Association (BEMA), the American National Standards Institute (ANSI) worked with the International Standards Organization (ISO) to develop a standard code for information interchange. Worldwide, this code has been adopted as the International Standard Code for Information Interchange (R646). In the United States, it is known as the American Standard Code for Information Interchange—ASCII X3.4/68 (see Fig. 1).

Simultaneously there emerged a new technology for processing data; optical character recognition (OCR). This led to the development of the American Standard Character set for Optical Character Recognition (X3.17/1966).

The standard electric typewriter array (X4. 7/1966) accommodated 81 of the 128 coded characters assigned in ASCII—and in OCR. All but the four abstract symbols had equivalents in ASCII. As a result, ANSI formed a committee of technical experts from user, government and manufacturing organizations

b_7 b_6 b_5 → / b_4 b_3 b_2 b_1 ↓ Bits / Row ↓ Column →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0	0	1	2	3	4	5	6	7
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

Fig. 1. ASCII Code Chart.

to develop standard alphanumeric keyboard arrangements accommodating the character sets of ASCII and OCR. The committee after several years of work has recently submitted the proposed standard to ANSI for final approval.

This standard, as are all ANSI standards, is developed for voluntary usage by the industry, the public, and the government. The means by which keyboards utilizing these arrangements are to encode the characters is not prescribed. This also applies to the physical characteristics such as size, shape, skew, and force displacement of the keys; such items are considered proprietary. However, it does define a contiguous character array and the relative location of the keys.

(Continued on page 34)

Electronic Memories quietly divulges some rather noteworthy improvements in its latest addition to our family of Severe Environment Memories: SEMS-8.

After almost ten years as the leading suppliers of especially rugged memories for the military, space programs and commercial aviation, we're rather pleased with this latest addition. Perhaps a comparison of this new SEMS-8 to our old SEMS-5 will explain our smugness.

We've gone from 128 cubic inches to 89 cubic inches. That gives us a tidy little five pound package (including address and data registers, input power monitoring and lockout control). 1470 bits per cubic inch. In speed, we've reduced cycle time from 2 us to 1.2 us and access time from .6 us to .45 us. Cost-per-bit is less than one half of our earlier versions.

In construction, we've gone from wired-in cordwood modules to plug-in printed circuit modules. And we've used monolithic IC's and hybrid data loop circuits in ceramic dual-in-line packages. The unit is therefore field repairable and easy to maintain.

Lest all that jazzy semiconductor talk should lead you astray, the SEMS-8 memory is built out of (dare we say it?) core. 20 mil lithium core. But don't worry. It's so small and light, your friends need never know.

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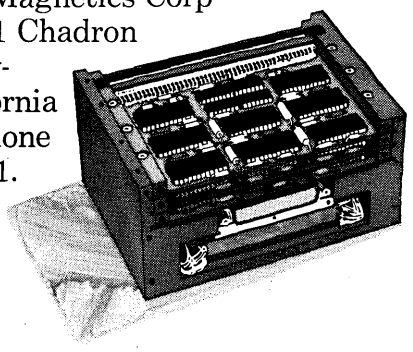

("I thought we told them to say 'Spectacular'?")

In addition, the following criteria were adopted (not listed in order of priority) to reflect the needed transition from historically developed keyboard designs to a standard.

1. The keyboard arrangement should accommodate all 128 (graphic and control) characters of ASCII and all 57 characters of OCR.
2. The location of a specific character should remain unchanged in keyboard arrangements accommodating fewer than the complete set of characters.
3. The keyboard arrangements should:
   a. Facilitate simplicity of design,
   b. provide ease of operation,
   c. minimize operator training and retraining,
   d. be acceptable for international standardization,
   e. have maximum resemblance to present office electric typewriter, data communication and data processing keyboard arrangements,
   f. minimize the total number of graphic keys, and
   g. minimize the total number of function keys.

The need for human factors consultation and guidance was recognized early in the committee's deliberations. Experts from universities, industry, government and private consulting firms volunteered their time and talent. Constant communication was maintained. They reviewed the four row arrangement and assisted in the location of the most frequently used alphabetic, numeric and punctuation characters. This group agreed with the necessity of maintaining the traditional typewriter-like placement of characters.

Subsequent work within the International Standards Organization supported this decision by adopting the traditional "Sholes" arrangement for the 26 alphabet, 10 numeric, period and comma characters as the basis for a proposed international recommendation. The current international proposal is almost identical to the U.S.A. proposed standard.

The proposed standard

The proposed standard (x4A9/199B) provides two arrays for implementing the ASCII character sets. The two arrangements are identical in the placement of the alphabetics and numerics but differ slightly in the placement of some symbols. Further efforts to resolve this difference would have delayed the much needed standardization.

The first keyboard arrangement (Fig. 2) assigns all of the characters of ASCII in a typewriter-like array according to the logical bit pairing principle, and expected frequency of usage. The logical bit pairing principle specifically pairs characters on a key so that there is a single bit "shift."

The second keyboard arrangement (Fig. 3) duplicates the standard electric typewriter array X4.7/1966 and assigns the remaining graphic characters according to expected frequency of usage.

Inboard and outboard locations are provided for the control characters of the United States of America Standard Code for Information Interchange Character Set. The "inboard" control locations on bit paired keyboards shall be on the alphanumeric keys bit paired with the characters as shown in Fig. 4 (see page 36). The areas designated for "outboard" controls are located to the left and to the right of the alphanumeric area. The outboard control area is undefined in the exact placement of keys because it will vary with application. The character DEL (Delete) when used on a key by itself shall be located in the

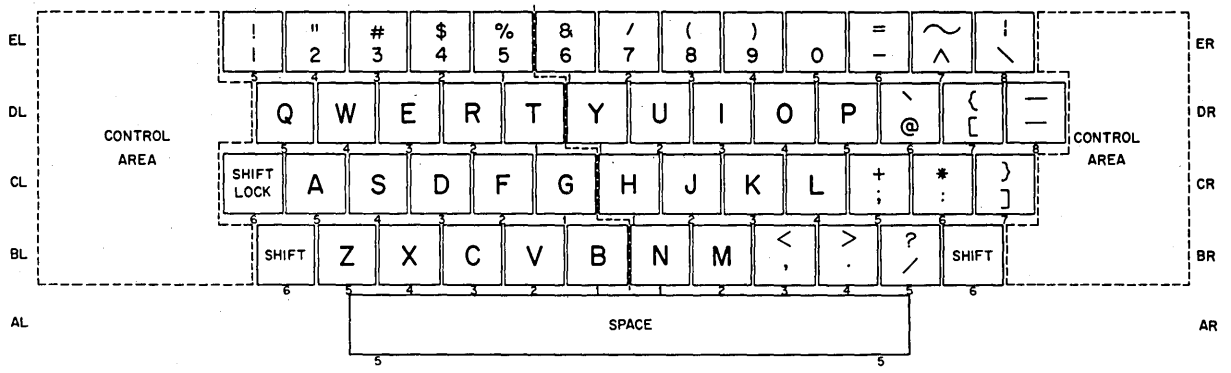

Fig. 2. Proposed U.S.A. Standard: Logical Bit Pairing.

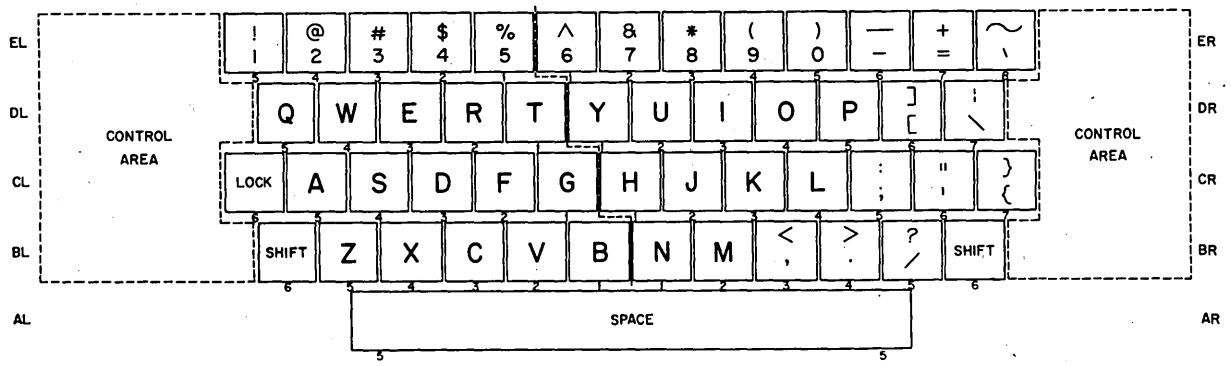

Fig. 3. Proposed U.S.A. Standard: Typewriter Pairing.

Electronic Memories gently draws your attention to an off-the-shelf planar stack so small that it will fit most commonly used printed circuit boards.

We built this one to solve our problems with the mini-computer people—and their problems as well. Yes, it's low cost: competitive with any other low cost planar stack on the market. Yes, it's off-the-shelf: we can deliver in volume in sixty days or less.

But the main point is this: the size is so small that you can fit this baby on just about any type of PC board. It's 1/2" high x 6" wide x 6 1/2" deep. And in that little package you get 4K x 18 bits of core storage. At a price no semiconductor can match. To the mini-computer designer, this means an immediate core memory source regardless of the system's physical room for storage area.

The stack will operate at either 700 or 800 nanoseconds, depending on whether you order 18 or 20-mil diameter core. Extended temp cores are standard for operation from 0 to 70° C.

The rather unusual "folded" design gives you almost fifty percent decrease in drive line inductance. Winding impedance and uniformity compares favorably to the compact frame designs. Much better than other planars.

Incidentally, we held a contest to find a good name for this stack. It is now called the EM 2220. Just goes to prove that we know more about core than about fancy names.

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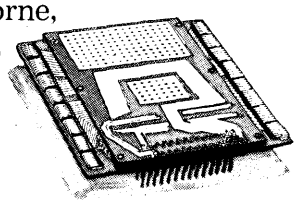


("I still think a couple of 'incredibles' would help.")

outboard control area.

Both arrays provide for the full implementation of the ASCII character set. It was, however, recognized that in some instances the complete character set is not required. Also, some equipment cannot accom-

NUL	@	DLE	P
SOH	A	DCL	Q
STX	B	DC2	R
ETX	C	DC3	S
EOT	D	DC4	T
ENQ	E	NAK	U
ACK	F	SYN	V
BEL	G	ETB	W
BS	H	CAN	X
HT	I	EM	Y
LF	J	SUB	Z
VT	K	ESC	[
FF	L	FS	\
CR	M	GS	]
SO	N	RS	^
SI	O	US	_

Fig. 4. Proposed U.S.A. Standard: Inboard Control Mode.

modate all of the keys in the array. Therefore, an orderly means of providing keyboard arrangements of fewer characters have been incorporated in this proposal.

Future program

Many problems still confront the committee in relation to keyboard standardization. Work will begin in the following areas:

Identifying and positioning.

1. Numeric clusters. Traditionally, numerics have been assigned to the top row of the keyboard. This has been satisfactory when an operator is engaged primarily in typing text with an occasional street address or date. Increasing the numeric content by 20%, 40% or 60% can alter the throughput significantly, hence the need for a more efficient array of the numerics. The questions are where and how? Where —inboard (as the key entry), or outboard (as in other devices)? How—according to the standard 10-key array, or as arranged in the widely-used keypunch, or in the new and widely-implemented "touch-tone" array?

2. Frequently used (outboard) control characters. BACKSPACE and TAB have a *fairly* consistent position assignment. CARRIAGE RETURN and LINE FEED locations have varied in the right hand outboard area. In some systems, they have been combined into a "NEW LINE" control. The use of other control characters are largely dependent on the terminal's function as part of a system. In some instances, not all control characters will be needed; which will be used most frequently, and in what position?

3. Control characters not now in ASCII or OCR, yet needed for new crt and key entry devices. Specific code assignments for XMIT, ERASE, ATTENTION, HOME and CURSOR arrows, used as local control on crt devices, do not exist. Similarly, there are no GROUP ERASE, CHARACTER ERASE and others needed for OCR document preparation. Is there a need to standardize on an array for the newer key entry devices, which also have many special control characters, such as ERROR RESET and LEFT ZERO following the traditional keypunch array?

Research.

We know that many so-called "dedicated" systems utilize special function symbols. While in the past these systems had restricted access and limited use, their worldwide availability is rapidly changing through time-sharing.

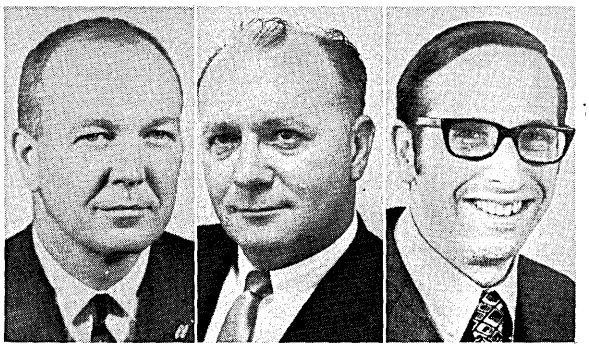
With the addition of control keys and expanded character sets, the same basic keyboard will be adapted to communications and direct processor entry. It has been estimated that, within several years, nearly a quarter of a million keyboards will be used for direct data processing through data communications networks.

A large proportion of operators will be exposed to keyboards serving functions, which several years ago were distinct, but which are being merged more frequently so that the three functions—local document production, communications, and direct processor entry—will become inseparable. Conservative indications are that, within a few years, there will be close to two million keyboard devices serving these three functions. With such a large number of keyboards, for the sake of consistency for the operator, standardization is an important consideration.

With such wide-spread usage, small changes in operator performance could result in a significant overall effect. If we were to postulate, conservatively, a two-hour-per-day use for the projected two million keyboard devices, the usage per year would total 500 million man-hours. Assuming a standard keyboard could be developed that would result in a half per cent increase in throughput and a half per cent reduction in error rate, a conservative estimate of effective savings would exceed two million hours per year in the United States.

It is rather obvious that the future program of work for this committee is indeed an important task.

Comments and suggestions relative to the proposed standard and future program of work are welcome and should be directed to the ANSI, 1430 Broadway, New York, N.Y. 10018. ■



Mr. Ancona (left) is currently director of standards, IBM Office Products Div., a position he has held since 1967. He joined IBM in 1952 and has served in Customer Engineering, Sales Engineering, and as technical assistant to the OPD director of standards. He is a charter member and vice chairman of the ANSI Subcommittee, Keyboard Arrangements. Mr. Garland (center) is a project engineer in r&d for the Teletype Corp., Chicago. He is a member of ASME and is active in the standardization programs sponsored by ANSI, BEMA, and EIA. Mr. Tropsa (right) is field sales manager for keyboards produced by Micro Switch, a division of Honeywell Inc. He has been with Micro Switch since 1951. He is a member of the BEMA sponsored ANSI committee for developing standards for coded keyboards.

Electronic Memories unobtrusively mentions the development of its 73 million bits-per-module Megamemory 1000; very compact, but a little too large to be unobtrusive.

Speaking gently about this little monster is a little like talking baby talk to a five hundred pound gorilla. (Actually, maximum weight is only 350 lbs.). But its speed belies its bulk: full cycle time of 1.5 microseconds and access time of 850 nanoseconds. You get a wide range of storage capacities—from 32K by 160 to 54K by 14. It's definitely a compact monster. A patented drive/sense scheme eliminates several switches normally associated with 2 wire 2 1/2D design. This straight-forward, practical design approach enhances reliability and breaks through price barriers that have always restricted core memory use in large-scale storage applications. As an add-on memory, Megamemory 1000 has been designed for interface with virtually any customer specification. If you need fast large storage either as an extension of your main frame memory or for peripheral memories, it would be difficult to conceive of a more compact, faster or more economical solution. But... you never know.

Here and Now: Megamemory 1000 is a little too large to lug to your place for a demo. But it's working at our place. We don't claim off-the-shelf deliveries, but we are geared up to produce. Fast.

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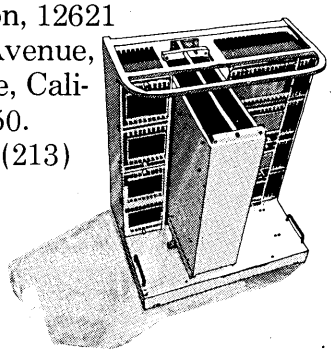

("Did we tell them to call it Supercore or Epicore?")

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Electronic Memories discreetly suggests a very low cost system for expansion modules or smaller main frame memories and that may even replace some disc memories: Micromemory 4000.

We recommend you read carefully. Because there's been a lot of wishful talk about a product like this one. The big difference is that we actually have it. We're talking about a 32K x 18 bits card type memory with control logic that allows it to be operated as 65K by up to 9 bits. Cycle time is 1.5 usec and access time is 800 nsec. And, starting April, we can deliver this memory off-the-shelf. By that we mean within days from receipt of order. Not weeks or months. And we don't want to talk price in this message; but we will say that the cost will cause many computer manufacturers to review their "make-or-buy" decisions. If you've been searching for a truly low-cost main frame memory or reliable expansion modules, we can assure you that this new family of "Micromemories" will open up a whole new area of system thinking. With regard to disc memories. With regard to claims you have seen or heard about semiconductor memories. With regard to other claims about low-cost core memory systems. If you have system responsibility, you really owe it to yourself to get the full details on our "Micromemory" family.

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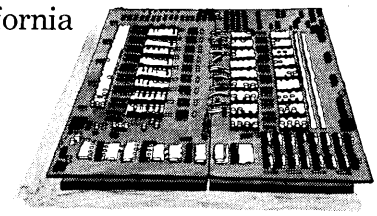
EM Electronic Memories is a division of Electronic Memories & Magnetics Corporation, 12621 Chadron Avenue, Hawthorne, California 90250. Telephone (213) 644-9881.



("Just one little 'new-and-sensational' wouldn't hurt.")

PERSPECTIVE

an interpretive review of significant developments

Vacancy Signs Appear for Canceled Reservations Firms

A nick-of-time $4 million plus investment late in January literally snatched Telemax Corp. and its parent Wellington Computer Systems from the jaws of the kind of financial disaster that chewed up three computer based travel service firms in less than a year.

Two of these, NARS Computer Systems, Inc., and Reservations World were primarily in the hotel and motel rooms and car rental reservations field. The third, Atar Computer Systems, had an automated reservations system for airlines.

NARS, the first to go, quietly disappeared from the scene last summer. Atar, hit hard when the Civil Aeronautics Board deferred approval of an agreement it had with eleven major airlines to provide a common reservation service, was "put in mothballs" late last year. At about the same time, limited assets of financially ailing Reservations World, which were down to some furniture, a phone number and a reservations office in Springfield, Ill., were sold for "a nominal sum" by American Airlines, which was having its own financial problems, to American Express.

A year ago, travel services were looked upon as one of the most appealing industry areas in which to develop an information system, particularly the room and car rental segment. Perhaps it was too appealing. In mid-1970 there were six leading bidders for a major share of the market in hotel and motel rooms and rental cars. This almost narrowed to two: American Express Reservations, wholly owned by American Express Corp., and International Reservations, a subsidiary of Planning Research Corp. But Telemax is still in there, thanks to its 11th hour financial reprieve. The other survivor, National Data Corp., Atlanta, Ga., provides an online reservations service for Mobil Oil Corp. which Mobil markets to its credit card customers. Its reservations traffic is mostly in motel rooms and doesn't come close in volume to the leaders. National's principal activity is in credit checking.

And the leading contenders have yet to turn a profit though they look to do so in the "foreseeable" future.

The qualities that made this market appealing still exist — a large worldwide group of potential clients in the form of travel agents, car rental agencies and resorts; lack of regulation and little likelihood of regulation except for possible setting of standards by industry groups; and steady growth (it's been estimated some 200 million reservations are made each year) with the increasing mobility of populations and increased leisure time.

The monkey wrench

But there's one big problem — profit margin, particularly in the light of high communications costs. The three remaining big reservations services operate on a System 800 (toll free number) basis which involves very high communications costs which have to be passed on to the customer — the hotel, motel, car rental agency or airline — and they're not willing to pay much. Average charge to a hotel for a definite reservation runs from $1 to $2. Travel agents pay less.

Telemax before its recent rescue had built up a whopping phone bill and was rumored to have been threatened with cut-off by the phone company. The new money saved them from this but to get it, it's been learned, they had to demonstrate to the then-potential-investors that their customers would accept a rate increase and that they could operate in the future in such a way as to keep their communications costs from getting out of hand.

Walter Brandenburg of Brandenburg & Associates, a Chicago-based consulting firm specializing in transportation systems, devised a plan for Telemax which would lead eventually to a completely mechanized system in which terminals would be placed in the offices of travel agents and System 800 activity would be kept to a minimum.

Brandenburg believes completely mechanized reservations systems are the only ones which will survive and feels the other big services will go this route in time. He also believes that offering total service encompassing tours and airlines reservations as well as rooms and cars is the way to go. The fact that those systems that bowed out were limited in scope might be viewed as backing up his contention. Atar, though, did have plans to offer a complete service by interfacing with International Reservations' system which would, in turn, have given IR a complete package.

Now International Reservations is out after the airlines on its own. At this writing, according to its president, William Lonergan, it had signed up one (which couldn't be named because of legal complications involving, of course, communications) and was talking to "8 to 10 others."

Telemax has contracts with 12 airlines including American, a hold-out from the group that was contracting with Atar, which it serves through an interface to the airlines' Sabre system. The other contracts are, in effect, paper tigers. Telemax has access to their seat availability but has yet to sell a ticket or turn a penny in revenue. Of the 12, only American and Frontier Airlines are domestic.

With its new financing, Telemax hopes to get the airlines' seat availability into the data base of its two Univac 494s in Fairfield, N. J.

The rescuer

The primary Telemax rescuer was Heizer Corp., a Chicago-based financial group with some $80 million in capital and headed by Ned Heizer, formerly with Booz, Allen & Hamilton. Heizer becomes a major stockholder in both Telemax and Wellington. Also involved were Riker-Maxson Corp. which sold Telemax to Wellington early last year, First National City Bank of New York, and Hambro Bank of England. At this writing both Wellington and Telemax were without chief executive officers. Phil Fellows, Telemax's last prexy, left in the fall and Bill Lucas bowed out as Wellington's top man when things were getting sticky in January. Their posts were to have been filled, reportedly from outside the company, by mid-February.

Telemax processes its reservations through a System 800 center in Omaha equipped with Sanders crt terminals and its comptuer center in Fairfield. International Reservations has two 360/50s in McLean, Va. and five reservation offices throughout the country. Its system includes 700 regular terminals and 100 crts. American Express has two 360/50s in Memphis and a reservations office there in addition to the recently acquired office in Springfield. It also has 19 reservations offices scattered throughout the world.

In terms of "properties" — individual hotels, motels and car rental agencies signed up — International Reservations has 6,800. American Express has 6,500. Telemax estimated theirs as, "high in the thousands."

All three operate with contracts with the properties for blocks of rooms, cars, airline seats, etc. Some are exclusive and some overlap. Many in the field attribute Reservations World's demise in part to the fact they didn't have contracts but operated on a "free selling" basis, often selling rooms which were not available. Their volume of reservations made was high, say observers, but that for reservations for which they were paid was low.

So what do you do if you're in the business and want to make it big? Lonergan believes it's a matter of changing the behavior pattern of human beings. Brandenburg sees travel agents as the answer — "the only way to get volume sales."

It's a competitive business. Those in it guard their traffic figures and watch the competition closely. But they're confident. They still see the appeal. But there are those who have reservations.

—Edith Myers

GAO Hits Wimmix Hard; FY '72 Funding Prospects Fading Fast

Plans for upgrading the World Wide Military Command and Control System (Wimmix) appeared to be more dead than alive last month after the General Accounting Office, Congress' Grand Inquisitor, finished examining the project.

In a report to the House Appropriations Committee, which hasn't been generally released, GAO accused Wimmix planners of using "highly questionable" cost estimates; setting up "fragmented responsibility for planning and direction of acquisition," and proposing to replace third generation equipment at some sites even though this might not increase their processing capability or capacity.

DOD was also accused of attempting to justify the buy with inadequate requirements data, and in at least one case, of using completely irrelevant data.

It allegedly ignored recent progress made by the Defense Intelligence Agency and "a private firm" in developing machine-independent data management systems, thereby neglecting a golden opportunity to make Wimmix a much more competitive procurement. The "private firm" wasn't identified in the report, but probably it's TRW, which has a 360-oriented DMS called GIM that is now being rewritten for the 1108.

The report is particularly significant because the House Appropriations Committee has said it will rely heavily on GAO's evaluation in deciding whether to give the Pentagon money for new Wimmix computers in FY'72. Closed committee hearings on DOD's budget for the coming year will begin soon. An rfp asking for bids on a maximum of 35 systems was released late last year. Potential bidders reportedly have spent around $2 million apiece preparing their proposals.

Possibly because of the GAO critique, RCA has reportedly withdrawn from the bidding competition. V.O. Wright, head of the company's systems development division, said only that the question is "under consideration."

Wimmixed up

DOD knows what's wrong with the Wimmix project plan, the GAO report indicates; the real question is whether the needed changes will be made. The report implies that the House committee should get concrete assurances before releasing any funds.

GAO felt that whatever plans the House ultimately OKs should "give cognizance" to "the need for a central office with authority and responsibility to plan, direct, and control the update program; possible utilization of a machine-independent data management system, and continued competitive procurement of computers."

The report suggests, basically, two alternative ways of upgrading the system: build it entirely from one type of computer (clearly this would be IBM gear, although GAO doesn't say so), or procure new systems competitively and evaluate the need for compatibility, site-by-site, within each service or application area.

Much of GAO's criticism was aimed at a plan announced in November '69 for acquiring a minimum of 34 new systems and a maximum of 87. Last June, this was scaled down to the current level of 15-35 installations. The new scheme is an improvement, GAO said, but still leaves something to be desired.

According to the report, the Pentagon expects to spend a total of $959 million on command and control and related intelligence information systems during the six years following award of the currently planned Wimmix update contract. This includes $42-206 million for hardware (depending, apparently, on whether 15 or 35 new systems are acquired), $722 million for software (including a new DMS), and $31 million for management. GAO explained that these are overall figures, encompassing "all anticipated costs" for all Wimmix and Wimmix-related sites — those that receive new computers as well as those that don't.

GAO said it couldn't evaluate the reasonableness of the figures because they lacked adequate documentation. The report also hesitated to endorse DOD's current plans for managing the Wimmix update.

Difficult for DOD

By coming down so hard on the 87-system buy announced in November '69, GAO probably will make it more difficult for DOD to refurbish Wimmix beyond the 15-35 systems currently projected, assuming Congress agrees to go along even that far.

— Phil Hirsch ■

NEWS SCENE

GE's Latest Designs Introduced by HIS

February 17 introduced six new considerations into Honeywell's already massive problem of incompatibility with the old GE product line. The 6000 series, consisting of the 6030, 6040, 6050, 6060, 6070, and 6080 computers, which obviously were in the late stages of development when GE hollered uncle, might be the last pure GE designs that will be seen. With their enhanced business applications capability, these six systems probably terminate development of the Honeywell 8200 model into a line of large-scale computers — which might be just as well, since that particular machine is said to have suffered software problems.

Only one GE-655 (Jan. '70 p. 137) of what was supposed to be a family of computers ever made it out the door of Phoenix-based GE, and it didn't stay in the U.S. But the 6000 series draws heavily on the lessons learned with the 655, which the larger 6000 systems supercede, so the family survives in its progeny. The systems are offered basically as single processor systems, with another cpu available to the four high number models. No cache memory or semiconductor main memory is to be found, though on this last point a source disclosed that HIS is working as hard as anybody else. Core memory is available starting with 64K on the smallest model up to what looks like a meager 256K on the largest system — but those are 36-bit words, not bytes, so that is roughly the equivalent of a megabyte of on-line storage. And those words can be treated like 6- or 9-bit bytes by the 6040, 6060, and 6080 business models.

Also of interest is a box called the ABU (for advanced business unit) on the even-numbered systems. It contains approximately 105 business-oriented instructions said to be well matched to the more commonly used COBOL statements. These commands are in addition to the 185 basic operation codes standard throughout the series, and result in a 30% improvement in business applications run times compared with 6000 series models that don't have it. All cpu's have built-in arithmetic.

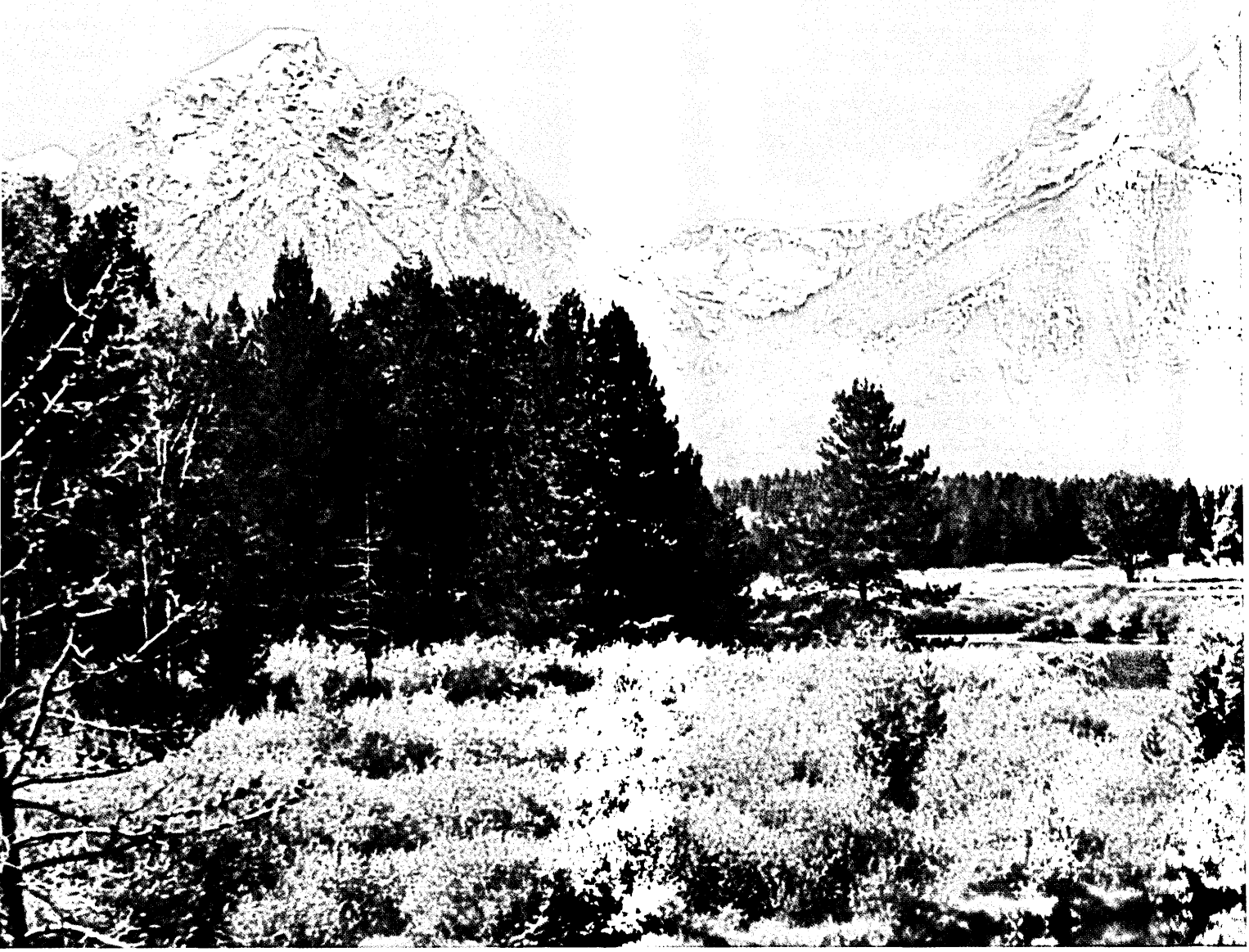
Another improvement over the 655 is in the I/0 controller, which with its 450 KC aggregate data rate left little margin for faster peripherals that would assuredly come along. The IOC's used with the 600 series have been abandoned in favor of up to four I/0 Multiplexors capable of aggregate data transfer rates ranging from 1300 KC on the *smallest* configuration, up to six megabytes on the 6070/6080's. That should accommodate almost anything that comes along.

The first device that the IOM can support at maximum speed is the DSS-190 disc storage system. Each disc pack contains up to 133 million characters and is expandable from a basic two-pack model up to 16 packs providing 2,128 million characters of storage accessable in 30 msec (average) and transferable at something over 1 million characters/sec. Another disc storage system debuting with the 6000 series is the 180, which uses industry standard packs like the IBM 2316, and is much more like a 2314 disc storage system than the 3330-ish DSS-190. The 180 requires 30 msec to access up to 495 million characters stored on 16 packs. Data is transferred at 416 KC, and the mini-

(Continued on page 47)

CPU	6030 (6040)	6050 (6060)	6070 (6080)
cycle time	1.2 usec, asynchronous	1.2 usec, asynchronous	500 nsec, asynchronous
word size	36 bits plus parity	36 bits plus parity	36 bits plus parity
index registers arithmetic	fixed and floating point binary and two's-complement	fixed and floating point binary and two's-complement	fixed and floating point binary and two's-complement
instruction overlap	no	yes	yes
Gibson mix cpu rate	250,000	500,000	1,000,000
instructions/sec if dual processor configuration	n/a	900,000	1,800,000
MEMORY			
cycle time	1.2 usec	1.2 usec	500 nsec
access	two words (or twelve 6-bit characters)	two words (or twelve 6-bit characters)	two words (or twelve 6-bit characters)
size	64-128K	96-256K	128-256K
increments	32K	32K	64K
interleaving	no	2- or 4-way	2- or 4-way
I/O			
channels	8-16	8-24	8-24
aggregate transfer rate, chars/sec	1,300,000	3,700,000	6,000,000

Environmental Data System. Reliable. Flexible. Economical. Westinghouse.



Collects air-water quality and meteorological data continuously in computer-compatible form with the proved Westinghouse Pulse-O-Matic® System.

The Westinghouse environmental data system monitors and records measurements of pollutants such as sulfur dioxide, nitric oxides, and carbon monoxide in air . . . dissolved oxygen in water and water temperature . . . along with such meteorological data as wind direction and solar radiation. It does the job efficiently, economically, and reliably. It gives you the continuous flow of accurate data you need for effective studies and decisions on pollution control.

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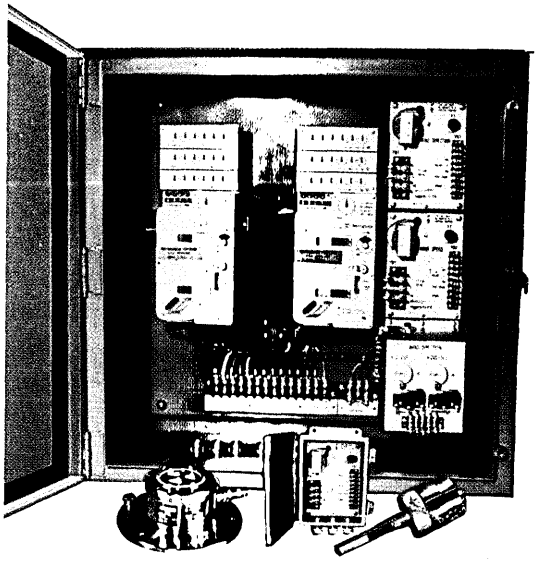
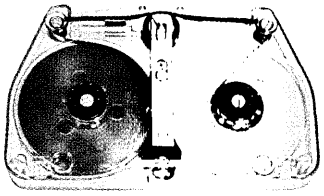
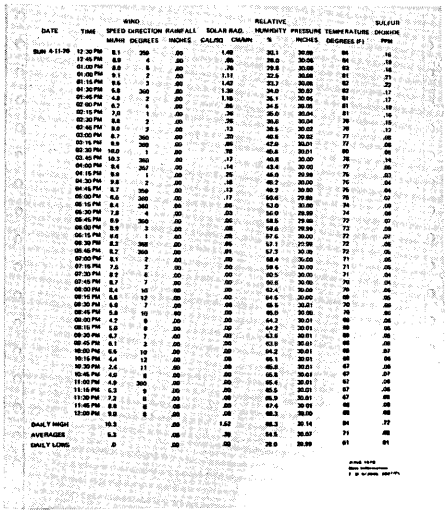




Data is continuously recorded at the site on reusable magnetic tape. Cartridges are changed monthly at the site, and returned to a service center where they are machine read and translated to computer format.



DATE	TIME	WIND SPEED MI/HR	WIND DIRECTION DEGREES	RAINFALL INCHES	SOLAR RAD. CAL/SQ CM/MIN	RELATIVE HUMIDITY %	PRESSURE INCHES	TEMPERATURE DEGREES (F)	SULFUR DIOXIDE PPM
SUN 4-11-70	12:30 PM	8.1	350	.00	1.48	30.1	30.08	66	.10
	12:45 PM	8.0	4	.00	.86	29.0	30.06	66	.10
	01:00 PM	8.0	5	.00	.86	29.0	30.06	66	.10
	01:15 PM	8.1	7	.00	1.11	32.5	30.08	66	.11
	01:30 PM	8.4	3	.00	1.42	30.2	30.02	66	.12
	01:45 PM	8.8	360	.00	1.38	34.0	30.02	66	.12
	02:00 PM	8.8	1	.00	1.38	34.0	30.02	66	.12
	02:15 PM	8.7	1	.00	1.38	34.0	30.02	66	.12
	02:30 PM	8.8	1	.00	1.38	34.0	30.04	67	.12
	02:45 PM	8.8	1	.00	1.38	34.0	30.02	67	.12
	03:00 PM	8.8	358	.00	.88	47.0	30.01	67	.08
	03:15 PM	8.8	358	.00	.88	47.0	30.01	67	.08
	03:30 PM	10.3	1	.00	.77	48.0	30.00	67	.06
	03:45 PM	9.8	350	.00	.74	48.0	30.00	67	.06
	04:00 PM	9.4	352	.00	.74	48.0	29.98	67	.06
	04:15 PM	9.8	1	.00	.74	48.0	29.98	67	.06
	04:30 PM	9.8	1	.00	.74	48.0	29.98	67	.06
	04:45 PM	9.7	358	.00	.77	48.0	29.98	67	.06
	05:00 PM	9.6	358	.00	.77	48.0	29.98	67	.06
	05:15 PM	9.6	358	.00	.77	48.0	29.98	67	.06
	05:30 PM	7.8	1	.00	.48	48.0	29.98	67	.06
	05:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	06:00 PM	8.0	356	.00	.48	48.0	29.98	67	.06
	06:15 PM	8.0	356	.00	.48	48.0	29.98	67	.06
	06:30 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	06:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	07:00 PM	8.1	1	.00	.48	48.0	29.98	67	.06
	07:15 PM	8.1	1	.00	.48	48.0	29.98	67	.06
	07:30 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	07:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	08:00 PM	8.0	1	.00	.48	48.0	29.98	67	.06
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	09:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	10:00 PM	8.0	1	.00	.48	48.0	29.98	67	.06
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	10:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	11:00 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	11:15 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	11:30 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	11:45 PM	8.0	1	.00	.48	48.0	29.98	67	.06
	12:00 PM	8.0	1	.00	.48	48.0	29.98	67	.06
DAILY HIGH		10.3	1	.00	1.48	48.0	30.08	66	.12
AVERAGES		8.3	1	.00	.49	44.5	30.07	71	.08
DAILY LOW		.0	1	.00	.48	30.0	30.00	61	.06

NC-2-70

Are you suffering from a computer complex?

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Maybe you should book a session with our Mr. Burgess.

You are not alone.

An on-line computer complex is a traumatic experience for many companies.

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On-line computer systems, after all, are every bit as fragile as the human psyche.

And the things that go wrong with them can be every bit as frustrating.

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This is why the analysts at Cybermatics stay so busy.

Cybermatics specializes in on-line computer systems. We've developed such systems for giants like CBS and Western Union, where a single schizophrenic slip could cost millions.

But we make it sound simple. We're good, and (like a good psychoanalyst) we can afford to skip the mumbo jumbo.

All this takes talent. But here at Cybermatics, the idea of talent is a virtual obsession.

In fact, of the eighteen great brains in on-line computers, four already work at Cybermatics.

Similar in both appearance and specifications to GE's stillborn 655, the 6000 series probably will fare better with HIS marketing effort behind it.

mum number of packs is three.

Also attending the 6000 series coming out party were three models of crt's called the 765, 775, and 785, the PRT 300 1150 lpm printer, and the MTH 502 and 505 tape units. The 502 is a 75 ips unit storing data in either 800 or 1600 bpi format, with the transfer rates reading respectively 80 and 160 KC. The MTH 505 is also an 800/1600 bpi unit, but reaches transfer rates of 133 or 266 KC by spinning tape at 125 ips. Unfortunately very little pricing information on the new peripherals was available, but as of now it appears a basic three-pack DSS-180 will sell for $96K, or rent for $2052/month on a five-year contract. It will be interesting to see how much money the DSS-190 requires, but the manufacturer says it will be somewhat less than comparable IBM 3330 configurations.

Compatibility is important at HIS (at least within series!), so the 600 series users should have little or no trouble migrating over to the 6000 systems. The standard assortment of languages is offered for doing batch, remote batch, time-sharing, and remote access processing, all controlled by the General Electric Comprehensive Operating System (GECOS) rumored to be much like the operating system IBM will introduce — in one to two years.

The 6030, 6050, and 6070 models will be available in July, and the business series deliveries are expected during the first quarter of 1972. A user can step into a new 6030 with 96K of memory, console, a three-pack DSS-180 disc subsystem, six tape drives, and one punch printer and reader, for $23,410/month on a one-year contract. Communications capability added to this configuration would up the monthly payments to $24,600. A big 6080 system with 196K of core, four DSS-190 disc drives, 12 tape handlers, three printers, two card readers, and a communication controller set up for 64 low speed lines, eight voice grade lines, and one 9600 baud line, would run $67,295/month on a one-year lease.

Maintenance Agreement Set by Lessors, Comma

Some eight months after the IBM 370 announcement, leasing companies last month disclosed some of their strategy to extend 360 usage.

In its first step to interrupt a migration to 370s, the 10-member Computer Lessors Association retained a consultant to investigate enhancements to the 360 systems.

Later, four leasing companies announced they would allow customers to avail themselves of a third party maintenance firm, presumably at lower cost and better responsiveness. They signed a long-term agreement with Comma Corp., authorizing the New York-based maintenance firm to provide maintenance to the more than 500 clients who use an estimated $600 million in 360 equipment.

The four are Data Processing Fi-

"READY"
is one of many messages INFOREX gives your operators to increase data throughput.

HERE ARE SOME OF THE OTHERS:

CANCELLED
COLUMN ERROR
DBL KEY
END OF FILE
ENTER LABELS
EOT
ERROR
FIELD FULL
IN PROCESS
INTERRUPTED
INVALID KEY
JOBNAME BUSY
LABEL OVERFLOW
NAME USED
NO JCS
NO JCS END
NO PROGNAME
NO RECORDS
NO UPDATE
NOT IN JOBFILE
NOT READY
PROCEED
READY
RECORD < 16
REKEY
STAT NOT C
STAT NOT I
STORED
TAPE BUSY
95% FULL

We built these messages into the INFOREX Intelligent Key Entry™ System because we believe a truly responsive system can significantly cut data entry errors and simultaneously increase data throughput. For example:

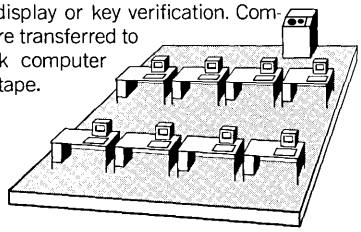
Our 125-character display screen does a lot more than provide a visual check on the operator's work. If she makes an error in procedure it tells her exactly what is wrong. Gives her the status of the job at any time. Issues instructions. Lets her resume work quickly and accurately after an interruption.

It helps the supervisor, too. She can use any station to check jobs in process or get a reading on each operator's performance and accuracy at any time.

Write for full data to help evaluate the Intelligent Key Entry System in your operation. We would also be pleased to have you check with present users on System performance and service. Write INFOREX, Inc., 21 North Avenue, Burlington, Mass. 01803 or INFOREX AG, Dornacherstrasse 210, Basel, Switzerland.

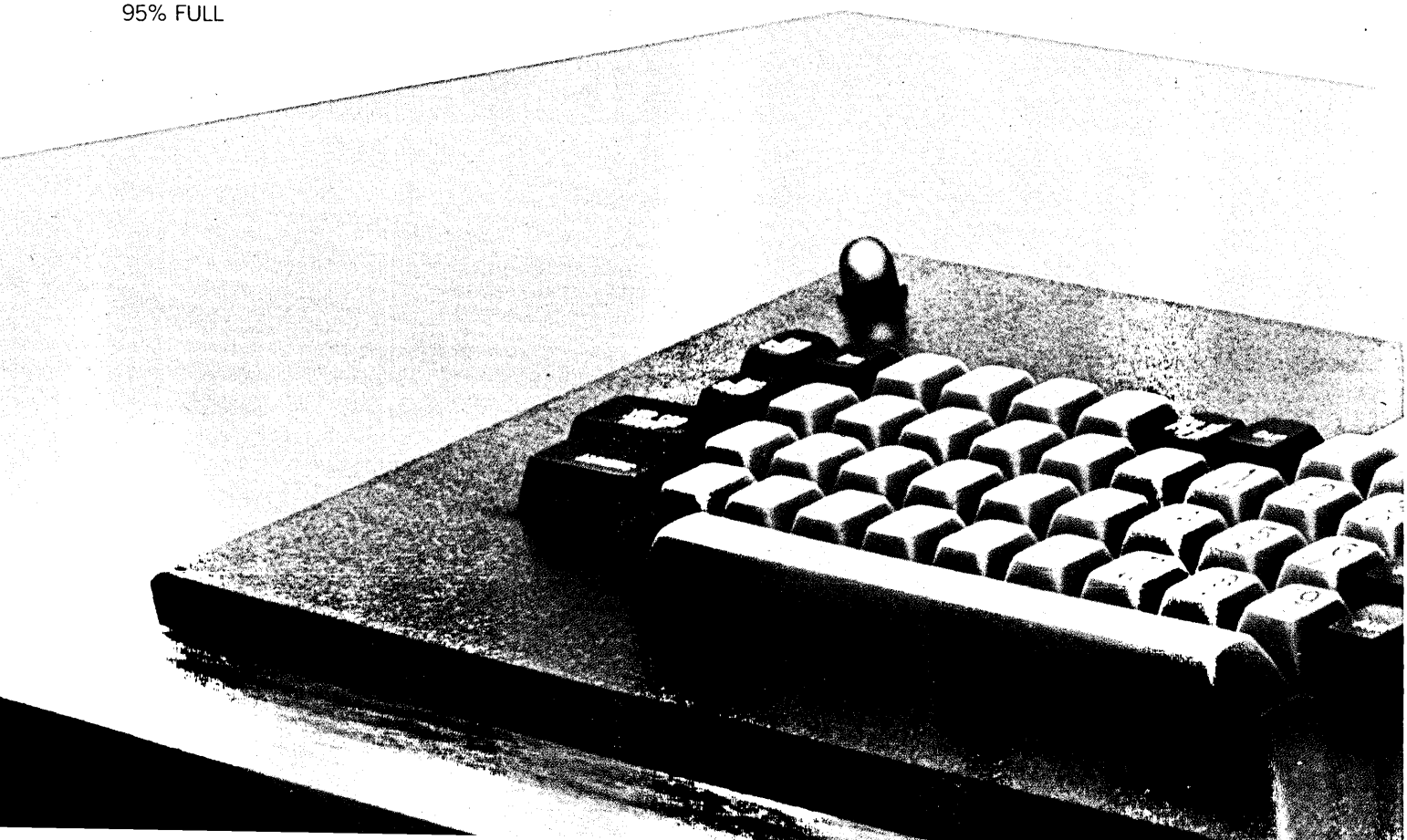
EIGHT KEYSTATION SYSTEM FOR $120 A MONTH PER STATION

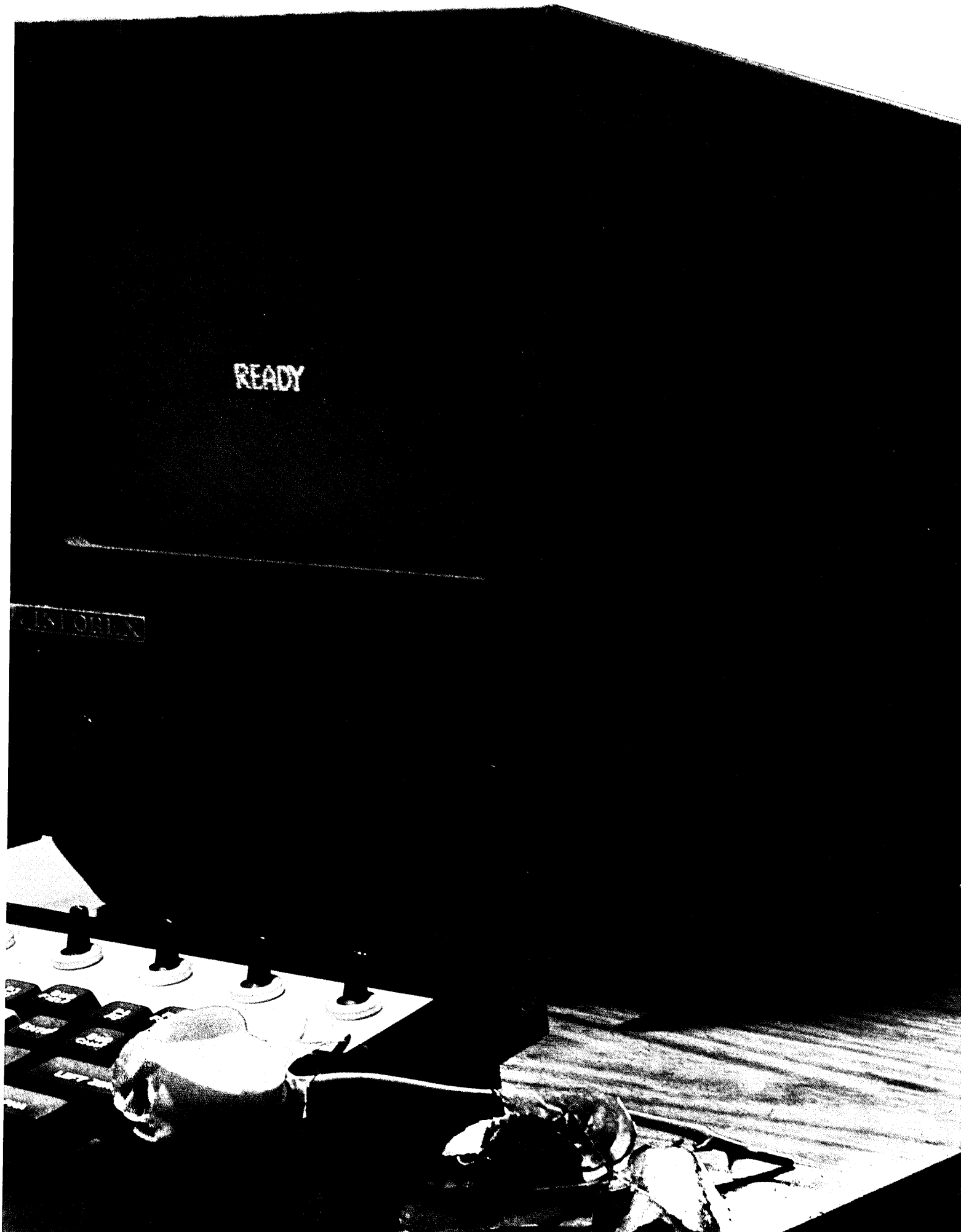
Up to eight keystations input to a memory and logic control unit capable of storing 128 program controls. Any keystation can simultaneously verify the work of any other by full record CRT display or key verification. Completed jobs are transferred to 7- or 9-track computer compatible tape.



INFOREX

CIRCLE 31 ON READER CARD




READY

nancial & General Corp. (DPF&G), Diebold Computer Leasing, Inc., Randolph Computer Corp., and Talcott Computer Leasing. The first three are system lessors. Talcott also markets compatible peripherals.

It's a first for the computer leasing firms who up to now would only allow maintenance by the manufacturer. Clients now have the choice of using Comma or IBM, as well as greater leverage in dealing with IBM maintenance. Comma president George Harmon said his company usually prices maintenance service 10% below IBM fees. He said IBM is too big to match his company's responsiveness.

Comma has 160 field engineers, mostly IBM-trained, in three refurbishing centers and 12 cities in the U.S. It has system maintenance contracts with 100 users and with 14 peripherals manufacturers.

Coma thinks the agreement opens an immediate market of more than $15 million a year.

The lessors association retained Compata, Inc., the Los Angeles computer systems consulting firm, to investigate enhancements to the 360 line. The 10 firms have an investment of some $2.5 billion in 360 systems and represent 65% of the investment in 360 systems by independent lessors.

Compata President Lowell Amdahl said a number of promising system enhancements are under consideration. "Some combination of these will lead to significant extension of the product life of the association owned systems," he said. Although reluctant to say what these were, Amdahl said the investigation would cover new peripherals, memory extensions and software.

Service Firms: Numbers Down, Revenues Up

The number of firms in the data processing service industry reached its peak at the end of the '60s and is in a decline.

This observation by the Association of Data Processing Service Organizations (ADAPSO), based on its Fourth Annual Industry Study, was accompanied by a prediction that the number of offices and total revenue in the industry will continue to grow in this decade.

The latest study was based on industry operating results in 1969 for 132 firms which operated 396 offices and which responded to a mailing to more that 1,000 firms last spring. The study indicated the industry in 1969 was made up of 1,150 firms which operated 3,079 offices in the U.S. Although the number of offices was 40% greater than in 1968 (May 1970, p. 185), the number of firms was down by 18%.

"The average revenue per customer increased from $7500 in 1968 to $10K in 1969. The average revenue per employee, which was approximately $17,000 in 1969, was also significantly higher than in 1968."

Total industry revenue, the report showed, was $2.044 billion in 1969, an increase of 28.5% over 1968. But average before tax profit decreased from 6.5% in 1968 to 2.5% in 1969. The percent of firms which reported

losses increased from 25% in 1968 to 31% in 1969.

So, while more offices were generating more business, the results generally were less than good.

But the prognosis isn't so bad, at least for the more successful firms. ADAPSO notes that 10% of all firms earned 36% of the revenue in 1968, while in 1969 18% of the companies earned 83% of the revenue.

The survey showed that companies in the industry in 1969 employed 120,000 persons, served 220,000 customers, and operated 2,850 computers.

Of the latter, 39% were IBM. Honeywell supplied 13%, and the remaining 48% was supplied by other firms with no one supplying more than 8%.

A typical service firm in '69 offered 24 different types of service, the study indicated, but the majority of its revenue was derived from fewer than five. The three leading groups of services were accounting, input/output, and information systems. On an individual service basis, the top three were key-punching, accounts receivable, and payroll.

Copies of the complete report can be obtained at $15 each by writing ADAPSO, 551 Fifth Ave., New York, N.Y. 10017.

If You Could Write a Book, You Probably Did

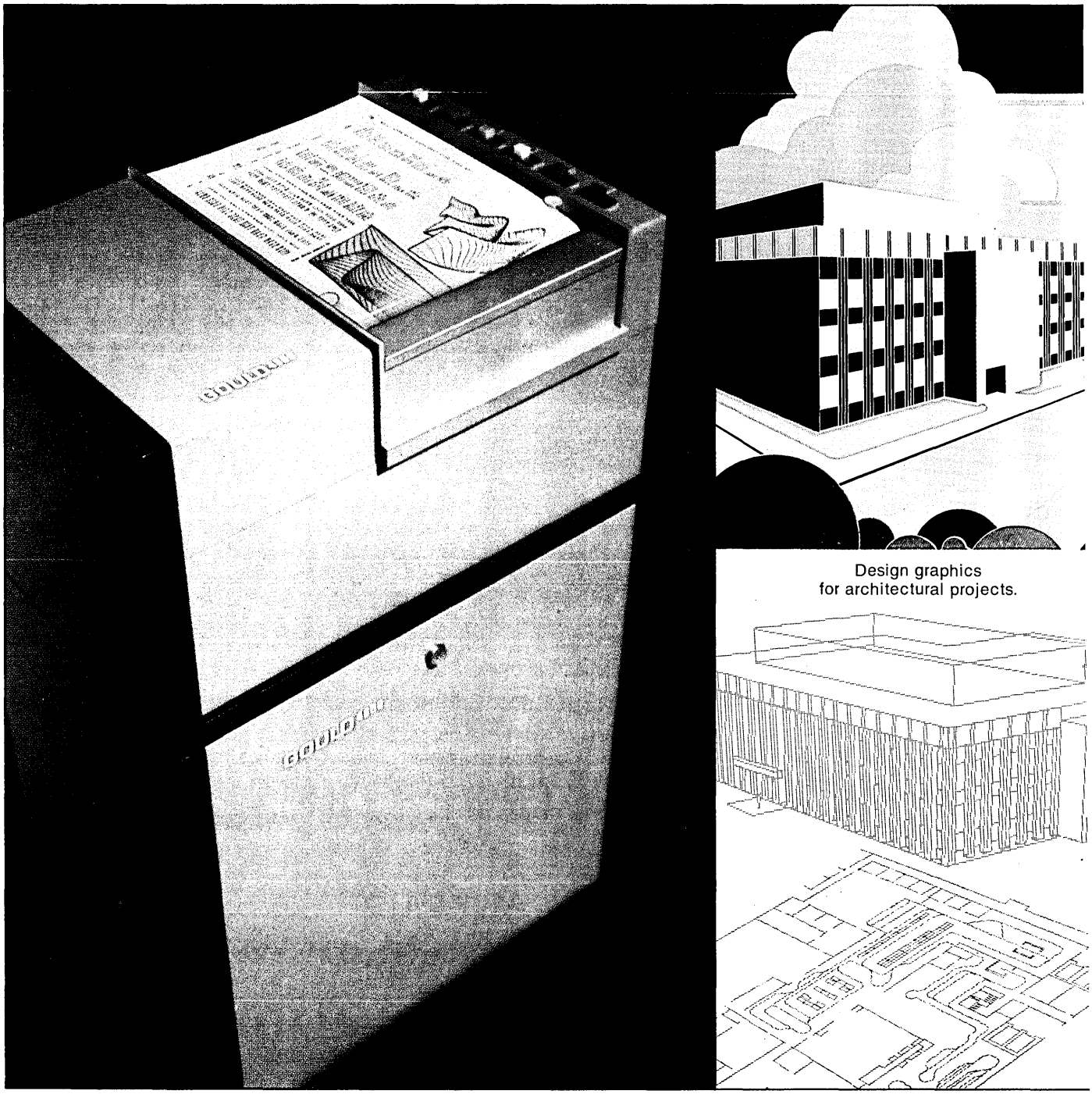
"The Beast of Business" and "Run, Computer, Run" are just two of 628 titles listed in the January issue of the *Computing Newsletter* published by the School of Business Administration of the University of Colorado. Under the heading "Books Useful in Teaching Business Applications of the Computer," the bibliography is separated into various curricula (introduction to edp, programming, languages, etc.) and also provides information on the type and style (textbook or reference book) of the literature (which may not be the right word).

When first published in 1967, the bibliography listed 200 books from 48 publishers. This year, the 628 titles came from 115 publishers. The *Newsletter* states that "Too many books are being published in some subject areas; in particular the introduction to data processing and computer programming subject areas. The section on Introduction to Data Processing contains 75 books. The section on Computer Programming lists 180 books, including 43 books on the FORTRAN language!"

Perhaps most computer professionals feel particularly qualified to write only on an introduction to edp. After that, you have to know what you're talking about.

On the other hand, states the *Newsletter,* several subject areas that previously had only periodical coverage now have hard-cover treatment, "notably the applications areas. Books are now available on the application of computers to the behavioral sciences, personnel management, collective bargaining and ecosystems."

Other titillating titles include "How Computers Do It," "The Anatomy of a Compiler," and, simply, "Comput-



Design graphics
for architectural projects.

We helped pull the plug in the computer bottleneck.

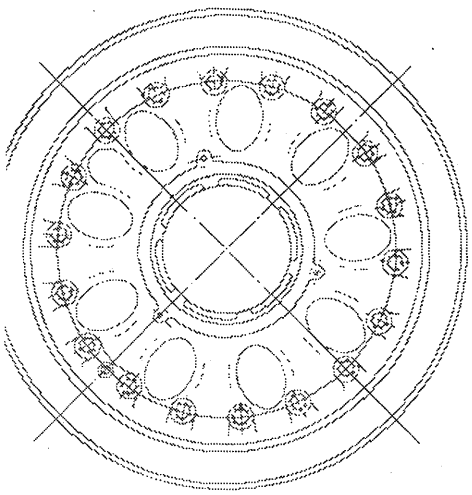
A couple of years back, there wasn't a printer around that could begin to keep up with the output capability of high speed computers. And if the data involved both alphanumerics and graphics, acceptable hardcopy took hours to come by.

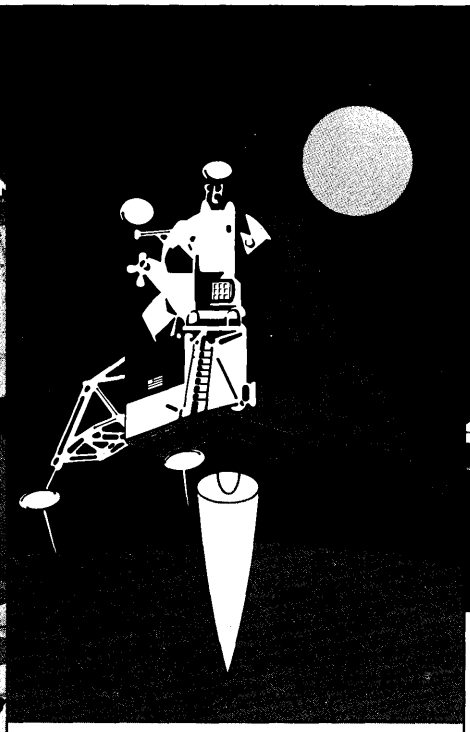
No more.

The Gould 4800 is the first printer to deliver both alphanumerics and graphics at 4800 lines per minute. That's several times faster than most printers on the market. What's more, the Gould 4800 can maintain such speeds as long as you like.

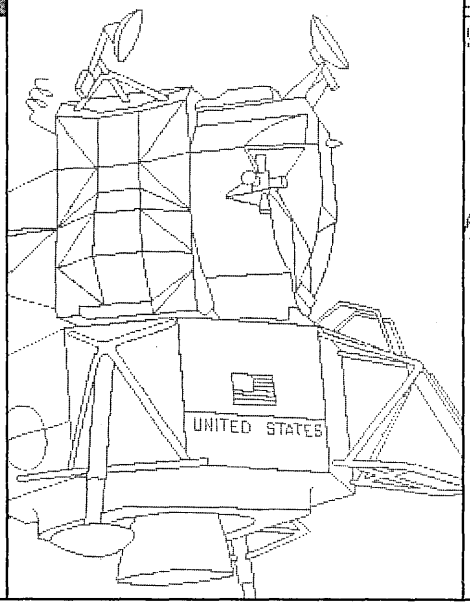
The Gould 4800 is electrostatic. So the

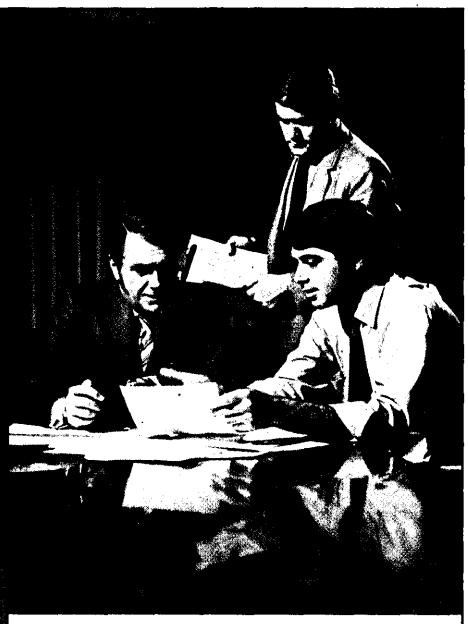
Computerized design for aircraft brake drum.



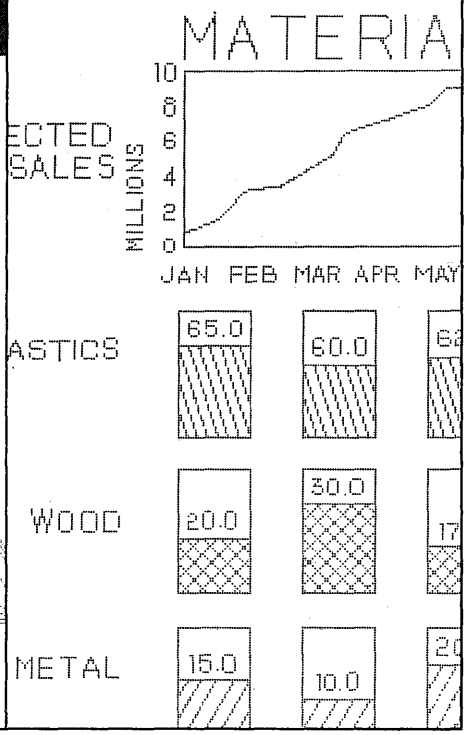


Critical aerospace graphics for quick evaluation.





On-time, easy-to-read management reports.



GOULD

clackety-clack of impact printers is replaced by silence. And people who get paid to think, get some peace and quiet for a change.

There are some nice options, too. Like a character generator. And a choice of 8½″ or 11″ format. We'll also supply software. Plus interfaces for almost any major computer.

Anybody who uses a computer can use it a lot more efficiently with a Gould 4800. It's another example of how Gould's Instrumentation Group puts hard-to-get information into easy-to-use form. Gould Inc., 8550 West Bryn Mawr Avenue, Chicago, Illinois 60631.

ers." You can whip through the "Standard Business Logistics Game" (19 pages) or finger-browse through the "Handbook of Automation, Computation and Control" (1250 pages). And you can make book on a further increase in books on computers.

Everything's Getting Up to Date in Mexico City

The new year in the Mexican computer industry began with the appointment of Dr. Sergio F. Beltran as head of the Informatics and Computation Division of the Federal Commission of Electricity. This development is significant (and refreshing) in that Dr. Beltran is a veteran computer expert.

In Mexico, 74% of the total computer capacity of the country exists within government agencies, and the Commission of Electricity itself operates 15 installations, which include a 360/50 and 65, three CDC 6400s, a Burroughs 5500 and 6500, and an assortment of Honeywell, NCR, GE-Bull, and Univac machines. A 370/155 will soon be installed and additional 370 models are on order.

According to Dr. Beltran, 95% of the estimated 300 computers installed in all of Mexico are U.S. manufactured. Most are in Mexico City, with Monterrey and Guadalajara accounting for much of the rest. Mexico will consider purchase of non-U.S. made computers only if users are satisfied that service and support are available on a reasonable basis.

Dr. Beltran estimates the population of programmers and systems analysts in Mexico at around 3,000, which represents a shortage as usage increases. Surprisingly, only 1% of this total are U.S. citizens, which might be because of a Mexican law forbidding companies to have more than 10% foreign employees. However, interest in working in Mexico is high and Dr. Beltran receives almost daily applications from U.S. and European programmers.

"Computerenglish" is an accepted fact in Mexico among at least 80% of responsible computer professionals, who have apparently decided that it's easier to learn English than to attempt to translate compilers and, most importantly, the relevant programming manuals.

The main problems facing the industry are a shortage of trained personnel, lack of adequate support, and inadequate remote access facilities. Although intercity telephone networks employ modern equipment and techniques, within the cities the service is antiquated, making efficient time-sharing services impractical.

Yes, IBM enjoys around 75% of the market in Mexico, just as everywhere. There are no minicomputers installed at present, but interest is growing for this kind of machine for business applications.

WESCON Seeks Proposals

The technical program committee for the 1971 Western Electronic Show and Convention (WESCON) has issued a call for session proposals in the form of letters proposing session topics, outlining session scope, and listing proposed participants. Subject areas in the computer, information technology, and communications fields listed by the committee as "of interest" include: small computer applications in research and engineering, new systems for solving engineering problems, trends in peripherals, new applications for time sharing, new time-share systems, data management, proprietary vs. off-the-shelf software, management information systems, programmable instrumentation, new data transmission techniques, and trends in telemetry technology. Letters, due by March 15, should go to Raymond L. Leadabrand, Technical Program Chairman, WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90010.

DCA to Meet, Drink

The annual meeting (read bash) of the Digital Computer Association, the forerunner to the Association for Computing Machinery in the Southern California area, will be held at Little Joe's restaurant, 900 N. Broadway, Los Angeles, on Friday, March 19, at 6:30 p.m. The DCA will try to limit attendance to 100 this year (no more than that will fit under the tables), and applications may be made to Miss Toni Schuman, 22400 Napa St., Canoga Park, Calif. 91304, or call her at work, 213/887-4076. Tickets will be around $6.50, which includes vino.

SHORTLINES

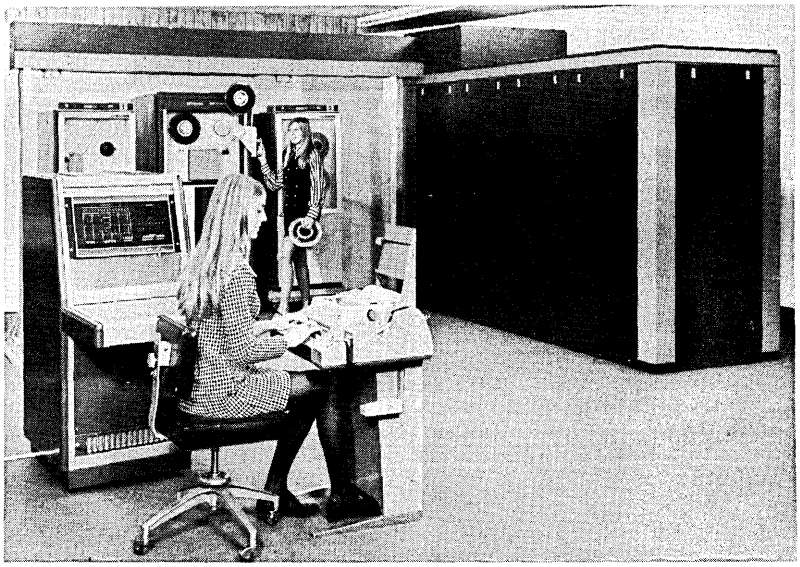
New signs keep popping up pointing to the growing importance of international markets. Univac Division of Sperry Rand Corp. said it will set up manufacturing facilities in Britain this spring ... Equity and Law Life Assurance Society Ltd., Brentford, England, was one of the first to order a Honeywell Model 2015 ... The University of Karlsruhe, West Germany ordered a $7.8 million Univac 1108 system ... A Control Data 3300 system was ordered by Taiwan Railway Administration. It will be used for business data processing and eventually for on-line communications for ticket reservation and car dispatching operations ... Nortronics Co., Inc., Golden Valley, Minn. manufacturer of magnetic recording heads, formed Nortronics, S.A. in Brussels to market its products in Europe and said it will set up a manufacturing facility later ... Information Management Inc. (IMI), a Cobol-oriented software/consulting firm headquartered in San Francisco, signed a reciprocal marketing agreement with a newly formed trans-European software company, Decision Data Corp. And domestically — the New York based research firm Frost & Sullivan, Inc. predicted the micrographics market will grow from $500 million in 1970 to $2.3 billion in 1980, in releasing its latest published analysis and forecast, "Micrographics Market." ... The Computer Searching Service Corp. ordered $250K worth of Omnitec portable data terminals to access the Computer Law Dictionary and stored data on U. S. Court decisions ... The American Bankers Assn. retained National Sharedata Corp. to conduct Basic Banking Systems Design and Analysis courses for its commercial bank members on both the east and west coasts early this year ... SYS Computer Corp. signed a contract with Optical Scanning Corp. to adapt the SYS 1000 microprocessor for use in an Optical Mark Reading Document scanner. Three prototypes were delivered last month and Optical currently is manufacturing the devices under a non-exclusive license ... ITT World Communications began serving its Washington, D.C. international telex and message customers directly from its New York operating center. ■

PRODUCT SPOTLIGHT

Automatic Tape Library

While some think that massive online storage and source data collection are the solutions to efficient feeding of the computer's appetite for data, here is someone who thinks automatic movement of tape reels from library to drive is a step in the right direction.

Saving minutes rather than microseconds, the LCS-5 automatic tape library system is an organization of tape bins, mechanical trolleys, elevators, and shuttles, all under computer control. The tapes are stored in bins, each capable of holding 1,000 reels.



Each tape and its bin location are indexed. They are pulled and returned to storage on the basis of location assignment, and the index list is updated to show any changes of stored data.

In operation, the tape is called out of the library automatically, by the computer if it operates under OS, or by the operator if it is a DOS/360 system. The OS calls can be programmed on the tapes, with each call summoning succeeding tapes when appropriate. The DOS tapes are called in advance of use through a keyboard. The tapes are conveyed by trolleys and elevators to the operator (a 10-second trip). When the tape is no longer needed, it is transported back to the bin.

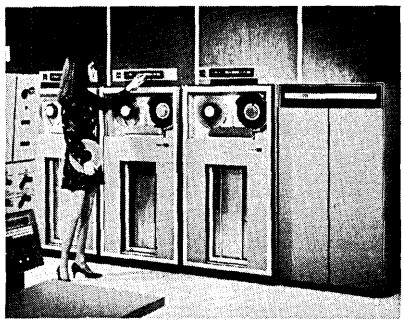
The system also automatically schedules tapes for cleaning and audits its own operation. It incorporates physical safeguards against fire —a 2-inch air space between cabinet and tapes—and magnetic invasion—a Halon purge of the tape bins.

The manufacturer, a new company, is concentrating initial marketing on the 360 Model 50 and larger computer installations with libraries ranging from 3,000 to 10,000 tapes. The price of a five-year lease is $1.50/month per tape. Deliveries will start in the fourth quarter. ADVANCED DIGITAL SYSTEMS INC., Mohawk, N.Y. For information:

CIRCLE 317 ON READER CARD

Tape Subsystem

It hasn't been very long since IBM introduced the 3803 controller and 3420 tape drives for 360/370 systems, and already the competition has the replacements ready. The 6803 controller and 6420 drives, incorporating MSI and LSI circuitry and microprogrammed diagnostics (in the controller), are being billed as "fourth generation" peripherals.



The major feature of the 6803 is called the radial device attachment, which allows each tape drive to connect to the controller independently, thus providing the ability to switch a drive off-line without interfering with the remainder of the tape system. Up to 16 tape drives can be controlled using two, three, or four controllers.

There are five tape drives in the line ranging in capability from the bottom-of-the-line 6420-3, a 75-ips model transferring data at 41 KB and priced at $15,750, up to the 6420-7 for moving tape at 200 ips and transferring information at a 320 KB rate. This model is priced at $25K. Leases are also available, as is a free 30-day trial. TELEX COMPUTER PRODUCTS, INC., Tulsa, Okla. For information:

CIRCLE 319 ON READER CARD

Commo Front End

Bigger things are planned for the 270T programmable communications controller which will initially debut as a transparent 2701/2/3 front end. Added responsibilities will make it a true preprocessing front end some time in the future; but for now, no software changes are necessary. Using the vendor's 900-nsec minicomputer as the controller, the 270T can be expanded as a teleprocessing user increases the size of his network. This would ultimately allow 256 lines to operate asynchronously at 300 baud simultaneously. For synchronous communication systems, the throughput of the 270T is 12,500 cps.

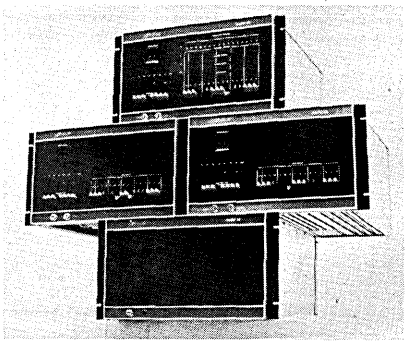
All the necessary software is included in the pricing, as is site analysis, installation, documentation, product enhancements, and training. The manufacturer lists a typical installation as capable of supporting 96 15-cps lines simultaneously. This 270T would lease for $3200/month, including maintenance, after a $22,500 charge for the software. TEMPO COMPUTERS, INC., Fullerton, Calif. For information:

CIRCLE 326 ON READER CARD

(Continued on page 56)

Minicomputer Family

Minicomputer announcements have become rare since the recession, but this firm is expanding its line and no longer limiting its market to OEMs. Originally called the 909 process control computer (Aug. '69, p. 166), the machine is now available in four models. The first two, called the 10 and 20, closely resemble the original 909. The 10 is a process control machine with a blank console and 1K x 16 read/write memory, expandable to 4K. Price is $3500. For an additional $450, the Model 20 includes an operator's console.



The third model, called 30, has 4K memory expandable to 32K of directly addressable memory. Price is $5950.

Finally, the Model 40 offers such new features as hardware multiply/divide, hardware double-precision N-bit shift/divide, eight general purpose registers, and floating point firmware. Execution time for a floating point square root is about 366 usec. Memory is expandable to 32K. Price is $7790.

All models are in production and are available within 30-60 days. Maintenance contracts are available for end users, and quantity discounts are offered to OEMs. GRI COMPUTER CORP., Newton, Mass. For information:

CIRCLE 323 ON READER CARD

Communications Gear

Honeywell has announced two new concentration systems and a modem by-pass for transmission up to 2500 feet. The concentrators, called the H1621 and 1622, convert up to 128 low-speed lines (45-300 bps) into one to four medium-speed lines (1200 to 9600 bps). Each system features auto restart, power-failure interrupt, and watchdog timer to permit unattended operation. An automatic recovery option allows programs to be loaded from the host computer, and other options include a cyclic redundancy check to permit medium-speed lines to operate with System/360 and binary synchronous communications line procedures. Both ASCII and EBCDIC codes are supported. The 1621 rents for under $1000 per month, and the 1622 rents from $1600 per month. Delivery is within 90 days.

The modem by-passes are plug-in replacements for the EIA RS232C modem. They operate at up to 10,800 bps, and may be used in tandem as repeaters for communication in additional 2500-foot increments. A pair of by-passes sells for $395; delivery requires 60 days. HONEYWELL INFORMATION SYSTEMS, Framingham, Mass. For information:

CIRCLE 324 ON READER CARD

Modem

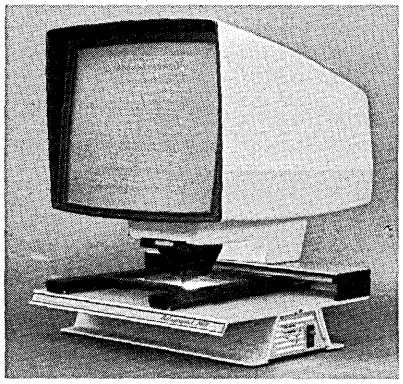
Modem prices continue to decline, and now even ITT is offering an inexpensive model, the ITT 2003 at $40/month or $1430 purchase. It provides 2400 bps asynchronous and/or synchronous operation, and will be available off-the-shelf in the next quarter. Features include a built-in delay-equalizer and capability of 1200 bps operation over dial-up or unconditioned lines. ITT, E. Rutherford, N.J. For information:

CIRCLE 333 ON READER CARD

Microfiche Viewer

A price tag of only $145 is attached to the DatagraphiX 1400 microfiche viewer, which is one of the handsomest units we've seen. Two models are available for displaying 24 or 42X fiche. Deliveries will start in May for the 1400. STROMBERG DATAGRAPHIX INC., San Diego, Calif. For information:

CIRCLE 321 ON READER CARD



Microfilm Duplicator

Duplication of both 35 and 16mm vesicular (heat processed) microfilm rolls up to 1,000 feet in length is possible with the model 1200. The unit is said to be easy to thread, and once threaded the 1200 duplicates film at up to 200 fpm with no special darkroom facilities required. The unit is priced at $7950 and is also available on a conditional lease/purchase contract. A three-year lease would cost $220/month and requires no down payment or interest. XIDEX CORP., Sunnyvale, Calif. For information:

CIRCLE 332 ON READER CARD

Remote Batch Terminal

Available to PDP-10 users is the DC71 remote station, made up of a 200-cpm reader, a 350-lpm printer, and the DS10 synchronous line interface. The package is priced at $53K. The DC71 has a PDP-8/I inside, so the station can also make use of the manufacturer's software library for that machine, including terminal-oriented routines and stand-alone software. The DC71 package also includes a software communications extension to the PDP-10 monitor. DIGITAL EQUIPMENT CORP., Maynard, Mass. For information:

CIRCLE 332 ON READER CARD

OEM Memory System

Up to 10 bits per word and 1K words describes the basic RAMM 1024 MOS memory system. The I/O section is structured similar to a core memory and has the advantage of non-destructive read out. Information is accessed in 500 nsec, with the cycle time for the TTL/TTL-compatible device given as 600 nsec. Single quantities, including a DC/DC converter, are priced at $495 and available 30-45 days ARO. STANDARD LOGIC INC., Santa Ana, Calif. For information:

CIRCLE 344 ON READER CARD

Mini Commo Controller

The recently announced SYNCOMP MICRO/1 minicomputer, which is biased toward architectural and engineering applications, now gets a mini communications controller for connecting up to nine interactive terminals. Three models are available: The SYNCOMP DATA/1 has 6K bytes of 1-usec core, 7 internal registers, and a quadruple cassette system providing 1 megabyte of storage. The DATA/2 has 4K of core, the tape cassette system, and a 102-kilobyte dual-disc system for accessing data in an average of 8.7 msec. Adding 4K of memory to the DATA/2 makes its a DATA/3. Up to 16 lines can be attached to each DATA/model, and since up to 16 such controllers can be attached to the MICRO/1, this would theoretically allow 256 subscriber lines. Available 90 days ARO, prices that include an assembler, text editor, and a math library, start at $17,690. SYNERGISTIC COMPUTER SYSTEMS, INC., Fullerton, Calif. For information:

CIRCLE 328 ON READER CARD

Microfiche Display

After inserting a cartridge containing 30 microfiche (20, 24, or 42X) into the front of the AMRDD (Automatic Microfiche Retrieval Display Device), the operator next selects the desired fiche by rotating the switch to the appropriate number, or letter, depending on data organization. When the "action" button is pressed, the index page for that particular microfiche will be automatically displayed on the viewing screen, informing the operator of the exact location of the desired information. Next the x-y coordinate switch is pressed, displaying the desired page approximately 1.5 seconds later.

When finished reading, the operator then presses the eject button and the fiche returns to the cartridge, which is then ejected.

A nice feature of the AMRDD is that the viewing screen is blacked out during search time, so one doesn't get dizzy watching the screen all day. The unit is priced at $1800, with volume deliveries available in the second quarter. MICROGRAPHIC TECHNOLOGY CORP., Santa Ana, Calif. For information:

CIRCLE 325 ON READER CARD ■

NOW AVAILABLE

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The Fourth Generation

— starting a unique and continuing series of in-depth analyses of the key issues in computing today.

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The Fourth Generation

Contents

Each Infotech State of the Art Report is edited to provide a logically structured, easily referenced, and intensely readable analysis of key issues in computing. It is based on material drawn at first hand from participants in the Infotech State of the Art Lectures and from other specially invited contributors.

THE FOURTH GENERATION contains:

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4) A specially selected annotated *bibliography* of important works relevant to future developments in computing.
5) Author and subject *indexes* referencing in detail all material in the Report.

Contributors to the Fourth Generation

I M Barron
P J Brown
J N Buxton
P Cox
E W Dijkstra
N D Gammage
G E Hall
D F Hartley
D Hendry
C A R Hoare
J R S Kistruck
K Kolence
I M Laing
B W Lampson
J G Laski
R M McKeag
D Morris
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☐ Please send further information on State of the Art Reports.

☐ I am interested in attending the State of the Art Lectures. Please send details of the forthcoming programme.

INFOTECH

SOFTWARE

Planning/Scheduling

Three program products for planning and scheduling have been announced. The first, called MINIPERT, is for using PERT in an interactive mode through a keyboard terminal. Written in APL, the program requires minimum memory to support that language, plus the APL program product.

Under OS, MINIPERT operates on System/370 and on System/360 Models 50 and up, with minimum 384K. For DOS, it runs on System/370 Models 145 and 155, and Systems/360 Models 40 through 75, with at least 256K. Availability is scheduled for July at $150 per month under license.

The second product, Project Management System IV, is a new version of a program that helps coordinate schedules, costs, and resources for projects that can range into thousands of activities. It is scheduled for availability this month, in four modules at the following monthly charges: report processor, $50; network processor, $50; cost processor, $50; and resource allocation processor, $200. It runs under OS. With the resource allocation module, it requires 128K on System/370 and System/360 Models 40 or larger; without the resource allocation processor, 64K is required and the 360/30 can accommodate the system.

Finally, the Vehicle Scheduling Program Extended, an enhanced version of a program which aids fleet owners in determining the most efficient routes and schedules for their vehicles, considering such delaying factors as traffic, is available now at $100 per month for DOS, and $175 for OS. The former version runs on System/370 Models 145 and 155, and System/360 Models 30 through 75 with minimum 64K. The latter requires 128K on System/370 and System/360 Models 40 and up. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 300 ON READER CARD

Teleprocessing Monitor

Users of the IBM FASTER (file and source data entry technique for easier retrieval) teleprocessing monitor might be interested in a rewrite of that package. MULTI-FASTER, while transparent to current FASTER users, adds the following capabilities: separate tasking of line control, providing for the overall control of the several message processing threads which may be in operation simultaneously; a priority message scheduling scheme allowing each transaction code and terminal within the system to have its own priority; and the capability for one or more message-processing threads to operate as independent tasks under the direction of the line and task control module. Additionally, other routines have been modified to make them re-entrant.

ISAM files are accessed via BISAM and QISAM. Multiple threads may access the same file concurrently through the use of multiple file control blocks.

The complete MULTI-FASTER system consists of the priority processing module, multithreading capability, disc queuing, and necessary interfacing and is priced at approximately $50K. Portions of the system are available for separate purchase, and MULTI-FASTER may be leased. The versions available are for DOS, OS MFT II, and OS MVT. Core requirements generally depend on the number of lines being supported. SYSTEM DYNAMICS INC., Oakland, Calif. For information:

CIRCLE 304 ON READER CARD

Macro Assembler

Using a 32K 360 running DOS, MAL-11 generates object programs for the Digital Equipment Corp. PDP-11. Among the features of MAL-11 are the capabilities for handling nested macros, parenthetical expression evaluation, arithmetic, logical relational, and shift expression operators, and for the data type to be determined in the operation and syntax of the item.

Included in the package, which is offered as an alternative to the PAL-11 program supplied by the PDP-11 manufacturer, is the assembler, a link-editor, and concordance. MAL-11 may be leased for $100/month, or $3K for three years. PROGRAMMATICS, INC., Los Angeles, Calif. For information:

CIRCLE 303 ON READER CARD

Cobol Abbreviator

The COBOL programmer can reduce coding to a minimum by changing typical COBOL statements into short mnemonics, according to the vendor of QOBOL. Abbreviations of standard COBOL words and clauses are changeable to meet the specific requirements of each user, a macro facility is provided, and the programmer can create abbreviations to be used in individual programs as he wishes. Each mnemonic has a maximum of four characters. A typical efficiency increase is said to be 20% for coding and keypunching. Price is $275. COMPUTER RESOURCES CORP., Wilton, Conn. For information:

CIRCLE 301 ON READER CARD

S/3 Store Inventory

Buyers for small department stores, specialty shops, and other retailers will be able to get more timely information about what is or isn't selling through a program called Unit Inventory Techniques for System/3. It runs on the Model 10, and generates reports that can include breakdowns on styles, colors, sizes, and pricelines, using the retailer's own data for input. It is written in RPG II and requires 12K of core. Availability is scheduled for July, at $75 per month under license. IBM DP DIV., White Plains, N.Y. For information:

CIRCLE 305 ON READER CARD

Fortran Cross-Reference

A symbolic name cross-reference dictionary is produced from FORTRAN programs by the Superef package as an aid to validation, maintenance, and documentation. The system is available for sale to users at under $3K, or for 11¢ per card plus a set-up fee at a vendor-provided facility. Superef is written in FORTRAN IV and requires 50K storage on CDC 6000 series cpu's; it accepts FORTRAN source code developed for most processors. Versions for System/360 and the Univac 1108 are under development. MANTECH CORP., Livingston, N.J. For information:

CIRCLE 302 ON READER CARD

(Continued on page 62)

one-upmanship

Model CDS 114

At the Fall Joint Computer Conference in 1969, Century Data Systems went one-up on the industry with the introduction of the CDS 114, the fastest, most reliable, most efficient and lowest priced disk drive on the market.

These disk drives are available to 360 computer users through Century Data's parent company, California Computer Products, Inc.

two-upmanship

Model CDS 214
Less than one year later, Century Data introduced the CDS 214, a disk drive that's actually twice as good as the CDS 114. The explanation is simple: the CDS 214 is two 114's in a single cabinet. It gives you 58 million 8-bit bytes of storage in half the space it took before.

Model CDS 215
And now, Century Data Systems introduces the Model CDS 215, a 400 track, two-high disk drive capable of storing up to 116 million 8-bit bytes, twice as much as our 214. How about that? Now we've even two-upped ourselves.

Century Data
SYSTEMS
1270 North Kraemer Blvd.
Anaheim, California 92806
(714) 632-7111

CIRCLE 10 ON READER CARD

. . . SOFTWARE

Time-Sharing for Banks

A series of six programs for small banks is being offered both for sale to time-sharing vendors and as a service in the southeastern states. The programs use the paper tape generated by NCR accounting machines as a by-product of posting to ledger cards to provide input via a t-s terminal. This data forms the basis for management reports, including such information as daily profit statements on both a cash and accrual basis, an analysis of time and demand loans to commercial accounts, a report on delinquent loans, bond portfolio analysis, and a safe deposit box report.

The package is written in FORTRAN IV and SuperBASIC and is operational on the vendor's dual GE-430 system with disc, but may be modified at extra cost for other equipment. Its basic price is $10K. COMPU-TIME, INC., Ft. Lauderdale, Fla. For information:

CIRCLE 313 ON READER CARD

Cobol Aids

Unlimited abbreviation capability throughout level F and ANSI COBOL divisions is the principal feature of the MAGIC-Shorthand package. Approximately 64K bytes of IBM 360 or RCA Spectra memory is required, which also holds a macro facility, syntax checking, and output formatting capabilities. Including installation and maintenance, MAGIC-Shorthand is priced at $3K.

Also priced at $3K is the MAGIC-Standard Enforcer, for providing an audit check of level F or ANSI COBOL. All nonstandard usages are automatically flagged or rejected. The MAGIC-Standard Enforcer is written in COBOL and BAL and requires 32K bytes. INFORMATION MANAGEMENT INC., San Francisco, Calif. For information:

CIRCLE 306 ON READER CARD

Correction

User restrictions on the TESTDATA package (Nov. 15, p. 173) should have read: A minimum of 6 to a maximum of 20,000 characters per physical record; from one to a thousand fields within records are allowed, as are up to 50 variable length fields.

(Continued on page 67)

Graphs

AUTOGRAF is designed to generate fully labeled graphs on 132-character IBM line printers. By means of a simple graph-specification language, the user selects from a variety of graph types, including vertical, horizontal, and profile bar graphs, point-plotting graphs, and line graphs. Overlay graphs make use of multiple labels, symbols, and variables to demonstrate complex relationships among data. Formatting options permit the user to position several graphs on one page or to extend a graph horizontally or vertically over several pages. The system is written in PL/I, and requires about 200K under System/360 OS. A 14-year lease is $7500, while a one-year lease is $350 per month. CAMBRIDGE COMPUTER ASSOCIATES, INC., Cambridge, Mass. For information:

CIRCLE 308 ON READER CARD

Personnel, Payroll

The Yale Univ. personnel/payroll system, in use by that institution for three years, is now available for sale to businesses as well as colleges. Called Manfile, the package provides payroll and personnel information, including provisions for local taxes, government reports, pensions, benefits analysis, union reporting, and even an employee phone directory. It is written in COBOL and BAL and runs under OS/360 on a minimum 256K Model 40.

The system is batch oriented but can be extended to remote applications. Price is $20-25K, depending on modules required, plus an installation fee to cover necessary customizing. INFORMATION TECHNIQUES, INC., Norwalk Conn. For information:

CIRCLE 307 ON READER CARD

Letter Writer

Over one million letters are estimated to have been written by PERNAM/360 and LWSS in the developer's own installation, and now both programs are for sale. The first component, PERNAM/360, enables a user to format or convert names and addresses from any input source in any format to a fully punctuated, expanded upper/lower case name and address, including a salutation if so desired. Titles, suffixes, and components of business names are recognized, as are abbreviations. Any number of lines of name and address is accepted by the 32K BAL program (sex recognition boosts the core requirement to 48K) on a DOS 360.

LWSS (Letter Writing Support System) composes the text using certain fixed and variable portions of data. Automatic line control and cascading are provided along with the ability to handle an unlimited number of variable-length inserts, it is claimed. Using the concept of a letter text matrix, set-up time for a full letter is said to be less than 30 minutes.

The user controls the hyphenation by entering the hyphens at acceptable locations when he nears the end of a line of text. The LWSS then ignores the hyphens that do not apply, which sounds like a good solution to the hyphenation problem. LWSS is priced $9K (including PERNAM/360, which is required), or PERNAM/360 is available separately for $6K. SOFTWARE TECHNIQUES, INC., Scarsdale, N.Y. For information:

CIRCLE 315 ON READER CARD

Business Programs

A comprehensive set of business programs is offered for the Data General Nova minicomputer line and the Atron Datamanager computer. The general ledger accounting program includes a general ledger, general journal, and income statement. The accounts receivable package includes activity reports, trial balance, aging report, order register, invoicing, and sales report. Invoice register, check reports, distribution report, and a cash requirements report is generated by the accounts payable package, while the payroll system provides a payroll journal, departmental summary report, earnings report, time sheet, quarterly report, 941A report, W2 forms, a termination report, and the checks.

The packages range in price from $5-12K, and generally require about 8K bytes. The prices include installation, documentation, and a guarantee that they will perform correctly. The developers can also provide complete turnkey systems. RHOMBIC RESEARCH, INC., Fort Worth, Texas. For information:

CIRCLE 314 ON READER CARD ■

Mars is talking, but nobody's listening.

The Jet Propulsion Laboratory's computers were standing ready to analyze the impulses from Mariner 7 as it passed close to Mars.

Suppose—right then—the Pasadena Laboratory's main power source developed a disturbance—blacking out priceless Martian data.

What would happen?

Nothing. Thanks to the back-up of General Electric's Static Uninterruptible Power Supply installed by our I&SE engineers.

In case of a power disturbance, the UPS carries on without interruption—data collection continues without missing a beep. Its job in essence, is making sure—which also pretty well defines the function of our I&SE engineers.

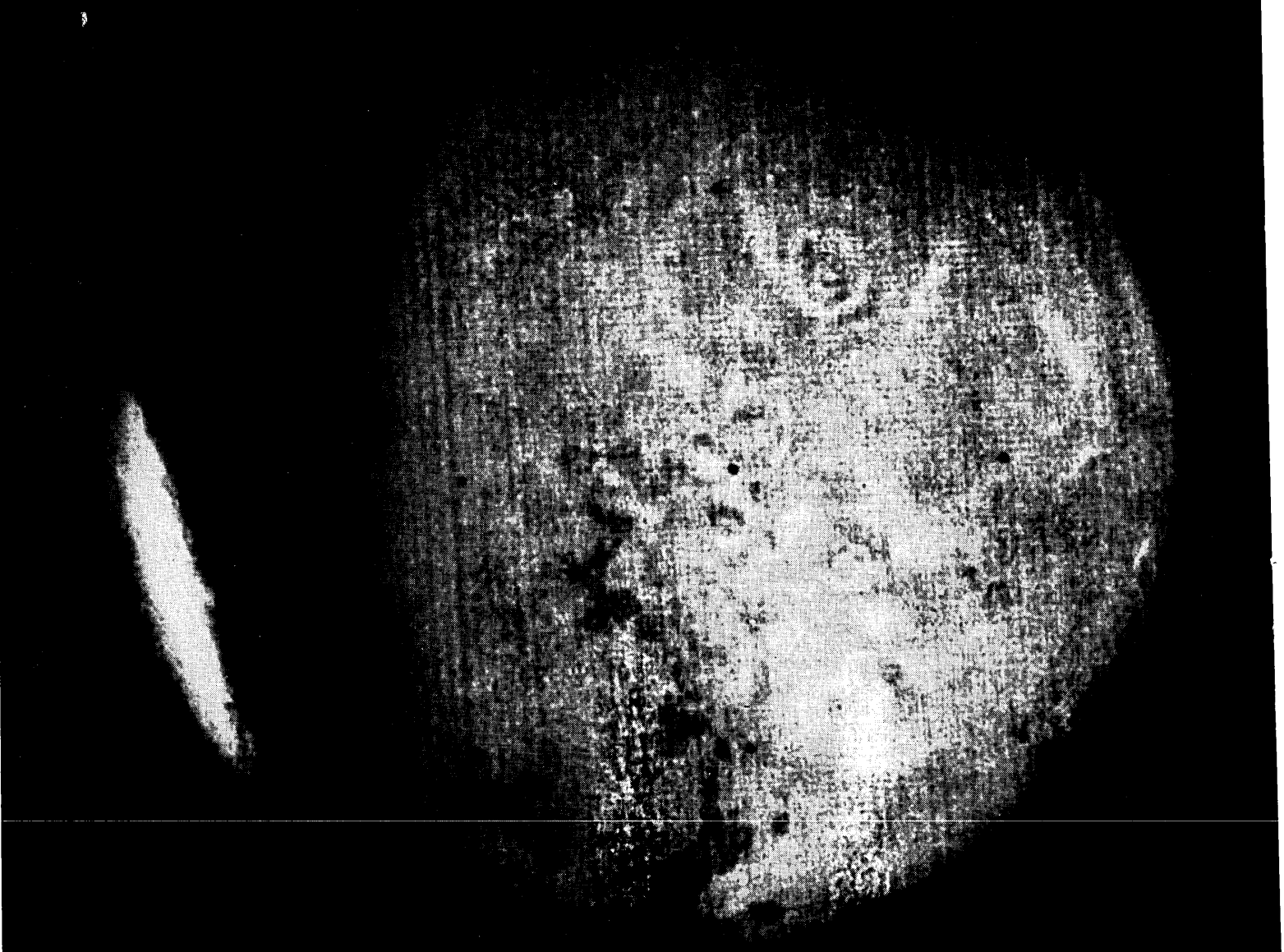
With the UPS, their job involved computers. But our engineers work with some 45 GE product departments in all—everything from turbines to transformers to nuclear equipment.

They oversee installation, supervise maintenance, train operating personnel—do everything possible to make sure GE customers get the most from GE equipment.

When you know the apparatus like they do, even making sure the word gets through from Mars can be all in a day's work.

Nobody knows GE equipment like GE people.

INSTALLATION AND SERVICE ENGINEERING DEPARTMENT



GENERAL ELECTRIC

CIRCLE 38 ON READER CARD

WORLD ROUNDUP

U.K. TURNDOWN TO PARALLEL U.S.

The turndown in the economy that began in the States over a year ago is just beginning to bite in Europe. Apart from a steadily increasing performance by Siemens in Germany, most other manufacturers are tightening their belts for a tough year ahead. In the U.K. in particular, Sir John Wall, chairman of International Computers, Ltd., has warned that 1971 will be a difficult one for British industry in general. The problems of an austere economic climate will be accentuated for many firms that also face the effects of adjusting to an ending of a government scheme of investment grants.

Sir John Wall referred to the impact of the ending of investment grants at a presentation of ICL's results for its last financial year ending October. This is one of the finance policy changes introduced by the Conservative Government in the fall to peg federal spending in the battle against inflation. But it is a policy that will cost the computer industry an immediate $85 million over the year plus many indirect consequences.

The investment grant policy was introduced by the Labour Government six years ago to stimulate capital investment and modernisation programmes. A number of key industries and regional development areas could claim a rebate on the purchase price of capital plant. This meant a 20% rebate on the purchase price of computers. On a direct sale the advantage went to the user. In rental agreements, the rebate goes to the titleholder or the machine (i.e., the lessor). Investment grants are being replaced by allowing a more rapid capital depreciation for tax purposes.

But the overall effect will be to put a squeeze on cash flow. This came at a time when the service industry was already feeling the draft in the economy. Cutbacks are already taking place among service companies. One of the first came at SIA, the London offshoot of the big Metra consulting organisation of Paris, with a CDC 6600 in London. About 50 have been axed.

Despite the gloomy environment, Sir John Wall forecasts a cautiously optimistic year for ICL. Results for the last financial one show a turnover of $315 million with pre-tax profits of $5.04 million to $18.17 million. Behind these figures lies a major reorganisation of ICL involving a $44 million write-off on dp equipment and other assets. Discussions between the ICL board and Government Ministers have given some assurance that the new political lot are prepared to recognize a need for a flourishing indigenous computer industry. In April the company is due to receive the final $6 million installment of $35 million the government is providing to bolster ICL's r&d. Of money received so far, not all has been used and $10 million has been carried forward against future r&d costs.

Software systems firm slashes printout costs, compresses production schedules with Gould 4800.

Automation Technology Inc. is a specialty software systems house in Champaign, Illinois. One of their many capabilities is the design and production of the precision artwork used for making printed circuit boards. To help meet the rapidly growing demand for increasingly complex and compact circuitry, ATI uses a Gould 4800 electrostatic printer/plotter.

Art Carroll, ATI's President, provides the details:

"One of the key steps in our operation is the validation of our circuitry designs. This is done with our design automation system and requires several iterations to arrive at the optimum combination of component placement, circuit paths, interconnections and drilling patterns. Before we had the Gould 4800, we had to go to our photoplotter for these iterations. This was both costly and slow as photoplotter time runs about $75 an hour and one iteration may take hours to produce.

"The Gould 4800 gives us both alphanumerics and graphics for pennies per page. And lets us pinpoint defective inputs and make corrections as we go. This way, we don't have to use the photoplotter until we're ready for the production master.

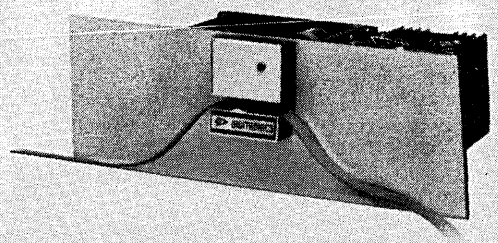
"As our circuit designs grow more complex, the Gould 4800 becomes even more valuable. At the rate of 100 sq. in. per sec., it furnishes a graphic printout that superimposes the wiring patterns for several layers of a multi-layer circuit. It also provides our alphanumeric "fail" list that gives us complete details on connections not successfully completed. This permits early manual intervention.

"This sort of speed, combined with its versatility, quietness and reliability, makes the Gould 4800 ideal for our operation. Without question, it's our key piece of peripheral equipment."

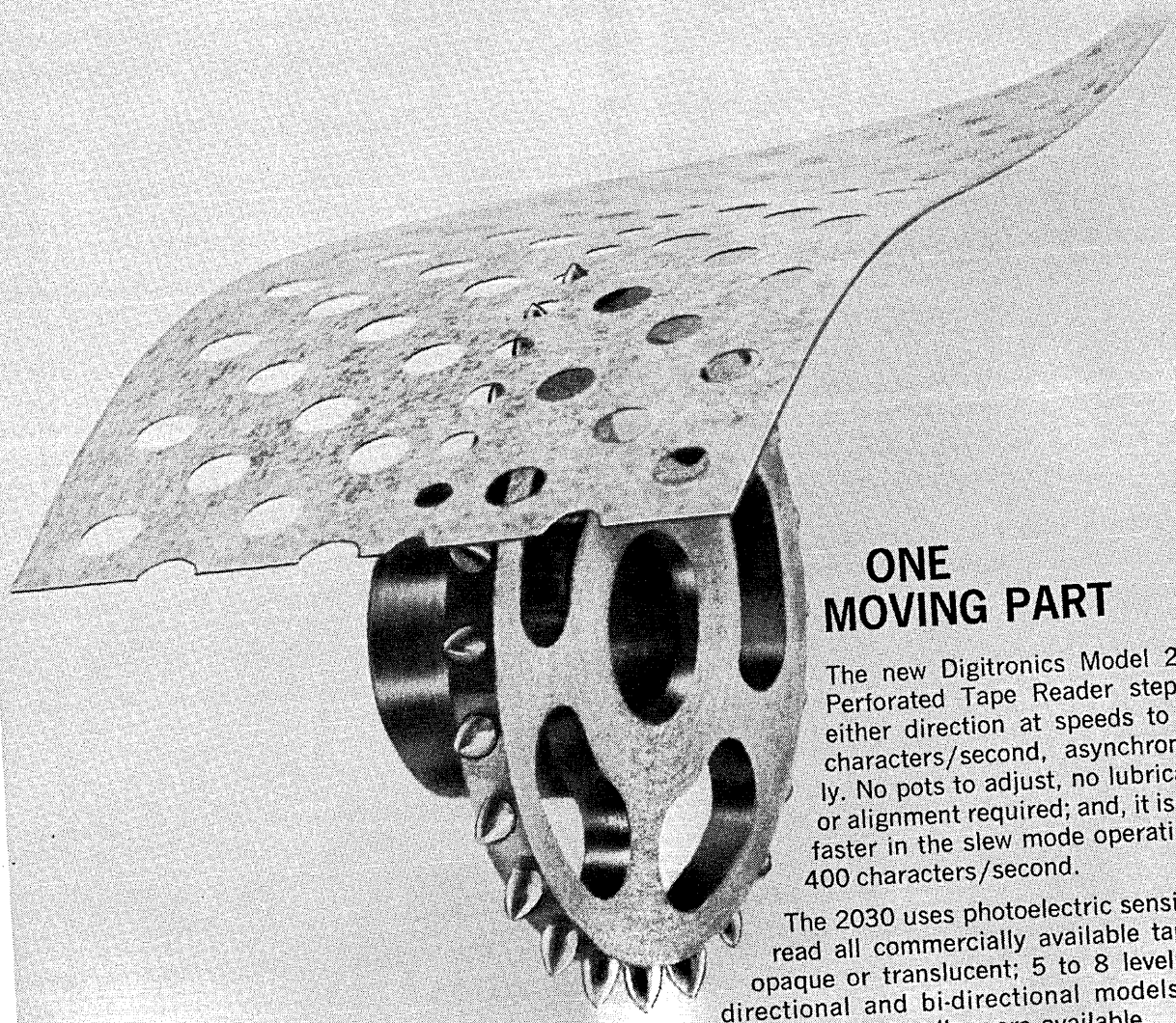
All kinds of companies with all kinds of hardcopy requirements have found the Gould 4800 to be an optimum solution. This smooth, quiet electrostatic printer delivers up to 4800 lines per minute on an 8½" or 11" format. It has an optional character generator. Software and interfaces for major computers are available. And while the Gould 4800 has relatively few moving parts and little need for maintenance, there are service facilities nationwide.

Find out what the Gould 4800 can do for you. Give us a call. Or write: Graphics Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

GOULD



FASTEST STEPPER IN TOWN...



ONE MOVING PART

The new Digitronics Model 2030 Perforated Tape Reader steps in either direction at speeds to 300 characters/second, asynchronously. No pots to adjust, no lubrication or alignment required; and, it is even faster in the slew mode operating at 400 characters/second.

The 2030 uses photoelectric sensing to read all commercially available tapes—opaque or translucent; 5 to 8 level. Unidirectional and bi-directional models with compatible tape handlers are available.

Our "fast stepper" also has fast delivery. Contact your nearest Digitronics representative (listed in EEM or EBG), or write, Digitronics Corporation, Albertson, New York 11507, (516) 484-1000.

DIGITRONICS® CORPORATION ... *when every bit counts.*

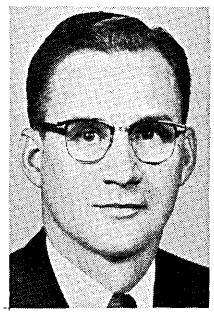
CIRCLE 23 ON READER CARD

PEOPLE

Burroughs Corp. announced top executive shifts which industry sources interpreted as a move to further strengthen its edp marketing position. **James A. McCullough** was named vice president and group executive of the Business Machines Group, succeeding **Richard O. Baily** who was named to head the company's Business Forms and Supplies Group. McCullough once was head of marketing with the firm's International Group and most recently headed product management. His new post formerly included direction of marketing, engineering, and manufacturing. But engineering and manufacturing last year was assigned to a Systems Manufacturing & Engineering Group headed by **Duray Stromback,** thus allowing McCullough to concentrate exclusively on marketing.

Burroughs, which said the moves were primarily executive promotions, also named **Stan Jones,** former director of computer systems on the corporate management staff, to replace McCullough. **Charles E. Exley, Jr.,** former vp and group executive of the Business Forms and Supplies Group, was named the corporation's chief financial officer following the resignation March 1 of **Harry G. Bowles,** senior vice president of finance.

Other appointments announced recently: **George K. Bardos,** New York regional director for Control



J. A. McCullough

Charles Exley Jr.

Data Corp.'s Data Services Div., was elected vice president of Brokerage Transaction Services, Inc. (BTSI), formed recently by Ultronic Systems Corp. and Control Data. Ultronic also announced the appointment of **William Rauch III** as vp for brokerage marketing. He will direct marketing of the company's products for the brokerage industry, including services offered by BTSI. . . . **George F. Troy,** former president of Commercial Credit Computer Corp., has been named director of corporate planning for the parent Commercial Credit Co., succeeding **Harold T. Hahn,** elected president of a subsidiary, American Credit Indemnity Co. of New York. Commercial Credit also named **M. Stanley Baker** director of computer operations and **Irvin W. Kues** director of computer systems, both in Baltimore. . . . **William J. Vitek** has left IBM after 20 years to join Xerox Data Systems as vice president and manager of the programming division. Most recently he had been with IBM's Service Bureau Corp. in San Jose as director of development and terminal services systems operation centers. . . . Modular Computer Systems, Inc., appointed **Seymour D. Schwartz** director of programming where he will direct planning, development, and support of the one-year-old company's measurement and control computer systems, called Modcomp. Schwartz left Systems Engineering Laboratories where he was vp of programming. . . . Computer Sciences Corp. has elected **Ezra D. Grodner** secretary and a vice president, succeeding **James W. Z. Taylor** who resigned. Grodner has been with the company five years, most recently as corporate counsel. . . . **Richard H. Hill,** who left Informatics, the software firm he helped found in 1962, has joined Honeywell Information Systems as director of advanced software development in the Computer Systems Div. . . . The Honeywell Institute of Information Sciences, which runs five training schools, will be headed by a full-time director for the first time since being formed in May 1969. He is **Roy J. Zabierek,** who was director of divisional marketing support with Honeywell. . . . **Theodore H. Bonn,** former director of applied research and standards with Honeywell Information Systems, has been named director of the digital techniques laboratory at the Sperry Rand Research Center, Sudbury, Mass. . . . **Dr. Donal B. Duncan** has been named group vice president of a newly formed Information Systems Group within the Singer Co. in San Leandro, Calif., where Singer's Friden Div. is located. Duncan is president of Friden as well as head of the new group which will expand activities of the company in the retail automation, office equipment, and data processing fields. ■

...try a Teletype® 37
...and look
into mag tape!

We don't have a crystal ball. And rarely resort to mystic means in recommending what terminal should be used for a particular data communications application.

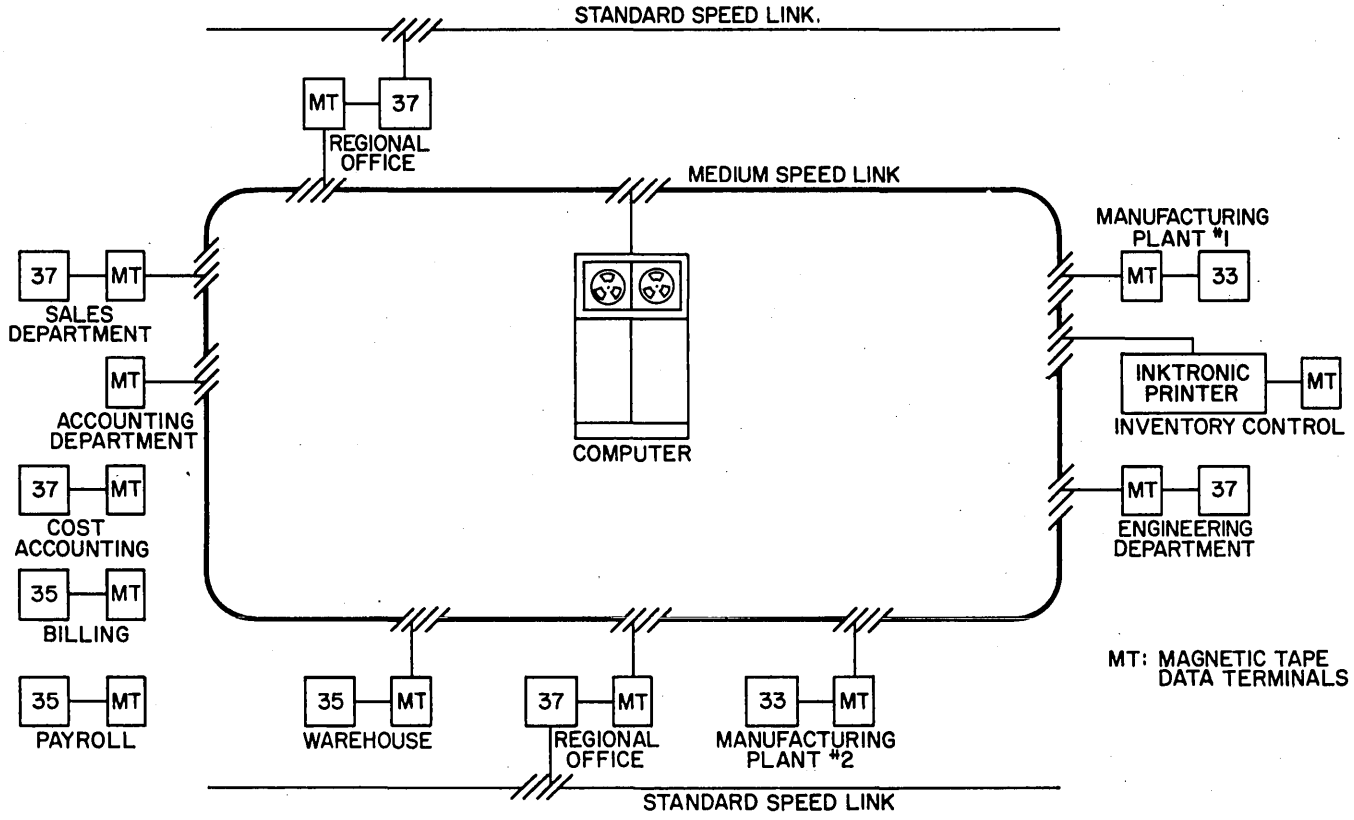
Some of the things, we at Teletype look at, that make the job a little easier are these:

Distribution	Volume
Urgency of message	Language
Frequency of use	Accuracy

The diagram below demonstrates how you can fit a number of Teletype terminals into a system based on function and usage requirements. Magnetic tape makes the speed and language of various terminals compatible. In this hypothetical case we use one computer program, one major line control procedure, one computer port, one type of data set per link. And deliver greater data through-put per on-line dollar. Using terminals that offer the best capabilities within each station's communication situation.

Using Teletype magnetic tape data terminals, combined with various Teletype keyboard send-receive sets, you obtain some unique system flexibility. And the on-line time saving aspects of operation are really dramatic. Magnetic tape data terminals can keep data flowing on-line at up to 2400 wpm.

In the example shown, the manufacturer has linked sales, engineering, accounting and inventory control departments to a central office computer. As well as manufacturing plants, warehouse and regional offices. He's covered all critical data points with a common medium speed link, using a variety of terminals. Magnetic tape data terminals make it possible.



DATA COMMUNICATIONS

equipment for on-line, real-time processing

Routine aspects of the system are maintained in standard speed links. Branch offices are tied into the regional office terminals on standard speed networks. Regional offices batch routine branch office data on one magnetic tape. Transmit the data to the central office processor at one time. Saving a number of additional computer port requirements.

Since data generated at manufacturing plants is urgently needed, but volume is low, low-cost model 33 terminals are used here. The warehouse data volume is higher, but not complex, so a heavy-duty model 35 is working here.

Volume requirements are heaviest in the accounting department. Cost accounting, payroll, billing and invoice payment functions generate data all day long. Here magnetic tape is prepared off-line at various terminals. And an on-line stand-alone magnetic tape terminal is used to transmit data to and receive data from the central processor.

Sales and engineering departments are equipped with Teletype 37 terminals. But for different reasons.

This terminal offers engineering people some unique format flexibility. Half-line and full-line forward and reverse line feed can be used to communicate complex equations and engineering formulae to the processor. It is possible to add special graphic engineering symbols to the normal compliment of letters, numbers and punctuation marks found in the typebox (up to 32).

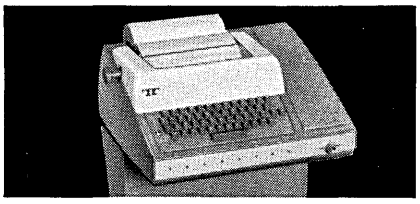
The sales department uses the model 37 for order processing. It has on-line vertical and horizontal tab set control, and form feed platen (optional) which makes data transmission and reception on multiple copy business forms easy and economical.

At the inventory control point, this manufacturer has an urgent need to obtain printed page copy of large volumes of inventory items. Magnetic tape is used to feed data to the processor and a Teletype Inktronic® KSR set receives data and prints page copy on-line up to 1200 words per minute.

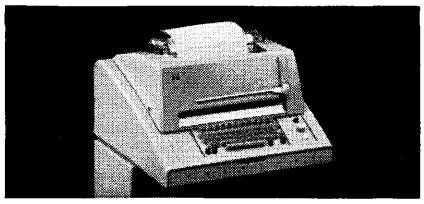
As you can see, Teletype's modular terminal design allows you to use various units as building blocks to meet the most demanding system needs. Teletype also has the station and error control accessories necessary for more efficient and economical data communications operations. Since cost is a very important part of the mix, Teletype offers greater terminal capabilities on a price/performance basis than any other manufacturer.

If you're involved in designing a teleprocessing, time-sharing, remote batch or computer switched system; looking into a multi-point private line, point-to-point private line or switched data communications network; talk to Teletype about terminals. For ideas, equipment and understanding, you'll find no better source. Anywhere.

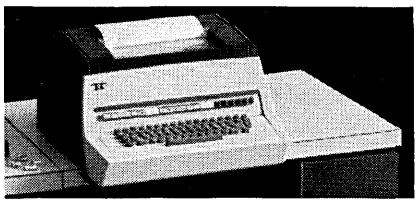
Teletype data communications equipment is available in send-receive capabilities of up to 2400 words per minute. If you would like specific information about any of the equipment described here, write: Teletype Corporation, Dept. 81-16, 5555 Touhy Ave., Skokie, Ill. 60076.



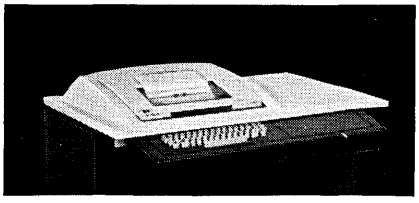
model 33 series: *An extremely low-cost 100 wpm terminal line. Uses ASCII. The most widely used terminal in time-sharing systems today.*



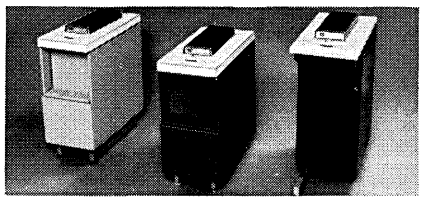
model 35 series: *A rugged, heavy-duty line of 100 wpm terminals. Uses ASCII.*



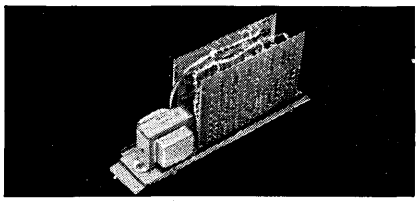
model 37 series: *One of the most versatile heavy-duty terminal lines going. Generates all 128 characters of ASCII. Operates at 150 wpm. Prints in upper and lower case.*



Inktronic® data terminals: *A unique electronic, solid state terminal. Prints up to 1200 wpm. Forms characters through electrostatic deflection (no typebox). ASCII compatible.*



magnetic tape data terminals: *Use compact reusable tape cartridges. Operate on-line at up to 2400 wpm, and connect "locally" to lower speed Teletype terminals using ASCII.*



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machines that make data move

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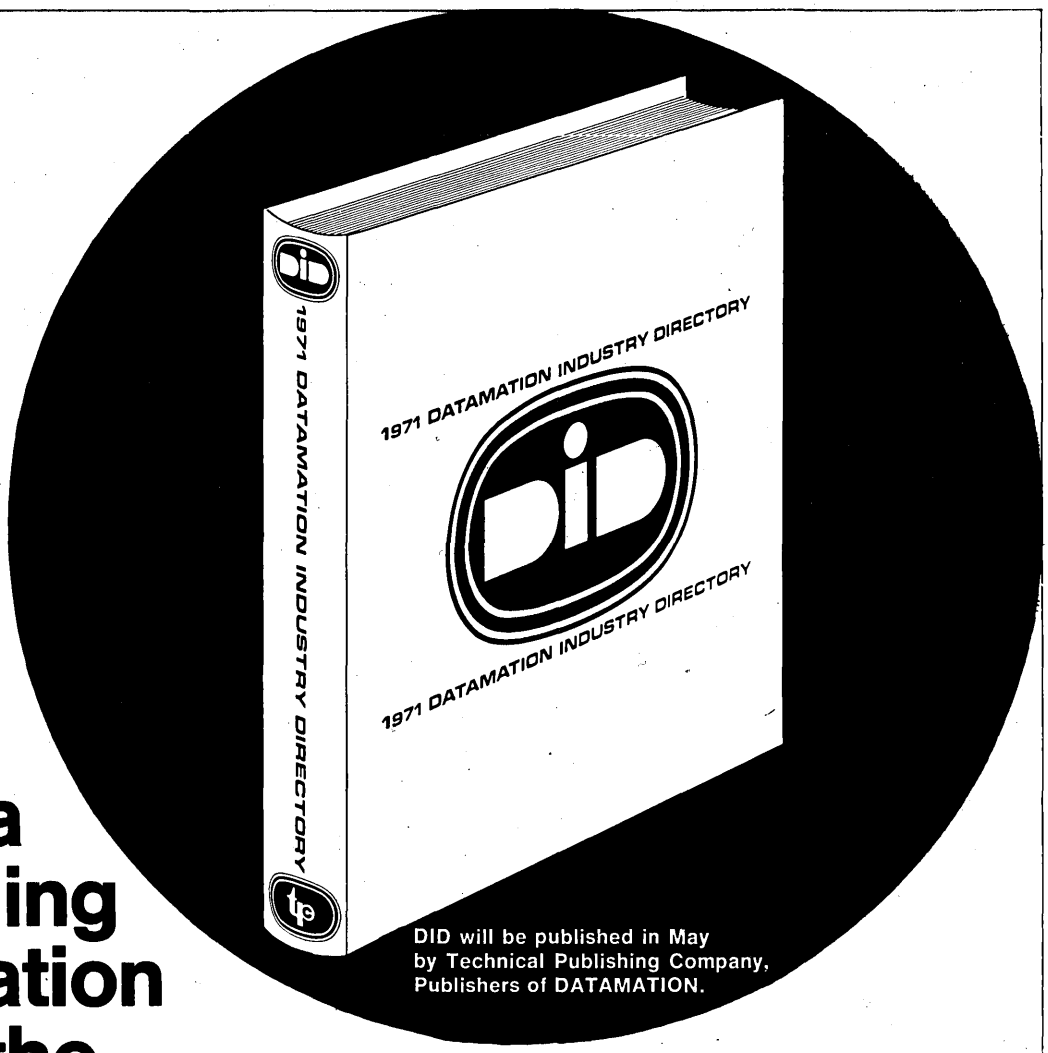

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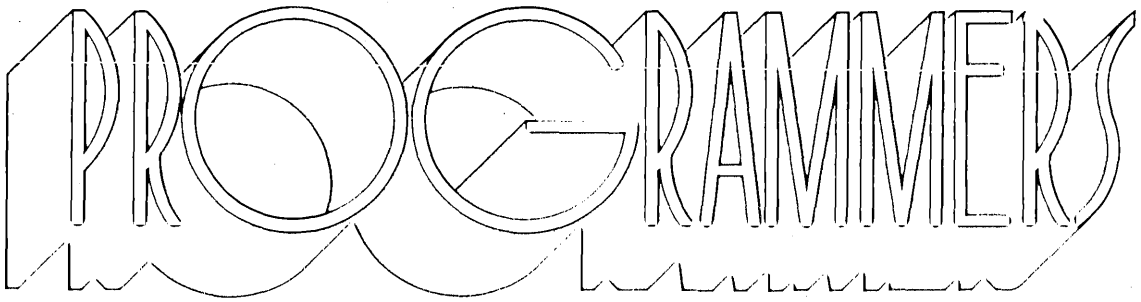

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The Forum is offered for readers who want to express their opinion on any aspect of information processing. Your contributions are invited.

THE FORUM

Realizing the Unrealized

The year 1970 brought with it a new experience to the U.S. computer industry. Sales plummeted, profit margins eroded, unhealthy firms fell by the wayside, and fuzzily-remembered terms like "liquidity" were brought into sharp focus. The glamor was off on Wall Street, and with it price/earnings ratios and the availability of venture capital.

Surely these things will pass. The need for the products of our industry are real and growing, and fundamental to a trillion-dollar gross national product. But what better time than now for introspection in order to assess whether we apply our technology with its greatest effect?

To set the proper mood, join me in donning hair shirts, covering our heads with ashes, and taking wire brushes in hand. As you read through the following material, don't think of the comments as having a scurrilous intent, but rather consider them to be observations meant to give insight and subject to contestation.

The computer industry derives its major thrust from the fast pace of technology in electronic components. Without question, core memories, transistors, and monolithic semiconductor circuits have had a revolutionary impact on computers. Just in the past five years the cost of a memory bit has dropped by a factor of five, and the cost of a logic gate by a factor of ten.

However, all is not well in the semiconductor and memory component houses. Memory suppliers have become far too dependent upon the foreign labor market. In large measure, they have in some ways failed to recognize the system aspects of core memories as a component in a hierarchy of memories. Perhaps as a consequence of this too-narrow a viewpoint, they appear to be poorly prepared for the possible future demise of cores as the most economic form of primary memory.

On the semiconductor side of component technology, the manufacturers are in the midst of an agonizing price war that may prejudice their ability to commit funds to needed research and development. The character of their business has changed enormously in recent years. For example, circuit design has migrated heavily from the system manufacturer to the semiconductor manufacturer. The increasing complexity of logic devices toward large scale integration, coupled with advances in semiconductor memories, carries this a significant step further—major functions of system design now come under their purview. An area of concern is that if major semiconductor suppliers are ambivalent about whether or not they should also be end equipment suppliers, then a cautious relationship may develop between computer and semiconductor manufacturers to the detriment of the computer industry. The alternative would be for all major computer manufacturers to become self-sufficient in semiconductors, a move that would tend to limit competition because of the heavy investment that would be required.

Despite the rapid advances in electronic technology, the residual benefits to the end user have accumulated far too slowly. The computing center is still, in the main, frustrated by operator involvement, by inadequate peripherals, by poor cpu utilization and other vestiges of system imbalance, by application programming that is about as difficult now as it ever was, and by continuing evidence of system unreliability compounded by software unreliability. In short, the carry-through of technology has fallen far short of its potential.

Let's talk more specifically about peripherals. It is apparent that the development of mechanical components has seriously lagged electronic components. This appears to be a fundamental problem, yet we have neglected to react quickly enough to surround mechanisms with greater amounts of electronics to counterbalance their deficiencies.

The independent peripheral manufacturers have for the most part failed to be accountable to the end user, to their own detriment and the detriment of the industry. On the one hand, the giant of the computer industry is scathed for over-price and under-technology, yet the prime concern of the industry is for plug-to-plug compatible equipment. On the other hand, the rest of the industry has been loathe to take really good ideas, that may not be compatible, and press forward to serious system solutions. We need further effort on vexing problems such as very low cost archival storage, ultra-performance secondary memories, and novel solutions for low-cost peripherals.

Part of the problem of peripherals has been one of standards. The government, computer manufacturers, industry associations, professional organizations, and peripheral manufacturers have seemed equally disinclined to engage in an aggressive and flexible program for standards. By default, the industry giant sets such standards with every major product announcement. The intent of the foregoing comment is not to represent these product offerings as being poor candidates for standardization, but to point out that the thrust of development of peripherals is being severely limited by the present lackadaisical industry attitude.

This brings us to the question of deficiencies of the computer manufac-

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turers. The most popular thing to do, of course, is to analyze the largest computer manufacturer. However, I would suggest that we do this too often, too easily, and that we derive far too much comfort from it. Rather than being totally preoccupied by crowding under the same price umbrella, or supporting the same customer in exactly the same way, the secondary computer manufacturers need to be less conscious of their giant competitor, and more conscious of putting together a consistent and purposeful approach to the market.

Again, peripherals are a case in point. The computer manufacturers are too easily swayed to a rigid compatibility approach to this problem. In so doing, they emasculate the creativity of their own development staffs, and at the same time preclude in large measure the possibility of important system differences.

There are, of course, positive aspects of providing users simple transitional capability to a new system. The increased use of microprogramming for emulation, and the use of highly popular peripherals for this purpose, are not being called into question. What is being questioned is a lack of initiative in setting new horizons.

There is another flotilla of computer manufacturers, larger in number, consisting mainly of small craft, and often drifting aimlessly off course. These are the minicomputer manufacturers. They are, nonetheless, a force to be reckoned with.

The competition among minicomputer manufacturers has been volatile, and within limits, has resulted in an amazing number of fresh approaches. The minicomputer industry is even showing evidence of maturing to the point where the end user is becoming a deep concern. There is good reason to believe that in the next few years this will result in systems that do meaningful work with much lower price tags than are currently available. Hopefully in this arena the number of competitors will be such that product announcements won't be synchronized every few years, but will reflect advances in the state of the art wherever and whenever they occur.

Miniperipherals and terminals for minicomputers may be the vehicle by which the latent potential of the independent peripheral manufacturers will be realized. There is already some evidence of this in tape cassettes, smart crt terminals, and high speed serial printers.

Data communications is another area that is crucial in bringing the benefits of technological advances to the user. Just as the small user can benefit from a small stand-alone system, he can benefit from sharing the resources of a large system by time-sharing, teleprocessing, or remote batch. While rapid strides are being made in terminals for such systems, data communication has proved to be a bottleneck that has muted and discouraged the exploitation of this significant area. As in the computer industry, there is a U.S. giant in communications which in this case is supported by a public monopoly. The world in general, and the computer industry in particular, owes this giant a debt of gratitude for the many developments of its laboratories, particularly the development of the transistor. It is an anomaly that this same giant has apparently failed to recognize the need for sufficient and timely capacity for high speed data communications. An announcement was made in 1970 that a national data network would be in place in five years—but how much better it would have been if this announcement had been made three or four years ago.

Let's turn our attention to system designers—the hardware and software architects of our systems. Here again we can see the failure to focus on end objectives, repeated false starts, and oft-time, a failure to follow through on novel approaches with true merit.

A simple example of this problem is system dependability. Sales personnel and customers have been encouraged to think that this problem has been solved. The system designers have indulged themselves in analyzing facets of multiprocessing and memory sharing, but there is rarely a concerted effort to provide a substantive solu-

tion to the problem. There has been a failure to identify all of the problems in hardware and software, and a preference to avoid the grubby details that are so essential to a total solution. Because of this, the notion of computer utilities and high reliability systems remains largely unimplemented.

In purer forms of architecture, there is little comfort to be derived from the pace of advancement in architecture. By comparison with component technology, there are few, if any, order-of-magnitude improvements to be cited, hardware or software. As an industry, we move ever so slowly in adopting microprogramming, multiprogramming, and dynamic memory allocation. And we fail the user by our lack of tools, and perhaps, lack of insight, for performance monitoring in a way that typically forces him to over-equip his system.

Lest any man feel exempt from this scourge, we should address the user. The user is king, although his best interests may not always be the primary consideration. But the user must also realize that he must meet the computer industry halfway. He needs to develop insight and expertise in computer technology, not only to evaluate product offerings, but to adapt the form of the statement of his problem to yield a better solution. He should not cling too tenaciously to the punched card as a unit record, the printed page as his output document, or magnetic tape as his archival record. With an open mind the user may find new ways of tying together accounting, factory, and management information. He might even find whole new businesses—the credit card, hotel reservations, or off-track betting.

At this point, having indicted the peripheral manufacturers for stodginess, the computer manufacturers for me-tooism, the communications industry for lethargy, the designers for lack of focus, and the user for inflexibility, I can now put down my wire brush, doff my hair shirt, and rinse off the ashes. I am basically optimistic, and in a real sense I perceive the current failure to fully utilize the potential of computer technology as an opportunity for future advancement.

—Lowell D. Amdahl

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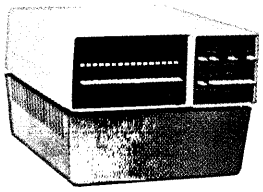
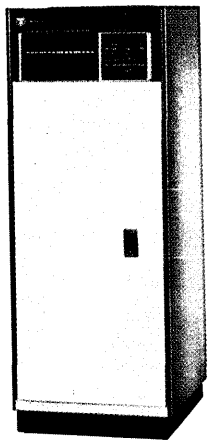
The growing family of Westinghouse Computers

Westinghouse Computer Department, dedicated to the principle that response to customer needs must be paramount, introduces the newest member of its expanding computer family, the Westinghouse 2550 Satellite Processor. It joins the recently-announced Westinghouse 2500 table model and rack-mounted model 16-bit digital computer line. The Westinghouse 2550, one of the industry's first user-oriented modular systems for remote and off line data processing, is available **today** for **today's** user requirements. The basic Westinghouse 2550 configuration incorporates the versatile 2500 computer with 4096 words of memory, control console, data set adapter, card reader, line printer, and supporting software (executive communication system, I/O handlers, data set adapter handler, communication formatter with data compression, and emulators compatible with IBM, UNIVAC, CDC and other terminal manufacturers).



Westinghouse 2500 Table Model



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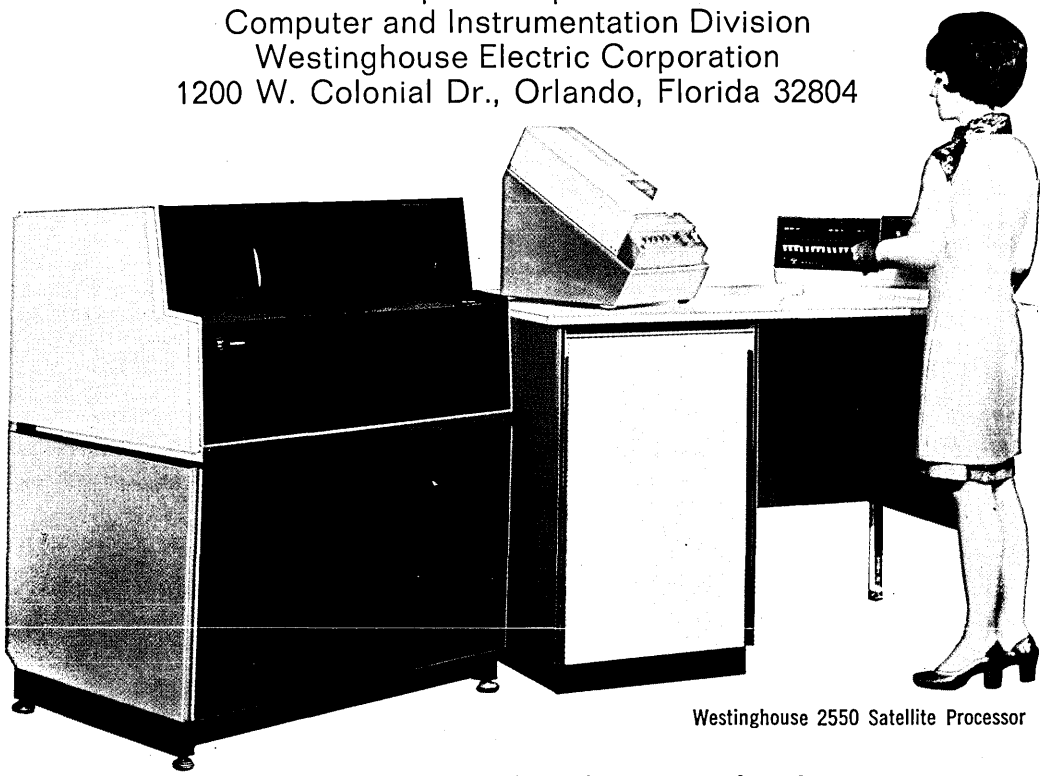

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