MAY • 1983

THE DEC* PROFESSIONAL

• VOLUME 2, NUMBER 3 •

THE MAGAZINE FOR DEC USERS

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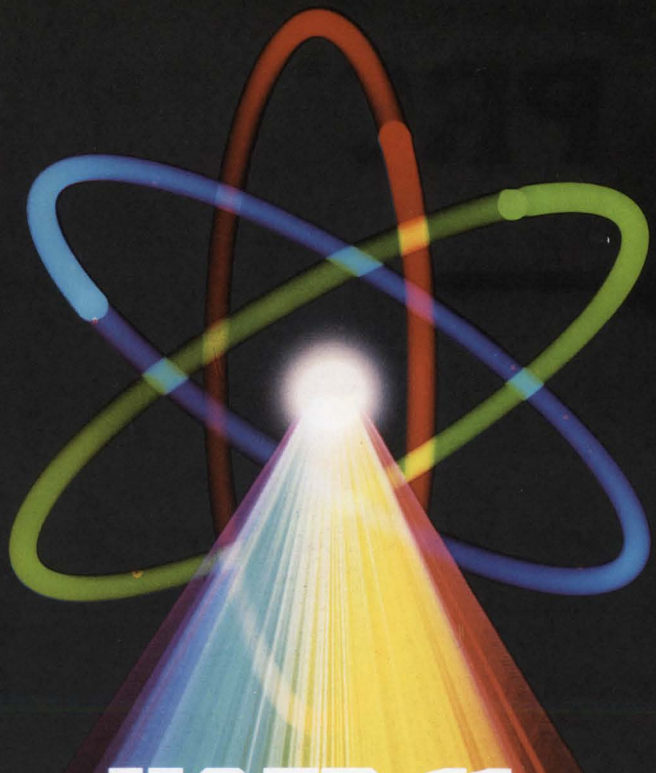

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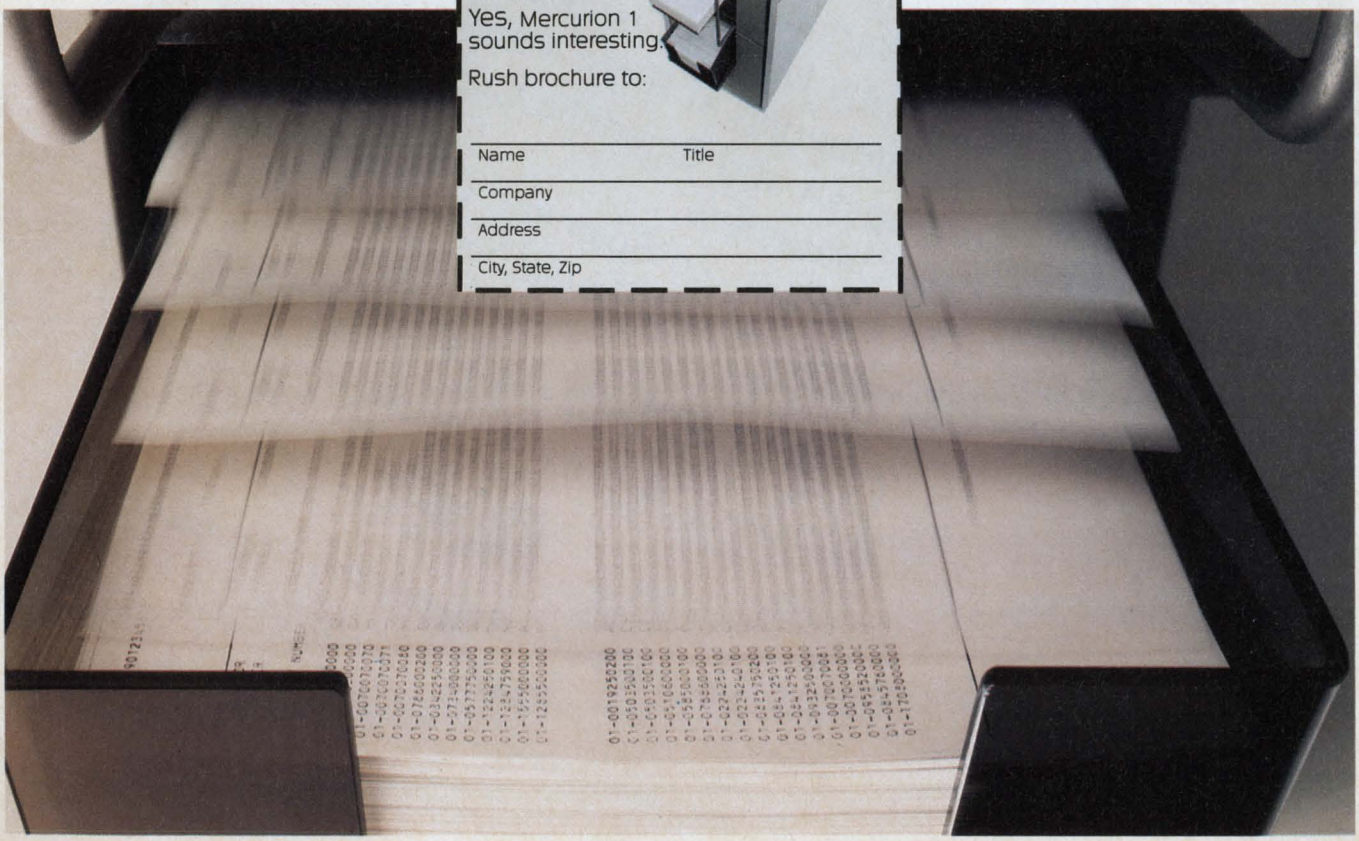

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CIRCLE D1 ON READER CARD

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I have seen more good looking plotters at the trade shows. Now I know what to do with them. For not too much money you can have your computer draw charts and graphs.

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The question of when to use a control task to access data and then have the users send/receive messages to get the individual data records is not easily answered. It works for this application.

STRETCHING THE CANVAS IMPACT ANALYSIS / Robert J. Walsh 14
System Development Methodology: A technique for project management, is the subject of this continuing series.

AFFORDABLE HIGH-SPEED NON-IMPACT PRINTERS BEING BASED ON ION DEPOSITION TECHNOLOGY / James W. Rule 20
High speed (laser fast) printing for your DEC system at more economical prices requires a new technology.

UPGRADE PATH FOR H11 [AND LSI-11] / Ed Judge 33
How about a DEC computer in a kit! It used(!) to be available.

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Unemployed Programmers? / Rick Scherle 54
Welcome to Rick, who promises to provide stimulating and important points of view for us all.

Converting Numbers to String Representations / Steven Davis 56
In our continuing effort to bring more and more PROFESSIONALS to our readers we are happy to be able to publish articles from the people at Software Techniques. Although we have had articles on this type of function, it has never been explained this well before. If we could all explain things this well...

A PRIDE OF EAGLES / R.D. Mallery 62
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The DECUS library has some good and some not so good software. Here is one entry that could be of interest.

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And I thought all migration was to a VAX! There are interesting and sometimes subtle differences between M and M-PLUS.

USING A RESIDENT LIBRARY FOR COMMUNICATION BETWEEN JOBS / Robert Grund 114
If you hesitated using SEND/RECEIVE because of high CPU overhead, maybe this is the answer. The idea of using shared libraries between programs (read/write of course) is useful to all operating systems that support such a concept.

THE ELEMENTS OF SOFTWARE SUPPORT: The Softness of Software / John M. Gram 116
The problem of support will continue to grow as prices for software fall (because we sell so many) and prices for support people go up. What happens when a PDP-11 product which has sold hundreds of licenses migrates to the PROFESSIONAL 350 where you can sell thousands and the support problem goes up by an order of magnitude.

MAPGRF / Kelly Felkins 120
A graph of a map from the task builder. Now if we just had that nice plotter I saw the other day we could...

MACRO AND THE CLASSROOM / Alan Hagerman 127
The PDP-11 and its MACRO assembler are popular classroom products for teaching assembly language. This is one experience.

ADVANCED EDT — PART 3 / Jeffery Gold 128
EDT continues in popularity. Here are more good ideas on how to use this very fine product.

BENCHMARKING DEC AND DEC COMPATIBLE HARDWARE SYSTEMS UNDER RSTS/E WITH YOUR APPLICATIONS / J. Peter Bryce 134
Benchmarking is close to our heart; there will be more in a continuing series on performance.

COMING

- More Reasons for Using TECO
- PortaCalc - Part 2
- Converting RSX Software to Run on Professional Computers
- RSX-11M Privileges: How To Maintain Control of the User
- Sorting with RT-11 and CTS-300
- DEXPO & DECUS Reports
- Current Disk Drive Technology for DEC
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GENERATION GAP

R.D. Mallery

I had another in a recent series of sudden, sobering visions the other day:

In two years, everything we used to call a PDP-11 will be replacable by a small box or two under the desk. Not only replacable, but the replacement will be an economic necessity!

Just as the change from RM/RP to RA or Eagle is an economic imperative today (massive cash savings in electricty, service and air conditioning plus super speed and low cost per megabyte), so the 70's and 44's will roll out to pasture . . . not because they don't work, but because it no longer makes economic sense to run them.

I am going to retire a 70 in the next year or so that has run 24/7 since December 1975. In all that time, I remember only one or two processor related service calls. The death knell will be the monthly field service and utility bills.

There must be some awful pressure up in Maynard right now to come up with a VAX chip set. But wait a minute . . . What will a chip set with J-11 speed or better do to all those lovely 750s and 730s out there? The answer is: Exactly what the Micro-11 with a J-11 will do to all those lovely 70s and 44s. The only problem is that it will be FIVE YEARS TOO SOON!

This brings to mind some problems that were faced by a number of mainframe leasing companies when IBM came out with the 43xx series and made obsolete an installed base worth billions.

So, if you come out with the VAX chip, you blow the 750 and 730 base. If you don't, you get eaten alive by all the other 32-bit sets now on the market. Making a slower chip is hardly worth the effort. Oh why won't technology wait for economics, depreciation and the IRS???

OUTPUT

Carl B. Marbach

There is a revolution about to happen and the surprise is that this revolution is not about disks; it's output devices. In 1966 DEC delivered an ANALEX (spelling?) 128 (!) column high speed line printer with the PDP-6 computer I used at the University of Pennsylvania. It had 128 hammers, made lots of noise, broke only in moderation and weighed about 1000 pounds. The printer that came with our last PDP-11/70 weighed less, cost less, printed a little slower, had 132 hammers and all in all was a lot like the 1966 version. While the electronics have changed a lot, the mechanics are very similar to the good old days.

A promising printer technology emerged with the laser printers from IBM and XEROX but these had three serious drawbacks; they were expensive, they were expensive and they were expensive. Sure, they were non impact, but if you wanted multiple copies they were fast enough to print it twice.

For DEC systems these printers usually need a "black box" to interface with the computer. To make the cost seem more reasonable, like most "big" equipment, they can be rented. While laser and xerographic printers are a step in the right direction, the price/performance ratio just doesn't seem to be what we need, and the costs haven't been dropping the way most computer equipment usually does as a product matures.

In this issue Southern Systems explains a new technology that promises to have the speed of the laser printers, but is more reasonable in cost. It will also interface to our computers exactly like conventional printers. Bringing a product like this, using a new technology, to market is difficult in the best of times. With the economy in the doldrums for the last couple of years, we have sorely missed efforts such as this. I hope that with the improving economic picture, the outlook for new products coming to market will also brighten.

Printers are not the only devices that will benefit from an improved economy, the whole industry will get a shot in the arm. Micro computers have stolen the show for too long; it's time the whole computer industry moved forward at an exciting pace. 1983/1984 should be two of the most exciting years for our industry—stay tuned in.

WELCOME

There are some new additions in this issue of the DEC PROFESSIONAL. Our resident RSX editor is Jim McGlinchey, and assuming the duties of West coast representative and author of "Programmers Notebook" is Rick Scherle. You may also have noticed that we have a continuing series on RT-11 by our RT-11 editor north of the Border.

All this is our continuing effort to bring the best in professional and technical articles to you. These people will not only be writing, but also soliciting more contributions from the user community. We know all of you join us in welcoming these important additions to the people who bring you the DEC PROFESSIONAL. Welcome aboard!

We thought about captioning our cover, but it might be more fun to let all of you out there have a try at it. DEC PRO T-Shirt to some of the best ones. How about a start: "Best field service rep we ever had," "good thing I don't have a memory management board this big," "I'll fix you if you fix me." Go to it!

Mail entries to:

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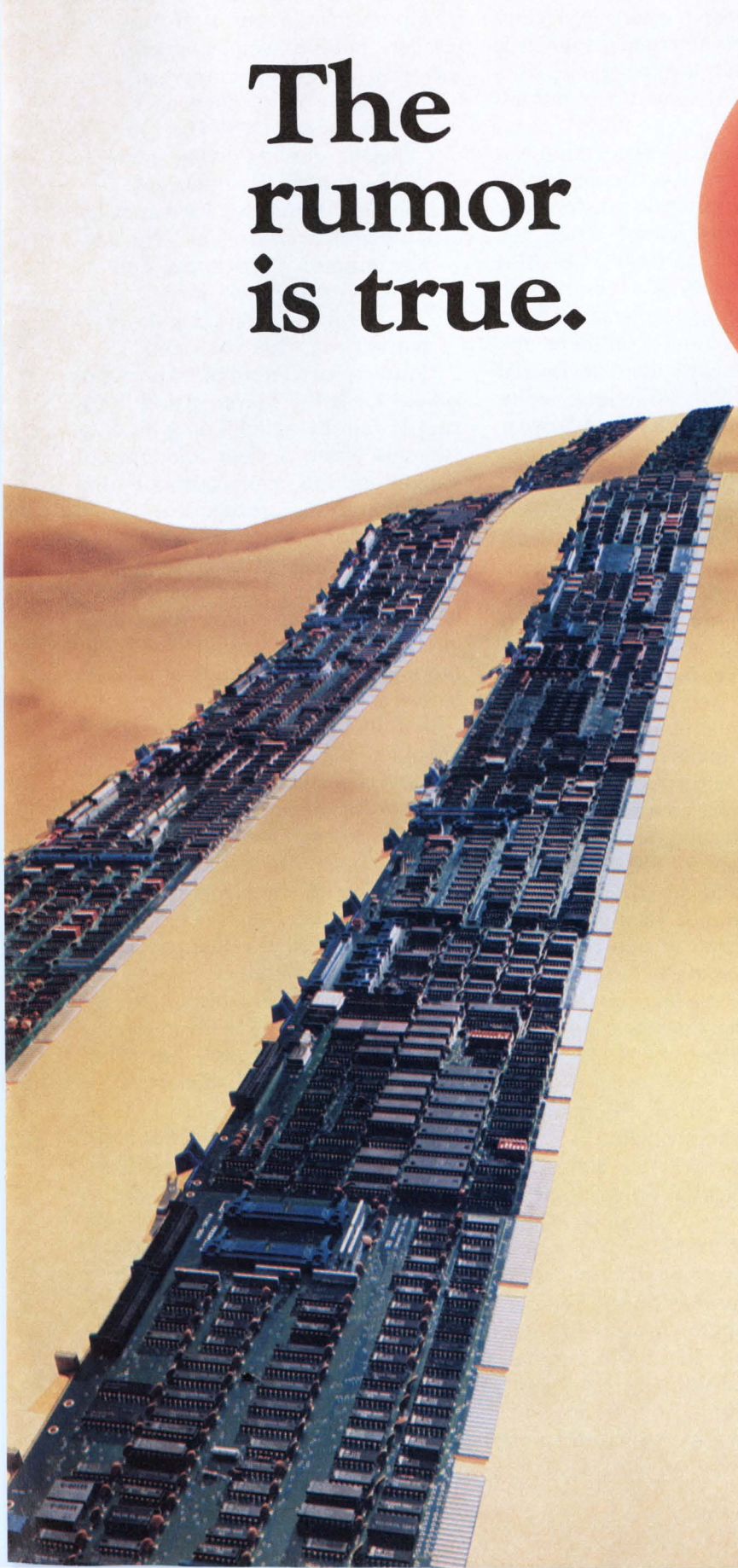
BPA membership applied for November, 1982.

The rumor is true.



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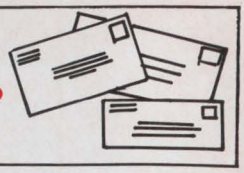
CIRCLE D6 FOR LSI-11. CIRCLE D54 FOR PDP-11.

LETTERS TO THE DEC PRO . . .



Send letters, comments, photos, etc. to: Letters to the DEC PRO, Box 362, Ambler, PA 19002.

I am interested in purchasing a spelling dictionary for my DECmate. Do you know of any software firm that has developed one?

C.W. Thomas, Supervisor
Engineering Administration
Colt Industries, Burbank, CA

We enlisted the aid of our colleague Larry H. Eisenberg, Encino, CA, on this one. Larry's response in part, "... the current status of the spelling dictionary for use on the DECmates. (Like all DIGITAL futures, it's up in the air, although there has been a commitment to bring it out. I am informed that DIGITAL bought an existing dictionary and will use it on the DECmate II, probably in Version 2, and may be able to include it with the DECmate I — but no promises.)

If nothing else, Mr. Thomas was interested in joining our Local Users Group, so he may have gotten far more than he originally bargained for when he wrote to you."

* * *

That was an interesting article on BUGGING (V2,#1). Speaking of bugs, let me tell you what bugs me... Reading halfway through an article before realizing that it isn't aimed at TEACHING me something, but at SELLING me something!! I can't believe that the DEC PRO is so starved for copy that it continues to publish type about software that some company will SELL to you (similar to software, incidentally that I saw running on a PDP-8 in 1974 at DEC). Since I'm busy throwing negative, I might note to the authors of said article that genius is never a substitute for experience. With an IQ of 164, and total recall, I still find that experience is the tool that I use the most, not raw brain power. Enough said.

I next address myself to the programmer (Mary Starr) who wrote a letter that appeared in the same issue. The letter expounded upon the need for programmers to be grammatical and proofreading wizards. I think she has overstressed the importance of grammar in a magazine geared to a technical reader. Personally, I get a good chuckle when I see grammatical errors, especially the "dangling participle" in the first sentence of her last paragraph!!

Then, in the same issue, there was some UNIX manager complaining about the lack of UNIX articles. Why doesn't he write some? I use "C" under UNIX and XENIX, PL/1 on IBM equipment, and PASCAL on micros, but I'm not going to write about them because they don't constitute the majority of the work that I do. People who wear UNIX underwear write UNIX articles. I wear RSTS underwear (and teeshirts) and write RSTS artices. He should take special note of the next paragraph ...

In closing, let me ask that the readers of this magazine rake out those pieces of code that they deem as their personal triumphs over difficult to understand manuals, and send them in for publication. I would rather wade through ten articles that are technical (even about UNIX), finding one that can help me in future endeavors, than wade through one article that is trying to SELL me something. If I want to be sold something, I'll renew my subscription to BYTE magazine (which measures its advertisement copy by the pound). I am making an effort to send one or two articles to the DEC PRO or the RSTS PRO every few months, to help increase the technical balance that the magazines present. YOU OTHER READERS CAN HELP TOO!!!

If you're not part of the solution, you're part of the problem.

Steve Roy
Diversified Consulting Co.
Bloomfield, CT

* * *

For the past year or so I have read articles and editorials on the general subject of computer security in your magazines, The DEC* Professional and RSTS Professional. I say "your magazines" because R.D. Mallery and Carl B. Marbach are listed as editors of each.

My dismay grew as I watched Mallery publish security articles, apparently in the public interest, back-to-back with a full page ad for his (your?) product, LOCK-11.

I believe the following example would be the moral equivalent.

> The City Mayor says, "We are all in danger. Arm yourselves." The People respond, "We know little of arms. What shall we do?"
>
> "You're in luck," says the Mayor, "I can sell you what you need."

Conflict of interest? Abuse of office? Or is the Mayor acting in his proper role by enlightening his constituents about a clear and present danger and then generously offering a solution to the problem.

Our national law-makers have decided that it is illegal for office holders to sell goods and services to their constituents, no matter how noble their intentions. Indeed, they must rid themselves of all conflicts of interest before assuming office.

That does not seem to be the policy of your publications. Like the Mayor, Mallery repeatedly calls his readers' attention to the subject of computer security. He even lectures on it.

The People, his readers, may respond, "You have made us aware with your many articles and presentations. But you never tell us what products to buy to protect ourselves."

"That would be unethical." (But by coincidence, on Page 51 my magazine (heaven forbid, not me!) has a full page ad on LOCK-11 that may just provide your answer.)

An exaggeration? Maybe. But I find the activities of the Mayor and Mallery to be very similar. Both sound the alarm for "More security." Both will personally benefit from their apparent concern for the public interest. Both use their office in a way not intended.

So what's it to me?

First, I feel betrayed as a reader of, and an advertiser in, your publica-

... continued on page 49

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CIRCLE D19 ON READER CARD

A GRAPHIC STATEMENT

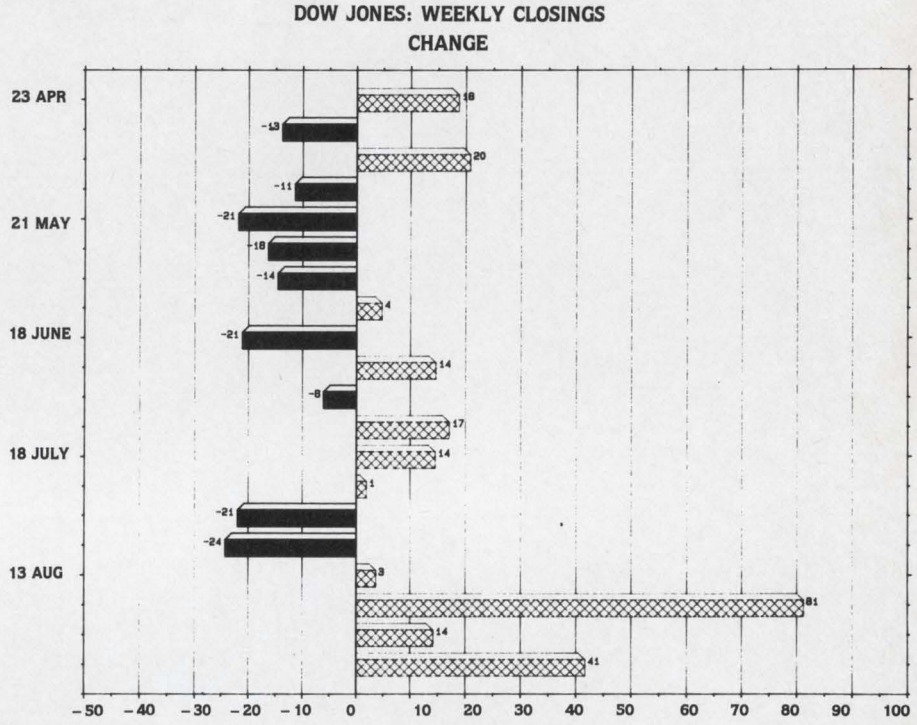
By Keven Sard, Data Processing Design, Inc., Placentia, CA

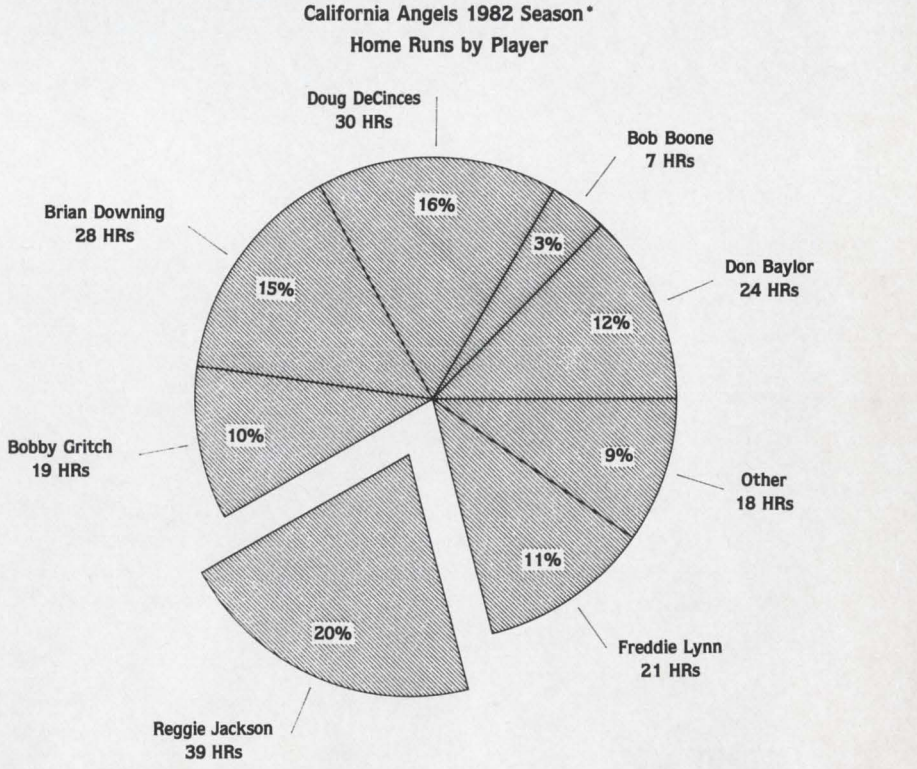
Do you have nightmares of being lost in a maze of $100,000 CAD/CAM systems? Do you find you pay more attention to what is behind Dan Rather than to the news he presents? Do you believe that the only affordable business graphics package ever made is being kept a secret for subversive political reasons? Is your company's idea of user-friendly graphics a dull No. 2 pencil, and a dime store compass?

If you have answered any, or all, of these questions "yes," continue reading. You may find the cure for your nightmares in a new business graphics package from Data Processing Design, Placentia, CA.

I grew up in an age when blood might be shed if someone tried to commandeer your IBM Selectric. So when truly user-friendly software came around for the DEC system we were using, it was a minor miracle. To think that the average guy on the subway could be trained to use a shared logic word processing system before he made his return trip . . . what an outstanding achievement in software. Never again to lose a diskette to those mysterious magnetic monsters that lurk on every secretary's desk, was something I had long awaited. Life seemed to sail by in multi-user bliss until someone in the office got the bright idea to incorporate graphs with written reports. So much for euphoria.

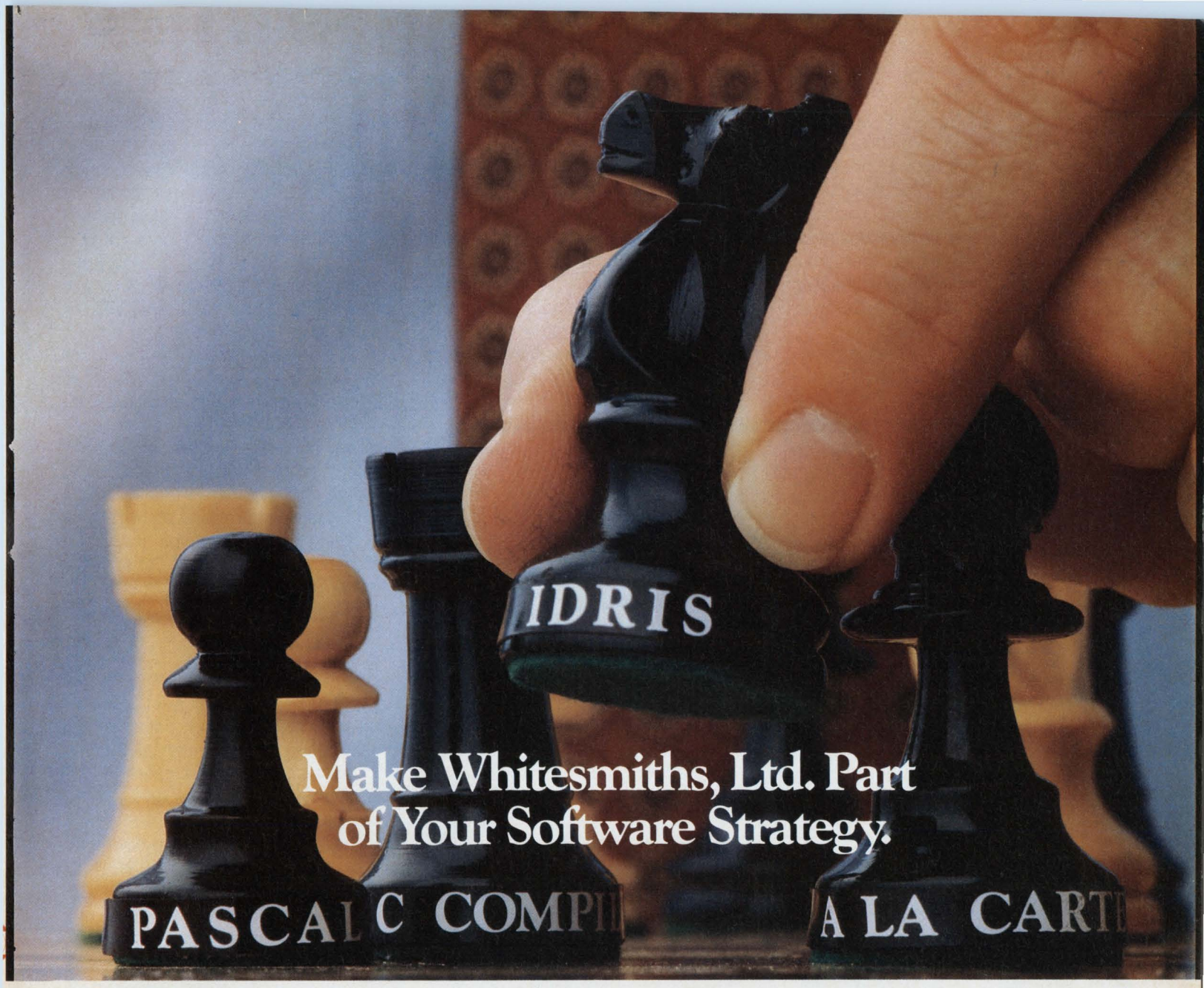
The problems with this idea were not as many as they were hard to overcome. First there was the question of software. It was hard to find, if not nonexistent. Then the question of operators. No one knew how to produce graphics. Then compatability. Would it operate with our word proccessing system. The conclusion was easy to come to, but hard to swallow. We watched with strained emotions, not to mention the budget, as the new terminal was set up in the office, and the new operator took her place in front of the screen.





*American League West Champions

'Other' includes Beniquez, Carew, Clark, Ferguson, Foli, Ron Jackson, Pettis, and Wilfong



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Since that time major improvements have been made in business graphics. DPD, best known for its word processing package, WORD-11, has recently started marketing the same concepts in user-friendly software with a graphics twist. The new package called IB GRAPH (Interactive Business Graphics) incorporates all that you could ask for in user-friendly software, plus the capability to turn out some very fine business graphics.

For those of you who are familiar with DPD's WORD-11 you may be surprised by what might be called a "rambling" menu system. However, after a few hours of hands-on use, specifying, modifying and producing charts is a breeze. IB GRAPH has several modules, but you will probably spend most of your time with the Main Menu, the Data Editor, the Chart Specification Editor, and the Plot modules. The modules let you amble through over 600 options to customize your chart right down to the size of the tick marks. Or you can just as easily "load" the information into a chart specification, and let IB GRAPH default to a chart that will meet most purposes. There is also a Translation Module that lets you convert DMS-500 ISAM, Block I/O, ASCII free format, RMS, CARD, TYPE-1, and WORD-11 and DECWORD List Processing format files into data groups. Plus a convenient Utility Module. It's amazingly simple, allowing the average office worker to quickly create line, bar, or pie charts.

If you still have a touch of paranoia derived from an experience at some graphics show you attended, consider this. IB GRAPH has a consistency checker. In case you're unfamiliar with the term let me explain. The IB GRAPH acts like a big brother. It lets you do as you please, mistakes and all, until you plot the chart. When you issue the command to plot, the Consistency Checker takes over, and informs you of any mistakes that will cause an incorrect plot. There are four levels of checking, ALL, PARTIAL, SUMMARY, and NONE. If only warning type errors are found IB GRAPH will ask if you still wish to plot. If you do nothing before the plot about the warnings IB GRAPH will change or ignore the cause of the warnings, helping you improve the appearance of the chart. The Consistency Checker can be invoked at the time of plot, or at any point while specifying the parameters of the chart.

As if this were not enough to get you through, there are Help Screens as well. Here again, a new twist has been added to a good idea. Help can be reached from any of the modules, and a LEAVE key puts you back where you left off. Perhaps the most impressive part of the Help Screens is while in the Plot Menu. If you invoke the Consistency Checker and receive errors, you may enter Help, and be told which option menus the mistakes were made in, and possible solutions for the problems. With this feature IB GRAPH makes it hard to make a bad chart.

By now you may have visions of the plush graphics you see between the covers of **BUSINESS WEEK** or **U.S. NEWS**, so let met set the record straight. IB GRAPH is not going to give you a graph in the shape of the United States, wallpapered in yen, showing the balance of trade between this country and Japan. If your vision of sugarplums just went "poof," wait a

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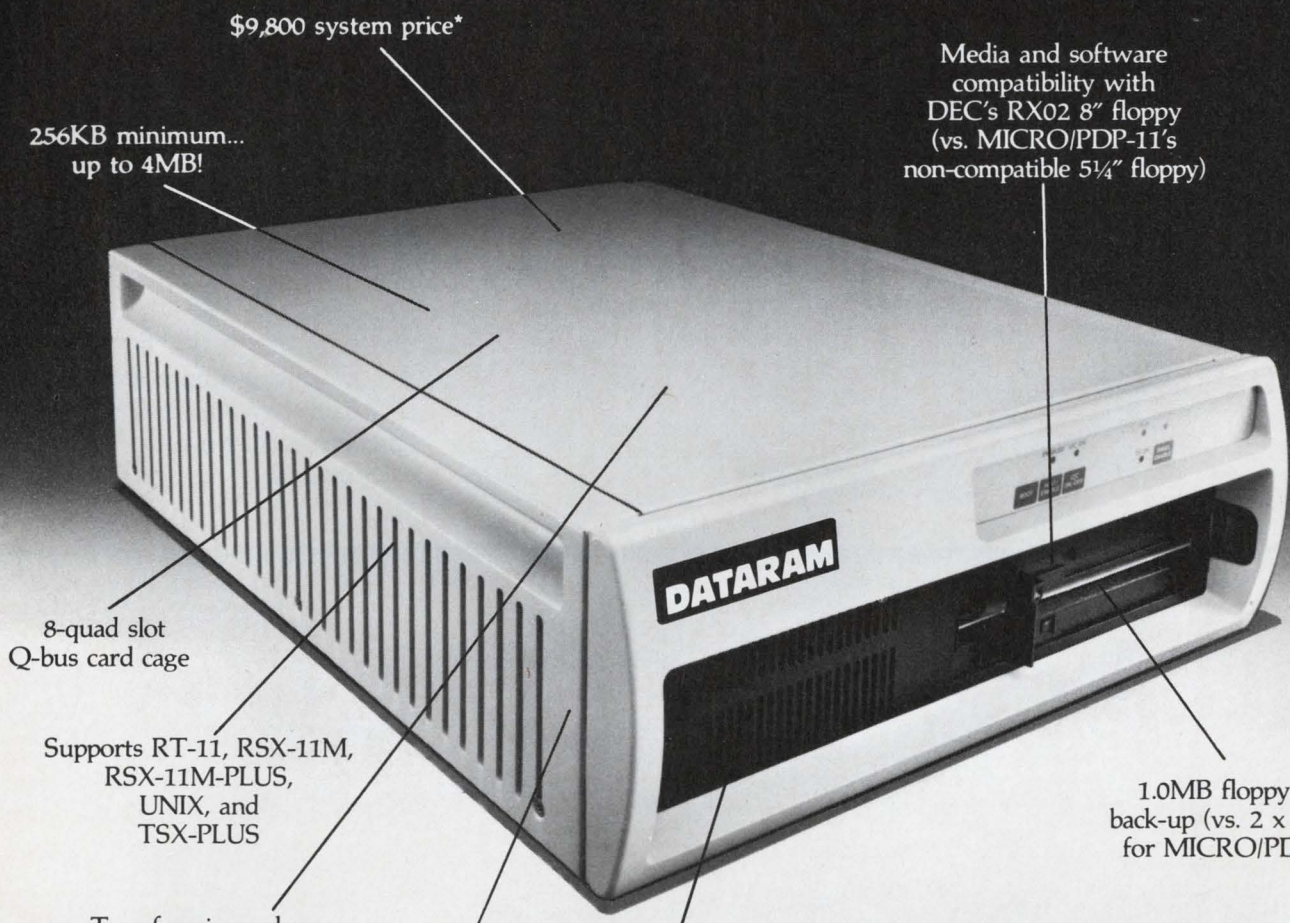

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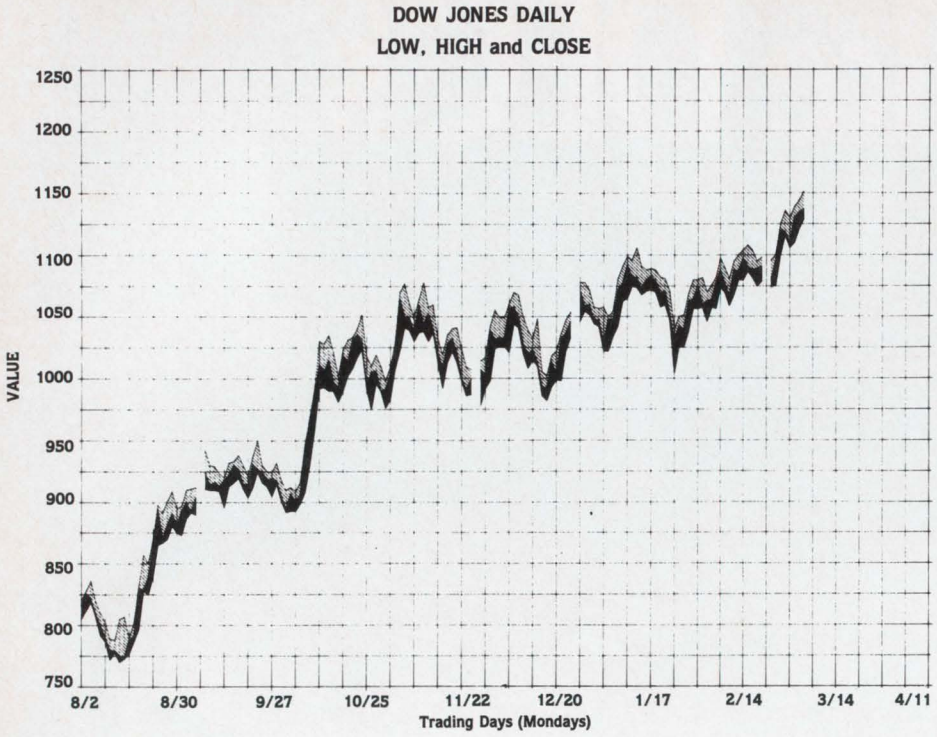

minute. IB GRAPH will show you the balance of trade reflected in a pie chart, or bar chart, or line chart. It will allow you to have stacked bars, bars with depth, patterned bars, solid bars, vertical or horizontal bars. The variations of line charts are just as numerous. You can get lines with point markers, shaded to the base line, stacked lines and more. Pie charts options include exploded segments, and segment descriptions that are printed inside, or outside the pie. Remember, there are over 600 options to chose from.

IB Graph requires a VT100 with the advanced video option, or any of the equivalent DEC terminals like the VT131 or VT132. IB GRAPH supports the VT125 terminal for displaying charts on-screen in black and white. An appropriate color monitor allows multi-color display.

SERVICE MODULE APPROACH TO MULTI-TASKING USE OF RMS11K

By C.W. Stahle, Avon Products, Inc., 9 West 57th Street, New York, NY 10019

In putting together a terminal driven multi-tasking application system under RSX-11M, the file access method must be carefully evaluated to avoid the 'deadly embrace' for files between tasks, the extreme overhead of opening and closing files by every task, or the overhead of using a general purpose file handler like RMS-11K.

In the design states of such a system, Avon Products, Inc. was faced with this problem. The initial implementation of the system incorporated RMS-11K into every task, without resident libraries due to machine size (PDP 11/34). In order to minimize memory requirements per task, the most highly overlaid version of RMS-11K was employed. To prevent the deadly embrace, file opening and closing was also performed by every task which updated files.

The result of this implementation, predictably, was terminal response times which were better measured with a calendar than with a stop watch. Disk activity due to overlays was phenomenal.

Forced by this extreme response time situation to do a system redesign, Avon chose the service module approach to file handling. The design of the service module incorporated the following features:

- A record handling front end to hold record requests during the actual file I/O.
- Record locking during I/O operations.
- Substitution of send/receive subroutines for the RMS-11K calls (DBGET, DBPUT, DPUPDATE, DPDELETE) to get to the single, less overlaid RMS-11K resident in the service module.
- Tape (or disk-journalling of all record update activity (before and after images) by the service module.
- File status handling, with the five most active files kept OPEN during the entire operating day.
- Time out handling for tasks which do not complete (purging the 'lock-table').
- Error interpretation for clear console display for file errors.

Implementation of the Service Module approach, implemented in BASIC-PLUS-2, provided a response time solution which made the application a success, with the added benefits of file control through journalling.

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DATE: **May 1, 1983**

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STRETCHING THE CANVAS-IMPACT ANALYSIS

By Robert J. Walsh, Winter Park, FL

Someone asks you to deliver a rush package from your Chicago office to Springfield. On the surface the request sounds reasonable. You hop in your car and you're on your way. Five hours later you're in Springfield, Illinois. Unfortunately, the package was to be delivered to Springfield, Massachusetts, and its contents were needed one hour earlier. Your project failed. What went wrong?

The driver assumed his instructions were complete. The warehouse supervisor assumed the driver was intelligent. The president of the corporation assumed his employees were competent.

The package contained a live, biological culture that took five years and three million dollars to develop. Since the president assumed the culture would be properly refrigerated on its air flight to Massachusetts, and it wasn't, it has long since been buried . . . with both employees.

Everyone assumed everyone else knew what was happening. No one bothered to question the details of the project. No one bothered to ask. A simple definition of a project is "something planned," which in many organizations is in direct conflict with standard corporate procedures.

Project planning begins with a request to do something. The Project Request may be verbal, formally written or scratched on the backside of a napkin at a business luncheon. In each case, someone somewhere wanted something done in some specified (usually extremely restrictive) time frame. The request can be expressed in one sentence or as part of a very lengthy worded narrative. It can originate from almost any level of management and can dictate virtually any unreasonable need.

The size of the corporation, EDP shop or project is immaterial when it comes to developing a quality product. Yes, larger projects will cost more if they fail, but a string of poorly planned and mismanaged smaller systems can be as devastating to corporate assets as the disasterous megasystem.

The development and management of a project's life cycle is more than tapping into the analyst's data bank of knowledge and expertise. It is utilizing a scientific approach for solving complex and often frustrating system development problems. It is a scientific methodology to take the analyst from project inception to completion and sign off.

Having a total System Development Methodology (SDM) in place prior to starting a project, is not only a necessity for total project control and continuity, but it is a must.

The first article in this series outlined an eight phase SDM. This article will define the first phase of project development, the Initial Impact Phase.

The number of phases, sub-phases and tasks, established and defined within the project's development life cycle, will vary from corporation to corporation, generally based on corporate needs, policies and procedures. The prime consideration is not the number of checkpoints built into the SDM, but the necessity for a formal corporate SDM. The reasons for a formal SDM are many, but the most fundamental are standardization, formalization, ease of systems maintenance and user-friendly documentation, not to mention the personal satisfaction of doing it right the first time!

There are many vendor type SDMs on today's market, ranging in price from $20,000 to $150,000, depending on the number of frills and lace you're willing to purchase. However, most corporations should be able to develop their own SDMs in a relatively short time, using the outlines, checklists and general guidelines found in these series of articles. Of course, any SDM, no matter how expensive or well tailored, will not develop systems automatically. It is a guideline and will be as effective as the analyst, project leader and EDP manager working with the system.

EARLY PROJECT DEVELOPMENT

A project can take a few hours or several years to complete. It can be a new system, an addition to an existing system, a branch or extension of a satellite system or it can be maintenance to one or several operational systems. And it is just as easy to foul up a two hour project. The only difference is the time it will take before someone discovers your mistakes (sometimes referred to as job security).

Every analyst, sometime in his career, has developed a methodology for taking a system from beginning to end. Unfortunately, ten project leaders will analyze, document and implement a specific project ten different ways, with ten different results (sometimes workable) and levels of documentation. However, most poorly developed and documented systems will not be interpretable six months after the project is up and running, unless a total SDM is in place from the start. There is nothing more frustrating than trying to decipher specifications that are incomplete, inaccurate and incomprehensible three months after the lead analyst on the project has left the company. Don't depend on the eternal expertise of the local system's guru. That person won't be available forever, especially in a market with an average annual turnover rate conservatively ranging between seventeen and twenty-five percent. Your best data bank is total documentation, and never mind the excuse that you don't have time to do it right because of external pressures.

If you don't have time to do it right the first time, when are you going to find time to do it over again?

PROJECT INITIATION DOCUMENT

One of the keys to successful project initiation is the utilization of a formalized Project Initiation (PI) document. When properly completed, the PI document will contain the information necessary to get the project off the ground. It will specify concise information and also have enough facts to give the analyst a basic, comprehensible starting point. If the project initiation was verbal, it should be documented by the analyst (if the user was reluc-

. . . to page 18

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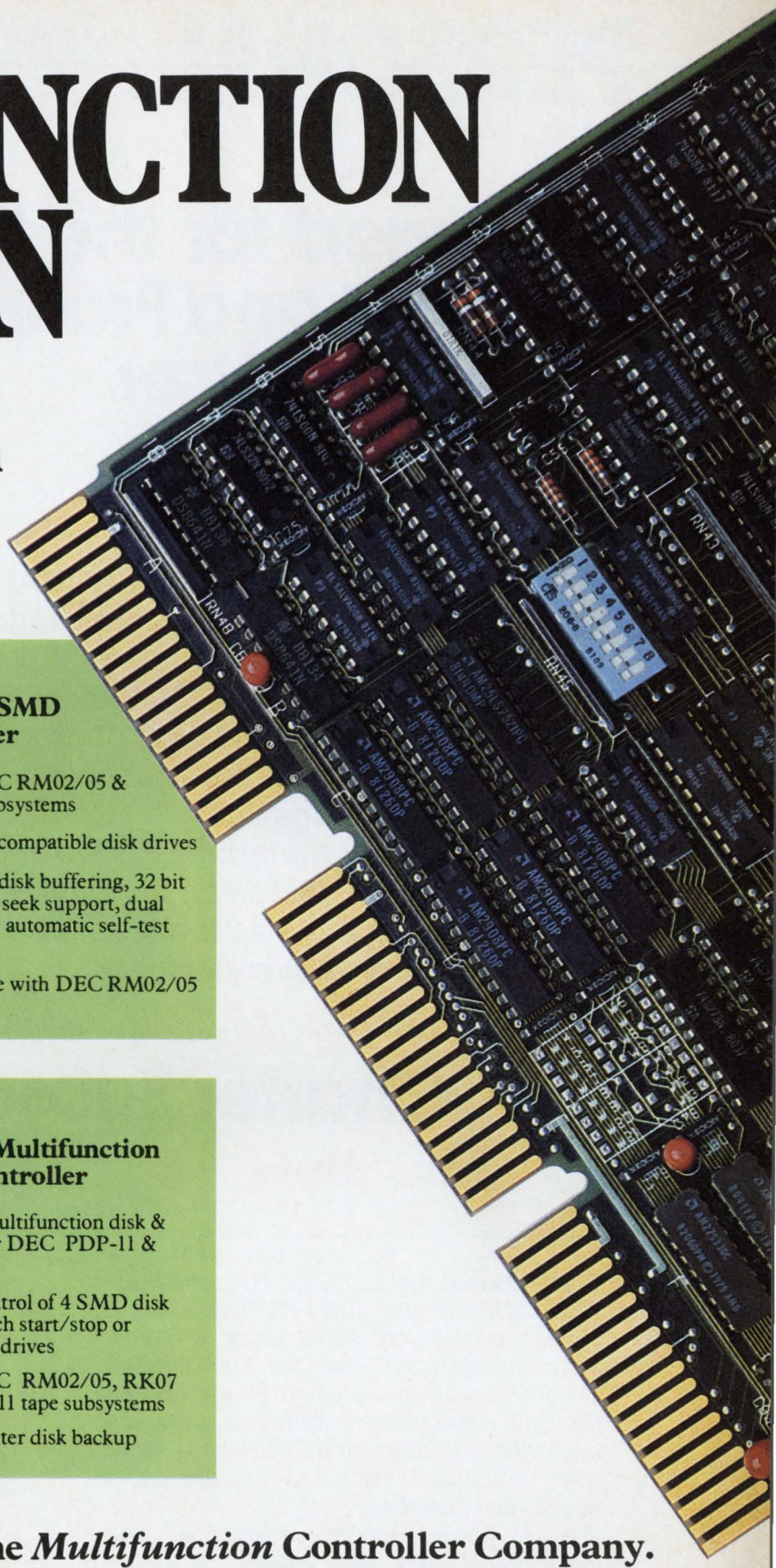

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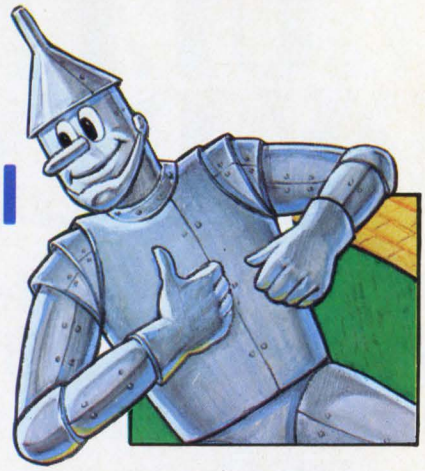

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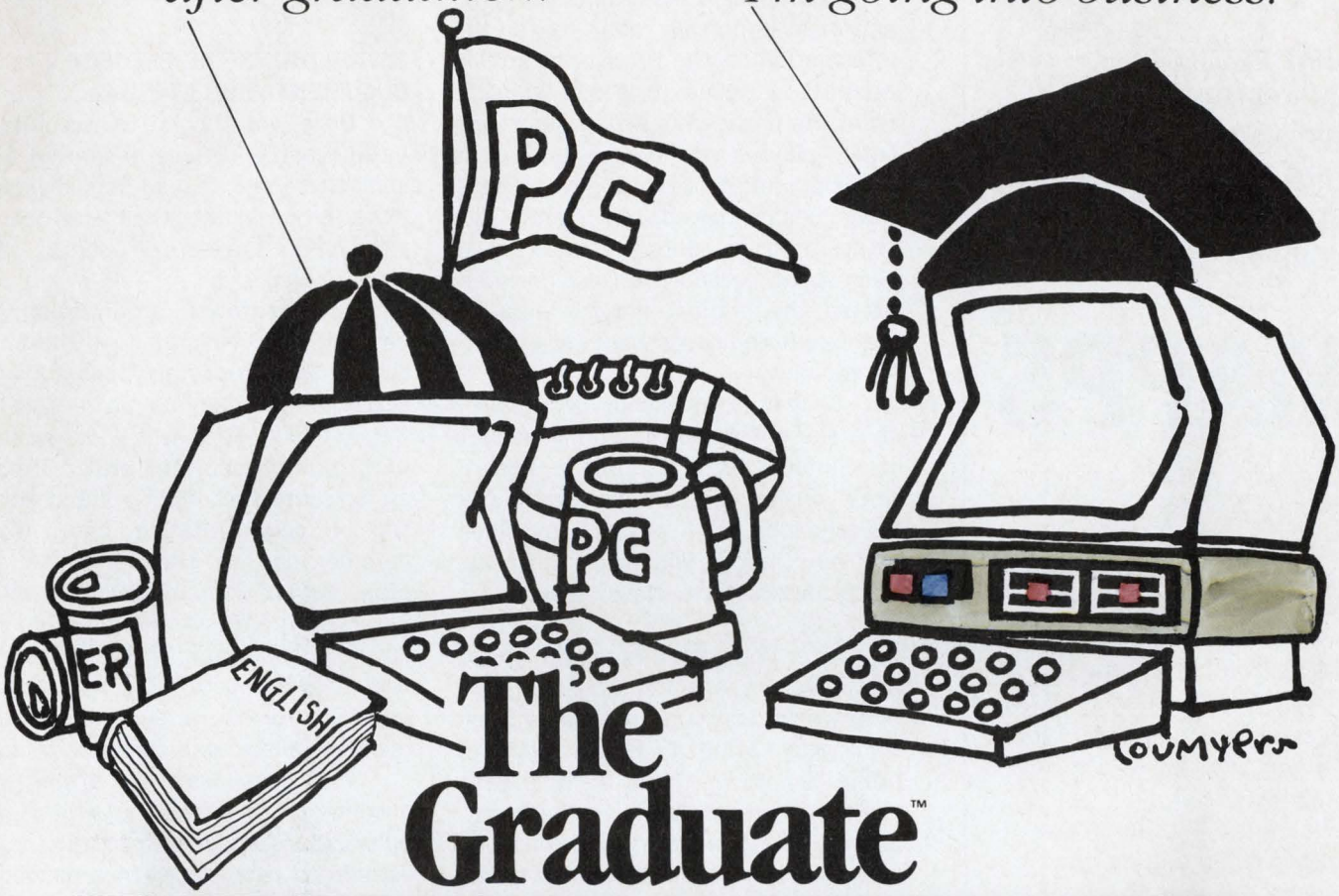

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tant to do so) onto the PI form and returned to the user for verification.

INITIAL USER CONTACT

Don't believe everything you read, and most important, don't rely on the information on the PI as being totally accurate . . . even if it did originate from the president's office. Communication plays a vital role in the project development process. Many projects have been shelved (or silently destroyed) after countless dollars had been spent, because someone misinterpreted the original project initiation statement and never went back to verify the data.

Once the PI is in your hands, study it, make notes and thoroughly analyze its contents. Prod it, poke it, push it until you feel comfortable with it. Ask yourself who, what, where, why, when and how before you begin the nitty-gritty detail work. Never assume . . . ask.

After you have a handle on the PI statement, rewrite the request in your own words. List your immediate questions and define all known problem areas. Set up an initial meeting with the user to redefine the PI statement, and air out all problems and concerns. Make certain you're both talking the same language.

- Redefine the project's requirements
- List immediate known areas of developmental impact
- Don't assume what you read is what is required
- Poke holes in the PI statement, if you can
- Expand or contract the definition
- Restate the problem in your own words
- Define all grey areas

Involve the users heavily in the project right from the start. This is their system! Use their expertise to gain an insight into their system. Don't rely on hearsay or previous documentation.

- Review everything with the user
- Get initial supporting data from the user
- Get the user's support and approval on the project's direction
- DO NOT commit resources at this time

The last item is of extreme importance. A user will try to get the EDP department to commit resources at a very early date in the project. Ask for time. There is still more work to be done before an educated commitment can be made.

ESTABLISHING THE PROJECT DOCUMENTATION MANUAL

Once you begin to accumulate data, whether you've generated it or someone else has, you should have a place to put it other than your bottom left hand drawer or some other obscure place.

Documentation organization can be subjective, which is why there is a definite need for establishing a Project Documentation Manual at the onset of the project. Consider a corporation with multiple projects, either in process or completed. With a standardized set of documentation any project member can be transferred to any other project without having to spend weeks (or months) trying to locate pertinent project data. With standardization, everything will be in the same order and format for every project and readily available and current.

The best way to organize a documentation manual is a phase by phase approach. As information is accumulated it is placed in a particular segment of that phase manual, for a specific project. An example of a project manual follows:

SEGMENT	DATA
1.0	Copy of the Project Initiation form
1.1	Project redefinition and statement
1.2	Project Impact Statement
1.3	Project Benefit Statement
1.4	Supporting project data
1.5	Phase end report
1.6	Project resource projections
1.7	Other pertinent phase data

Segments normally required, but not used for a specific project, can be identified by inserting a standardized omission page with the reason for omission, the date and analyst's initials.

The data accumulated for the Impact Phase is normally static, that is, once it is developed and approved it will not change during the remaining life cycle of the project. The entire manual becomes a valuable historical

. . . **continued on page 28**

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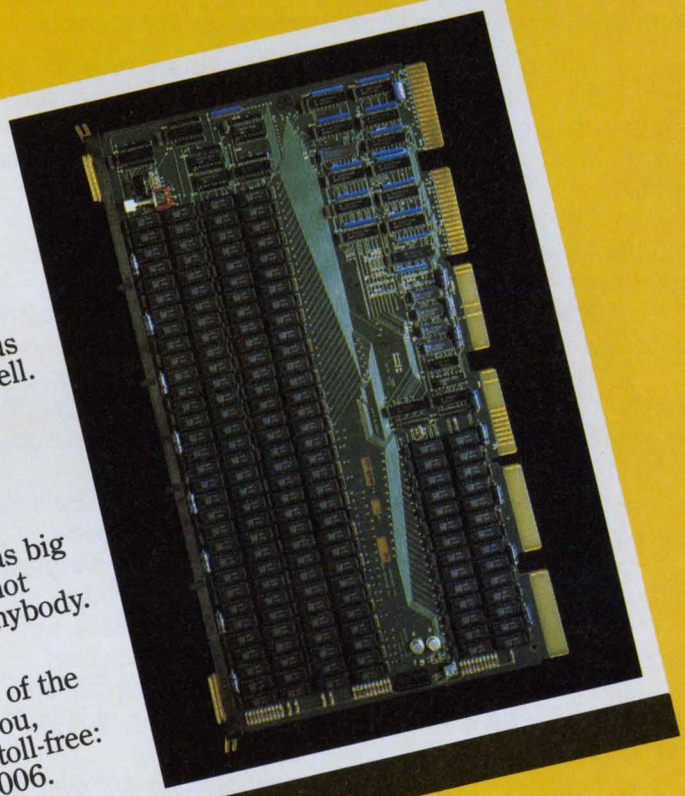

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AFFORDABLE HIGH SPEED NON-IMPACT PRINTERS BEING BASED ON ION DEPOSITION TECHNOLOGY

By James W. Rule, Vice President/Marketing, Southern Systems Inc.

DEC users faced with a new range of choice in high speed, non-impact printers, are a case study in the overall revolution occuring in the high speed output demands of the computer industry.

The choice facing DEC users this year will be entwined with the selection and evaluation of technologies, primarily two major contenders, xerography and ion deposition imaging.

Yet the choice need not depend on new criteria; printer versatility, reliability, ease of operation and maintenance cost, and plug compatibility remain the basic considerations.

Data processing managers with DEC processors can pose a series of specific criteria to evaluate printer products, criteria that essentially are based on the standards set by their own experience in using impact technology. For example,

— Multiple font selection. All characters must be of high quality and be comparable to today's letter quality printers. A large catalogue of fonts of varying sizes and formation that can be inter-mixed in the output stream is needed.

— The machine must be easy to use by the operator and not have an intimidating front-panel design. The product must provide excellent print quality.

— The printer should be capable of producing both landscape and portrait orientation output.

— The printer should have the capability of protecting data with sufficient buffer sizes in case of jams. The IO should be structured in a common industry standard, such as the Dataproducts seven-bit parallel interface.

— The printer should have the capabilities of handling 8-1/2x11, 8-1/2x14 and the European A4 size papers.

— The paper handling must be reliable and designed with output face-down for proper report sequencing.

— The paper must be easily removed and have sufficient capacity to avoid constant loading and unloading.

— The unit, like all peripherals, should have diagnostic and error detection circuitry and feed this information back to the user and/or field engineer when required.

— It preferably should be designed to be compatible with all current line printer controllers and made available in an off-line print station for those systems that cannot support the speed.

— It should be a product designed to handle 40 ppm minimum to meet the market segment with the most promising potential.

— The physical size of the machine should be limited as much as possible.

— It should be extremely quiet, less than 55 dba being the goal.

— It should meet all international safety standards and should be produced for the international market with various power requirements kept in mind.

— Optional features should include the capability of doing logos and signatures.

To answer these needs, a totally new technology is essential. One holding enormous potential is ion deposition imaging.

Ion deposition printer systems, using a sophisticated electrical charging process that is simpler and less costly than xerography, hold one of the greatest potentials of satisfying the criteria of the marketplace. Ion deposition technology, in fact, has brought the high speed, non-impact printer market to the threshold of its first major technological shift. To understand what development of ion deposition printer systems means to today's markeplace, it's essential to contrast this technology with xerography and to examine the primary printer functions needed by users.

Today's primary high-speed non-impact technology, laser xerography, is considered by many users to be the major source of non-reliability and the cause of the high cost of non-impact printing. Although this technology — which evolved from copier machine technology — is dominant, it is not answering the primary needs of the major market segments in non-impact printing, especially those needs of the 60 to 100-page per minute user.

Unlike xerography, which evolved from a different area of business equipment, that of copying machines, ion deposition imaging was developed specifically for high speed non-impact printing.

Simplicity is the major quality of ion deposition imaging. Only four steps are required versus the six steps of laser xerography. Ion deposition's inherent advantage is that the image is formed electrically rather than photographically. In addition, ion deposition uses a hardened aluminum rotating drum to create the print impressions, a drum that is inherently rugged. The process also uses mono-component toner, rather than dual, and it eliminates xerography's two separate steps of transferring the image and then fusing it. These two steps are combined into one, a process called transfixing. Transfixing actually cold pressure fuses the toner onto the paper. There is little wear effect on the hardened aluminum drum even during the automatic cleaning process.

The basic concepts, in more detail, are as follows:

ION DEPOSITION

The technique used to charge the dielectric (aluminum drum) cylinder is the process called Ion Deposition Imaging

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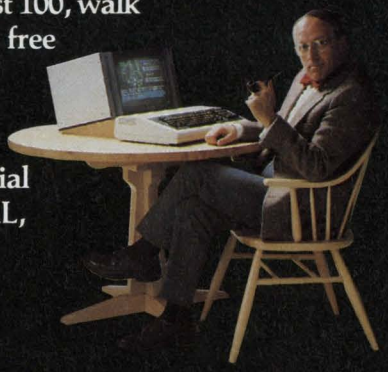

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(IDI). In this process, a cloud of free ions is created in a cavity by means of a high frequency electric field. A second field is used to accelerate a small portion of these ions through an orifice onto a dielectric surface. By controlling either the ion generation field or the accelerating field, the ion 'jet' can be turned on and off as the image cylinder passes under it, creating a series of charged strokes on the dielectric surface of the image cylinder. Using an array of such jets, perpendicular to the motion of the dielectric, a two-dimensional pattern of charges can be created corresponding to the desired image.

The implementation of this process is shown in Figure 1. The pool of free ions is generated by putting a high frequency voltage between the drive line and finger lines at the top of the cavity. A positive bias on the finger will hold the negative ions in the cavity, while a negative bias on the screen attracts the positive ions and discharges them. At the appropriate time, the bias on the finger is made negative, repelling the negative ions, and causing them to follow the electric field through the screen orifice, down to the dielectric.

Either the ion generating field, or the finger bias may be used to control the jet, since both are necessary to the process. The ion cartridge makes use of this characteristic of the process.

Since the images created have a resolution of 240 dots per inch, it is necessary to have 2048 ion jets perpendicular to the direction of travel. If only one of the controlling fields were to be used, it would require 2048 switchable drivers. In the Ion Cartridge, a skewed matrix is used which multiplexes 16 drive lines and 128 fingers, reducing the number of required drivers to 144. IOM electronics time the selection of drive and finger lines to create the strokes appropriately for the image.

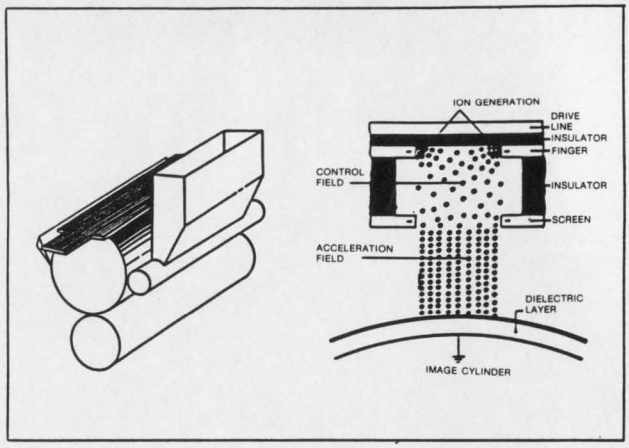

FIGURE 1

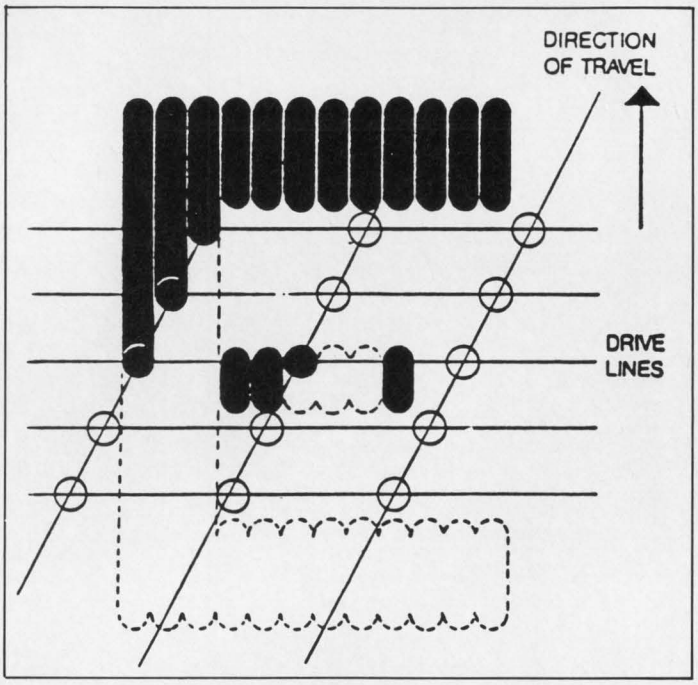

FIGURE 2

IMAGE GENERATION WITH SKEWED MATRIX

Figure 2 shows a simplified version of the skewed matrix which is used to generate image patterns. The 'E' to be imaged is charged onto the dielectric cylinder as it passes under the matrix in the direction of travel indicated. As a section to be charged passes under each jet, the drive line and finger line for that jet is activated. In practice, each drive line is selected in turn, and the finger line for each jet to be fired for that drive line is selected at the same time.

TONER APPLICATION

Toner is applied to the charged image by means of the toner subsystem shown in Figure 3. As the charged image on the dielectric makes contact with the toner, a circuit is formed through the toner, which is conductive. The circuit takes away negative charge from the toner particles, leaving a net positive charge. This causes the toner particles to adhere to the charged image as it rotates away from the toner "brush."

The toner is supplied from a reservoir through a slot as shown. The front edge of the slot is used to meter the flow of toner so that a consistent and ample level of toner is maintained on the toner roll. Also, excess toner coming around the roll piles up behind the slot, acting as a valve to prevent too much toner on the roll as it rotates, and provides a precise contact area with the dielectric.

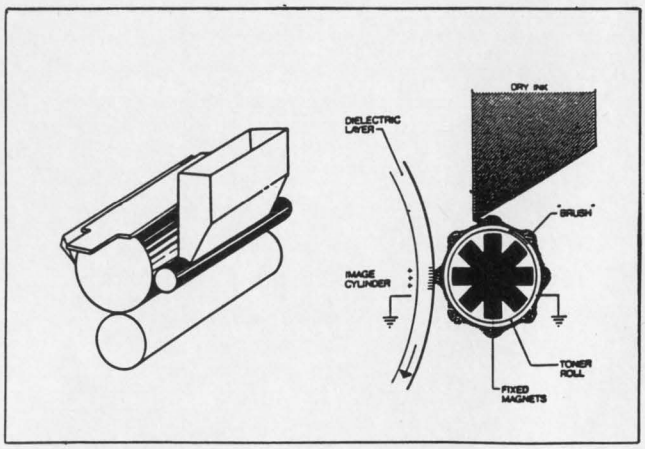

FIGURE 3

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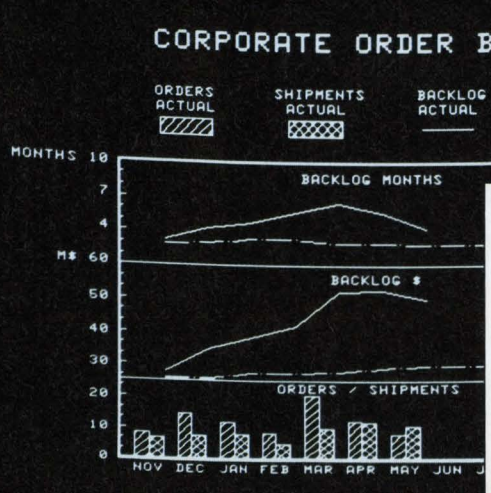

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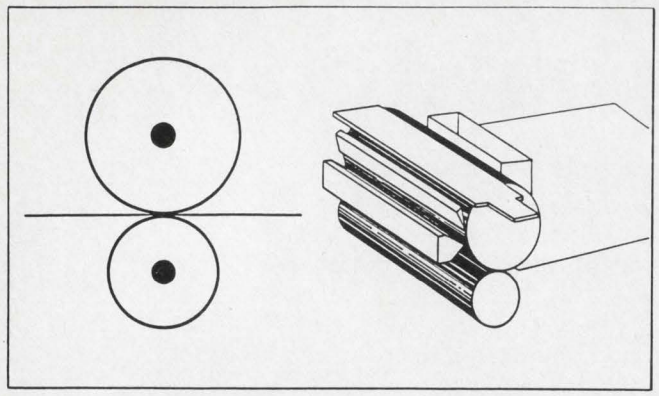

FIGURE 4

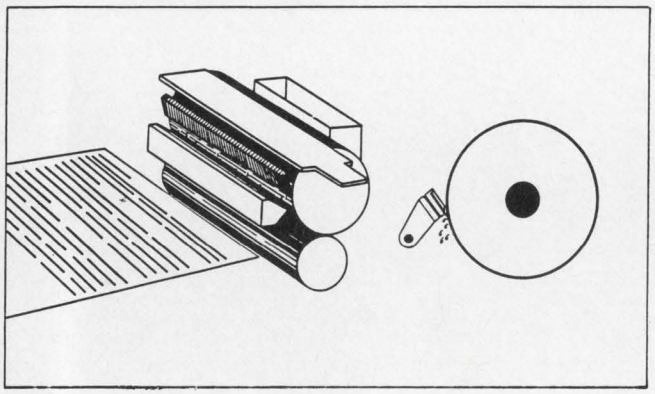

FIGURE 5

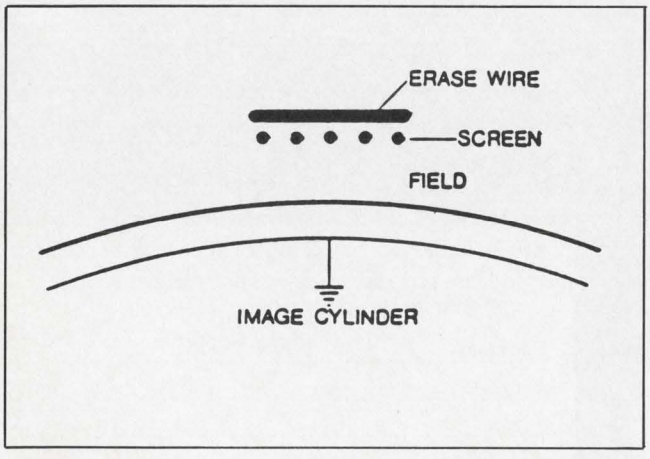

FIGURE 6

TRANSFER AND FIX

Once toner has been applied to the image, it is transferred to the paper, and fixed in place (transfixed) by a method of cold pressure fusing. (Figure 4) In short, the toner is pressed together with the paper between two rollers, the upper of which is the dielectric cylinder carrying the toned image. The characteristics of the process are such that over 99 percent of it adheres to the paper, rather than the cylinder.

CLEANING

Since a small amount of toner is left on the cylinder, as well as some residual charge, two processes prepare the dielectric surface for further imaging. The first scrapes off any remaining toner, the second restores the surface to ground potential.

The scraper blade (Figure 5) is a steel blade held to the surface of the cylinder by spring tension. The surface of the cylinder is very hard compared to the blade, and quickly hones it to a near-perfect fit to scrape off any toner particles left clinging to the surface. These are caught by the catch-tray below. The blade also takes off paper dust which may have transferred to the cylinder from the paper.

The erase head (Figure 6) is an element which restores the dielectric surface to ground potential before imaging. It consists of an insulated wire behind a conductive screen. The screen is kept at ground potential while an RF signal is applied to the wire. This creates a pool of ions which can be attracted by any charge remaining on the dielectric surface, leaving it electrically discharged and ready for the next image.

The most exciting benefit in the utilization of ion deposition imaging is its inherent capability to reduce the cost of ownership of products utilizing it. It is readily apparent that the maintenance cost should be much less because of the inherent increase in reliability over laser xerography products. The mean time between failures or copies before failure should increase considerably; estimates indicate reliability increases four-fold. Due to ion deposition simplicity, the mean time to repair will be reduced substantially. The end result should be a total cost per sheet reduction of about 50 percent.

Due to these and other characteristics of ion deposition technology, products such as the Mercurion 1 being marketed during first quarter 1983 by Southern Systems Inc. of Fort Lauderdale, FL, should have a dramatic effect on the printer marketplace, answering for the first time the market requirements at an affordable price, approximately $60,000, including total interface for the majority of the computers on the market today as well as being software compatible with existing line printers.

Users can look forward to ion deposition-based products, using cutsheet feed, yet replacing directly today's line and letter quality printers — without software changes — and emulate those line printers exactly.

The dramatic effect of ion deposition is destined to trigger a major shift in printer technology that will dominate the high speed, hard-copy output market through the end of the century.

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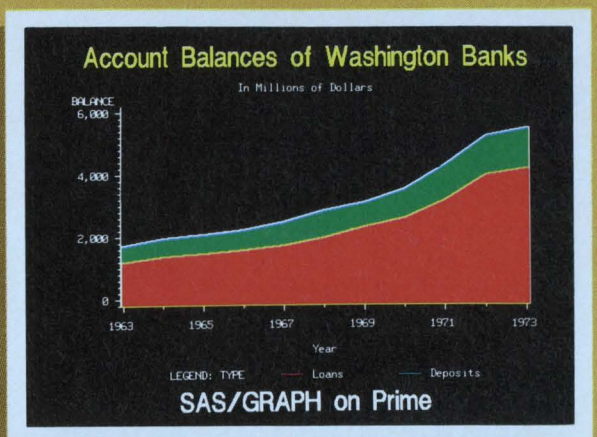

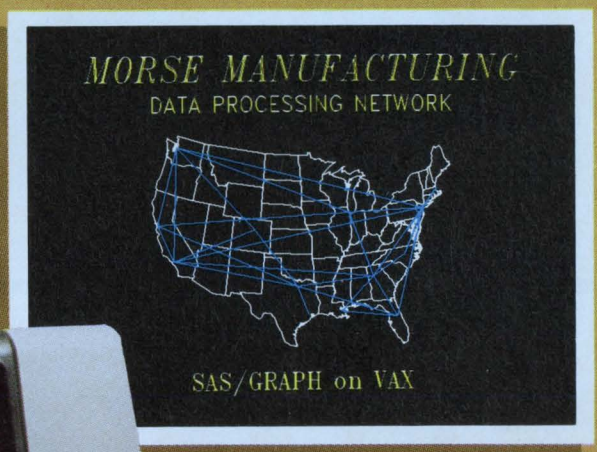

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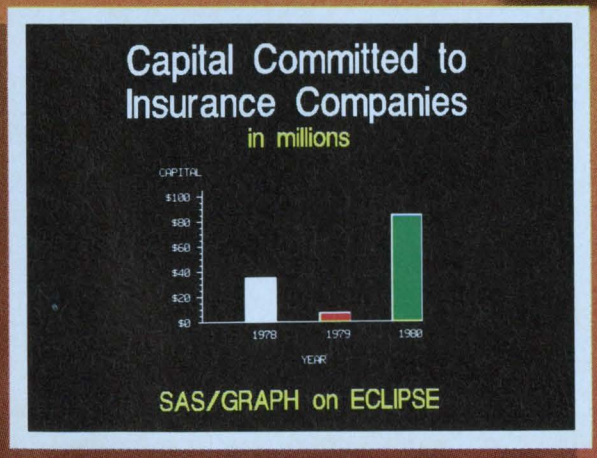

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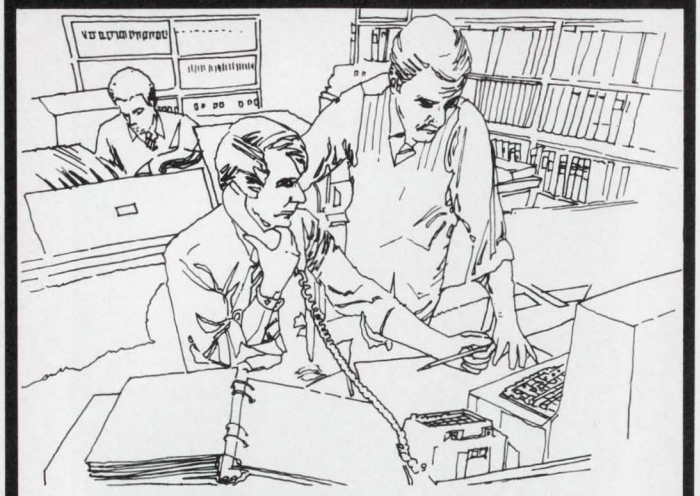

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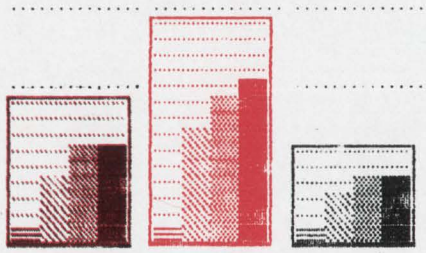

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FROM THE RSX EDITOR

By James A. McGlinchey

Allow me to introduce myself. I've joined The DEC* Professional as the Editor of the RSX Department. Many of you may be familiar with my name through my participation at the DECUS Symposia; others of you have possibly seen my name as author of several articles which have already appeared in The DEC* Professional.

For those of you who haven't the foggiest idea who I am, let me list those items in my not-so-illustrious past which are pertinent to the position I now hold. I have been in the Data Processing trades for thirteen years, the most recent six of which have been spent as a user, system programmer, and consultant in the RSX-11M world. I currently teach the DEC Seminar, "Design of Applications under RSX-11M." I have been an independent consultant for the past three years, being primarily interested in industrial automation using PDP-11's and major microprocessors.

I view my position at The DEC* Professional as one of being responsible for acquiring, editing, and writing articles of interest to the users of RSX in all its versions. In that capacity I have considerable freedom to choose from the available articles and to solicit articles from proven authors. Such choices reflect not only my understanding of my new position but also the purpose of The DEC* Professional Magazine.

The articles I am looking to publish basically address the question of WHY a programmer or designer uses RSX in a certain way. The WHAT has generally been answered satisfactorily in that Digital has written a comprehensive manual set for the RSX family of Operating Systems. The users always have difficulty, though, in deciding what facilities to use out of the large complicated set of functions available.

Other articles which would be of interest would include:

Migrations to or away from one of the RSX Operating Systems, such as RT to RSX, RSX-11M to RSX-11M-PLUS, RSX-11M to VMS, UNIX to RSX - any likely combination.

Design Trade-Offs - Do it this way rather than that way, and why.

Expansions of items in the manual, mentioning GOTCHAS, explaining which facets of an RSX facility are useful, which are troublesome, and why.

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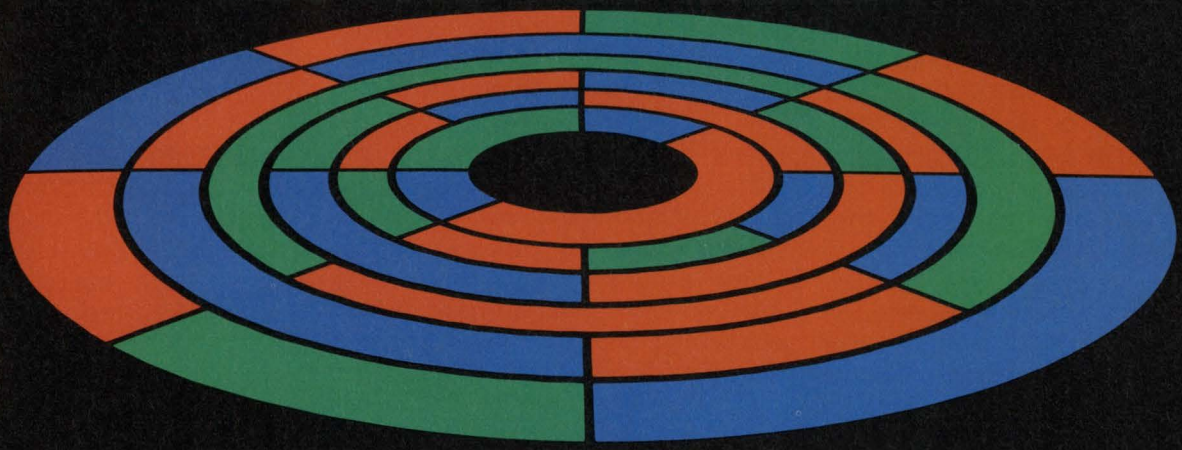

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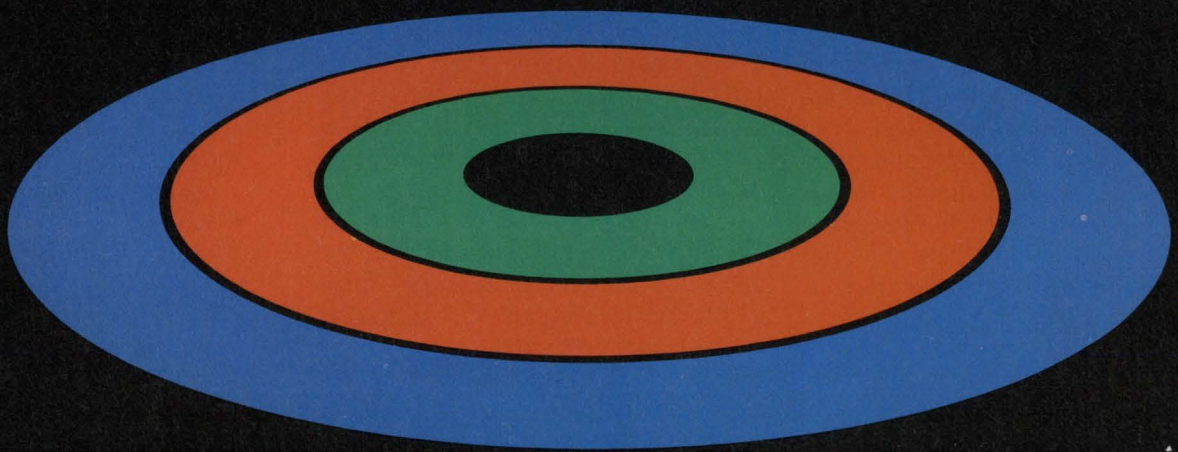

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tool for post-project evaluation and will be used for future project planning and resource projections for similar projects.

THE PROJECT IMPACT STATEMENT

A project is initiated because someone needs or wants something. Many times the users can't determine the total impact their requests will have on corporate resources, because they are unfamiliar with the day to day idiosyncracies of the EDP world. Most users don't know a bit from a byte and many don't concern themselves with it. Their primary concern is bottom line; how much is it going to cost and when will it be implemented.

On the other hand, some users can't distinguish between a need and a want. A user may need a vehicle to travel between points 'A' and 'B'. A bicycle may perform this function adequately, but the user wants a Concorde because the competition has one.

The initial impact statement may discourage this extravagant want before the project develops. However, various system alternatives will be analyzed in depth and cost justified in the next phase, the Feasibility Phase.

The purpose of the impact statement is to arrive at an overall feel for total project resource commitment. The project cost and resource estimates arrived at in this phase are 'ball park' figures and can change radically as the project develops. It is always at the discretion of management to cancel or delay a project at any point in its cycle, because of a change in corporate needs, status or resource allocation, regardless of previous commitments.

The analyst assigned to the project should be experienced and hopefully familiar with corporate resources available, skill levels of team members, hardware and software options, the present systems configurations and the overall constraints and restraints of the operational system in general. This knowledge will enable the analyst to make an intelligent 'educated guess' for the initial resource projections and allocations.

Once this knowledge is put into place, the project tasks can be identified. A detailed task analysis will be made during a later phase in the project.

First, identify the number of phases that will be associated with the project. Smaller projects may combine phases and resources. Very small projects may be one phase. Next, develop a general task list for each phase. For example, the Impact Phase may require the services of one analyst for one week. The Design Phase, on the other hand, may require two analysts and three programmers, performing two hundred and fifty tasks. Remember, these early projections are guesstimates, based on previous project knowledge and past experiences with corporate hardware and software configurations. The user should be made aware of this early in the phase.

Use a standardized task list to project resource allocation. The tasks can be self generated or generated by the aid of a computerized Project Management System (PMS). A computerized PMS can automatically generate task lists, allocate available resources and project time and cost estimates as required. There are several excellent vendor Project Management Systems available in the $8,000 to $80,000 price range. Three of the better systems on the market average about $40,000.

In either case, initial resource allocation should be established to determine the overall project cost and time projections. Once resources are identified, the dollar projections can be arrived at by utilizing a standardized 'plug-in' cost factor. This should include hourly salary plus overhead.

The Impact Statement will contain a summary of your projections for the entire project.

- Identify the phases associated with the project
- Specify the general tasks to be performed by phase
- Develop an overall task list by phase
- Develop a GANTT or similar projection chart
- Produce a total cost and schedule projection by phase
- Write the Impact Statement

Don't forget to include time for meetings, phone calls, writing specifications and revisions (there will always be revisions). If a conversion of data will be required, include this as a separate phase projection.

At the end of the Impact projections, the analyst will have developed:

- A firm cost for the Impact Phase
- An educated estimate for the Feasibility Phase
- A guesstimate projection for the remaining phases

THE BENEFIT STATEMENT

The Benefit Statement is developed to offset the shock of the Impact Statement. This is not a formal Cost/Benefit Analysis. It is a general listing of the projected benefits of the new system. A formal Cost/Benefit analysis will be performed during the Feasibility Phase.

Benefits fall neatly into two categories; tangible benefits and intangible benefits. Tangible benefits are those benefits that can be measured directly. Basic areas of tangible benefits are:

- Elimination of office machinery, postage, stationery, etc.
- Reduction of costs due to improved procedures
- Increase in money accruing as a result of a feature of the new system
- Reduction of personnel

The tangible benefits are easily calculated or are measureable. Intangible benefits are desirable effects which are difficult to measure in direct monetary terms. In other words, a simple benefit may be a standardization of corporate procedures, which leads to a series of increased skill proficiencies or overall improved efficiency of corporate personnel. These benefits can be classified into many categories. A partial list follows:

- Information availability
- Reduced tedium
- Corporate image
- Data Reliability
- Performance measurability
- Improved forecasting
- Improved accuracy
- Speedier results
- Improved customer service
- Responsive data analysis
- Improved data control
- Improved personnel control

The combination of tangible and intangible benefits is usually sufficient to overcome any costs or inconveniences that will be incurred during the project's development life cycle.

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However, some projects may show a considerable loss at first, or may never show a projected return on investment, due to a crisis situation or federal law, etc. that must be implemented to survive.

The Benefit Statement task list should include the following steps:

- Analyze and weigh all benefits
- Project tangible and intangible benefits
- Weigh the benefits against the impact
- Write the benefit statement

IMPACT PHASE USER REVIEW

Usually the Impact Phase review is not a formal review per se. The phase end report should be neatly typed and presented to the user in a business like fashion. But in general, it is a statement to the user on the future status of the project. It is a projected commitment of corporate resources for a given time frame. It tells the user what total impact can be expected and what benefits can be derived. If total commitments are too far out of line, the user may opt to cancel or postpone the project for an indefinite period of time, or when corporate resourecs may be more readily available.

If the user decides to go ahead with the project, a formal corporate level review is normally made of the request and its associated impact/benefit analysis.

PROJECT PRIORITY

Everyone wants his project done yesterday. If we didn't we wouldn't be human. Most corporations have assembled a group of knowledgeable individuals, with vast corporate and/or data processing backgrounds, to review new project requests. These individuals determine project priority, that is, which projects will recieve most of the available resources and which projects will be shelved or cancelled. The group is usually called a User Review Group, Steering Committee, Control Committee or other such applicable name. Their main function is to review the status of new and existing projects to determine where they should be placed on the ladder of corporate EDP priorities.

Some decisions are relatively simple to make. If a project is initiated based on a federal, state, county or local regulation, the priority is generally set based on the required implementation date.

Other priorities are not as cut and dry. Several objective and subjective factors are generally taken into consideration. A project initiated by the Chairman of the Board will surely carry more weight than one generated by an insignificant department manager.

However, all other factors being equal, the impact and benefits the project will have on the total corporate assets will generally aid in project placement on one of the priority rungs. This is where the analyst's or project leader's initial evaluation and analysis of a project can lay a convincing role in helping the committee to prioritize the project.

PHASE SUMMARY

At the end of the phase, management will have the data necessary to make an intelligent decision as to the disposition of the project based on your Impact/Benefit Statement and projections for total corporate resource allocation.

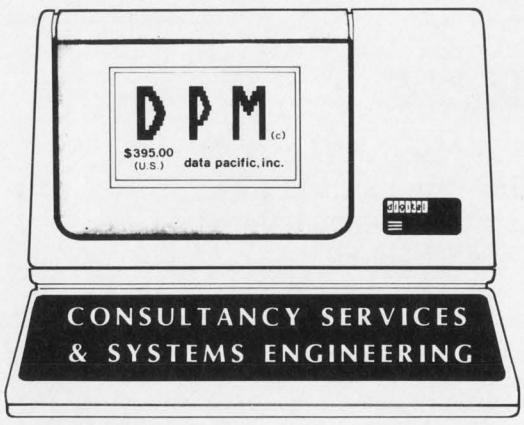
Make certain you are comfortable with the time frame established in your projections. Don't try to be a hero. Estimates that are too critical will cause the project to shift from first gear directly into a crisis mode. Once in the crisis mode, there is no reverse!

The Impact/Benefit Phase, is in effect, the first step in painting the Mona Lisa. It would be inconceivable for Leo to have begun his painting without first preparing the canvas. In reality, the Impact/Benefit Phase is stretching the canvas. Once this is in place, the artist can sketch his product.

The total SDM is a tool and is not intended to hamper the creative abilities of the analyst, programmer or project leader.

Instead, it provides a direction to travel when developing the systems. It is a guide for solving complex systems problems. It helps the analyst through the web of questions, problems and alternatives that blanket a project's development life cycle.

Future articles will take the project from the Feasibility Phase through the post-project evaluation of the implemented system.



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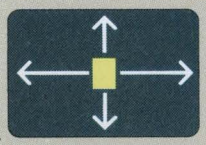
THE QUESTIONS:

1 EDITING



Which kind of editing operation is quickest to execute and easiest on the eyes of the word processing user?

a) Full screen editing allowing for easy cursor movement around the screen?

b) Moving the cursor around by doing a line count?

c) Editing on the bottom line of text only?

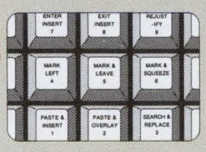
2 DOCUMENT LAYOUT

Whatever document format you choose. . .you want to see what the finished article will look like. Should you. . .

a) View it on the screen as it would come out of the printer?

b) Run it through a pre-processor to see what it looks like and then if you like it, print it?

3 KEYSTROKES



Using a well designed w-p system, how many keystrokes should it take to execute the most often used w-p functions?

a) One easy stroke with no codes?

b) Two or more with complex w-p codes?

c) Three or more?

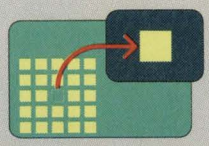
4 FLEXIBILITY

As the business manager of your company, you would like to find w-p software that you can tailor to your company's specific needs. Should you. . .

a) Look for w-p software that allows you to change and add menus, and change function keys?

b) Write your own custom software?

5 RETRIEVAL

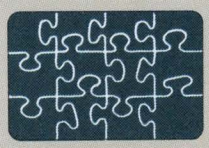


If you want to retrieve information quickly from a large database, which w-p software should you choose?

a) One that can access a particular record by going to it directly?

b) One that searches through all the records on the database sequentially until it finds the right one?

6 COMPATIBILITY



As a manager of MIS, you want a w-p system that can be integrated with other application software. Should you choose w-p software with. . .

a) ASCII formatted files?

b) Software which requires non-printing characters in it's file system?

7 MATH

Your company has a number of financial applications and is looking for a w-p package with math capabilities. Should you choose. . .

a) On screen calculating allowing for editing, storing and recall of equations, calculations integrated with your word processing applications?

b) Software where the math capabilities are tied to the list processing module?

c) A separate math package?

THE ANSWERS:

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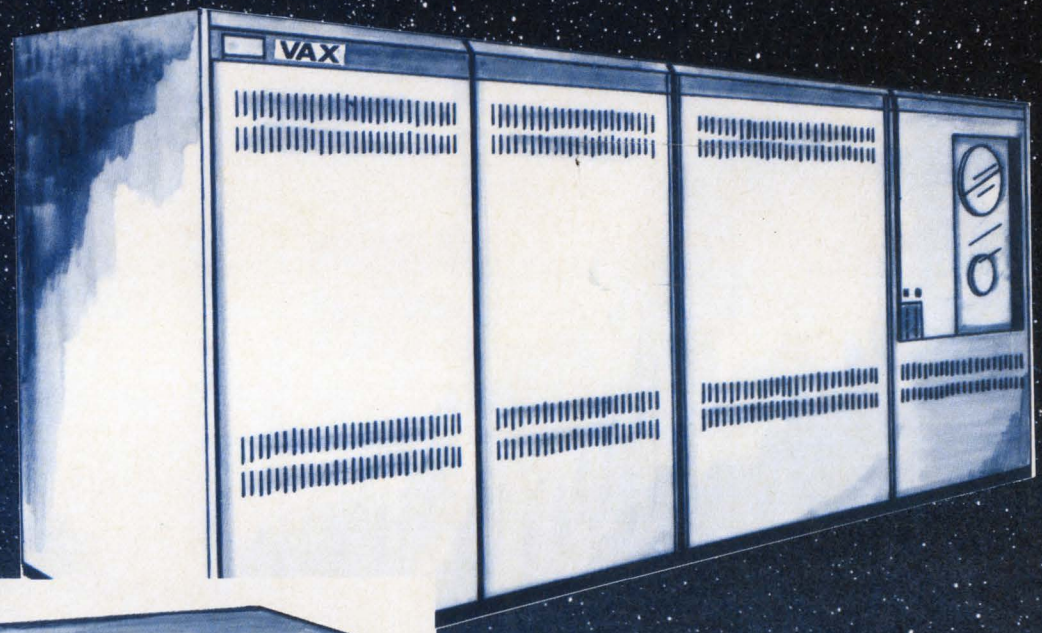

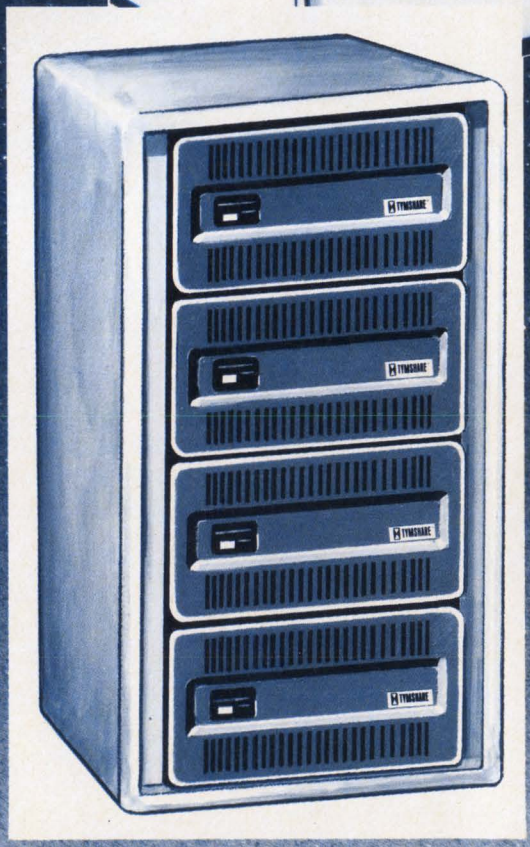

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CIRCLE D11 ON READER CARD

UPGRADE PATH FOR H11 [AND LSI-11]

By Ed Judge, Fairbrother Associates, Box 685, Northampton, MA 01061

Many of us who wanted to get into electronics and/or computers in the old days must remember looking at the Heath catalog and wishing for this or that. For me, this or that was their analog computer, and later their H11, a kit version of the LSI-11.

Many must remember when the H11 came. Putting together the power supply and trying to assemble those plastic connecters on the back,maybe running a switch so you could control your line-time clock from the outside of the case. Wondering why they didn't use DB25 connecters, and why they didn't put the line-time clock switch on the front panel, as they finally did on the later models. And, of course, the big one: why did they drop the line, and how could they leave so many loyal customers holding a very expensive bag? Oh well, life goes on, and what can you do about it?

After you've thought about it for a while, you can do either of two (legal) things:

(1) — You can try to sell the unit for whatever you can get and buy another brand that stands behind its product, or

(2) — keep the unit and hope for better things.

I opted for the second, and as no one was really trying to support the the H11, I looked further, and found many people supporting the DEC PDP-11/03. Fairbrother Associates was formed to bring some of the fantastic 11/03 support to people with Heath equipment (and hopefully, to make some money to pay for some nifty new equipment). We attempt to be aware of what's going on in the less expensive end of gear for the H11/PDP-11/03/23, and share this with our customers.

Over the last year, we have had many customers, and have learned many things, both good and bad, about the future of the H11 system. One of the most important things learned is how to go about upgrading the H11 while keeping as much of the old system as possible. Much thought and action has been expended on this subject, and I feel that many people who own H11's would be interested in what has been learned. Another reason is that for the most part, the people who bought the H11 were planning to use it in a serious manner, not just to play games. Many were willing to upgrade the H11 and use it for their businesses, if an affordable way could be found to do it. We felt that "affordable" meant using as much of the old Heath equipment as possible, and maximizing the utility gained from the new equipment.

Basics first, for those who ". . . walk the walk . . ." but haven't, as yet, learned how to ". . . talk the talk . . .".

The H11 is Heath's version of the Digital Equipment Company's (hereafter referred to as DEC) PDP-11/03 (Programmable Data Processor, type 11, model 3) computer. It was the first single-board computer with the PDP-11 instruction set. It was applauded as the first big step to get the computer into the hands of the people, as it offered 16-bit word length, the standard PDP-11 instruction set, and a lot of computer power for its relatively low price. It also offered a crude (at the time) but "user-friendly" (some cynics insist on using "idiot-proof," but they usually consider themselves an elite group of one or two people) operating system called RT-11, the "RT" standing for "Real-Time."

The ease of use of this operating system has directly contributed to the popularity of the CPU. With V3 coming out in 1977, and V4 coming out in 1980, 11/03 users had one of the best single user O/S available to any small computer user. And with TSX and TSX-Plus, timesharing came almost painlessly to RT11. V5 is scheduled for release this May. We'll see.

An important thing to note: even if you purchased the CPU from Heath, you are still entitled to the same privileges as any person who got it from DEC. This means you can use the LSI Hotline (call DEC in Marlboro at 617-467-5111 and ask for the number, for out of state it may be toll-free) and join the several Special Interest Groups. I recommend you join the RT11, LSI, and perhaps the Structured Languages SIGs. Call and ask what you must do to join. Don't miss out on this, as DECUS (Digital Equipment Company Users Group, One Iron Way, Marlboro, MA 01752) is a very valuable asset. They hold big (I mean BIG) meetings every six months or so that are interesting to attend. You can make many useful acquaintances there.

Upon examination, the "other" OP/SYS, CP/M, is a poor vision of RT11. The CP/M file system is very similar. In fact, it is rather easy to read CP/M discs on an RT11 machine. A program to do it is in the public domain. There is also UNIX and its limitations, which work well when most of the bugs are removed, whenever that is. Some people think UNIX is great. There are a whole bunch of people with 8-bit machines running CP/M and thinking its the best OP/SYS going, until they see RT11, with all the things they have dreamed of having, and many they never even thought of.

RT11, with its English-like command language (user expandable in V5), is much easier to use initially, much more powerful. Its device-handling structure makes it very easy to maintain, add, and change configurations. With active input from the User's group and Special Interest Groups sponsored by DEC, the development path is usually along the lines of what the majority of the users want. As proof, the much proposed idea of putting FORTRAN IV+, the optimized version of DEC's FORTRAN IV, on RT11 is finally happening. Wish lists from the users finally prevailed. Of course, DEC stands to make a little money on the deal. A long awaited new BASIC is also rumored to be coming out "soon," with long variable names, compound conditionals, etc. Finally!

All of this implies the first upgrade path for those who wish to do more than just play with their H11's—get RT V4. Various ways of ob-

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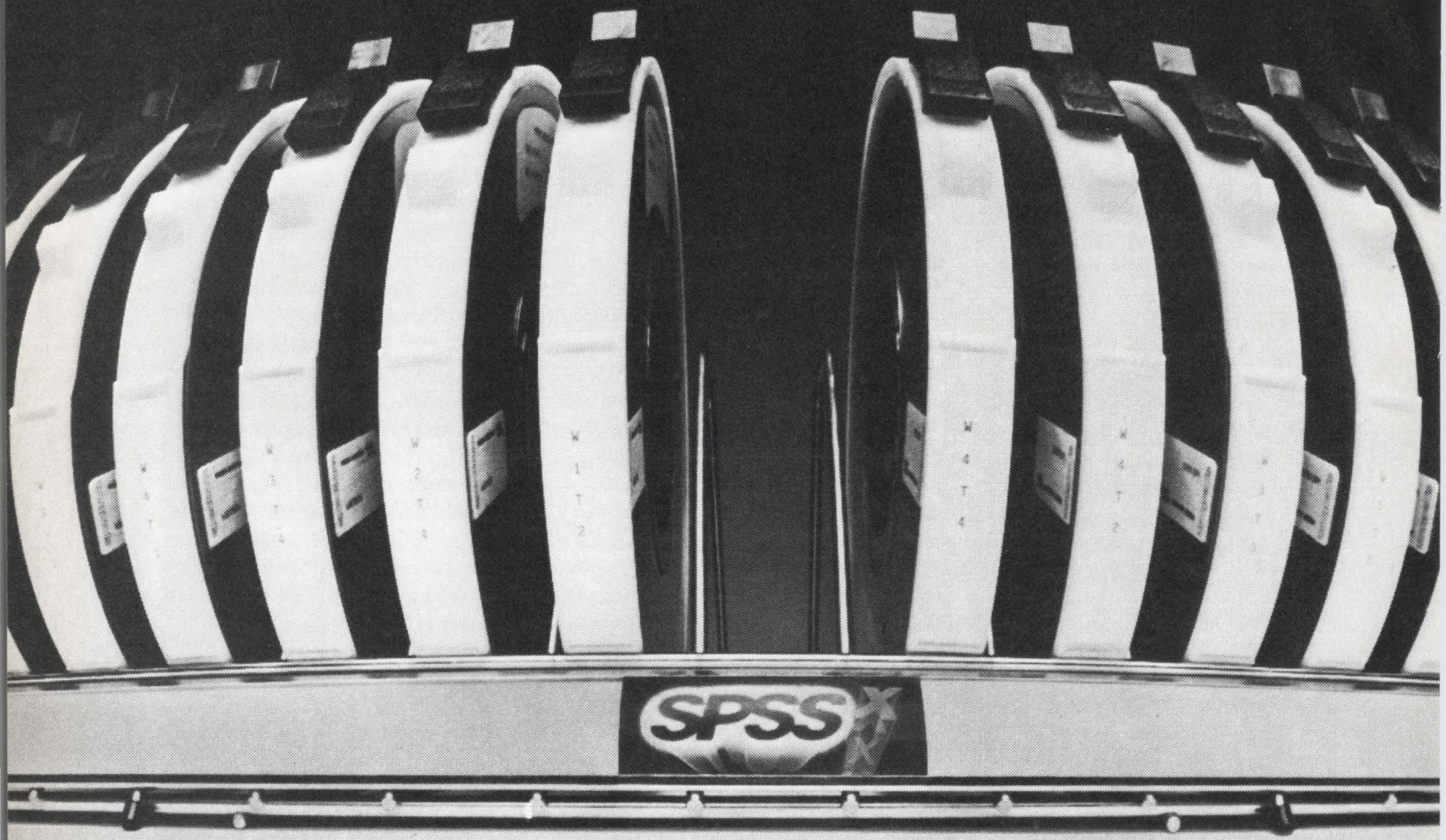

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taining this should occur immediately to the afficianado, but know that there are many different licenses available. Some, with run-time utilities, cost a few hundred dollars.

Many universities run DEC machines, most with RT11 somewhere. Go there! Make friends! Use the new RT (or even the old V3)! See if it isn't all I've said!

These universities may also sell the RT11 manuals very cheaply to their students (oddly enough, they look a lot like you) because of some special license deal that DEC gives to them, probably to hook them early on RT, so they won't feel comfortable working with less. Less is just about anything else.

HT11 is a very buggered-up version of RT11 V2C. Heath has put some routines in the code that make it almost useless if one wishes to get more out of the 11. Much of the public domain software that is available won't even run under HT11. Again, this is the first step, but once done, the world opens up to you.

As a side note, inquiries have been made to Heath about getting this code when they stop supporting the H11, but no response has been forthcoming. It isn't even known (by anyone outside Heath) how many H11 owners there are, although I've heard that the contract Heath and DEC entered was worth about $5 million dollars. Attempts to get a list of customers have also met with complete failure.

Moving right along, once RT11 V4 is obtained, you should then look at the system software available for the 11. First, there is FORTRAN. Old and as full of bad ideas as it is, it still is one of the best languages available for the 11, as the 11 architecture is nicely adapted to running FORTRAN, and FAST! There are several preprocessors such as RATFOR, FLECS, and SFTRAN, which allow full structured constructs such as DO-WHILE, REPEAT-UNTIL, IF-THEN-ELSE, CASE, and others. These give you the convenience and ease of programming that these constructs allow, and the speed, portability, and compactness-of-code that most FORTRAN compilers have after millions of man-hours of development. This is a very important feature that you should not let any "language snobbery" take from you. FORTRAN 77 is supposed to be available with V5, which will be a blessing for those who have fought and waited so long for it.

As for portability, if the program doesn't have any system dependent extensions, it will most likely compile as it stands. I took a sort program from a Harris computer and compiled it without error on my 11-23. Not bad for a language that is so belittled by many people.

There are many other languages available, such as *PASCAL, COBOL, BASIC, *FOCAL, *C, *LISP, *FORTH, *APL, DIBOL, DBL, DYNAMO, *ALGOL, MUMPS, MUDDLE, CORAL, BLISS, *MODULA-2, . . You get the idea, LOTS. Many languages were developed on the PDP-11, and some of these (*) are available in the public domain. Most of them are available from DECUS (Digital Equipment Company Users Group) or from other organizations and individuals, such as Fairbrother Associates. Excellent time-sharing systems are available to further enhance the unit's utility.

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to how far you want to go in getting peripherals for the 11. There is a stunning amount of equipment that will fit on an 11. The design criteria was maximum flexibility and minimum complexity. One can go from the stock system with 11/03, 64KB, SS/SD (Single-Sided/Single- Density) 8" floppies, and serial or parallel ports, up to almost any configuration desired.

Adding a new peripheral is in most cases a matter of inserting the controller and putting the requisite system handler on the system disc. With a new 22-bit backplane, one can get an 11/23 with floating point and up to 4 MB's of memory. Boards are more expensive than the 8-bit machines, but not as expensive as UNIBUS boards, is the standard 16-bit bus structure DEC normally uses.

All Heath boards for the H11 are not usable as they stand. The serial board in particular needs some attention, as one of the lines is not terminated. It works erratically, depending on its position in the backplane relative to the other boards. I plan to write an article for the Heath Users Group newsletter, REMark, explaining what can be done to fix the situation. It requires a few pieces of wire and two resistors.

Now for some concrete examples on expanding a stock system to maximize the return of your money in terms of utility offered per dollar spent. The following path is what Fairbrother Associates recommends to its customers.

The first thing we think should be done is to upgrade storage. Our MXV-21 controller costs $995.00 (with cable). With it you get double-density right away, and the controller is a DMA (Direct Memory Access), and is much faster in reading and writing to the floppy or to memory. Double density gives you about 960 blocks (depends on how many directory segments you want), and the ability to run programs without the messy problem of switching to another disc to compile, and another one to link, etc. The newer version of RT.11 is always bigger than the previous version. The added storage space is necessary for V3 and later versions. With no other upgrades, the functionality of the system has been expanded considerably, with a minimum investment. But there is more!

Our controller offers two features that Heath's (or DEC's, for that matter) controller doesn't. First, if you want to upgrade one or both of your original Heath Memorex floppies to a double sided model (we recommend Mitsubishi or Qume DATRAK-8; NEC FD1160's are nice, but are slower and cannot have a write protect switch installed), all you have to do is unplug and unscrew the old drive and replace it with the new one. Depending on the make and model, a few holes may have to be redrilled, and a little sheet metal may have to be filed here and there, but nothing bad. An adapter to couple the SS AC power plug to the DS type is also needed. The options on the drive will have to be set correctly, but then all you do is use double-sided discs for a storage capacity of 1.2 MB, which is about 1964 blocks. Two of them store as much as was stored on the old RK05-J hard disc, but are slower.

You can do a lot with that much storage. I know several people who find this to be enough for professional use of the 11. If you replace both drives with newer models, you can get another timing prom to get full speed out of the drives for about $15.00. The new drives are about twice as fast as the original Heath Memorex drives.

The second feature involves memory. If you wish, you can have up to 256KB of memory in the backplane. The 11/03 processor can only address 64KB of memory with 16 address bits. The backplane, a full Q-BUS (what DEC calls the backplane organization), has 18 address lines (newer models of the Q-BUS have 22 address lines), so you can manipulate the extra two address lines to get an additional 192 KB of memory. With our controller, we include a file to activate the two additional lines and use the upper memory as an "electronic floppy disc." This is done in a transparent manner by calling "DY7:" in a program. When the handler sees this, it goes to its routine of handling the upper memory in the same manner it controls the floppy drive. With more memory, you can run TSX, and put the swapping area in the memory above 60KB.

An important point to notice is that everything purchased so far is usable when you decide to get an 11/23. The 256 KB board has 22-bit addressing lines, and can be used in full house timesharing systems with 4MB of memory. The controller is 18-bit, but when 22-bit floppy protocol becomes standardized for the Q-Bus, we hope to have a handler to access the memory above 256 KB as "DY7:" also.

An 11-23 with MMU, 256 KB of memory, and TSX-Plus will give you timesharing RT11, marking the start of an upgrade path that will give you up to three to four users each with its own RT11 workspace and very quick response, and without a hard disc. More users will cause swapping and degrade response, but a hard disc will allow fast swapping to disc, and will extend the number of terminals to about six to eight without much degradation of the response time.

TSX-Plus can also be used as an extended RT11 single-user operating system. It allows full printer spooling, and simultaneous access to several programs at a time. Since the system editor, KED, does not have a multi-file "window" function, I use the "Virtual Line" facility instead. TSX-Plus allows you to control more than one program from the same CRT. I edit on the original channel, and if I need to look at another file, I call up another "virtual" line. A virtual line is like sitting at another CRT and running another program. This allows me to get what I need, and either sign off, or leave it right in the middle and go back to the original workspace. I may have to go back to it again, or I may have to use still another workspace to do something else, all at the same time. RSX (DEC's big OP/SYS) has this facility, but the price is rather steep, especially compared to TSX-Plus.

You can have several workspaces controlled from your CRT, switching between them as necessary. If something needs to be done, or output is to be displayed, the other terminal beeps you at your terminal. You can interrupt what you are doing, switch to the other line and check out what the beep was about, take appropriate action, and go back to what you were doing before. Once you get used to having this utility, you can't figure out how you were plodding along before. Spooling also allows you to print out a report to a file and have it printed out without taking up the line — you can go about your business without waiting for the printout to finish.

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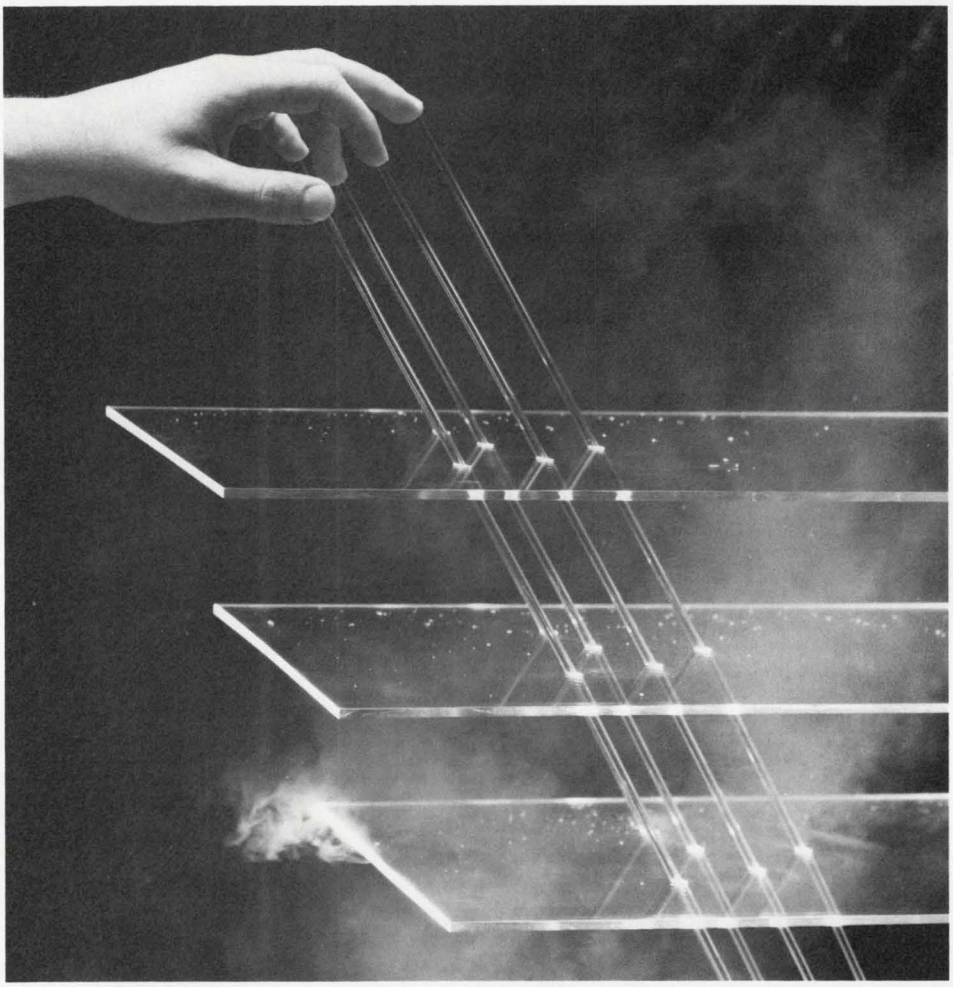

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buy a new backplane with 22-bit addressing for about $400.00, and use more memory. Most replacement backplanes are about the same size as the Heath unit, but have about twice the capacity. Be careful if you buy a used one, as there are several types of Q-Bus backplanes. Unless you want to use an old DEC RL01/RL02 dual quad controller, avoid the "C-D bus" type, as you can only use half of it for anything except the RL01/RL02 controller boards. This special bus seems to me to be one of the biggest goof-ups DEC has made recently. Avoid them unless you know what you are doing.

TSX-Plus allows you to use the full 4 MB for terminals, if you wish. Some people have 10-15 users, several spooled printers, and some modems (there is time-out support), and are very happy. I don't know how many people you could have ultimately, but with 4 MB you could theoretically have 63 users. Each would have a full 64KB workspace, though the response time would not thrill anyone. Any sort of solid-state disc emulator will allow even more. The trick is that TSX-Plus has a very low overhead compared to that of RSTS (DEC's timesharing OP/SYS) or RSX with comparable utility. Another nice thing is that you only have to learn a handful of new commands that extend the utility of RT in the timesharing environment, as the bulk of the commands are the standard RT11 ones.

Most programs will run under TSX-Plus unchanged. An exception to this is any program which directly uses the I/O page. This can crash the system, and cannot be allowed indiscriminately in a timesharing system. There is a facility to do real-time work concurrently with normal timesharing, if you want to, for something like data acquisition. Programs like this are rare. The most used program that does this is FORMAT, which directly handles the registers for the device being formatted.

Storage does not stop with floppies. Fairbrother Associates runs a large (169MB, 5 logical RK07's, 28 MBs, 53000+ blocks each) Fujitsu Winchester disc with an Emulex SC02 controller, and this is not the max that can be handled. The Emulex controller has operated perfectly, and the people there have shown themselves to be very competent and easy to talk to.

Mr. Gaio, of their customer service department, spent several hours on the phone with me getting the first drive up, as no one had configured a Fujitsu on the SC02 before. Now there are a lot and what the disc requires is well known, but in the beginning someone had to do it first and find out what was needed. The disc has performed perfectly and is very fast as well (27ms track to track, 55ms worst case), and we at Fairbrother Associates cannot speak highly enough of this combination.

RT11 has several limitations on discs, which at the time they were implemented seemed quite reasonable. The new RT11 V5 will handle much more, up to 64K devices. Each will be limited, however, to 64K blocks, or around 33 MB, because RT can only count up to 2↑16.

Backing up was a problem, so a Cipher Microstreamer ½" tape drive with a DILOG DQ 130 controller, which will take up to eight 800/1600 BPI drives, including streamers, was ob-

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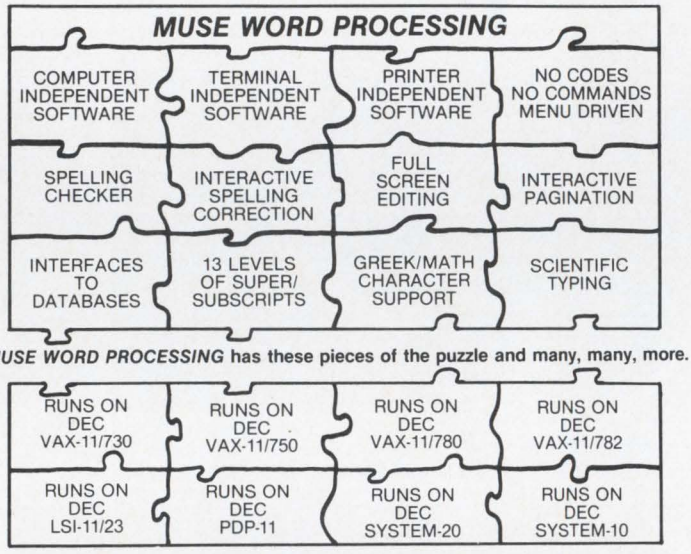

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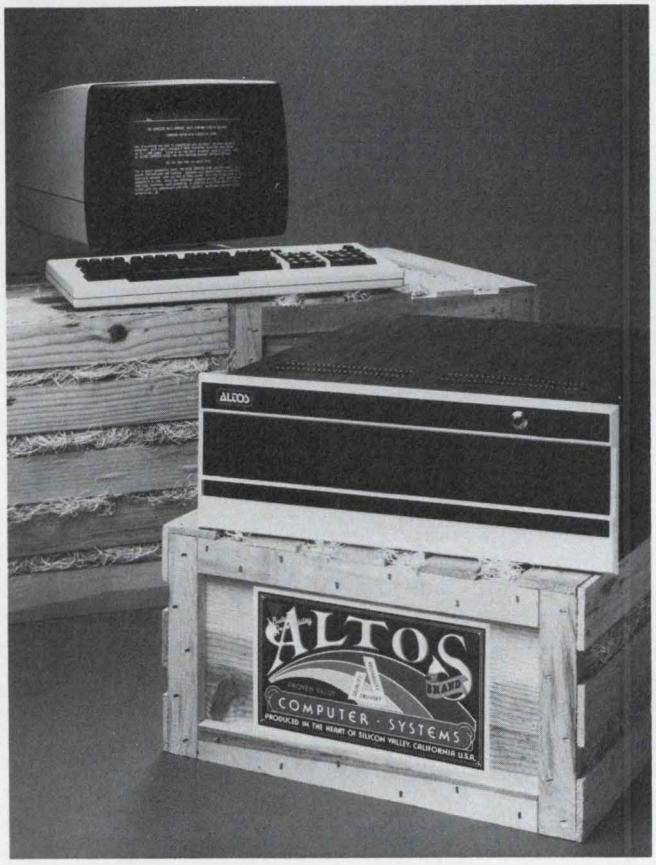

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CIRCLE D163 ON READER CARD

tained. DEC is selling the microstreamer under their own name as the TSV05, without the steaming mode. I find the microstreamer to be a very reliable device, and once you learn the rites of passage into magtape (this means read the manual concerning tape copy operations), simple to use. The DQ 130 has also performed very well, and no problems have been encountered in two years, aside from the ones that would not have occurred had the manual been fully read first.

Many companies sell full tape subsystems from under $5000.00 for a small 12 ½ IPS tension arm model, to over $9000.00 for a 125 IPS vacuum column model. Because of the Winchester back-up problem, tapes are being developed that are cheaper, faster, and more reliable than their predecessors. If a tape is out of the question right now, wait a while, as some new ¼" cartridges with 45-70 MB of capacity will be available shortly.

Once the Fujitsu was up and running, we didn't need the RL01 or RL02, but we wanted to keep them on line for swapping software. We procured a NETCOM backplane that accepts the RL controller (two quad-wides) in two special slots, and allows 12 more dual wide boards to be used. It's also of much better construction than the DEC backplane, which was sometimes very temperamental.

Most people won't have the RL problem, but it is easy to fix if you should. We try to use all of our equipment, to get the most out of our system. A little drilling was necessary to make it fit in the DEC box, but it took only about two hours to get it out, replace the backplane, and assemble it back together.

Big discs can present problems, so there is some software around, some public domain, some proprietary, to help with some of them. In P/D, there is a virtual device handler that allows you to further break up the discs into "virtual" devices. They look like a large file on the disc directory, but inside they look just like a block-replaceable storage device, an odd sized disc. We have several to aid in logical storage of different types of files. LETTER.DAT has our correspondence, FORTRA.DAT has FORTRAN programs, MACRO.DAT has MACRO programs, etc. They are given the logical name to indicate their functions, such as FOR:, MAC:, GAM:, etc. The assigns are handled in the start-up indirect command file "STARTS.COM" on each boot-up.

Locating a file in this environment can be frustrating, so some proprietary programs were written to help. Among other things, Fairbrother Associates sells a program called LOCATE. LOCATE will search a user-entered list of devices, virtual, logical, or physical, for a given filespec, and print out a report at the CRT or on the printer. This makes keeping track of files on systems with several virtual device files much easier. (For information, send a SASE and $1.00 to Fairbrother Associates and literature will be sent to you on this and other products we have that might interest you).

Virtual devices can also be nested (at least with the VD handler, some others may not) to provide a nested file system. With TSX-Plus, which allows you to restrict each password (optional) to a list of devices, you can have private and public file sets.

There are other techniques and pieces of equipment available with some interesting properties.

Andromeda Systems has a floppy/Winchester, dual-wide controller. This is fine for single-user systems, and saves backplane room for more expansion. However, it seems it would pose problems for a timesharing environment, as the controller can not do both at the same time. This may not be the case, but until I hear from some people who have used it, I can't say for sure.

For more performance, the 11-23 can have a faster clock crystal installed. I'm sure DEC will frown on this, but if you modify an IC socket and solder it into the place where the crystal was, you can switch them back again if problems occur. Don't expect DEC to repair it if this modification is done, but there are others who will handle the repair, and indeed, will do the modification for you. The typical replacement for the 13.75 MHZ crystal is around 18.5 — 19.5 MHZ, for approximately a 30 — 40% increase in speed. This surpasses an 11-34. At this speed, you are running near the maximum speed the Q-Bus will allow. Some boards may limit the speedup even more, but most can run in the 18 — 19.5 MHZ range.

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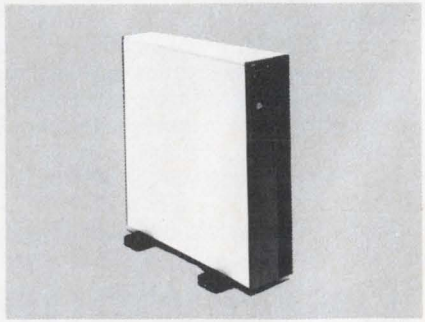

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CIRCLE D189 ON READER CARD

sounds quite interesting. It allows you to run a Motorola 68000 CPU, with its own special bus, along with the Q-bus. I don't know much about it so far, but it looks like the next step for someone who needs more power than the 11-23 can give.

The 68000 is a 32 bit CPU, and is usually considered faster than a VAX. The drawback is, of course, the software. Unless someone comes up with an RT11 emulator program (a lot of bucks to be made for the person who gets this package together), you will have to write a lot of your own system stuff. If an RT11 emulator that will run in parallel with the '03 or '23 is written, perhaps the 68000 will do the computing, and use the '03 or '23 to handle the peripherals and I/O, keeping much of the old RT software. It looks as though the 68000 will really catch on, giving companies the incentive to make other things available. This could be a real sleeper. We'll see as things progress.

For the real engineering types, some small array processors are available, notably the SKY processor, which is on two quad boards and fits right into two adjoining slots in the backplane. They usually have many FORTRAN callable subroutines IN HARDWARE to manipulate arrays.

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CIRCLE D217 ON READER CARD

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They are VERY fast. A thought— since text is just an array of characters, would this turn an 11-23 into a fabled database machine?? An interesting project for someone.

I/O is now usually done with DLV11-J boards. They have 4 RS-232 "data leads only" (pins 1,2,3,7, with 20 held high) on one double wide (half quad) board. Since DEC equipment works on Control S/Control Q protocol, almost anything serial that uses it will run on the system. Modems don't have to use the expensive DLV11-E board, although the software changing of the baud rate, etc. is nice but not necessary. They can be purchased from aftermarket manufacturers for about $250-300 dollars. DEC's costs $450.00. A dual wide board with eight serial lines is available, to save even more space.

Another nice thing is that the Z-19 terminal is a VT-52 CRT emulator. It can be used on the pile of software that uses VT-52 code. I don't know why the "ASCII" mode wasn't upgraded to be VT-100 compatible, as this is where the big sales-numbers are. Heath could have been first and cleaned up, but they dropped the ball somewhere. I understand that there are some people coming out with a chip to do just that. That's the second big mistake that Heath/Zenith made, the first being not to support the H11 as it should have been. Ah, well, life still goes on...

It may interest some people to know that there are very good A/D and D/A converters available for about $600—$1000.00. These are really professional boards. The "MINC," the laboratory data acquisition computer system, has many similar I/O modules available, and a large library of subroutines to take in data and massage it into reports and realtime graphics displays. These have a special BASIC that has built-in commands to handle the interfaces and the data. This makes writing your own programs to handle the data the way YOU want much easier.

DEC and the aftermarket crowd are always putting out new gadgets for the 11. Whatever DEC puts out, a month later someone has a better model, with more features and at less cost than DEC's. On the other hand, DEC puts all its products through lengthy tests to make their products as reliable as possible. When chips were new, this was very important, but as chip reliability has gone up, the boards have become very reliable. Perhaps all the testing DEC does isn't necessary unless it is for super-critical industrial or military purposes. If it doesn't fail in the first three months (usually under warranty) it probably won't fail for its lifetime, if its environment is stable.

Finally, speaking of stable environments, a final thing to consider is a power conditioner. The boards last a long time if their voltage isn't exceeded. I had a friend who left his computer plugged in during a rainstorm when lightning hit the power lines MILES away. He lost a couple of power supplies and some serial lines, and had some damage to his CRT and other systems. One of my printers would beep and feed several sheets of paper through and settle down every once in a while. It also occasionally occurred during a printout. This is irritating, especially on long runs.

Both he and I now open the circuit breakers when bad weather comes along. I have installed a couple of power line conditioners to short out noise and spikes from the power lines. They say they protect equipment from lightning, but I don't want to test it on my system. This is in addition to the circuits in my power distribution panel. It's not that expensive, and can save a lot of time and trouble.

In conclusion, the Heath H11 owner should simply rename his machine a DEC PDP-11/03, and realize the world will be a better place. It may cost a little more, but you have a real business/engineering machine, not a toy. Remember, those thousands of PDP-11 users can't all be wrong. Someone, whose name eludes me, once said "Nobody loses ALL the time." Take heart, for though the jury is still out on the H11, the PDP-11 is a great machine.

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CIRCLE D211 ON READER CARD

RECOVERY SYSTEM

By Brian Johnson, 54 Oakleigh Gardens, Bitton, Bristol, England

This article describes the design process behind a general purpose recovery system for interactive real-time RSTS applications. This could be applied to any multi-tasking operating system.

Design Objectives

The main objective was to allow the files for a set of application programs to be restored to as near as possible the state that they were in prior to a system failure, either hardware or software. I will refer to the processing of the original work as the "live run" and its recovery as the "recovery run."

The applications involved the online and real-time updating of data files. The design was influenced by the need for the files to be updated as the user information was entered. It was possible for two users to be updating the same data record and for either of these updates to be rejected at user request. As an example, two users could be entering stock requisitions. Each requisition covered a number of stock lines, one or more of which is common to both requisitions. While the stock balances have to be updated as the entries are made, either of the users could reject his requisition before its completion.

The programs were to be written in BASIC PLUS using our own file indexing and access routines on straight block/IO data files. As the updating of certain of the data records was to be real-time with the data entry, program size was thought to be a critical factor. We also wished to make the system as general purpose as possible, and for it to be capable of being integrated into any BASIC PLUS program with as little programmer effort as possible.

As in reality the incidence of system failures resulting in data loss requiring the use of such a recovery system is rare, the system would have to have only a small impact on performance and system capacity.

Design Considerations

Our first thoughts were directed to removing the need for a software solution and in the event of a system failure, restoring to the last backup and re-processing. This was rejected as the system was to be used in the remote offices of timesharing customers on over 30 terminals by a variety of users. The system was to be recovered in a way that involved the end users as little as possible.

We then thought along the lines of logging the images of all disk records that were updated to files on more than one disk. This would allows us to restore all the files to their latest state in the event of a failure. The problem was to cater for overlapping transactions such as the stock requisition example given above that were only partially completed at the time of the system failure. This could have been overcome by updating the stock information "temporarily" and then completing the update when the transaction was confirmed. Whilst some of the record content was updated in real-time, in order to meet program size and response constraints, as much as possible was left until the end of a batch and carried out by other programs. As well as partially completed transactions we then had partially completed batches to cater for.

The obvious answer was to log transactions and then re-process these against the restored backup files. However, this would have involved heavy costs either in "outside" software or in our own development time. If we had carried out the development, unless we decided to write our own transaction processing package, we would have been writing application specific code and therefore not meeting the objective that the solution should be general purpose and involve as little programmer effort as possible during the development of the application code.

As the applications were basically interactive, we then looked at the possibility of logging the users' data and re-processing this against the restored backup files. Providing we could pass this data back to the programs in the order it was entered, the same programs could be used in the recovery run that were used in the live run.

We had a set of functions that handled all user I/O. If we could embed the recovery system within these functions it would mean that there would be little effort in implementing the recovery system within our existing applications, and the recovery considerations could be transparent to the application programmers.

In adopting this approach the computer had to carry out as much work in the recovery run as it did in the live run. This would only be appropriate in situations where the data entry portion of the application represents the bulk of the work, and where the critical factor in processing times is user data speed.

Recovery System Design

We decided to use a detached logging program to which all user responses would be directed during the live run using send/receive. The data would be logged on up to three files which could be on disk and tape.

The logging program requires the name and user's account number for each program that is run. As we had a menu system through which all programs are run we could have modified it to supply this. However, as additional information would have been needed on each menu entry, and we did not wish to introduce menu system file changes at this stage, we introduced an initialisation function which we inserted at the start of each program. The initialisation function looks up the location and file name of the program and the user's account details and sends this to the logging program.

The initialisation function also opens the keyboard on a specified channel number during live processing. The keyboard is automatically replaced by the null device on this channel during a recovery run. All print statements are made to this specific channel number or they must be made conditional on a flag set by the initialisation function to indicate a live or recovery run.

The initialisation function passes three other items of information. The first is a flag to indicate if the recovery is to be frozen whilst the program is running. The need for this resulted from program synchronisation considerations. In dealing with interactive programs, the overlapping of the programs during the recovery run is effectively controlled by both re-running programs and re-processing the users' responses in chronological sequence.

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However, the recovery run will have the effect of compressing these responses into a shorter period than that in which they originally took place (you hope!). You may have programs or parts of programs which are non-interactive and which, during the recovery run, must not be overlapped with the processing of user responses that may have been entered in the live run after the completion of the non-interactive phase. An example would be the entry of stock receipts where the updating of the file is carried out after the batch of receipts has been entered. If during the recovery run the file updating became overlapped with stock issues that had originally been entered some time after the receipts had been processed, out of stock conditions may arise that did not occur during the original run. To cater for this it is possible to "lock" or "freeze" the recovery process. The lock may be requested within the initialisation function at the start of the program or executed by a lock function called within the program. During a recovery run, after a lock is requested, no further programs will be started or responses passed to other programs until the program executing the lock calls an unlock function.

The second piece of information indicates whether the program is "run" or "chained." During the recovery process run programs are started by the recovery system whilst chained programs are started by the preceding program as normal. A standard core common layout includes status information indicating whether a program has been run or chained and whether it is part of a recovery or live run.

The third piece of information is the message packet size for communication with the recovery logging system. During the logging of the users' responses, the effect on the system's performance is minimised by the logging interface routine in the application program building several responses into a packet and sending one message to the logging program. The size of the packet is given by two parameters. One specifies the maximum number of responses that may buffered before the packet must be sent and the other specifies the maximum size in bytes to which the packet can grow. These govern how much data may be lost in any unlogged packets in the event of a system failure. The optimum packet size is a function of the size of and the likely rate of entry of user responses in any particular program. If the rate is likely to be high then a large packet size is probably appropriate, whereas if the user data entry rate is low, a smaller packet size is preferable.

A termination function is also introduced at the end of each program. This merely informs the logging program that the program has ended and bands any part filled packets.

The input functions operate by logging all user responses. No knowledge of the purpose of the response is needed by either the application or the logging programs. There are some instances where this assumption falls down. The first is illustrated by the case where the user is asked to load or unload a disk or tape unit. Even if the unit number is the same during the recovery, the recovery system will need to pass the request to the user for action and hold the recovery run until the user signifies the action as having been completed. It may also happen that the response could differ during the recovery run from that entered during the live run.

The second case arises because the compression of the user responses from different users can create a situation where functions overlap during the recovery run when they did not during the live run. We have already discussed the lock and unlock functions above. This is a slightly different

problem and an example would be a prompt for a stock product code. This prompt may give rise to a "disk block interlock" condition in which case the user is informed of the interlock and re-prompted. If this happens during the live run an additional response would be requested that may not arise during the recovery (as the disk block interlock may not occur). Alternatively, it can arise during the recovery when an additional response would be required that was not supplied during the live run. In either case it can result in the user responses getting out of step with the corresponding prompts and the failure of the recovery. This is prevented by a "re-prompt" flag. If this is set the prompt field for each input is checked against the previous one. If they are identical (including any screen co-ordinates) during the live run, only the final response to that prompt is logged. During the recovery run the logged response will be re-submitted until the prompt changes.

The impact of both logging and recovery processes on the system's performance is minimised by only logging programs that modify the content of the data files. Obviously report and enquiry programs need not be recovered.

Recovering a System

The recovery program will sort all user responses, program start and end records and recovery lock and unlock records into chronological sequence. The data files are then restored to their state at the beginning of the logging session. The recovery program will then run the programs detached and feed the responses back to the programs. A flag in core common which is picked up by the initialisation function indicates that the program is recovering in which case it will receive the responses from the recovery program.

After the last of the logged responses is passed to the programs, the recovery program sends a final message which causes each program to revert to live running. It enters a hibernating state until it is attached to when it displays the next user prompt. The recovery system logs the recovery process so that it is possible to let each user know what previous responses were processed. The possiblity that the recovery program should log each program to the terminal from which it was initiated during live processing was rejected on security grounds, though obviously this would be a trivial change.

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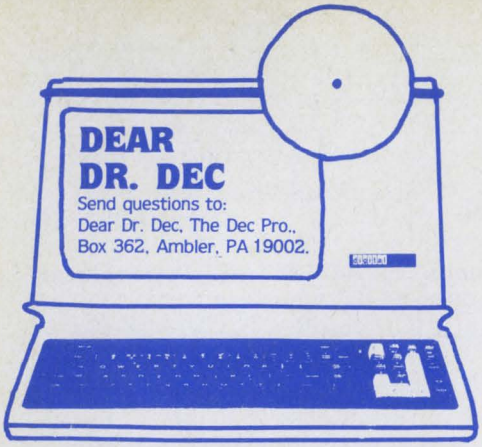

Dear Dr. DEC:

As fine a stand-alone as our DECmate I is, it seems to be viewed by DEC and by aftermarket folks as DEC's bastard child. We've tried since taking delivery last June to get answers to these questions:

1. What exactly is the VT-278 processor in the DECmate?
2. How does it alter the terminal from the basic VT-100?
3. Is the DECmate/VT-278, although PDP-8-based, compatible with PDP-11 equipment?
4. Can memory be expanded with plug-ins, as can the myriad of micros and minis out there?
5. Can memory be expanded by connection to a PDP-8 minicomputer?
6. Is there a Winchester hard disk available?
7. Can the DEC Personal Computing Option for the VT-100 be added to the DECmate/VT-278?
8. Can a VT-100 terminal be added to the DECmate, and the DEC Personal Computing Option added to the VT-100?
9. Where can we find software equivalent to VisiCalc? Is Pyramid's "Number Cruncher" the closest?
10. Where can we find graphics software?
11. Can we control cursor blink, reverse video and forms mode, as on the VT-62?
12. Are any of the above options worth the cost, considering the number of machines now available with up to 256K?
13. Can the new Pro 300/DECmate II use the 8" RX02 drives? This would allow us to add a DECmate II as a second, more versatile stand-alone, and use our present 8" media files on either machine.

We'd appreciate your help on these questions; if you can't answer them in your column, perhaps you'd do it by letter, or refer us to the appropriate people at DEC. We've tried numerous departments, including Field Service, but to no avail.

Phillip B. Warbasse
Warbasse Associates
Natick, MA

Dear Phillip: *Thanks to Gary Cole at Digital Equipment Corporation for his help in answering your questions. Gary used to work with DECmate I's but is now working on Rainbows.*

Here's what we've learned:

1. A PDP-8.

2. The terminal is not a VT100. It simply shares the shell, tube and keyboard, but is entirely run by the PDP-8 processor.

3. The connection of DECmates to PDP11's is best done using its DX communications capability.

4. DECmate I comes with maximum memory (32K) already installed.

5. No.

6. RL02 disks were planned for the DECmate I's.

7. No.

8. No.

9. Digital maintains a software catalog for the DECmate I's which contains many software packages including some financial modeling.

10. Only limited graphics (VT100 type) are available.

11. No. But the VT278 processor does emulate VT100 screen capabilities.

12. The DECmate I remains a viable product because of its price and availability.

13. There is an adaptor to allow use of eight inch RX02 disk drives.

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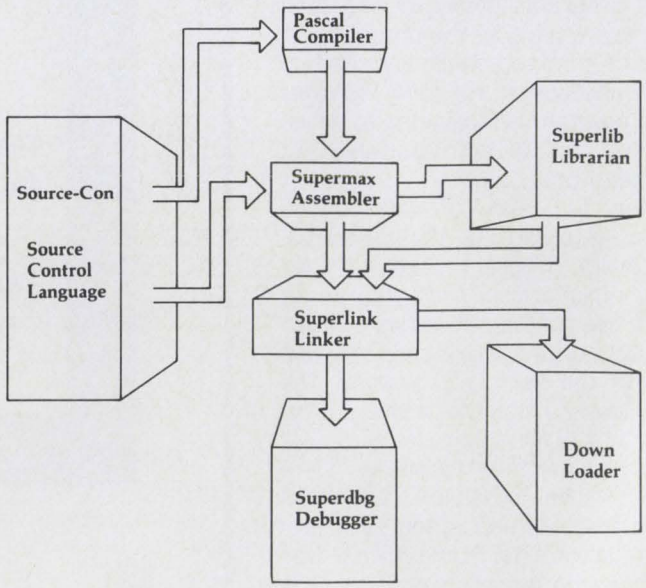

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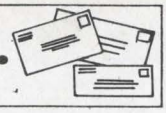

Send letters, comments, photos, etc. to: Letters to the DEC PRO, Box 362, Ambler, PA 19002.

. . . continued from page 6

tions. I wonder at which other editorials and articles, ostensibly written to inform me, the reader, are not but camouflage for other self interests.

Second, I wonder if you have not gained an unfair business advantage over competing software products by having access to user responses and "bingo cards." Information generated and paid for by your advertisers.

Finally, there is the issue of your readers personal and professional security born out of trust for their editors. They think their editors tell it like it is. Nothing but the whole truth. And I wonder...

Have you not breached their security?

Joseph Musler
RAXCO Inc., Atlanta, GA

* * *

It was interesting to note the March 1983 letter in which it was said that "there simply isn't enough profit margin to support highly trained technical sales people" (in selling personal computers). A comparison is made to the automotive industry.

I should like to point out that today the electronics industry is successful, the automotive industry isn't. Computers cannot be sold by car salesmen who only know enough to tell us it "comes in six decorator colors." One of the reasons the electronics industry is doing well today is that companies do a job of telling the customer what the product is all about.

Government handouts keep the American automobile industry going. We in the electronics industry do not need to learn the tricks of the automobile salesman so we can emulate the beggars of Detroit.

Sherman Rigby, P.E.
Nova Biomedical
Newton, MA

* * *

I can't thank you enough for publishing my letter in The DEC* PROFESSIONAL (January 1983 issue). The response was overwhelming. Not only was my problem solved (couldn't form feed my LA100) but many new ideas were brought to my attention by some of the many ingenius people who read your magazine.

I wish I could thank all of the people that responded to my call for 'help'. They were very helpful.

You'll hear from me again.

Thanks, Marty Chojnacki
Inland Diesel, Inc.
Butler WI

* * *

Do you think your readers could give us a hand? We're looking for some older Digital Equipment Corporation equipment that was used in their ill-fated microcomputer system. We're particularly interested in finding the following:

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If any readers have any of these bits and pieces, we'd appreciate hearing from them. We are interested in adding them to our collection of early and obsolete microcomputer equipment. This is a non-commercial venture quite apart from our normal work in technical writing. We think it's important to preserve some of this older equipment and we're actively collecting it.

Thanks for your help.

Jonathan A. Titus, Ph.D.
The Blacksburg Group, Inc.
Blacksburg, VA

* * *

The points raised in the article by Yuan Sung, "Comparison of Floating-Point Numbers in Basic Plus" in the January *DEC Professional,* apply to all computers and computer languages, not just BASIC PLUS. Most fractional numbers cannot be represented exactly in floating-point format, hence the problem.

One of the early programming laws states: Floating-point numbers are like sand. The more you play with them, the dirtier they get and you lose a few grains here and there.

Robert Rosen
Manager, CAD/CAM Systems Group
Department of the Army
Adelphi, MD

* * *

In the January DEC Professional I had an article describing the EDT help file format. Within the article there was an amusing figure that illustrated the format of the EDT help file. Unfortunately, there is an error.

The help level for "TERMINALS" was incorrectly numbered with a level of "4" instead of "3." The manuscript I had sent to the DEC Pro was correct. Somehow in the typesetting process this was "corrected" to read "4" instead of "3."

I apologize to the readers for the inconvenience and confusion that this might have caused.

David Spencer
Infinity Software Corporation
Santa Monica, CA

* * *

Re: "Friendly is in the Eye of the User," March 1983

As a fellow word processor user/installer (of CTOS), I think the USER-SEDUCTIVE SYSTEM is a great idea if one of the USER-CAPABILITY features is correctly referenced as a:

Boilerplate - static or consistent part of a document — [Colloq.] n. the stereotyped news, feature, and editorial items that are syndicated to small publications.

not:

Potboilers - commonly referred to as quickie articles — n. a piece of writing or the like, usually inferior and uninspired, done quickly for money.

Users of CTOS, or any word processor - probably would not like to be referred to as producing "inferior or uninspired" documents.

Inspired,
Stephanie Felling Wilkins
System Manager
Vision Computer Systems
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Fullerton, CA

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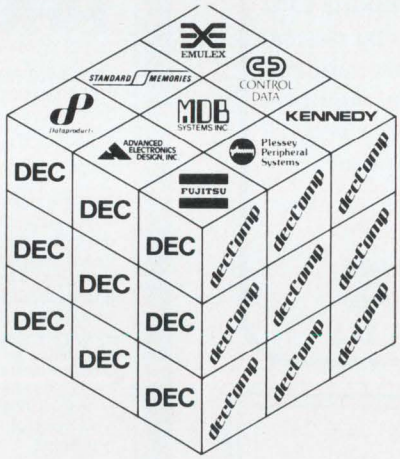

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MEMO: FROM THE SYSTEM MANAGER

. . . JOE DOYLE

While most DEC systems don't seem to have operators, we all ought to pay more attention to other people's problems. Sometimes it's as simple as . . .

During the last several weeks, I have noticed an abandonment of common etiquette by many employees while using the line printers throughout the building. There are several items we should all keep in mind when using these machines.

1. The computer room line printers have default paper types. LP0: uses standard 14 inch paper. LP1: uses narrow white paper. Please feel free to change the paper if you need to, BUT . . . assign the machine before changing the paper, put the original paper back in the machine when you are finished with your special form, deassign the machine when you are finished, and see to it that the form is at top of form in the printer, AND ON LINE!

2. Occasionally, we change the ribbon type in LP1:. If you change the ribbon type, remember to put the original ribbon back in the machine when you're done. If you don't know how to change the ribbon DON'T!!! If you ink the ribbon, please leave the "inker" where you found it.

3. If you open a box of paper, neatly cut off the box flaps or the top. This improves appearance, makes the box easier to store, makes the work area neater, and most importantly allows the paper to easily leave the box and enter the printer.

4. When you are done with a box of paper, return it to a storage tray, shelf, or area. Don't leave it in the middle of the floor where someone else will trip over it or have to move it.

5. If a printer is broken, tell someone in D/P. We will fix it as soon as we can.

6. Don't open a new box of paper unless you are sure you need to. Most of the clutter in the printer areas is due to multiple boxes of the same type. (I was going to say laziness, but thought better of it.)

7. The printers in departmental areas do not belong to the department. They belong to the company. Those printers were placed in those locations for the convenience of the department. If a printer is broken in an area, please ask the other department if you can use their printer. If someone asks to use a printer and you are not using it, please help them out. Most of our printers are underutilized.

8. Use the correct printer for the job. Word processing printers should only be used for letter quality printing.

9. Most people (myself included) are not satisfied with PL1: as a letter quality printer. It is however a good standard printer and if care is taken it does work as a letter quality printer. I will look into replacing it, but this will take time.

10. Occasionally it is a good idea to change a printer's ribbon. It's nice to be able to read what you are printing. You each should be able to change a printer ribbon and it does not take more than ten minutes.

11. Check the bins for LPO: and LPI: printouts regularly. They seem to pile up. If you receive unnecessary or duplicate reports, tell us. In the meantime, don't expect someone else to discard them. You are responsible for your reports.

12. We are all aware of the problem with LPO: printouts not folding properly. We are trying to rectify this situation, but in the meantime, let's all help out by folding reports, and placing them in the bin, even if they aren't yours.

Thank You.

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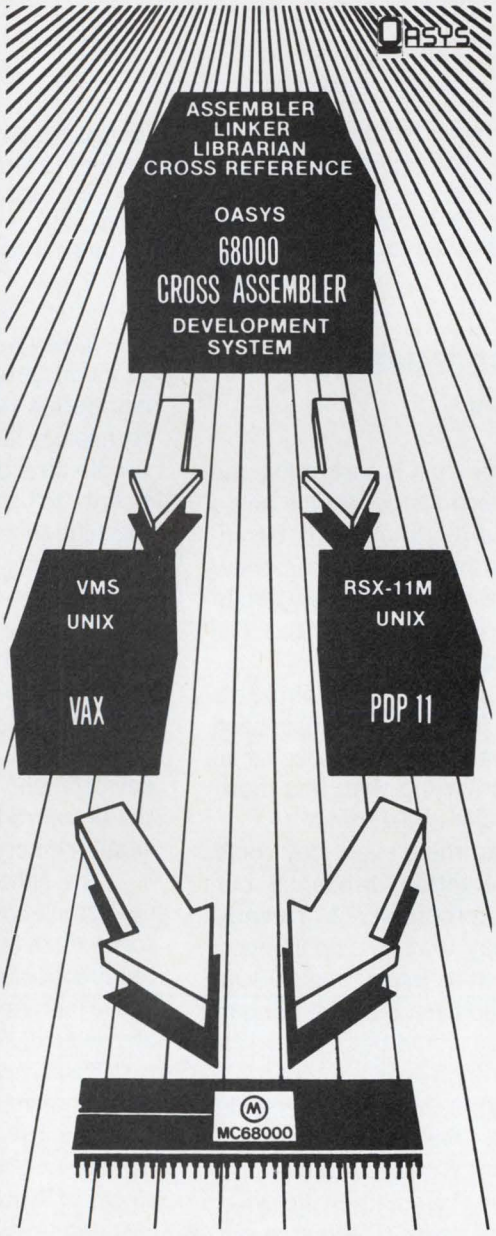

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CIRCLE D215 ON READER CARD

Programmer's Notebook

Rick Scherle is President of Software Techniques Inc., a small international consulting firm. At 28 years old, Rick has been in the computer business for 11 years. Beginning as an Electronics Engineer, Rick worked at NASA, Xerox, and Digital before co-founding the southern California-based firm four years ago.

When he isn't exploring hot springs or camping in Mexico, Rick concentrates his energy on finance and marketing in the computer field.

UNEMPLOYED PROGRAMMERS?

By Rick Scherle

"I have to think that the average man is sort of like me in his comprehension of computer technology. Maybe he's a half-step behind me. He isn't stupid (he knows what computers are). But, I just learned the other day that somehow every aspect of a PRINT statement is stored in the system in electrical impulses, organized in little groups of 16. I will never know 'exactly' how that's done."

"It makes me believe that we may be headed into this sort-of-frightening picture of the future which has been foreseen by so many people. It's not hard to visualize us all spending most of our time communicating with and interfacing to systems that we don't really understand."

Certainly, working with programmers every day could lead you to agree that this observation, made by our marketing manager, is indeed prophetic. I recently overheard a brilliant programmer say that he didn't understand why high-level languages (such as BASIC and COBOL) had ever been invented. "If people had been programming in MACRO all along," he reasoned, "they would be so good at it by now that they wouldn't 'need' a high-level compiler."

It follows (if taken to the extreme) that MACRO should never have been invented either. A "really good programmer" could toggle it in from the front panel. To go one step further, we can imagine a "super guru" who, knowing what the machine will do in any situation, doesn't bother to put the instructions in the machine at all.

But this discussion overlooks the fact that the declared purpose of any profession is to obsolete itself. For example, when medical science is really working effectively, we won't need doctors because we will all be healthy. The focus will be on prevention rather than after-the-fact treatment.

The computer profession is the same. Programmers, for the time being, are a necessity. But, a new generation of technology could make today's highest-demand job as obsolete as that of "auto worker."

Today's computer science suffers from a simple economic problem: the people who make the decision to buy computers cannot make them work. If computer technology is to survive, the machines of the future must be usable directly, without today's need for hiring expensive talent to translate the purchaser's requirements into machine code. In fact, the job "programmer," as we know it, will probably not exist in another decade.

The new trends in computer design are toward more usable systems. Artificial intelligence and heuristics already play an important role in the systems of the 80's. These new architectures rely more heavily upon good systems analysis and design than on efficient coding or "trick" data structures. These systems are optimized for usability, low development costs, and easy maintenance rather than for the more traditional design goals of fast execution speed or small memory size.

The benefits of these design trends are obvious in our own small company. Our staff produces very sophisticated software in only a fraction of the time that would have been required just two years ago. In fact, their productivity is far above industry norms. This is due, in part, to the application of powerful software development tools.

These tools save hundreds of man-hours by generating code, managing databases, and controlling terminal I/O; tasks which would otherwise have to be programmed "manually." At present, these individual tools produce only pieces of systems. But, once all of their capabilities are integrated into a single tool, it will be possible to generate entire systems at "design speed."

Those data processing professionals who adapt to these new methodologies and who keep up with the pace of technology by investing in their own education will migrate into the twenty first century as designers, managers, and engineers. But, the MACRO guru of today, intent on specializing in his own obtuse skill, may well find himself standing in the unemployment line, reminiscing about "the good old days" when his skill was in such demand that he could go anywhere he wanted and name his own salary.

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Programmer's Notebook

Steven P. Davis is Manager of Technical Services at Software Techniques Inc., a small international consulting firm, where he is responsible for all software development. Although he had originally intended to go into hardware, Steve's last seven years have been spent in software.

His expertise at systems analysis and program management has made Steve a highly-respected technical author and a frequent speaker at computer conferences. When he isn't working, Steve likes to prowl old record stores for rare albums, watch foreign films, and travel.

CONVERTING NUMBERS TO STRING REPRESENTATIONS

By Steven P. Davis, Software Techniques, Inc.

A common problem presented to applications programmers is the ability to convert a whole number into its English language translation. That is, to take a number, say 25, and translate it to the string "twenty-five." The most common use for this conversion process is the printing of a check-protect string on drafts produced automatically. We take for granted our human capability to look at a number and do this translation. We, as software engineers, recognize that the computer has no developed ability to do this (conversion).

At first, the task of writing a piece of code to do this conversion may seem complex, considering the exceptions that must be handled. This is an illusion. The process of converting whole numerical quantities into English may be broken down into a consistent, understandable algorithm for coding in any language.

Rather than include only an example of code that performs this conversion, I will present the development of the algorithm in an effort to expand its usefulness in applications not envisioned by myself. Let's start by taking an arbitrary number, such as:

1462395

Let us call this number N, for it may be any whole number. Now, using the common notation of a comma, we will break N into its primary parts.

1,462,395

We will call these primary parts "groups"; a group is formed by the collection of three numbers from right to left until no more groups can be made. We will represent a group by using an upper case G. Groups are thus a subset of N, our number. This particular number has three groups, and to denote groups we will use the notation G(n), where "n" is the group number. Group numbers will be assigned from right to left as the groups are formed, starting with zero. Thus, this number may be grouped as follows:

Group	Elements
G(0)	395
G(1)	462
G(2)	001

Note that where a zero is implied in the number N, it is now represented explicitly when the group is formed. The individual numbers within a group we will call elements, and we will represent elements with the symbol E. Where groups are a subset of the number, elements are a subset of the group. Each group contains exactly three elements, the hundreds, tens, and units column. We will represent these elements with the symbols, Eh, Et, Eu, respectively.
So, to redefine our number N to its basic elements:

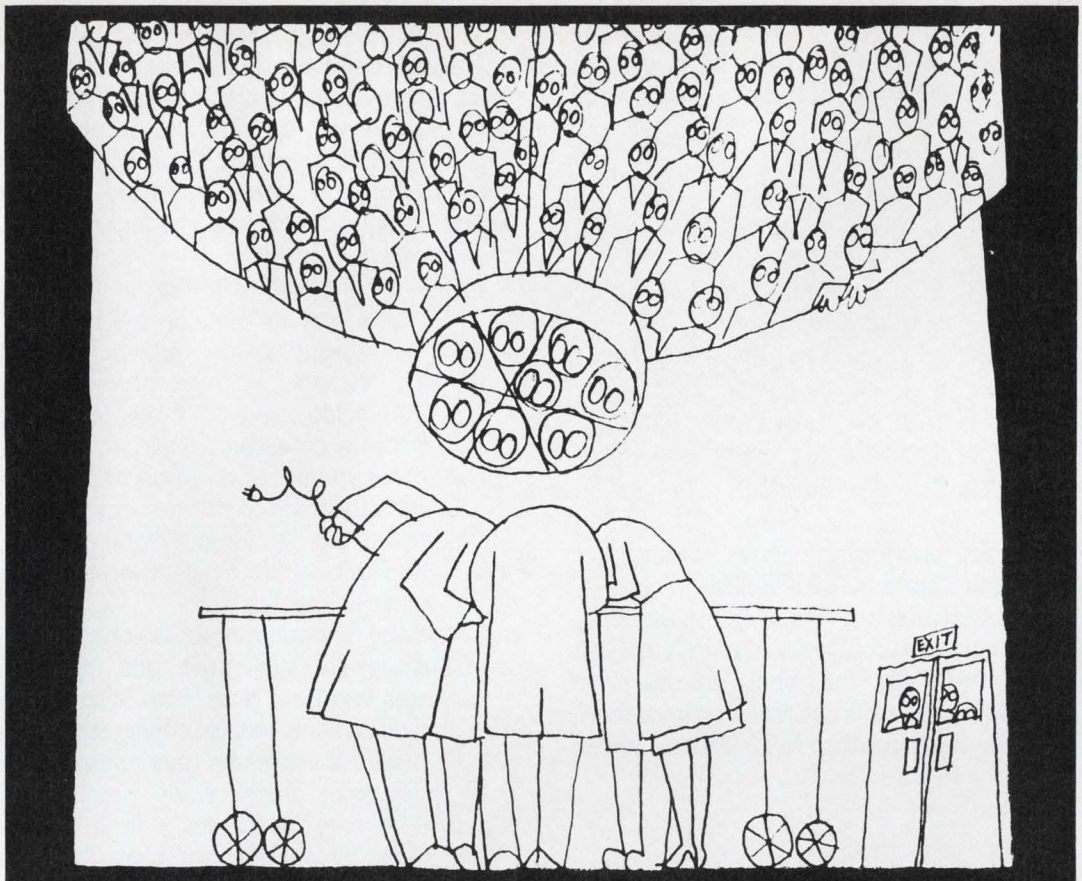
Group	Eh	Et	Eu
G(1)	3	9	5
G(2)	4	6	2
G(3)	0	0	1

We can now take any whole number, N, and divide it into its finite groups, G(1) ... G(i), and divide each group into its individual elements, Eh, Et, and Eu.

Now that we have developed this terminology, we are ready to develop the algorithm to convert N to its English representation.

We must first define all the text that will be necessary to build our output string. We will use the symbol "*.text(n)" reference the text elements, where "*" will represent a descriptive prefix for the text, and "n" represents the associated number we will replace with text.

The hundreds and units column of any whole number, Eh and Eu respectively, may be replaced with the text defined below. For example, for Eh of any group, the text element unit.text(Eh), as defined below, may be added to the



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output string. The primary thing to note here is that "zero" is only used when the whole number is "0", or in our terminology, there is only one group, G(0), and Eh, Et, Eu are all zero.

```
unit.text( 0 ) <- "zero"
unit.text( 1 ) <- "one"
unit.text( 2 ) <- "two"
unit.text( 3 ) <- "three"
unit.text( 4 ) <- "four"
unit.text( 5 ) <- "five"
unit.text( 6 ) <- "six"
unit.text( 7 ) <- "seven"
unit.text( 8 ) <- "eight"
unit.text( 9 ) <- "nine"
```

The tens column of any group, Et, is basically as straight forward as the text elements above. There is, however, a special case that must be handled. The sequence of numbers where Et = 1 introduces an exception, although it is easy to handle. These are the whole numbers 10 through 19 inclusive. Note that 10 is not really an exception, but if included will allow the algorithm to check only for Et = 1, instead of Et = 1 and Eu <> 0.

```
ten.text( 0 ) <- ""
ten.text( 2 ) <- "twenty"
ten.text( 3 ) <- "thirty"
ten.text( 4 ) <- "forty"
ten.text( 5 ) <- "fifty"
ten.text( 6 ) <- "sixty"
ten.text( 7 ) <- "seventy"
ten.text( 8 ) <- "eighty"
ten.text( 9 ) <- "ninety"

teen.text( 0 ) <- "ten"
teen.text( 1 ) <- "eleven"
teen.text( 2 ) <- "twelve"
teen.text( 3 ) <- "thirteen"
teen.text( 4 ) <- "fourteen"
teen.text( 5 ) <- "fifteen"
teen.text( 6 ) <- "sixteen"
teen.text( 7 ) <- "seventeen"
teen.text( 8 ) <- "eighteen"
teen.text( 9 ) <- "nineteen"
```

The text elements defined so far will allow conversion of any group to its English equivalent regardless of group number. After each group we must add a suffix to indicate, in English, which group number it is. We will limit the scope of numbers to the billions, although the algorithm will handle an infinite number of groups. Note that G(0) has no suffix, and as such is defined as a null string.

```
group.text( 0 ) <- ""
group.text( 1 ) <- "thousand "
group.text( 2 ) <- "million "
group.text( 3 ) <- "billion "
```

Now, referencing the symbols above, we will develop the algorithm to do the conversion. We will assume that we have already separated the target number into its groups, and that we will convert the number starting from the highest to the lowest numbered group. Of course, if the target number, N, is zero, we need do nothing, the output string becomes "zero" and the algorithm is not run.

Thus, the algorithm:

1. We must first set the group we are to convert to the highest group in our target number.
2. If this group has the value zero, that is Eh, Et, and Eu are all zero, we may proceed to step 8 there is nothing to convert for this group. Also note that no suffix is necessary either.
3. If the hundreds columns of this group, Eh, is non-zero, then add to the output string unit.text(Eh), and the string "hundred." Note that the hundreds and the units column use the same text replacement without the suffix.
4. If the tens column, Et, is equal to one, then this is an exception. We must add to the output string teen.text(Eu). Note that even if Eu is zero, the replacement text is proper. Since we do not need to check for either the tens column or units column for this group anymore, we may proceed to step 7.
5. If the tens column, Et, is non-zero, then we must add to the output string ten.text(Et). We also know that the we will have to add a hyphen to prefix the text just added if the units column, Eu, is non-zero. So we will set the symbol hyphen to "-".

   Otherwise, if Et is zero, then we know that a hyphen need not be added to the output string, so we will set the symbol hyphen to a null string.
6. If the units column, Eu, is non-zero, then add to the output string the symbol hyphen, unit.text(Eu), and a trailing space.
7. Add to the output string the appropriate suffix for the group number. If i represents group number, use the text group.text(i).
8. If this is group zero, the algorithm terminates. Otherwise, decrease the group number by one and return to step 2.

In order to make the algorithm more easily convertible to code, I have also included a representation of the concept in a notation that was used by Donald E. Knuth in Volume 1 of the Art of Computer Programming: Fundamental Algorithms, section 1.1. I have taken the liberty of making it "program" oriented, instead of mathematically oriented.

Algorithm C — Given any whole number N, convert it to its English translation. Start with i = n, where n is the number of groups in N.

[SEE PAGE 61]

I have also included a version of the algorithm written in BASIC V2.0 to verify its operation, and provide a working example.

[SEE PAGE 60]

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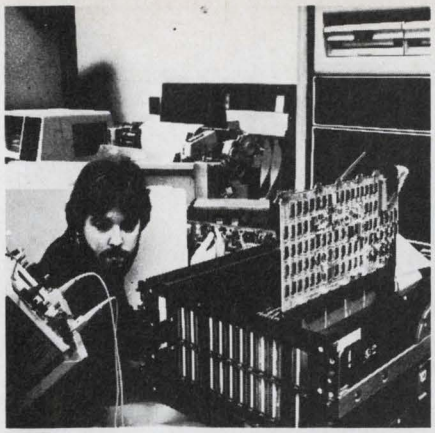

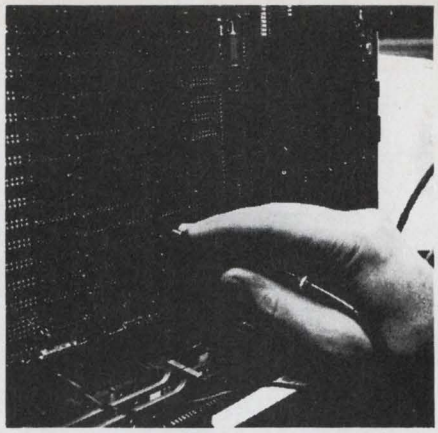

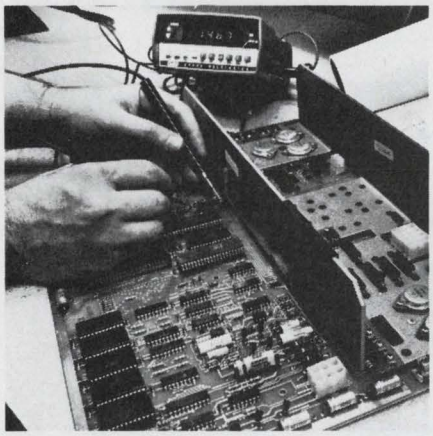

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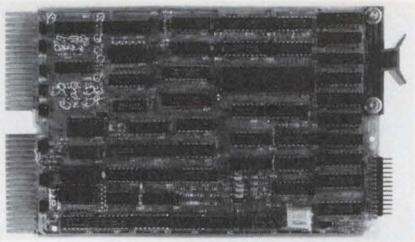

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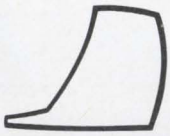

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CIRCLE D146 ON READER CARD

Example

. . . continued from page 58

```
1       DECLARE INTEGER
                 EH
                ,ET
                ,EU
                ,I
\       DECLARE DOUBLE
                 WHOLE
\       DECLARE STRING
                 OUTPUT.STRING
                ,HYPHEN

\       MAP (XGROUP)

         STRING PARSE.GROUP( 3 ) = 3

\       MAP (XGROUP)

         STRING PARSE.GROUP = 12

\       MAP (ELEMNT)

         STRING ELEMENT.TEXT = 3

\       MAP (ELEMNT)

         STRING EH.STRING = 1
        ,STRING ET.STRING = 1
        ,STRING EU.STRING = 1

\       DIM
         STRING UNIT.TEXT( 9 )
        ,STRING TEEN.TEXT( 9 )
        ,STRING TEN.TEXT( 9 )
        ,STRING GROUP.TEXT( 3 )
        ,INTEGER G( 3 )

\       UNIT.TEXT( 1 ) = "one"
\       UNIT.TEXT( 2 ) = "two"
\       UNIT.TEXT( 3 ) = "three"
\       UNIT.TEXT( 4 ) = "four"
\       UNIT.TEXT( 5 ) = "five"
\       UNIT.TEXT( 6 ) = "six"
\       UNIT.TEXT( 7 ) = "seven"
\       UNIT.TEXT( 8 ) = "eight"
\       UNIT.TEXT( 9 ) = "nine"

\       TEEN.TEXT( 0 ) = "ten"
\       TEEN.TEXT( 1 ) = "eleven"
\       TEEN.TEXT( 2 ) = "twelve"
\       TEEN.TEXT( 3 ) = "thirteen"
\       TEEN.TEXT( 4 ) = "fourteen"
\       TEEN.TEXT( 5 ) = "fifteen"
\       TEEN.TEXT( 6 ) = "sixteen"
\       TEEN.TEXT( 7 ) = "seventeen"
\       TEEN.TEXT( 8 ) = "eighteen"
\       TEEN.TEXT( 9 ) = "nineteen"

\       TEN.TEXT( 0 ) = ""
\       TEN.TEXT( 2 ) = "twenty"
\       TEN.TEXT( 3 ) = "thirty"
\       TEN.TEXT( 4 ) = "forty"
\       TEN.TEXT( 5 ) = "fifty"
\       TEN.TEXT( 6 ) = "sixty"
\       TEN.TEXT( 7 ) = "seventy"
\       TEN.TEXT( 8 ) = "eighty"
\       TEN.TEXT( 9 ) = "ninety"

\       GROUP.TEXT( 0 ) = ""
\       GROUP.TEXT( 1 ) = "thousand "
\       GROUP.TEXT( 2 ) = "million "
\       GROUP.TEXT( 3 ) = "billion "

\ INPUT_WHOLE_NUMBER:
\       INPUT "Whole number"; WHOLE
\       PARSE.GROUP = FORMAT$( WHOLE, "############" )
\       C1:     I = 3
\               OUTPUT.STRING = ""
\       C2:     ELEMENT.TEXT = PARSE.GROUP( 3 - I )
\               G( I ) = VAL( ELEMENT.TEXT )
\               IF      G( I ) = 0
                THEN    GOTO C8
                END IF
\               EH = VAL( EH.STRING )
\               ET = VAL( ET.STRING )
\               EU = VAL( EU.STRING )
\       C3:     IF      EH <> 0
                THEN    OUTPUT.STRING = OUTPUT.STRING + UNIT.TEXT( EH ) + " hundred "
                END IF
\       C4:     IF      ET = 1
                THEN    OUTPUT.STRING = OUTPUT.STRING + TEEN.TEXT( EU ) + " "
\                       GOTO C7
                END IF
\       C5:     IF      ET <> 0
                THEN    OUTPUT.STRING = OUTPUT.STRING + TEN.TEXT( ET )
\                       HYPHEN = "-"
                ELSE    HYPHEN = ""
                END IF
\       C6:     IF      EU <> 0
                THEN    OUTPUT.STRING = OUTPUT.STRING + HYPHEN + UNIT.TEXT( EU ) + " "
                END IF
\       C7:     OUTPUT.STRING = OUTPUT.STRING + GROUP.TEXT( I )
\       C8:     IF      I = 0
                THEN    PRINT OUTPUT.STRING
\                       GOTO INPUT_WHOLE_NUMBER
                ELSE    I = I - 1
\                       GOTO C2
                END IF
\       END
```

Algorithm C . . . continued from page 58

```
C1. set i <- n, set output.string <- "".

C2. if G(i) = 0
      then go to step C8.

C3. if Eh <> 0
      then set output.string <- output.string
                              + unit.text(Eh) + " hundred ".

C4. if Et = 1
      then output.string <- output.string + teen.text(Eu) + " ",
           go to step C7.

C5. if Et <> 0
      then set output.string <- output.string + ten.text(Et),
           set hyphen <- "-".
      else set hyphen <- "".

C6. if Eu <> 0
      then set output.string <- output.string + hyphen
                             + unit.text(Eu) + " ".

C7. set output.string <- output.string + group.text(i).

C8. if i = 0
      then stop, the algorithm terminates,
           output.string is the result.
      else set i <- i - 1, go to step C2.
```

"I know it looks silly, but I have yet to crash this system."

ATTN: VAX SYSTEM MANAGERS

By Terry Shannon
System Manager, Galson and Galson, P.C.
East Syracuse, NY

If any of you VAX system managers have wondered why your accounting reports make reference to the UIC (2, 3) when you never created such a UIC, the following explanation of what this is and why it exists may be of interest to you:

In any VAX/VMS system configured for magtape, there is one — and only one — MTAACP (Magtape Ancillary Control Process, or device driver) available as a system resource. This ACP is called into a transparent system UIC (1,3) whenever a magtape related service or command is invoked. When not active, MTAACP is in hibernation to save on system overhead. Immediately after a dismount command is issued, MTAACP exits the system as it is no longer needed. For reasons unknown to me, MTAACP manages to exit the system several milliseconds before VMS becomes aware of its absence. Because only one process can be active in any given UIC and because the MTAACP always is executable in (1,3), the lag time between the exit of MTAACP and the operating systems knowledge of the exit can lead to potential problems. Thus, when forced to exit, MTAACP reassigns itself to UIC (2,3) for the brief period of time required for the exit procedure. The accounting utility senses activity in this UIC and associates the CPU time consumed with the parent account which has used the MTAACP. In essence, the MTAACP is treated as a subprocess. From an accounting standpoint, the small amount of CPU time consumed by UIC (2,3) is attributable to system overhead. Below is an example of why the MTAACP functions in the manner described:

User A issues a dismount command, thereby forcing the MTAACP to exit the system, which it does almost instantaneously. At this time, VMS is not yet aware that the process is no longer resident. The next executable machine instruction is a mount request from user B which automatically invokes MTAACP in UIC (1,3). VMS senses the presence of user B's MTAACP and, because it has not recognized the exit of user A's process, assumes that it has two active processes in the same UIC — a situation which simply cannot occur. The end result is that the operating system issues an error message and, among other things, refuses to service user B's MTAACP by reassigning its exit procedure to UIC (2,3), the MTAACP effectively prevents this situation from taking place.

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By R.D. Mallery
Publisher
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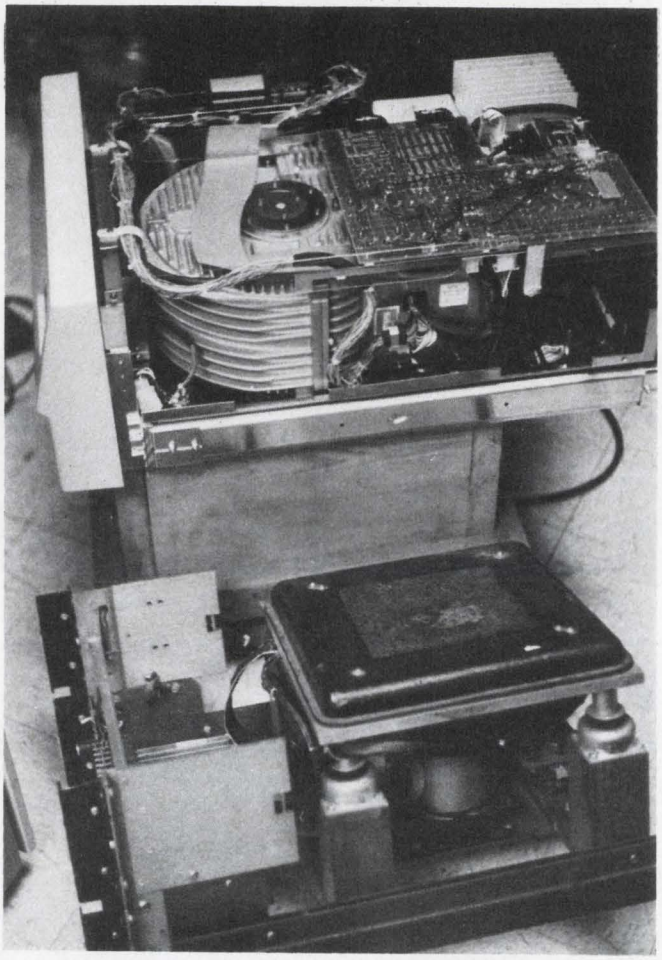

Thirteen years of disc technology! A DEC DS32 (32K 12 bit words for your PDP8) and my new Eagle (415 MB formatted for RSTS)

Being prone to practice what I preach, I recently acquired a pair of 'Eagles' for my '70. (cf Editorial, Vol. 2, #1)

Being both cheap and curious I decided to install them myself. I had an old H967 DEC rack available (they practically give them away surplus). I was delighted with the perfect fit I achieved (and the grand I saved for the cabinet).

Most disc factory manuals are very short on installation instructions. There are three major areas of concern:

1) Physical installation in the cabinet.

2) Identifying and unlocking all shipping locks (no problem).

3) Getting the correct orientation of the cables (invariably a problem).

The actual physics of mounting the drive with its sliders on the cabinet is usually omitted entirely and left to the intuition of the installer.

Previous Fujitsu drives (160 MB) had splendid, obvious, easy to slide-off sliders. You slid them off, bolted them into the cabinet, then slid the drive in.

Not this time. After several hours of head-scratching, I was convinced that if there was an easy solution (one like the above, in which at least one rail of the slider remains on the drive to facilitate insertion), it was lost on me. A call to the vendor confirmed my fears. You unbolt the sliders from the drive, mount them in the cabinet, then use several strong individuals to hold the drive between the extended sliders while you bolt them back on.

The finished product speaks for itself. There are no adjustments, no alignment, none of the rituals involved with older discs. You don't have to format the pack, badding is already done, just run one pattern and go.

There are several shocks for the new owner. The first is when you power up the drives, there is almost no noise and almost no heat. In fact, the Eagle's power consumption is a joke. Under full flight, seeking like crazy, there is no vibration and almost no noise. (Sorry Carl, they don't click.)

The other shock comes when you actually load data into them. Your senses revolt as 12, 15, 20 reels of tape pour into them. Nothing that small should hold that much data!

The controller manufacturer supplies patches that make INIT.SYS believe that Eagles are large RM05's (with 830,000+ blocks). All the rest of RSTS goes along with whatever INIT.SYS thinks, except for a single patch you must make to each monitor SIL you generate. They supply a pre-patched version of INIT on a bootable tape, leaving you with only a single patch to make after you SYSGEN.

With little ceremony, we powered down three 9766's that had been spinning for four years. Noble drives, almost perfect, but their time has passed. The change was immediate. The room became about ten degrees colder. The whine in the electric meter went down in pitch. I expect to save a grand a month between electric (and air conditioning) and service charges . . .

The last, and perhaps the best part is performance. The 9766's (RM05's) transferred at 1.2MB/sec on the mass bus. They sought at 33ms. The Eagles transfer at 1.8 MB/sec and seek in 17ms. This has to be classified as 'substantially' faster. In my installation, going from three drives to two, I gave up a little performance offered by the third set of heads. I am sure the new-found speed will more than offset the loss.

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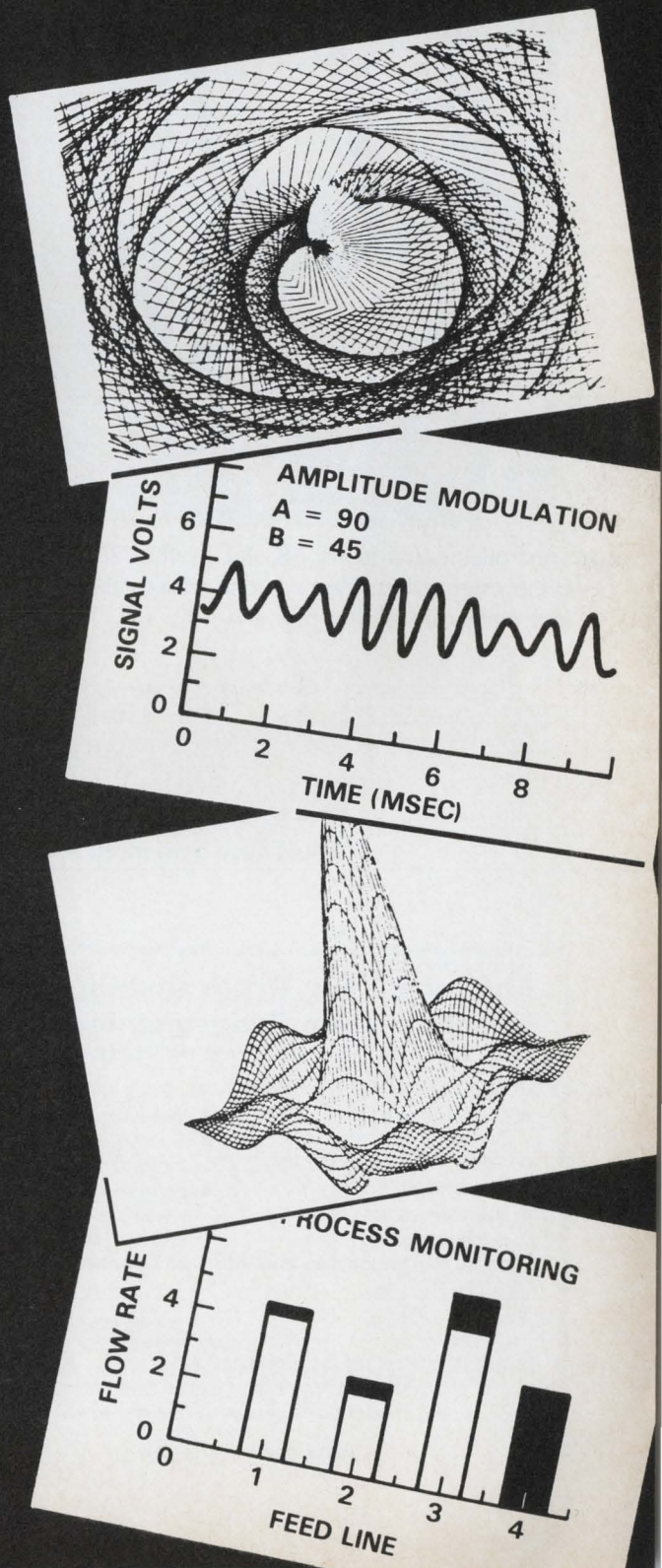

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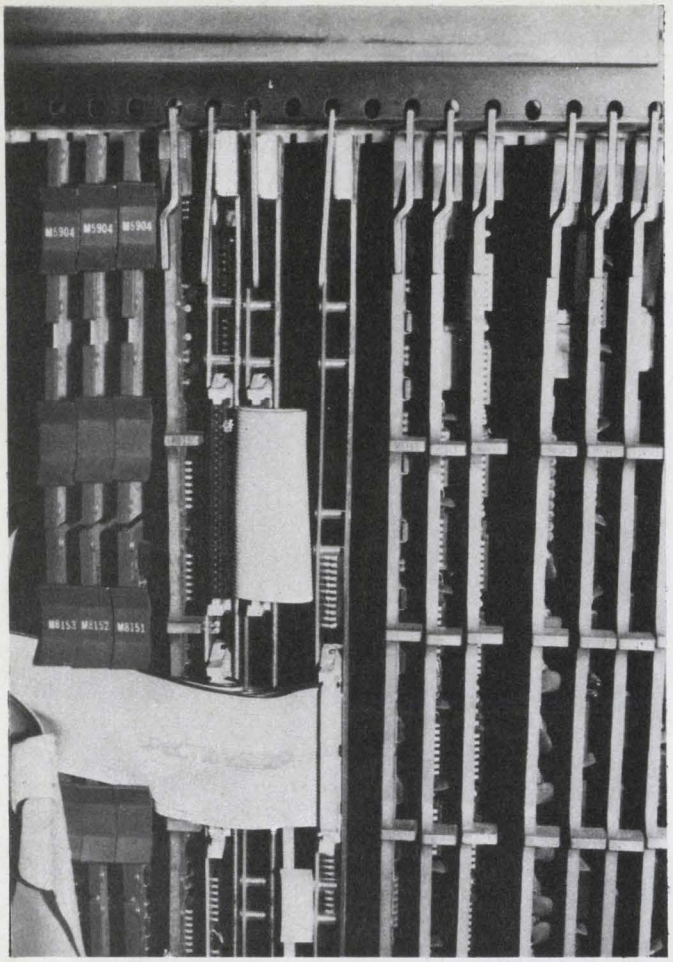
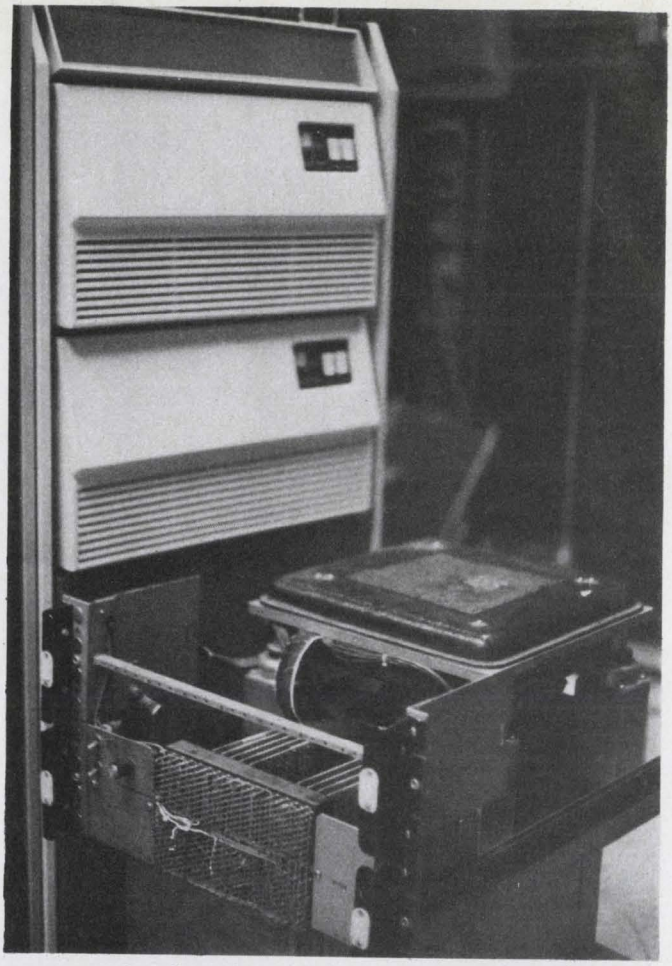
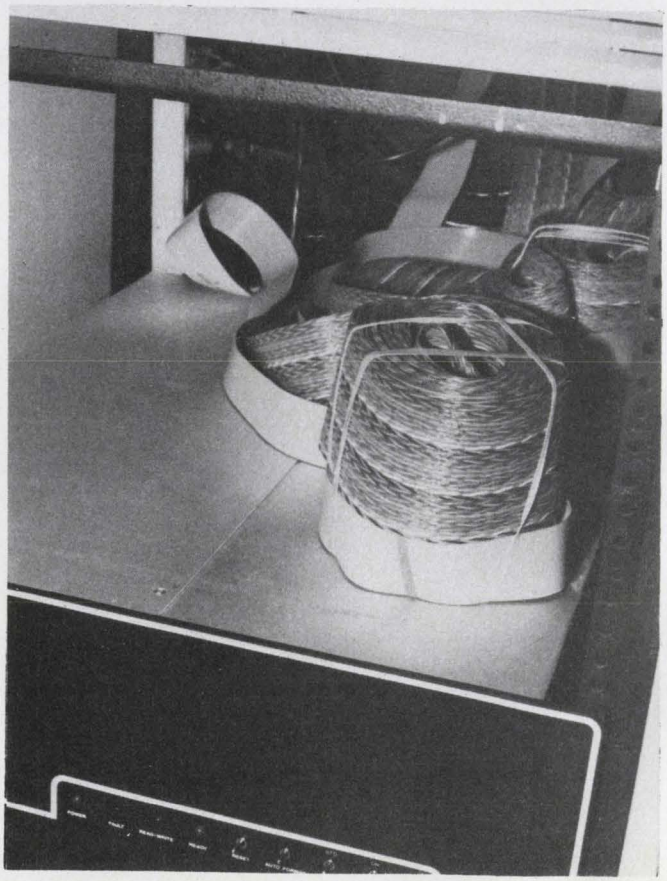


Controller cards in an RH slot in the '70. Note the proper cable orientation. There is one other cable that enters the left most card at the top. ▲



Another view of the generation gap. ▲

How to hide those ugly cables. Short cables would have been much better. ➤



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. . . to page 69

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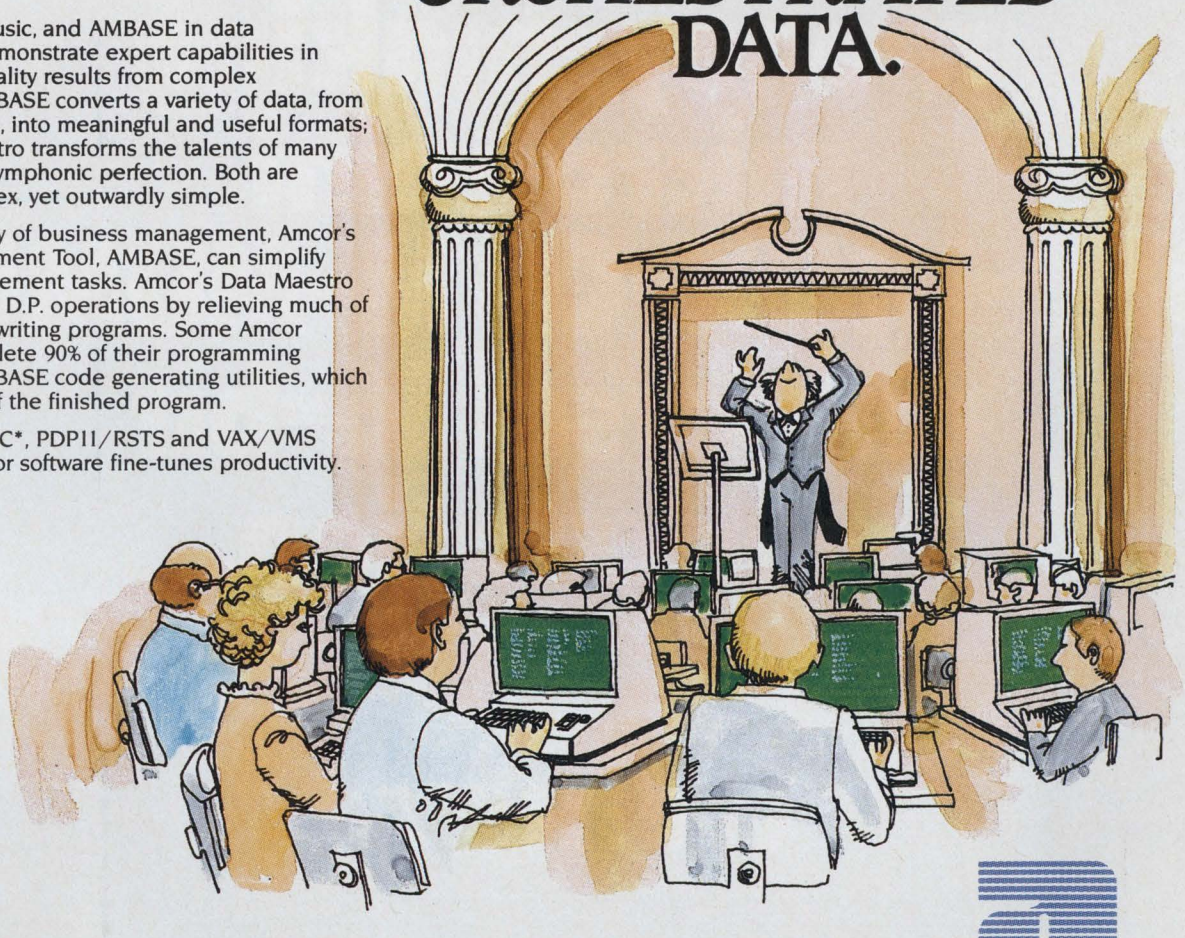

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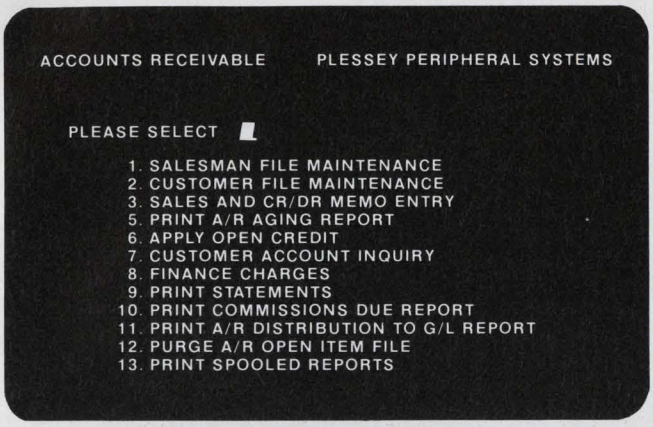

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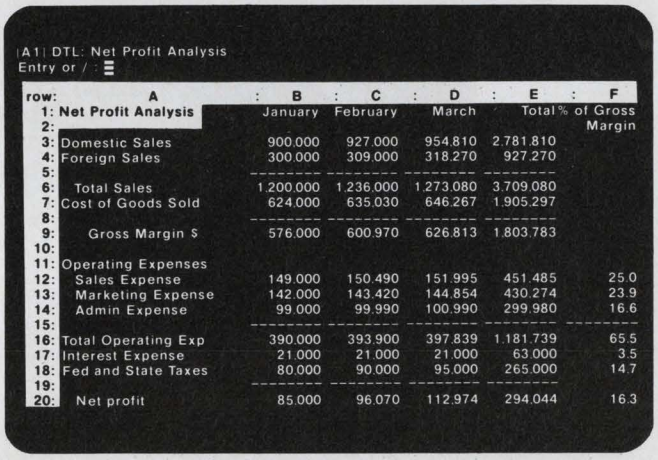

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1:	Net Profit Analysis	January	February	March	Total	% of Gross Margin
2:						
3:	Domestic Sales	900.000	927.000	954.810	2.781.810	
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6:	Total Sales	1.200.000	1.236.000	1.273.080	3.709.080	
7:	Cost of Goods Sold	624.000	635.030	646.267	1.905.297	
8:						
9:	Gross Margin $	576.000	600.970	626.813	1.803.783	
10:						
11:	Operating Expenses					
12:	Sales Expense	149.000	150.490	151.995	451.485	25.0
13:	Marketing Expense	142.000	143.420	144.854	430.274	23.9
14:	Admin Expense	99.000	99.990	100.990	299.980	16.6
15:						
16:	Total Operating Exp	390.000	393.900	397.839	1.181.739	65.5
17:	Interest Expense	21.000	21.000	21.000	63.000	3.5
18:	Fed and State Taxes	80.000	90.000	95.000	265.000	14.7
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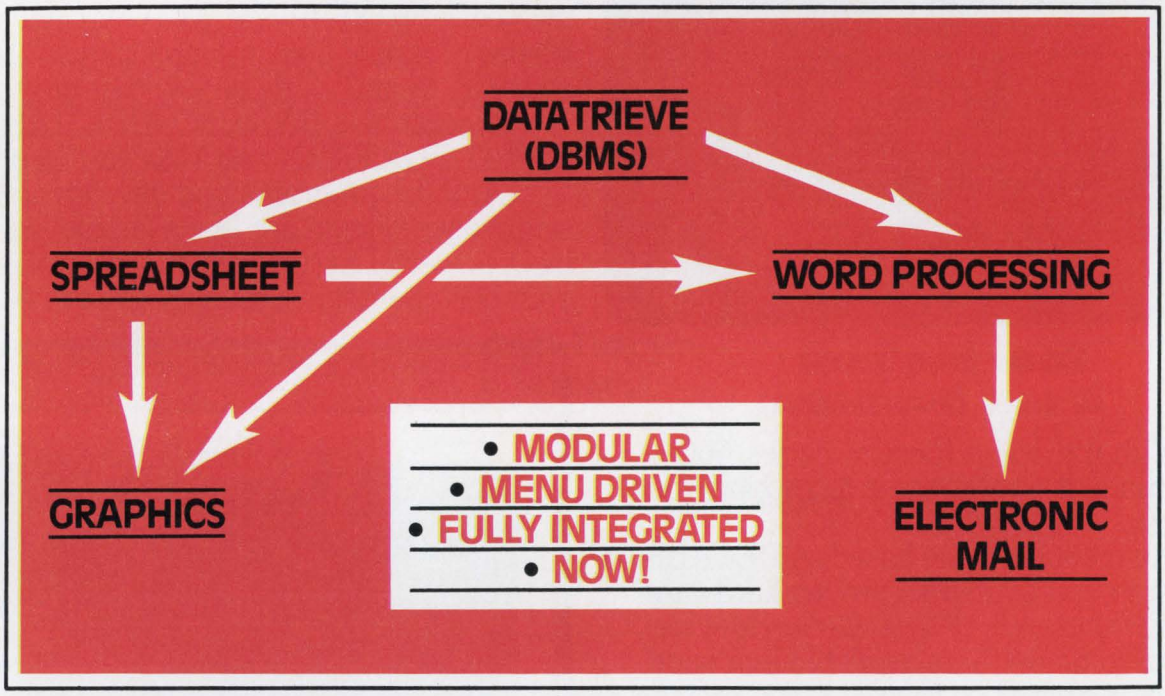

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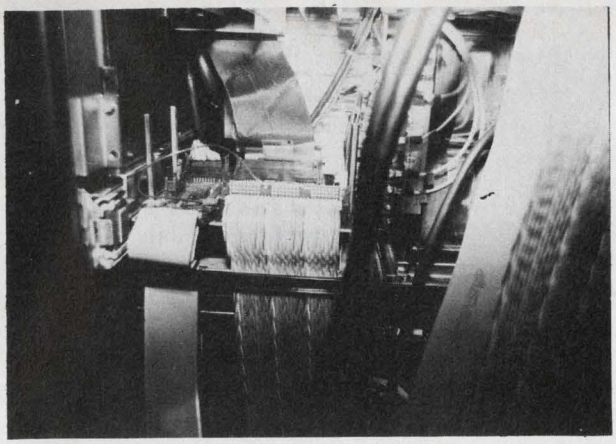
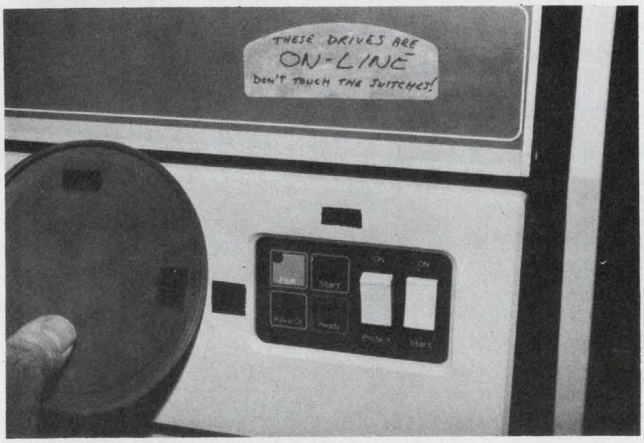


Correct Drive Cable orientation.



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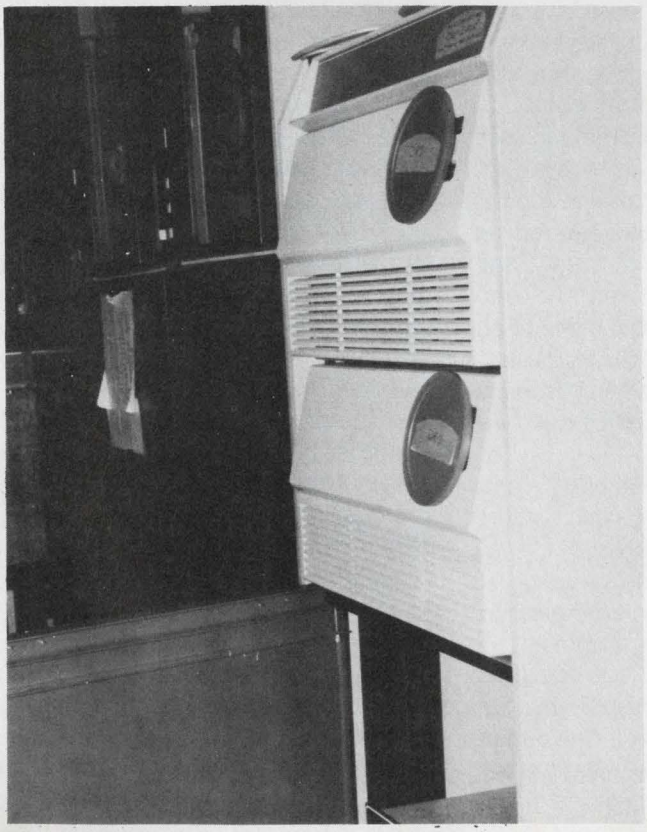

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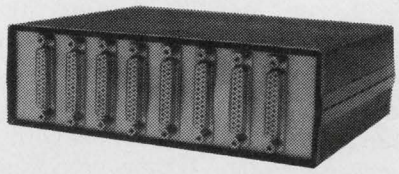

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UNIX CONSIDERED

By Barry Shein and Steven Sneddon

INTRODUCTION

UNIX is a general purpose, multi-programming environment written by programmers for the purpose of software development. Dennis Ritchie and Ken Thompson, who first designed UNIX at Bell Laboratories, described UNIX as follows:

> It offers a number of features seldom found even in larger operating systems, including
>
> (i) A hierarchical file system incorporating demountable volumes.
>
> (ii) Compatible file, device, and inter-process I/O.
>
> (iii) The ability to initiate asynchronous processes.
>
> (iv) System command language selectable on a per-user basis.
>
> (v) Over 100 subsystems including a dozen languages.
>
> (vi) High degree of portability.

This last feature has led to its proliferation on hardware as diverse as the PDP-11, VAX, MC68000 and IBM/370 computers.

HISTORY

The first version of UNIX ran on a PDP-7 computer at Bell Labs and shortly thereafter migrated to a PDP-11/20. the very first system was written by Ken Thompson and later versions were developed with Dennis Ritchie both of Bell Labs. The basis for the current time-shared system (PDP-11/34 et al) was completed in February 1971. This came to most of us as UNIX Version 6 and is still very popular. The later versions (V7, system-3) are oriented more towards the larger PDP-11 configurations (45, 44, 70, VAX) but can be run on the smaller processors without too much difficulty.

At the high end UNIX is being run at Bell Labs on an IBM-3033 processor giving service to as many as 300 interactive users.

A popular variant of UNIX is the PWB (Programmer's WorkBench) which is an augmented Version 6 supporting a host of utilities for management of large software projects.

A recent development of UNIX has been its appearance on personal computers. Several versions are available for the MC68000 and Z8000 processors. The natural migration of UNIX from the PDP-11/34 to the LSI-11/23 makes it likely that UNIX will be very popular among the new generation of DEC Professional computer users. The multi-programming environment and ability to network to host UNIX systems make this highly attractive.

In addition to the Bell Laboratories' version, the University of California at Berkeley and several manufacturers offer enhanced UNIX systems with such features as real-time processing, advanced text processing, graphics and data base managers.

SHELL

To a user, the most visible portion of UNIX is the command interpreter called the 'shell'. Rather than being part of the kernel, the shell is an application program. Each user's entry in the password file specifies the program that is initially run at login.

The standard UNIX command shell is in many ways similar to the DEC command languages, with a few powerful additions. The shell splits up its input into a command name and arguments to that command. The command is almost always the name of an executable file. If the file is in the current directory the shell attempts to execute it; otherwise it searches standard system directories for it.

To illustrate basic use of the command shell, suppose we wish to sort two files using defaults:

```
sort filea fileb
```

The files would be sorted together and the result printed on the terminal. The sort program receives the specified names and would be responsible for checking their validity, etc. One option of the sort utility is to reverse the order of sorting:

```
sort -r filea fileb
```

Hyphenated arguments, by convention, specify options to programs.

Often we do not wish to see the output of the sort on our terminal. By default, the output of 'sort' appears on the terminal, the 'standard output.' However, the shell can 'redirect' the standard output to a file:

```
sort filea fileb > sorted
```

Similarly, input can be redirected from a file by '< file.'

The natural extension of I/O redirection occurs when one program's output is passed to a second, asynchronous process. UNIX provides a mechanism for this, the 'pipe'.

To illustrate a pipe, suppose we wished to remove all lines with duplicate sort keys before placing them into the 'sorted' file. There is a utility called 'uniq' that does this:

```
sort filea fileb | uniq > sorted
```

As a further example, we might want to know the number of unique lines. we could accomplish this by typing:

```
sort filea fileb | uniq | wc -1
```

The last command, 'wc -l', simply reports the number of lines in its standard input.

These examples illustrate how UNIX turns programs into something akin to a good subroutine library in a programming environment.

There is no separate batch facility on UNIX but a program can be run in the background by terminating the command with an ampersand thus:

```
sort file > sorted &
```

executes the sort in the background.

The shell can be invoked, just like any other program, and can take commands from a file. In effect a batch stream can be set up by placing a series of commands in a file, e.g., 'batch', and executing the shell in the background:

```
sh batch &
```

Shell files may also contain control-flow primitives and string-valued variables making the shell a programming language as well as a command interpreter. There are (in newer shells) command aliasing,

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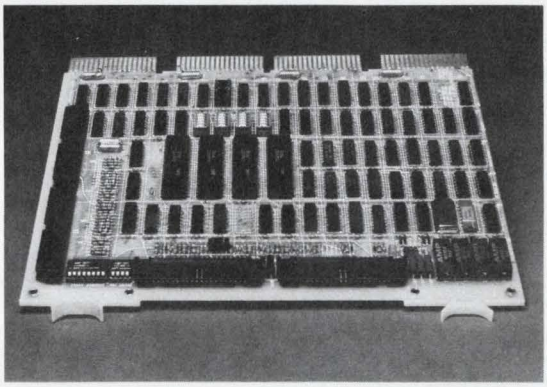

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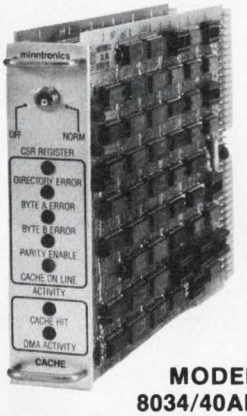

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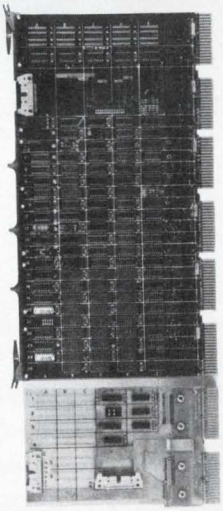

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variables, local and global environments to specify such things as type of terminal you are on and the default libraries to search. Application programs can access these environment descriptors so programs can execute appropriately. Good examples of this are the Berkeley terminal programs which use a data base of terminal descriptions to automatically tailor screen editors, output filters and other applications to the type of terminal the user is currently on. An environment variable is simply set at login (or automatically from a login shell script.)

Similar to DEC command languages, there are facilities for specifying files with wildcards. They are:

1) * matches any string
2) ? matches any single character
3) [c1...cn] matches a single occurrence of the specified characters.

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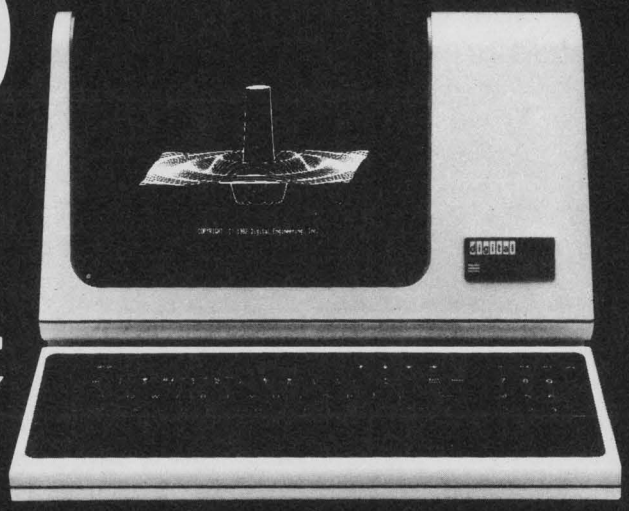

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DEVELOPMENT ENVIRONMENT

Central to the UNIX philosophy is the importance of software tools. Separate utilities, each performing a single job well, were preferred over a few large programs with many options. The system 3.0 UNIX user's guide lists over 200 general purpose commands. Among these are:

- Editors — Line, screen and stream editors all using a common pattern matching syntax for search and replacement.
- File Management — Recursive directory search by owner, type, access, name etc. allowing the application of any command to matched files. Pattern search and replacement on groups of files. Sort, merge, split, archiving and user backup are provided.
- Word Processing — Programmable formatters and macro libraries for devices as diverse as letter quality printers and phototypesetters. Preprocessors for generating equations, tables and graphical output. Spelling checkers based upon dictionary and statistical methods.
- Software Project Management — A source control system for maintaining multiple versions of programs. Conditional system generation based upon modifications and varying targets.
- Languages — C, FORTRAN, FORTRAN77, BASIC, BASIC+, LISP, ALGOL, SNOBOL, APL, PASCAL and assembler.
- Compiler Development — Compiler-compilers, a lexical analysis generator.
- System Maintenance — Accounting, file system repair, device management and incremental backup.
- Miscellaneous — Graphics, forms, games, networking, circuit design and data base utilities.

PROGRAMMING ENVIRONMENT

Another attractive feature of UNIX is its program development environment. This is particularly true for the C programmer since C is the native language of the operating system and

the language in which most of the utilities are written. UNIX provides a layered environment at the bottom of which are system calls which handle file management, process management and unbuffered I/O. At the next level are portable routines for implementing buffered I/O, math routines, graphics packages, etc. At the next level is the ability to execute other programs and use their results. Finally there are program generators and systems for project management and system regeneration.

Even at the lowest level, UNIX system calls provide flexibility for the programmer. For example, when issuing a read call you do not need to know in advance physical device characteristics.

```
n = read(file,buffer,nwanted)
```

Read returns the number of bytes actually placed in the buffer or zero for end of file.

As an example of making use of another program within a program, assume that the variable 'infile' holds the name of a file to be sorted and 'outfile' is the name of a file to receive the sorted data:

```
sprintf(cmdbuf,"sort %s > %s",infile,outfile) ;
system(cmdbuf) ;
```

Sprintf( ) formats the command into 'cmdbuf' and system( ) invokes the shell with the command and waits for completion.

A few examples at the higher level of software development are:

YACC and LEX, compiler development tools. YACC accepts a BNF-like input and produces a C program to parse the specified grammar. LEX accepts regular expressions and generates a lexical analysis program which is often used in conjunction with YACC output.

Lint checks C programs for portability and questionable constructs reporting potential bugs such as unreachable code, unportable type coercions and inconsistent usage of function parameters and return values.

MAKE automates rebuilding system software by allowing the user to specify dependency relationships between source and object files leading to the desired result. MAKE then issues the minimum number of commands necessary to regenerate the target file.

SCCS is a system of programs for managing different versions of source files, recording changes of modules. SCCS can recreate earlier versions of the software and offers various audit and administrative features.

LIMITATIONS

Along with its many strengths UNIX also has some weaknesses. Primarily these are due to intentional design omissions since they would incur degradation of performance and/or simplicity. Some obviously lacking features are:

a) Real time services.

b) Contiguous files for better disk throughput.

c) Shared core, file locking.

d) Record oriented access methods.

e) Security against a hostile user community.

Augmented UNIX systems which provide these features are becoming available from independent software vendors, in part due to the availability of complete sources from Bell Laboratories.

SUMMARY

UNIX is a well designed, highly integrated software development environment. The operating system provides a high degree of portability of both people and software between many diverse machines. Owing to the support of Bell Laboratories, the academic community and several commercial software houses UNIX is growing rapidly in popularity on DEC and other computer systems. UNIX is not the final word in operating system design, but it has set a standard against which others will be judged.

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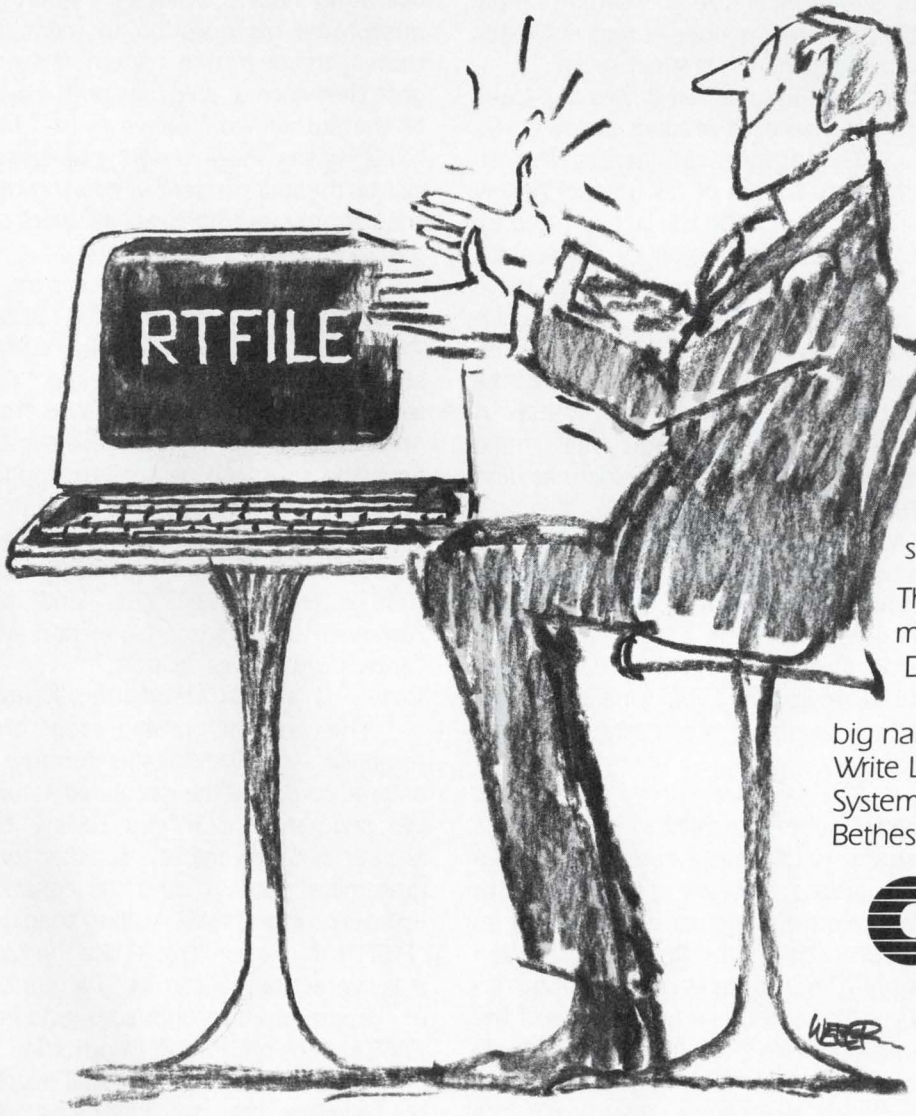

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CIRCLE D129 ON READER CARD

A BAD REVIEW FOR A REVIEW

By Roger Brown, President, Interactive Technology, Inc.

(Editor's Note: The following correspondence was too long for inclusion in our "Letters to the DEC PRO" section. Because **The Dec Professional** wishes to be fair to all its readers and advertisers, we are publishing this letter unedited. Again, we are publishing this letter in fairness to ITI. It is not the intention of this magazine to get into a "who struck John" situation.)

SURPRISED and **DISAPPOINTED** are the words that best describe our reaction to the article in the March, 1983 issue of The DEC Professional entitled "**A Review of Database Management Systems for RT-11**". We at Interactive Technology, Inc. of Portland, Oregon, filled in a questionnaire that served as the basis of the article. We completed the questionnaire in response to the author's statement that, "I have been approached by The DEC Professional magazine to write an article comparing those commercially available DBMS which run under RT-11." Since we did not recognize Logicaid, Ltd. as a producer of a product in that environment and because they have not appeared as advertisers in The DEC Professional since its inception, we participated in the study, believing it was truly independent and sponsored by your magazine. We were then quite surprised to find that the resulting article covered only three of the systems available and that the article included a product produced by the author's company.

Several aspects of the article suggest to us at ITI that the author is perhaps less than qualified to fully analyze the products and that the author's review of the questionnaire was insufficient if not blatantly superficial. By not carefully reviewing articles like this, you, as publishers of the article, perform a disservice to your readers.

We were disappointed to find that the article only covered three products, two of which have been prominently advertised in your magazine as well as others and displayed at industry shows. We wonder why other products having comparable exposure were not reviewed, yet we must accept the author's explanation that other product reviews were either not received or arrived after the deadline. It is interesting to note that the two independent products reviewed are produced by companies in cities distant from the author: Portland, Oregon and Bethesda, Maryland. We can't help but note the omission of "Simile," produced in New York. Did the producers of Simile recognize the author simply because they realized it was not really an "independent product review"?
because they realized it was not really an "independent product review"?

The author rationalizes the incomplete nature of his product review simply by pointing the lack of response to his questionnaire within the allotted time. For your information, Interactive Technology received the questionnaire on December 20, 1982 and was requested to return it to the hands of the author by January 15th, 1983. A period marginally longer than three weeks, including the Christmas and New Year's holiday periods. If in fact the author's response was light, it may very well have been significantly influenced by his lack of prior planning and not providing adequate time. We were disappointed to find such a superficial review in your magazine, for which we have previously had much respect.

The "vendor survey" techniques elected for this review provided the author with a great deal of specific information; however, as is true with many questionnaires, the author's interpretation of that information significantly shapes the resulting article. The author's interpretation of the questionnaire's results leads us to question both his diligence and his technical knowledge. Specifically, the author chastises the two independent vendors for claiming that their systems operate in less than 64Kb of memory in a standard TSX+ system. In fact, it appears that both independent vendors answered the question of "What is the minimum memory required for the single user facility?" by indicating the memory requirements for the vendor product **exclusive** of the operating system, whereas the author interpreted his question to mean including the operating system. We suggest that normal diligence on the part of the author would have caused him to clarify the answers with a telephone call to the independent vendors rather than simply writing these answers off with a sarcastic comment.

An additional example occurs in the questionnaire section titled "DBMS AND FILE STRUCTURE". The author submitted a question that asked, "Can a data item's value be calculated from other data items? If so, please explain how the user causes this to happen (does he enter a formula, what does the formula look like, etc.)? In the case of our product, our response to the first question was **YES**, and our response to the second question was "enters formula as follows:
Item = (1 + item 2/sqrt (Item3)) etc."

The author interpreted this response as a "PASCAL-like formula is entered to define the calculated value." We suggest that if you review the answer with technically qualified programmers, you will find the equation listed is no more "PASCAL-like" than it is "FORTRAN-like" or "BASIC-like". In fact, it is syntactically incorrect in a number of programming languages-including PASCAL. For presenting information to both technical and nontechnical people, we believe a more accurate translation

would have been an "algebraic-like equation," which in fact is the case. If the author had sufficient technical competence to recognize the answer as not specifically a language response, or had the author been reviewing it in an unbiased fashion, his conclusion would have been to either question the vendor or to interpret the answer as an algebraic equation, something far more broadly understood by the population than a specific programming language syntax.

Should you at this point need additional basis for questioning the "independent" nature of this review, I direct your attention to the second paragraph of the article which stresses in sentence two that "the DBMS should be thought of as a tool used in building a final application." With this idea in mind, we believe the author's treatment of the screen and menu support section, which he glibly writes off as "technically not a DBMS function," is a substantial disservice to your readers. The vast majority of data management systems uses screen input forms as a primary data input mechanism. Why then does the author reserve less than half a page for screen discussions, not treat the ability to create menus and commands at all, and yet use nearly a full page to talk about report generation and a second full page to talk about DBMS integrity? All four subjects probably warrant equal treatment for the true application development user. It appears more than coincidental that the treatment of these features corresponds directly with their absence in the author's own product.

Lastly, I draw your attention to the pricing and conclusion section of the article wherein the author disclaims any accurate comparison of apples to apples on the basis that "the prices stated are for complete "bundled" systems." While he disclaims any responsibility to present comparative information, the author summarizes the cost of the various systems in an extremely distorted fashion. On the questionnaire provided, the author was informed that the RDM system was priced at $2500 and that additional extensions were available for an additional $2500. The author chose to add the total for presentation rather than list the comparatively accurate price of $2500 **or** question the vendor. The fact is that the complete RDM package — including not only file creation, report writing, and file maintenance capabilities but also full screen development, command and menu development, and process definition capabilities—is all provided for $2500 in RT-11, TSX+, RSX, POS, **or** the RSTS/E operating system versions. ITI provides an additional PASCAL library to programming organizations for enhanced programmer productivity.

Misrepresenting the product and its pricing does your readers a disservice. We at Interactive Technology are extremely disappointed by the lack of a careful review of the article and its authors qualifications.

Again, my purpose in writing is to draw your attention to the significance of complacency in article publication. We applaud the breadth and depth of The DEC Professional as a magazine, and we hope you will accept this letter in the spirit of constructive criticism with which we write it.

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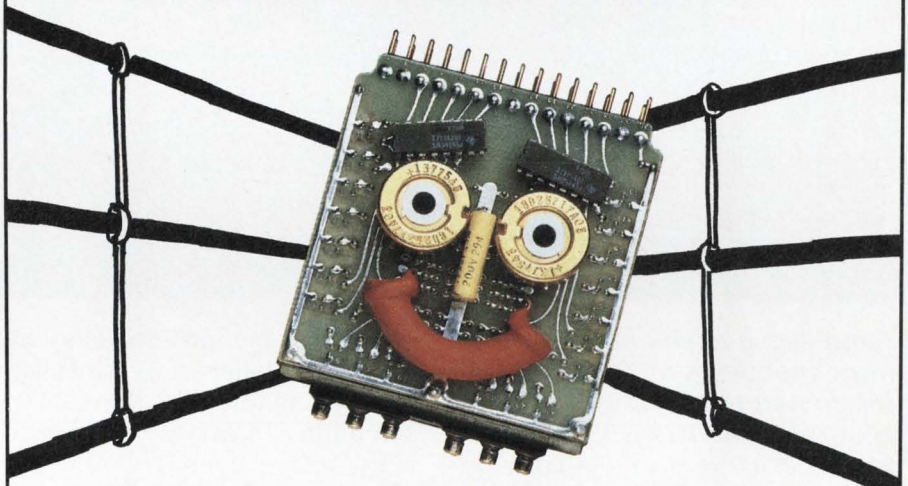

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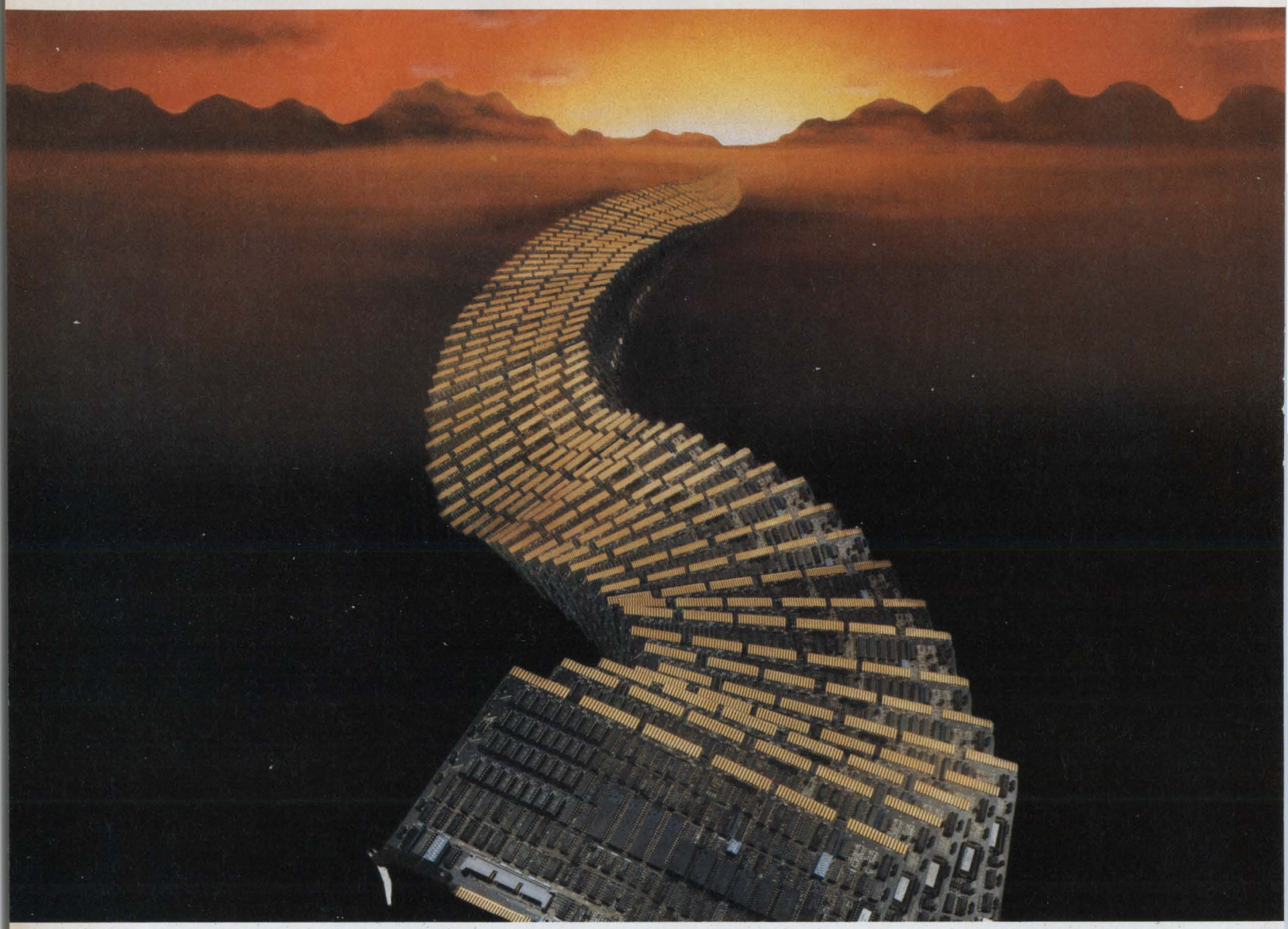

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CIRCLE D36 ON READER CARD

PROGRAMMING THE FLOATING POINT PROCESSOR
(or, those Ferocious Floaters . . .)

By Bob "Macro Man" Meyer, Fieldsboro, NJ

Greetings, MACRO fans.

In this article I'll describe the basics of the KT-11 floating point processor, talk about it's instruction set, and show some (simple) programming examples of how to use it. (In MACRO, of course . . .)

INTRODUCTION

The FPP can do wonders for your CPU. It's basic purpose in life is to carry out large (15 or 31 bit) signed integer calculations, as well as 23 or 55 bit floating point goodies. It's quite fast, so I'm told (you may look up timing information in the 11/70 processor handbook) and it operates in parallel with the CPU itself. I found this a bit confusing at first, but it's really quite simple; only FPP instructions can access the FPP'S accumulators (six available to the user, each 64 bits wide), so the program can execute an FPP instruction, go do something else for a few fractions of a second, and go back to fetch the results of the calculation. If the FPP hasn't finished the requested operation, the hardware will 'hang' the CPU until the FPP has finished. This sounds pretty clever, but I seriously wonder if anyone has ever written software with this in mind . . .

Some of the FPP'S claims to fame are its full set of addressing modes (like the PDP-11), ability to access any location in memory, (or any general register), complete set of data conversion instructions, error detection and trapping, full 64-bit add, subtract, multiply and divide, its own set of condition codes which can be tested and compared, exponent handling instructions, and mode control instructions. (Whew . . .)

The FPP operates on integers in one of two modes, integer or long integer. While operating in integer mode, instructions which convert data between integer and floating formats will treat the integer data as if it were 16 bits long. When in long integer mode, the data will be handled with 32 bits. The desired mode should be selected before any processing is done by the user. This is done with the instructions:

```
SETI
```

which sets the processor to integer mode (16 bits), and

```
SETL
```

which sets it up for long integers (32 bits).

Before I forget, any attempt to execute FPP instructions on a machine without an FPP will result in a Reserved Instruction Trap; various operating systems will handle this in different ways.

INTERNAL FORMAT

Floating point numbers, like integers,are operated on in one of two modes: FLOATING (SINGLE PRECISION) mode, which provides 23 bits of fraction (plus one hidden bit which we'll discuss in a moment), eight bits of exponent, and one sign bit; or DOUBLE PRECISION mode which gives us 55 bits of fraction, eight of exponent and a sign. To place the processor in floating (single precision) mode, use the instruction:

```
SETF
```

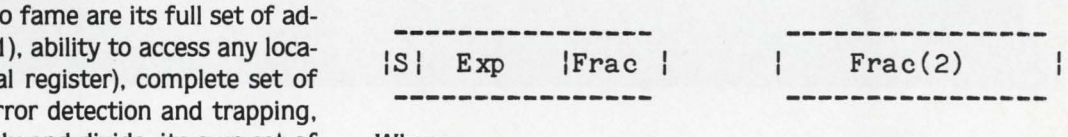
or if you need lots of digits, execute:

```
SETD
```

which places the processor in double precision mode. (These FPP states are (usually) preserved by the operating system during timesharing so that each user may 'tailor' the FPP to his/her needs.)

Next we'll talk about the internal data representation. Not being a "math heavy" by nature, I found this a bit complicated at first, so I consulted MY guru, the amazing 'Dr.' Jude Suszko, to untangle my aching brain cells.

Refer to the following diagram (you might find some better art work in the processor handbook chapter on the FPP) for the following discussion.



Where:

- S is the sign bit for the entire number
- Exp is the 8-bit exponent
- Frac is the first seven bits of the fraction, and
- Frac(2) is the remaining 16 bits of the fraction. (Note that when using double precision mode, two more words of fraction will be added, giving a total of 55 bits for the fractional component of the number)

The 'hidden bit' we spoke of earlier is a bit that is always present (unless the entire number is zero, in which case nothing is stored), and therefore is NOT stored in the internal representation of the number. Let's talk about this with an example. The number 1 (decimal) is stored internally as 40200 (octal) in the FPP (you math majors, please bear with me). If we break this down into binary, we get:

```
0  4   0   2   0   0    Octal
0 100 000 010 000 000    Binary
```

. . . to page 82

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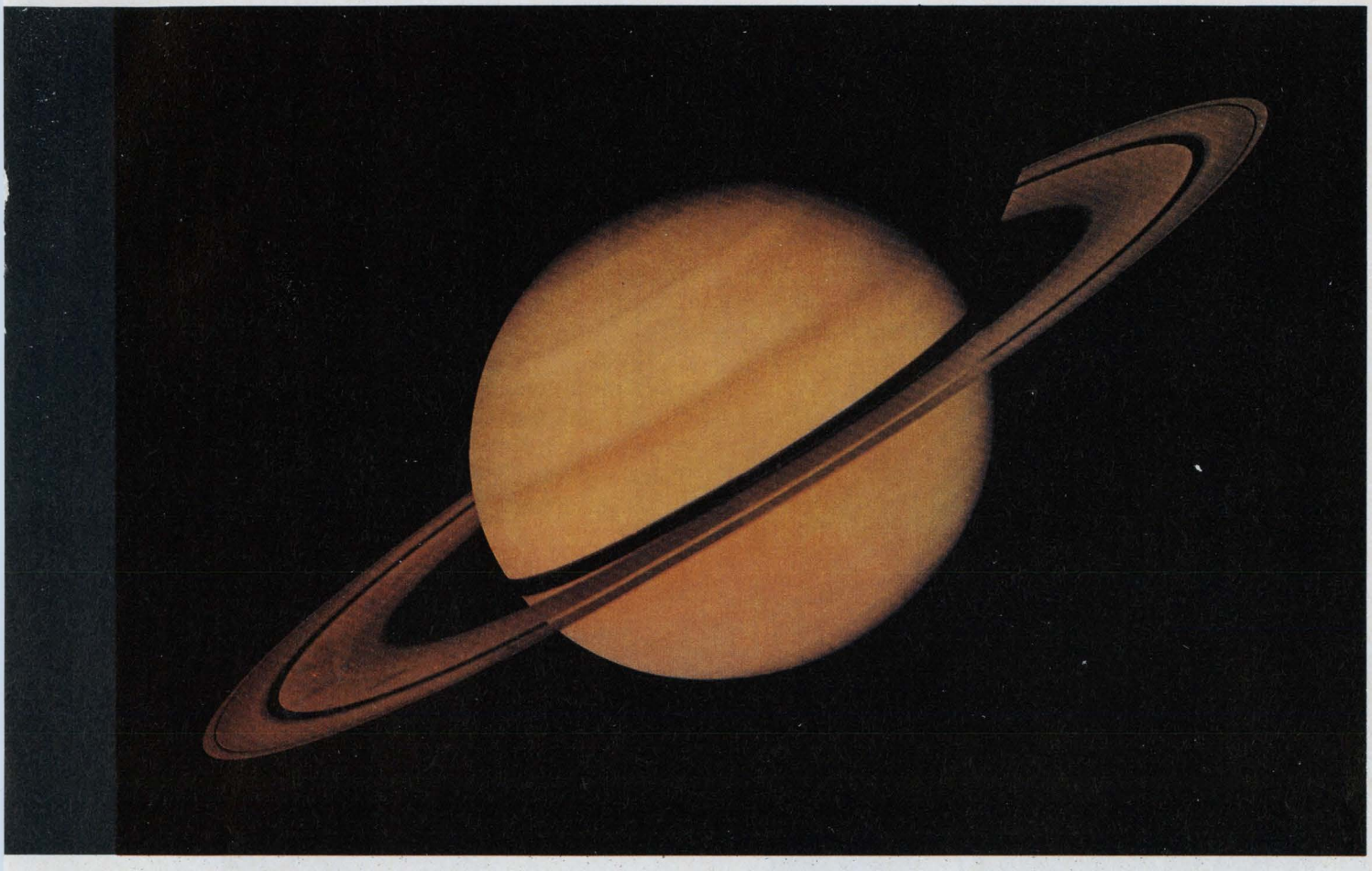

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Now we separate the bits into FPP format:

```
      0 ¦ 100 000 01 ¦ 0 000 000

      ^       ^         ^
      !       !         !
      !       !         !
    Sign   Exponent   Fraction
     0.      129.        0.
```

Now let's take a look at what we have; The sign is zero, making the whole number positive. The fraction is zero, but when we add the 'hidden bit', we get:

.1 (binary)

The exponent is 129., but this is 'excess 128. notation', therefore 128. is subtracted from the exponent, giving us an exponent of 1. (this way exponents never go negative).

We use the exponent (1.) to move the binary radix point to the right. So our example goes from:

.1
to
1.

which is the correct value for the number 40200 (octal).

Now let's take the number 40300 (octal), (which I know to be 1.5 decimal ('cause I'm Macro Man and you're not, so there)) and break it down into internal format.

First we get it in binary again:

```
0  4   0   3   0   0    Octal
0 100 000 011 000 000    Binary
```

Now into internal format:

```
      0 ¦ 100 000 01 ¦ 1 000 000

      ^       ^         ^
      !       !         !
      !       !         !
    Sign   Exponent   Fraction
     0.      129.        1 (binary)
```

Ok, the sign is still zero, indicating a positive number. This time we have a fraction of 1 (binary); this gets positioned AFTER the hidden bit, giving us:

.11 (binary)

We convert our exponent into decimal, which gives us 1, and move the binary point that many places to the right. Now we have:

1.1 (binary)

Which, in decimal is 1.5 (numbers AFTER the binary point have values of .5, .25, .125, and so on . . .)

The decimal number 1.25 would be 40240 octal, and in binary:

1.01

after the binary point is moved.

The number 2 would be 40400 in octal or:

10.0

in binary.

INSTRUCTIONS

Most of the instructions in the processor handbook will be displayed with two mnemonics, some even with four.

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CIRCLE D181 ON READER CARD

The various mnemonics for the same instruction all generate the same machine code, however they do make the assembly code a bit easier to read. For example, if you were operating the floating point processor in floating (single precision) mode, and wanted to load one of the floating point accumulators, you would use the

```
LDF   (load floating)
```

instruction, rather than the

```
LDD   (load double)
```

instruction, indicating to some poor soul trying to read your code that you were loading a FLOATING, not DOUBLE precision number. Note that while this is not required, it's good practice.

We'll talk about some of the basic instructions here, and give some examples of their use.

LDF/LDD

Meaning: Load floating/double

```
Syntax:   LDF        NUM,F0   ;LOAD 'NUM' INTO FLOATING ACCUMULATOR 0
```

Simply loads the operand into the specified accumulator. This is the simplest way to get data INTO the FPP.

NOTE: In order to use symbols such as F0 to represent floating point accumulators, you must define these symbols as follows at the beginning of the program:

```
F0    =%0
F1    =%1
      .
      .
      .
```

Incidently, some folks prefer the symbol AC0 (for accumulator); this would be defined as:

```
AC0   =%0
AC1   =%1
```

and so on.

If the instruction

```
SETF  (set floating)
```

were executed previous to the LDF instruction, two words of data would be loaded into accumulator 0; if the FPP were placed in double precision mode using the instruction

```
SETD  (set double)
```

the LDF instruction (which should then be written as LDD) would load four words into the accumulator. (An example program follows the next instruction.)

STF/STD

Meaning: Store floating/double

```
Syntax:   STF        F0,OUT   ;STORE CONTENTS OF F0
```

Store the single or double precision number in the specified floating point accumulator.

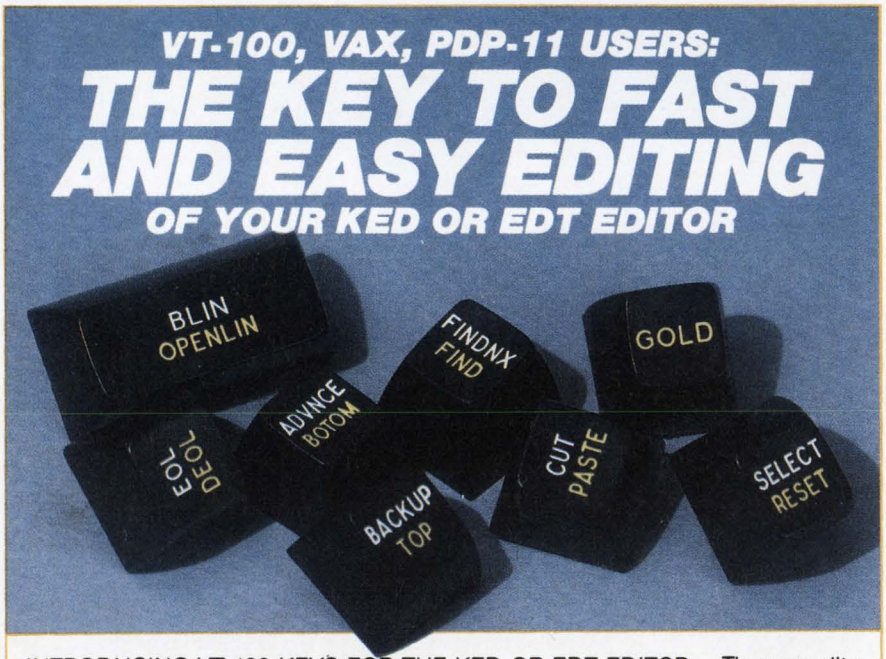
The following code demonstrates the use of the instructions LDF and STF.

```
IN:     .WORD   1,2,3,4         ;SIMPLE TEST NUMBERS
OUT:    .WORD   0,0,0,0

F0      =%0                     ;DEFINE FLOATING ACCUMULATOR ZERO

F:      SETF                    ;PUT THE FPP IN SINGLE PRECISION MODE
        LDF     IN,F0           ;LOAD THE INPUT NUMBER INTO ACCUM. ZERO
        STF     F0,OUT          ;STORE IT OUT AGAIN SO WE CAN SEE IF IT WORKS
        BPT                     ;STOP SO WE CAN HAVE A LOOK

        .END    F
```

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CIRCLE D137 ON READER CARD

A slight knowledge of ODT is assumed here in order to actually verify the results of this program; if the reader is not familiar with ODT, read on, I'm sure you'll understand the example. (If you wish to know more about ODT, consult the RSX/IAS ODT Reference Manual.)

First, you must assemble the program above (we'll call it FPP.MAC, and I'll try to keep the example operating system independent).

From CCL or MCR:

```
MAC FPP=FPP
or
MAC FPP,FPP=FPP
```

if you'd like an assembly listing.

To task-build:

```
TKB FPP/DA,FPP=FPP
```

to get an executable image (FPP.TSK) and a task-builder map (FPP.MAP).

The /DA tells TKB to include the 'Debugging Aid', ODT.OBJ, from the system library.

Now run the program:

```
RUN FPP
ODT:FPP
```

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CIRCLE D184 ON READER CARD

The '_' is ODT's prompt; to look at the output data area, find the Global symbol OUT in the task-builder map. (on my system (RSTS/E V7.0) this was 2010, and remember, all numbers are OCTAL unless otherwise specified)

The following command will list the output data area on the terminal:

```
_2010;2016L
```

This tells ODT to list the memory area between 2010 and 2016 inclusive on the current terminal. The area should be zeros and look something like this:

```
002010/ 000000 000000 000000 000000
```

Now we can execute the program:

```
_G
```

This is the ODT command 'GO', which tells ODT to allow the user program to execute from the beginning.

When the BPT (Breakpoint Trap) instruction is executed, ODT will take control and prompt the user:

```
BE:002032

_
```

Again, these numbers may vary between operating systems and versions.

To look at the results, just type the 'L' (list) command again (if no arguments are specified with 'LIST', the range of memory locations last shown will be listed again):

```
_L
002010/ 000001 000002 000000 000000
```

Thus demonstrating the (single precision) LOAD & STORE operation of the floating point processor.

In comparison, the four word (double precision) operation can be shown by making a simple modification to the same program. Simply change the first instruction from

```
SETF    ;set floating point mode
```

to

```
SETD    ;set double precision mode
```

and re-assemble & task-build the program as described above.

This time the results after execution should be:

```
_L
002010/ 000001 000002 000003 000004
```

MORE INSTRUCTIONS

A few other FPP instructions and their format follow:

ADDF/ADDD

Meaning: Add floating/double

Syntax: ADDF NUM,F0

Adds the value stored in NUM to the contents of FPP accumulator F0.

The following sample program demonstrates the ADDF instruction. (The assembler directive '.FLT2' defines a two word floating number; the directive '.FLT4' (not shown here) defines a four word floater.)

This program can be used to experiment with the MULF, DIVF, AND SUBF instructions described below, by making the necessary changes.

```
NUM1::  .FLT2  1
NUM2::  .FLT2  2
OUT::   .FLT2  0

F0      =%0             ;DEFINE FLOATING POINT ACCUMULATOR 0

F::     SETF            ;SET FLOATING (SINGLE PRECISION) MODE
        LDF    NUM1,F0  ;GET THE FIRST NUMBER IN ACCUMULATOR 0
        ADDF   NUM2,F0  ;ADD IN THE SECOND NUMBER
        STF    F0,OUT   ;STORE OUT THE RESULT
        BPT             ;STOP SO WE CAN LOOK AROUND

        .END   F
```

SUBF/SUBD

Meaning: Subtract floating/double

Syntax: SUBF NUM,F0

Subtracts NUM from FPP accumulator F0, leaving the result in F0.

MULF/MULD

Meaning: Multiply floating/double

Syntax: MULF #10.,F3

Multiply the contents of accumulator F3 by 10 decimal. Result is stored in F3.

DIVF/DIVD

Meaning: Divide floating/double

Syntax: DIVF #8.,F1

Divide the contents of accumulator F1 by 8. Result is stored in F1.

MOFD/MODD

Meaning: Multiply and integerize floating/double

Syntax: MODF #1,F0

This instruction can be used to separate the integer from the fractional part of a floating point number; which proves to be a very handy way to output floating point numbers.

When the instruction

```
MODF    #1,F0
```

is executed, the floating point number in F0 is multiplied by one (and therefore unchanged), after which the integer part of the number is stored in F1, and the fraction in F0.

Multiplication by 10. can be used to 'strip off' digits after the decimal point (also handy for printing).

LDCDF/LDCFD

Meaning: Load and convert from double to floating or floating to double

Syntax: LDCDF NUM,F0

This instruction works two ways, depending on the mode the FPP is operating in.

In floating (single precision) mode, the source operand is assumed to be double precision and is converted to single precision. The number will be either rounded or truncated (if necessary) depending on the state of the FT (floating truncation) bit in the FPP status register. The various bits in the FPP status register (FPS) can be set or cleared with the LDFPS instruction.

In double precision mode, the source operand is assumed to be a single precision number, and is simply loaded left-justified in the accumulator. The low half of the accumulator is cleared.

STCFD/STCDF

Meaning: Store and convert from floating to double or double to floating

Syntax: STCFD F0,NUM

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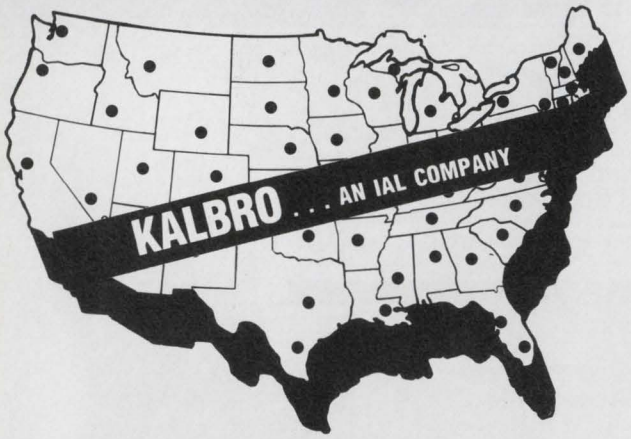

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In single precision mode, the specified accumulator is stored left justified in 'NUM' and the lower half of NUM is cleared.

In double precision mode, the AC is converted to single precision, truncated or rounded depending on the FT bit (described above) and stored in NUM.

LDCIF/LDCID/LDCLF/LDCLD

Meaning: Load and convert from: integer to floating, integer to double, long integer to floating, or long integer to double

Syntax: LDCIF NUM,FO

These instructions are used to convert from either of the integer modes (integer or long integer) to either of the floating point modes (floating or double), depending on the current FPP state. Again, the state of the FPP is controlled with the instructions:

```
SETF    ;set floating (single precision) mode
SETD    ;set double precision mode
```

on the floating end, and the integer side with:

```
SETI    ;set integer mode
SETL    ;set long integer mode
```

The source operand (NUM) is converted and loaded into accumulator FO.

STCFI/STCFL/STCDI/STCDL

Meaning: Store and convert from: floating to integer, floating to long integer, double to integer, double to long integer

Syntax: STCFI FO,NUM

These instructions complement the 4 load instructions above. Data is converted from either of the floating modes to either of the integer modes, depending on the current state of the FPP.

LDEXP

Meaning: Load exponent

Syntax: LDEXP NUM,FO

Load the exponent of the specified accumulator with the data contained in 'NUM'. NUM is converted to excess 128. notation (see the description of INTERNAL FORMAT above for details on excess 128. notation).

STEXP

Meaning: Store exponent

Syntax: STEXP FO,NUM

Stores the exponent of the specified accumulator in NUM and converts it from excess 128. notation to 2's complement.

CLRF/CLRD

Meaning: clear floating/double

Syntax: CLRF NUM

Clears the specified location or accumulator.

TSTF/TSTD

Meaning: Test floating/double

Syntax: TSTF NUM

Sets FPP condition codes depending upon the contents of location 'NUM'.

Note that before the standard BRANCH instructions can be used, the floating point condition codes must be copied to the CPU'S condition codes using the instruction:

```
CFCC
```

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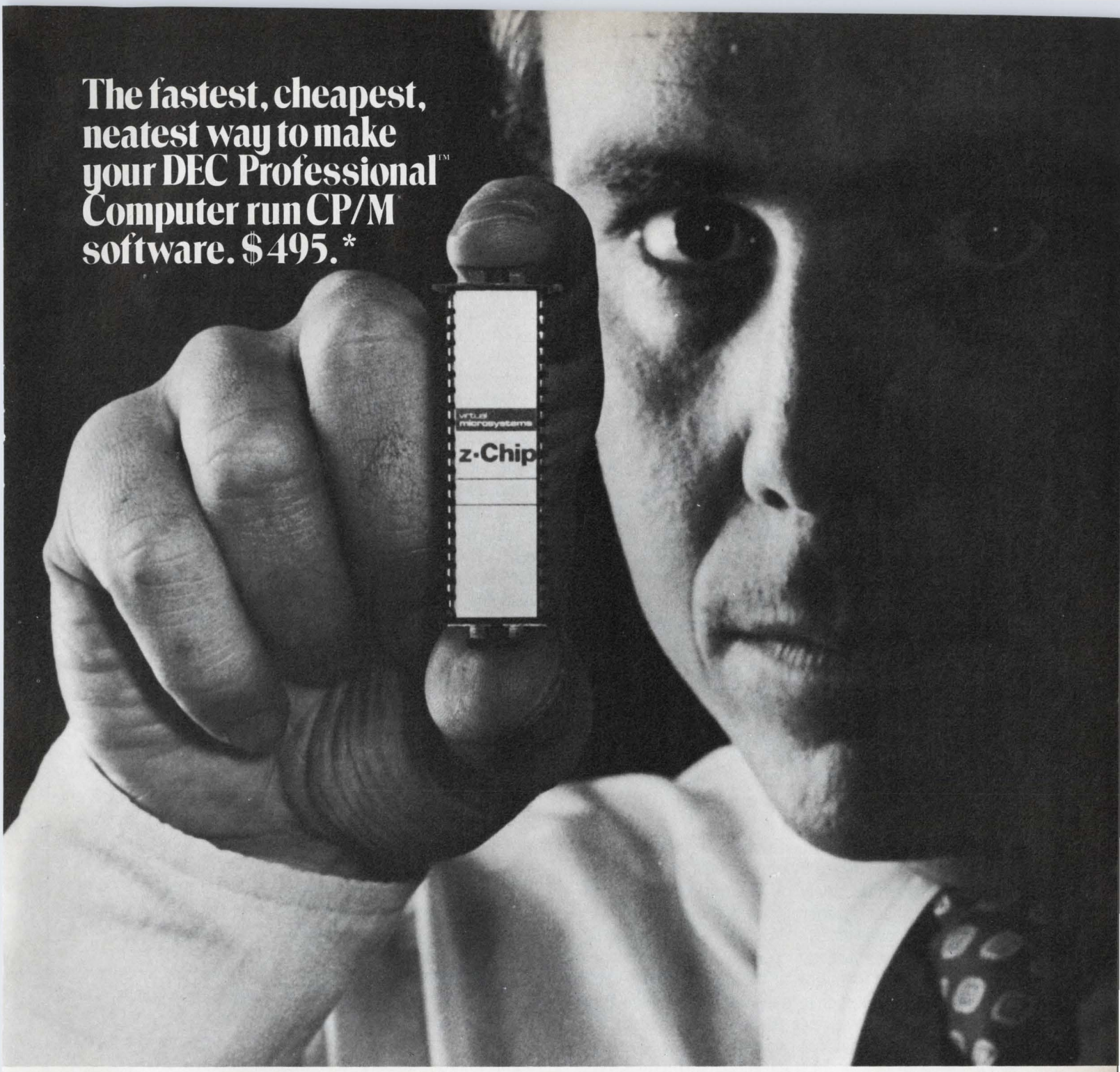

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PortaCalc is similar to many other spreadsheets in that it displays a matrix of cells on a screen (up to 132 columns wide) which map onto a larger number of cells kept in the computer. At each location, there is a number and a formula, either of which may be displayed. Display formats can be chosen from the entire FORTRAN repertoire and individual columns may be set to different widths. Each cell may have a different format for its output, and the default format may also be changed. Unlike some sheets, PortaCalc allows multiple equations in each formula. (You can even comment the equations.) Any cell can refer to a command file which can be used to add user defined functions, using any cells and having 27 accumulators available which can handle integer data, floating point data, or multiple precision data of up to 99 digits width. (You can use a built-in interactive calculator at any point while working on a sheet also, and return to the screen display after, if you need to make further computations outside of sheet context). Maximum sheet size is determined by parameters set at compile time so that it depends solely on memory available. On PDP11 a 40 by 32 sheet is generally used at our site (nobody has needed a larger one yet). On VAX, the size is essentially unlimited. The spread sheet is of course somewhat slower than some commercial ones due to the HOL and the way it computes formulas. However it is usable, and recalculation can be done manually to remove that overhead where it is not needed. The entire sheet can be driven from command files, which are able to prompt the user for terminal inputs, perform conditional tests and looping, and control inputs. There is even interaction with the sheet so that a computation in any cell can be used to control the looping in a command file. There is a data extraction command in the embedded calculator which can query sequential files to dynamically extract numbers or formulas from predefined files which can be created and maintained with normal editors. Thus, PortaCalc is designed to be used with command files as well as from terminals. A knowledgeable user can program PortaCalc for a variety of applications.

PortaCalc is unique in that every cell on the screen can (if desired) become a separate window onto the physical sheet. It is up to the user to determine what should be mapped. A pair of "origin reset" commands act as a fast scrolling operation for contiguous parts of sheets. The mappings set up onto the screen can be used in computation, so that they define a projection onto the physical sheet which can be summed over, averaged, etc.

The PortaCalc sheet as supplied to DECUS presently supports VT100 terminals (with or without AVO), or VT52 terminals. Also there are versions of the UVT100 subroutine (which is the only screen access routine) for Datamedia Elite 1500 terminals and for Datamedia Colorscan 10 terminals. The program is designed to be easy to recustomize for terminals with more than 24 lines also. Versions for RSX11M, RSX11M+, and VMS are easy to generate with supplied command files, and all documentation is machine readable. Also supplied, in the hope it will be helpful, is a document describing known features of the FORTRAN used (FORTRAN IV PLUS) not part of the ANSI 66 standard. It is not complete, but will give a good start to people modifying the package for their own machines.

Due to space limitations, PortaCalc does not have built in graphics. Rather, there is a separate program which reads saved sheets and can produce histograms or scatter plots of any parts of a sheet by name. Since one can save or restore whole or partial sheets, or restore partial sheets to different locations, these save files will normally be made anyway to simplify merging different sheets. The graphics utility can access these files. It, too, is available in source. The current intention is that data base access and word processing may be integrated by this route. The screen can be saved as a normal ASCII file, of course, at any time and that can be easily included in documents.

The following are two pictures generated by PortaCalc of its screen and including the row/column labels. These may be suppressed if they are not wanted. The VT52 type cursor is added in by hand; the VT100 reverse video effect cannot be reproduced this way.

Note that on the VT52, the ">" character indicates the cursor. On a VT100, reverse video is used instead, and the entire cell is shown in reverse mode. The formula of the current cell is always exhibited at the bottom of the screen if any exists.

The documentation supplied is sufficient to use the sheet. However, a calculator from DECUS was used as the computing engine (which made writing the rest a two week job). Its documentation is also included, but not integrated with the documents for the spreadsheet. You'll need to examine both to discover which functions exist and can be used. Full "scientific calculator" functions exist, plus some statistical ones. Financial ones, however, are not (the neces-

```
Demonstration of Appearance of a Typical VT52 Screen
ROW/COL   A= 1                                B= 2       C= 3       D= 4       E= 5
    1> General Priv. Inst. Expansion        100.000    100.000    100.000    100.00
    2> SVC insts expansion                 3000.000    200.000   3000.000    200.00
    3> Interval Timer Service               500.000     25.000    500.000     25.00
    4> Virtual Interval Timer Service       500.000     25.000    500.000     25.00
   21> Virtual Timer Updates/sec             20.000     20.000     20.000     20.00
   22> SVC's per Second                     200.000    200.000    200.000    200.00
   23> Average MIPs of MCF CPU                3.000      3.000      3.000      3.00
   24> Time to init paging                    0.050      0.050      0.050      0.05
   25> Minimum Runtime Quantum                0.100      0.000      0.100      0.00
   26> Total Inst Ovhd Time/Sec               3.158      0.602      0.608      0.09
   27> Total I/O Time                      >  0.390      0.390      0.390      0.39
   28> Total Wait Time                        0.077      0.003      0.077      0.00
   29> Total Time                             3.625      0.995      1.075      0.49
    5> Protected Memory References          500.000     25.000    500.000     25.00
    6> I/O Interrupt Svc.                  2000.000    500.000   2000.000    500.00
    7> I/O Startup Overhead                6000.000   1100.000   6000.000   1100.00
    8> Non-SVC Sensitive Insts              100.000     25.000    100.000     25.00
    9> VMM scheduling ovhd                2.000E+04  1.000E+04  2.000E+04  1.000E+0
   10> Time in Sched Wait Q                    0.010      0.000      0.010      0.00
   11> Device Wait Time                        0.010      0.000      0.010      0.00
  B 27>
B12+B16*(B14+B15+2*B24)
```

FIGURE 1. VT52 Screen, Numeric (default) Display (Note how display has 3 regions: Rows 1-4 Rows 21-29, and Rows 5-11)

```
Demonstration of Appearance of a Typical VT52 Screen
ROW/COL   A= 1                                B= 2       C= 3       D= 4       E= 5
    1> General Priv. Inst. Expansion        100.       100.       100.       100.
    2> SVC insts expansion                  3000.      200.       3000.      200.
    3> Interval Timer Service               500.       25.        500.       25.
    4> Virtual Interval Timer Service       500.       25.        500.       25.
   21> Virtual Timer Updates/sec            20.        20.        20.        20.
   22> SVC's per Second                     200.       200.       200.       200.
   23> Average MIPs of MCF CPU              3.0        3.0        3.0        3.0
   24> Time to init paging                  .05        .05        .05        .05
   25> Minimum Runtime Quantum              .1         0.         .1         0.
   26> Total Inst Ovhd Time/Sec             (B17*B8+B1(C17*C8+C1(D17*D8+D1(E17*E8+
   27> Total I/O Time                       >12+B16*(BC12+C16*(CD12+D16*(DE12+E16*
   28> Total Wait Time                      B11+B13+B1C11+C13+C1D11+D13+D1E11+E13+
   29> Total Time                           B27+B28+B2C27+C28+C2D27+D28+D2E27+E28+
    5> Protected Memory References          500.       25.        500.       25.
    6> I/O Interrupt Svc.                   2000.      500.       2000.      500.
    7> I/O Startup Overhead                 6000.      1100.      6000.      1100.
    8> Non-SVC Sensitive Insts              100.       25.        100.       25.
    9> VMM scheduling ovhd                  20000.     10000.     20000.     10000.
   10> Time in Sched Wait Q                 .01        0.         .01        0.
   11> Device Wait Time                     .01        0.         .01        0.
  B 27>
B12+B16*(B14+B15+2*B24)
```

FIGURE 2. VT52 Screen. Formula Display

sary trick to add them by indirect files is mentioned in the documents though). Also, PortaCalc does not have a lookup function as such. Rather, it gives you a way to treat the entire sheet as a large array and access any of it computably. This is a similar but more general function, since it gives the ability to make two dimensional tables rather than just single dimensional ones.

The PortaCalc program is already in use by DECUS staff internally, and will be available shortly from the library, though its order number has not (as of 2/15/83) yet been assigned. Expected cost for order will be about $140 for the special collection tape containing all code, and possibly around $60 for the single program version which will leave off some extra goodies added to the original submission not related to PortaCalc. Earlier versions will appear on DECUS RSX (and maybe VAX) SIG tapes for Fall '82, but users wanting the full version must order it from DECUS. There are of course NO license restrictions. If you have RSX and desire file security, you may obtain the special collection and use the secure virtual disk package included therein to handle the security needs separately from this package; that driver is included in the special collection tape version of DECUS PortaCalc.

ABSTRACT:

The PortaCalc spreadsheet is a FORTRAN written program able to perform the usual "what if" types of calculations for anyone with a compiler, 31KW of task space (more or less), and (in the present version) an ANSI 3.64 terminal (e.g. VT100). The program is easily recustomized for other terminals and designed for portability and functionality. A data management system interface is built in, permitting spreadsheets to access a potentially unlimited number of files and records or parts of records in those files for user defined functions, numbers, formulas, text, or whatnot. In fact it has many of the attributes of a language.

Three versions are provided, with complete source code for all: a PDP11 version for I/D space machines that builds flat under RSX11M+, an overlaid version for other mapped PDP11's under regular RSX (11M or 11D/IAS), and a version for VAX that builds (flat of course) under VMS. I assume the F77 compiler but the program is in FORTRAN 66 (I use the /NOF77 switch). It is expected only minor changes would be needed for the DEC FORTRAN IV compiler however.

A separate graphics output task is documented in PCG.DOC and provides histograms or scatterplots of any areas of the saved spread sheets with a simple command syntax.

RESTRICTION:

The overlaid version provides only a rather small spreadsheet, though it is large enough to be useful in many applications. There are some overlay tricks I haven't tried to increase the size.

SPECIAL HARDWARE:

The software must be built for the appropriate terminal. Versions of the UVT100 subroutine for VT100, VT52, and Datamedia Elite terminals are supplied, with command files for most combinations. The VT52 version will show what the minimum requirements are for control. Most any terminal can be easily interfaced to the package by editing one of the UVT100 routines to correspond to the terminal's control sequences, provided direct cursor addressing is supported.

BUILD:

There are 4 build files.

COMPIL.COM	Build for VAX/VMS . . . only compiles. Concatenate the objects and link.
MAKE.CMD	Non-overlay I/D space build for RSX11M+ V2 (uses F77 Compiler in non-F77 mode)
OMAKE.CMD	Overlay build. Medium sized overlay, small sheet. For 11M systems, any 11.
SOMAKE.CMD	More compact overlay structure, bigger sheet. OK for any 11, RSX11M/M+.

Note: THERE ARE COMPILER WARNINGS (ABOUT FUNCTION "INDEX") WHICH SHOULD BE IGNORED DURING THE BUILDS.
I ASSUME FORTRAN 77 IS INSTALLED AS . . . F4P.

PRIOR TO BUILD:

You must be sure the final VKLUGPRM.FTN is as you will need it. The PDP11 command files generally copy one of the template versions to this file, but the parameter file may be edited as may any template. The VAX versions of com-

mand files generally assume you know what you have is right. READ the appropriate template.

Supplied templates include:

VVKLUGPRM.FTN	VAX "standard" version for VT100 with or without AVO
BVKLUGPRM.FTN	VAX "big" version for VT100
VVKLUGPR5.FTN	VAX "standard" version for VT52 systems
BVKLUGPRM.FTN	VAX "big" version for VT52 terminal use
MVKLUGPRM.FTN	PDP11 version for RSX11M+ V2 I/D space, VT100
MVKLUGPR5.FTN	PDP11 version for RSX11M+ V2 I/D space, VT52
SVKLUGPRM.FTN	PDP11 version for RSX11M/M+ overlain, VT100
SVKLUGPR5.FTN	PDP11 version for RSX11M/M+ overlain, VT52

Note that several variants of UVT100 exist too. The ones presently included are:

UVT100.FTN (.FOR for VAX)	VT100 control, no Advanced Video Option (AVO) assumed. Many entries are not called by PortaCalc. The ones that are used are: CUP Cursor Position ED Erase Display SGR Set Graphics Rendition EL Erase Line ANSI set ANSI mode (may be nooped)
UVTAVO.FTN	VT100 control with AVO terminal support. Includes only entries needed. Also uses underline to underline alternate rows and will display display-sheet row numbers as well as physical ones.
UVT52.FTN	VT52 control. Since VT52 terminals have no reverse video, draws a ">" character in first col. of cell pointed at to indicate cursor location.
UVTDM.FTN	Datamedia Elite 1500 control. Similar to UVT52 but cursor controls for Datamedia.
UVTCS.FTN	Datamedia Colorscan-10 control. This terminal uses VT100 sequences, but UVTCS will use some of the color setup sequences to create a multicolor spread sheet.

You may easily adapt the UVT100 subroutine from any of these to handle whatever terminal you have using these routines as examples. Note the parameter JVTINC in the VKLUGPRM.FTN which adjusts for the backspace generated by UVT100 on SGR calls needs to be set correctly.

Adapting UVT100 to your terminal and setting up VKLUGPRM.FTN correctly are the necessary setup actions needed prior to compiling and building PortaCalc. You may of course get UVT100 to determine what terminal type is there itself, or use the VMS terminal independent cursor positioning logic, if you wish. On a VAX you may also want to inhibit scrolling. To get PortaCalc to control the PDP11 more efficiently you may also want to SET /SERIAL=TI: under RSX (which will inhibit MCR from grabbing input you want to send to PortaCalc). Remember under VMS to copy the desired file to VKLUGPRM.FTN before compiling.

Ignore compiler/linker errors in RSX or VMS. They are harmless warnings.

WRITEUP:

This is a spreadsheet written in FORTRAN (the only universal assembler) for portability. Its functions are described in the separate document file; it assumes VT100, but the UVT100 routines are the only places the VT100 is actually handled in screen mode, and may be altered for other machines.

The spreadsheet sizes may be defined by editing the parameter file Vklugprm.ftn (caveats and restrictions are listed there). There are 2 sheets — a big physical sheet and a small display sheet which is what's really shown on screen. Sheets may be saved/merged/restored/ linked (via saved files)/printed or hardcopy made onto files. Numerous other functions exist. The thing is built with I/D space here but ought to be able to be overlaid. Specifically, CALC and its routines can be diskbased overlays, and DSPSHT should be able to be another leaf. However this is not tested. You can tailor the size by editing physical sheet size.

WHEN BUILDING PORTACALC, YOU MAY ENCOUNTER FORTRAN WARNINGS ABOUT THE INDEX FUNCTION BEING ASSUMED USER SUPPLIED. IGNORE THESE; THERE IS AN INDEX FUNCTION SUPPLIED HERE, AND THE WARNINGS ARE OF NO CONSEQUENCE, EITHER ON PDP11 OR VAX.

The program has been tried overlaid. However, if you use the module OXQTCMD instead of XQTCMD and OSPREDSHT instead of SPREDSHT, an overlay structure could be used roughly like this:

Root: Spredsht,Index, all commons, UVT100, VARSCN
- Leaf 1: XQTCMD
- Leaf 2: RECALC, CALC, and all subroutines of CALC
- Leaf 3: DSPSHT

The subroutines of Calc may be possible to overlay so that Leaf 2 (which will likely be the largest) can be shrunk. You will want to edit VKLUGPRM.FTN to make a sheet the size you like. If it gets bigger than rather smaller, you will possibly have to use virtual arrays or some other trick. By the next DECUS symposium there may be a better version or one that will work on smaller systems completely defined, but you may be able to fit this on a small system by overlays. On a VAX of course it all builds flat with as large a sheet as you like.

REVISION:

There are 2 ODL files, either of which can build a reduced version when the fortran files are compiled with OVKLUGPRM.FTN renamed to VKLUGPRM.FTN, included. There is a bit of extra space so the parameters in that file can be enlarged somewhat. They use a very overlain FCS and F4P OTS. You may be able to do similar things clustering an FCSRES and a F4PRES together too. However, the overlay versions (made with the OMAKE.CMD file) do work, though more slowly than the I/D space one. This at least gets you something on a machine with only normal 11/34 type resources. I assume the F4P or F77 compiler here for the OTS part. You will need to tailor to other Fortran compilers on PDP11's yourself.

. . . continued on page 115

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CIRCLE D191 ON READER CARD

FROM THE
RT-11 EDITOR

HOW TO USE RT-11 WITH DISKS WITH BAD BLOCKS

By Arthur Edward Groulx, Logicaid Limited, Nepean, Ontario, Canada

All disks or diskettes used in LS1-11 or PDP-11 computers store information in logically discrete units called "blocks." A block consists of a contiguous sequence of 512. characters (or 256. words). The logically discrete units are usually physically discrete on the surface of the recording medium as well, although in some cases (RX01/2 and RL01/2, for example), the logical blocks may be subdivided into smaller physical sectors. In this article, though, we'll talk about blocks as if they were physically contiguous areas of 256. words.

This might surprise some readers, but not all disk packs, disk cartridges and diskettes (hereinafter referred to simply as "disks") used by RT-11 are perfect in the sense that they store all information completely. Most magnetic media, whether purchased from Digital or not, contain slight imperfections on their surfaces which can inhibit the proper storage of data thereon. Usually these imperfect areas appear at random positions on the disk. These imperfect areas are generally referred to as "bad blocks."

A bad block can exist on a disk the day it is born, or can develop over a period of time. Sometimes disks are manufactured which have no bad blocks at time of birth. When you order disks from DEC, you can specify these special disks by ordering part numbers ending in EF (error-free) instead of DC (data cartridge). For example, an RL02EF disk is guaranteed to have no bad blocks when you receive it. An RL02DC disk carries no such guarantee, although it might accidentally have no bad blocks on it. The guarantee increases the cost of the disk, and it does not provide any warranty that the disk will not develop bad blocks at some time in the future. A new bad block can be created simply through age, or, more commonly, by powering down a disk drive while a data transfer is in progress.

When the manufacturer discovers during testing that an RL01/2 or RK06/7 disk was born with bad blocks, that information is stated in machine-readable form on the disk itself. This information is called "Factory Written Bad Sector Information." The information includes the disk serial number and a table of what bad sectors were identified during factory testing. This information is important as far as RT-11 is concerned. We shall refer to the FWBSI (faw-busy) often in this article. The FWBSI normally appears in the last few blocks of the disk.

How to Determine if Your Data Cartridge Has Bad Blocks

The DUP utility of the RT-11 operating system determines whether any disk contains bad blocks. It is invoked by the RT-11 keyboard monitor DIR command. The format of the command is:

```
.DIR/BAD XXn:
```

where XX is the device mnemonic (for example, DL for RL02's) and n is the drive number.

During the execution of this command, DUP attempts to read and write each block on the specified disk. After completing, DUP displays a message stating what bad blocks, if any, were found, and where the bad blocks were located on the disk. If the message is not received, if the message received doesn't make sense (for example, a humungous number of bad blocks), or if RT-11 loops or crashes, recovery procedures as outlined below must be followed.

There are three types of bad blocks detected by DUP. These are "Hard," "Replaced," and "Replaceable." Hard bad blocks are those which are either permanent, or might only be recovered by reformatting the disk (more on formatting later).

Replaced bad blocks can exist on only RL01/2 or RK06/7 disks. These types of media contain a table in block 1 (the so called "home" block) which was created at some previous time. The table contains information required for mapping bad blocks of the disk onto good "replacing" blocks. The replacing blocks in the disk normally reside at the end of the disk in front of the FWBSI and are usually not accessible by RT-11 programs. Each entry in the bad block replacement table in the home block contains two words. The first word is the number of the bad block; the second word is the number of the replacing block. The table ends with a zero. RT-11 does not permit block zero to be a bad block. For RL01's and RL02's the table may have a maximum of 10. entries. The table for RK06's and RK07's may have a maximum of 32. entries. How the replacement table is created will be covered in greater detail later.

Replaceable bad blocks are blocks which DUP deems to be bad but which do not yet have an entry in the bad block replacement table.

Replaced and replaceable bad blocks only occur with RL01/2's and RK06/7's. Hard bad blocks occur with any

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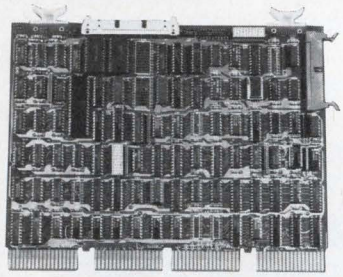

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device that does not support bad block replacement. Such devices are thus any devices other than RL01/2's and RK06/7's. Hard bad blocks may also occur with RK06/7's and the reasons why appear below in the section on how the bad block replacement table is created.

How Bad Block Replacement Works

Another overlay in DUP is used to create the bad block replacement table, via the RT-11 keyboard monitor INIT command. DUP attempts to read and write each block of the disk. If the operation is successful, the block is good. If it isn't the block is bad. If there is room in the bad block replacement table, an entry is ALWAYS created if the device is an RL01/2, and MAY be created if the device is an RK06/7. For the latter device type, the entry is only created if the block was bad because of a bad sector error (BSE) or header vertical redundancy check error (HVRC). Any other error type results in RT-11 deeming the RK06/7 bad block to have a "hard" error. The FWBSI information is merged with the scan information to complete the replacement table. In RT-11 version 4 or later, if there are more bad blocks on the disk than the maximum allowable entries in the bad block replacement table, the user is permitted to specify the subset of the bad blocks which are to be replaced, by responding to prompts after a replacement table overflow warning message. The remaining bad blocks are treated as if the device did not support bad block replacement (see "Getting Rid of Bad Blocks" below). In no case will RT-11 permit initialization of a device containing bad blocks in the "system area". The system area consists of blocks zero through six inclusive, and on bad block replacing devices, the use of a device having more than 128 bad blocks. The actual reason for this last restriction is unknown.

After an RT-11 boot, the first access to each RL01/2 drive causes the bad block table on the disk to be read into memory. Each bad block table is at most 20. words long (a two word entry for each bad block). For systems with the maximum four drives, this means 80 words are allocated in the DL handler for storage of the bad block replacement tables. When the DL handler does a data transfer, it breaks up the transfer into pieces which straddle any bad blocks. For example, suppose a data transfer requests the reading of 40 (octal) blocks starting at block 7000 of drive 2. The DL handler first checks to see if the bad block table for that drive is in memory. If it isn't, it reads it first. Next, after insuring the replacement table is available, let's say it determined that block 7003 was replaced by block 23743, the handler reads three blocks starting at 7000 and ending at 7002, reads block 23743, then reads blocks 7004 through 7037 inclusive. If there were other bad blocks in the interval being read, the intervals would be further subdivided to skip the bad blocks.

The situation is somewhat different with RK06/7 drives. Because the maximum number of entries in the bad block table is 32., this means 32. (thirty-two entries) times 2 (two words per entry) times 8 (eight drives per system) or 512. words of memory would have to be reserved in the DM handler to accommodate all bad block replacement tables simultaneously. When memory in the lower 28Kw is at such a premium, it is simply unrealistic to devote that much memory to a function which might not even be used.

This problem is circumvented using the following technique. If a data transfer on an RK06/7 results in a BSE or HVRC error, the handler THEN checks to see if the bad block replacement table for the offensive device is in memory. If it isn't, the table is then read, possibly destroying any other bad block replacement table which might have been there previously. The bad block is looked up, and the transfer then proceeds as per the RL01/2 case. Consequently, only 80 words of memory need to be reserved for the RK06/7 replacement table. You can now see why bad blocks on an RK06/7 which DO NOT result in a BSE or HVRC error must be called "hard." Such bad blocks cannot trigger the replacement mechanism, and consequently cannot be replaced.

There is a penalty paid for bad block replacement. First, a single data transfer is broken up into two or more data transfers. Second, some extra latency occurs when the bad block table itself must be read into memory. This is particularly apparent in multi-drive RK06/7 configurations if many of the drives contain disks with bad blocks. The handler would be constantly reading the bad block replacement tables over one another. This significantly affects performance in transaction-oriented systems, as the heads in such drives must always return to the outermost cylinder of the disk in order to reread the replacement tables.

One also has to be very careful of switching disks in an

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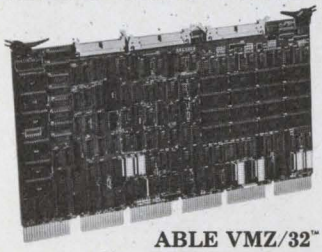

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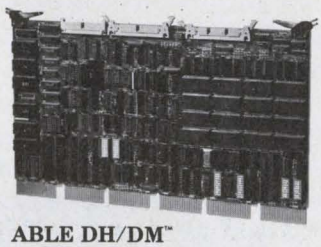

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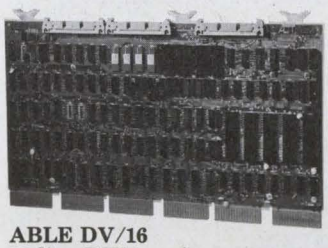

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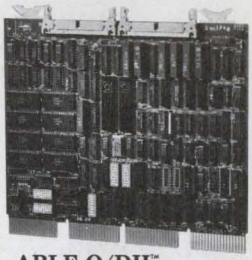

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RL01/2 or RK06/7 drive while the RT-11 system is running, without rebooting the operating system. It is possible to lose data if the system is not rebooted after every disk change. This is because the DL and DM handlers treat the memory resident bad block replacement table as if it belonged to the current disk, instead of the disk from which the bad block replacement table was actually read. The subsequent act of bad block replacing can destroy data on the current disk, by writing data into replacing blocks which are actually mapped to another area of the disk.

All RT-11 utilities which require unloading and reloading of RL01/2 or RK06/7 disks force a reread of the replacement table from the new disk. User programs may also do so by using "special function" programmed requests documented under .SPFUN in the RT-11 Advanced Programmer's Guide.

One wonders, then, whether bad block replacement is actually worth it. Its existence is necessitated by the fact that all files in RT-11 are contiguous, that is, files in RT-11 are comprised of a sequence of adjacent blocks. If there is a bad block in a disk, the size of the largest file on the disk would be the size of the largest disk space on either side of the bad block. It is thus seen how bad blocks restrict file sizes. By making the files LOGICALLY contiguous, at least insofar as straddling bad blocks go, the largest file can still be as big as the size of the disk.

For your convenience, the following table contains information summarizing bad block replacement on RL01/2s and RK06/7s. All block numbers and counts are stated in octal.

	Number of replacing blocks	Block number of first replacing block	Block number of first FWBSI block	Number of FWBSI blocks
RL01	12	23742	23754	14
RL02	12	47742	47754	14
RK06	40	64664	64740	26
RK07	40	150734	151010	26

Getting Rid of Bad Blocks

In order to minimize the number of bad blocks on an RT-11 disk, follow the upcoming prodecure. We will assume that the disk to be initialized contains no valuable data, as we plan to write on every block on the disk. We will assume that you have an RT-11 version 4 or later single job operating system running, with the relevant device handler available on the system disk, and that the RT-11 utilities DUP.SAV and FORMAT.SAV are also present on the RT-11 system disk.

STEP 1: Disk Hygiene

First, don't promote the possibility of creation of bad areas on the disk surfaces by sloppy computer room practices. Make certain fingers are kept off disk surfaces. Do not permit smoking in or around the computer area. Don't power down a drive while a disk transfer is in progress — halt the processor first and then bring down the drive.

Next, get your disks cleaned regularly by a reputable disk cleaning firm. The name of such a firm can be found in your yellow pages under "Data Processing Equipment — Repairs and Maintenance." If you are experiencing intermittent disk input/output errors, the disk may be dirty. Cleaning the disk is the first step to removing bad blocks.

STEP 2: Primary Initialization

This step should be performed on all disks which support bad block replacement. The reason for this step is that if the disk has been used in the past by RSX-11 (another operating system) or by DECX-11 (DEC diagnostics), the bad block replacement table can be corrupted which can cause any other RT-11 procedure to loop or crash. The primary initialization procedure writes a zero in the first word of the home block, indicating that no bad block replacement table is present. The correct RT-11 keyboard monitor command is:

```
.INIT/NOQUERY XXn:
```

(Hereinafter, the device name will be referred to as XX and the drive number as n.) If this operation fails, particularly with the message that there is a bad block in the system area, then either there is indeed a bad block in the system area, or the FWBSI has been accidentally corrupted. To recreate the FWBSI, follow the instructions in Step 5 below now. If there is a bad block in the system area, the disk is unuseable by RT-11 and must be discarded. If the disk is brand new, return it to the manufacturer, as even if the FWBSI is corrupted, it means it was corrupted by the manufacturer. It is the manufacturer's responsibility to give you a valid FWBSI.

STEP 3: Formatting

There are two types of formatting. The first type of formatting is "block header" formatting. Block header formatting is used on the following device types: RX01, RX02, RK05, RK06, RK07, RP02, and RP03. When this type of formatting is performed, information used by the device controller is written into the header of every block.

The second type of formatting is "verification" formatting. It is used for every other type of device not formatted with block header formatting.

The correct RT-11 keyboard monitor command for block header formatting, except for RX02 diskettes being formatted in single density mode is:

```
.FORMAT/NOQUERY/VERIFY/PATTERN:1 XXn:
```

The correct RT-11 keyboard monitor command for block header formatting on RX02 diskettes being formatted in single density mode is:

```
.FORMAT/NOQUERY/VERIFY/PATTERN:1/SINGLEDENSITY DYn:
```

The correct RT-11 keyboard monitor command for verification formatting is:

```
.FORMAT/NOQUERY/VERITY:ONLY/PATTERN:1 XXn:
```

The format command will report information found in the FWBSI (if there is one) as well as other bad blocks not found in that table. All formatting using a PATTERN value

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of 1, leaves the disk with a verification pattern of zeroes, meaning the disk contains all zeroes. This is exactly what is needed so that no further bad block replacement is attempted. Other values of the PATTERN parameter give different results. They should not be used for disk initialization.

STEP 4: Final Initialization

Final initialization creates the bad block replacement table (on disks that support that feature) and the initial RT-11 directory.

The correct RT-11 keyboard monitor command for devices that support bad block replacement is:

```
.INIT/REPLACE/NOQUERY XXn:
```

The correct RT-11 keyboard monitor command for devices that do not support bad block replacement is:

```
.INIT/BAD/NOQUERY XXn:
```

For the latter type of devices, and RK06/7's with hard bad blocks, RT-11 will allocate files over the bad block areas. These files have the name "FILE .BAD" (spaces intentional). These files are very difficult to access using most RT-11 keyboard monitor commands. Some RT-11 commands recognize this special name, particularly the SQUEEZE command which squeezes files "around" the .BAD files, as well as not moving the .BAD files during the squeezing.

If RT-11 reports that there is a bad block in the system area and the device is therefore unuseable, if the device is an RL01/2 or RK06/7, then it may still be possible to recover the disk using Step 5. Otherwise, the disk is actually unuseable and must be discarded.

STEP 5: Recreating FWBSI

The RT-11 directory system and constraints in the handler prevent normal RT-11 programs from both reading from and writing into the FWBSI. It is still possible to do so, accidentally, from user-written programs. Corrupting the FWBSI results in an inability to initialize the disk even if the disk actually has no bad blocks.

A MACRO-11 program has been provided at the end of this article which permits FWBSI creation in a rather superficial form. It assumes that there are (were) no factory-detectable bad blocks on the disk, and sets up the FWBSI as if that were the case. It therefore relies totally on the DUP program for correct detection of the bad blocks on the disk and their inclusion in the bad block replacement table.

The program also recreates the disk serial number. The serial number of the disk can be found on a small sticker on the bottom of the disk pack after the base has been removed and before insertion into the drive. The serial number consists of at most ten OCTAL digits. The serial number appears as the first part of the FWBSI. We don't know of any RT-11 programs which make use of the serial number, so if the sticker has been removed, don't worry. The utility will give the disk the serial number 7777777777.

For RK06/7's, the FWBSI also contains a flag indicating whether or not the disk is an alignment cartridge. The FWBSI program sets the flag as if the disk is NOT an alignment cartridge, so please don't use the program on your alignment cartridges. Alignment cartridges are normally red in colour.

After creating the program, called FWBSI.MAC, using your favorite editor, assemble it using the RT-11 keyboard monitor command

```
.MAC FWBSI
```

and create a program module using the RT-11 keyboard monitor command

```
.LINK FWBSI
```

In order to use the program, enter the RT-11 keyboard monitor command

```
.R FWBSI
```

FWBSI is used like any other RT-11 utility. In response to the prompting asterisk, enter the name of the device and drive, followed by a /H and /L switch or switches with values

```
*XXn:/H:00567/L:43210
```


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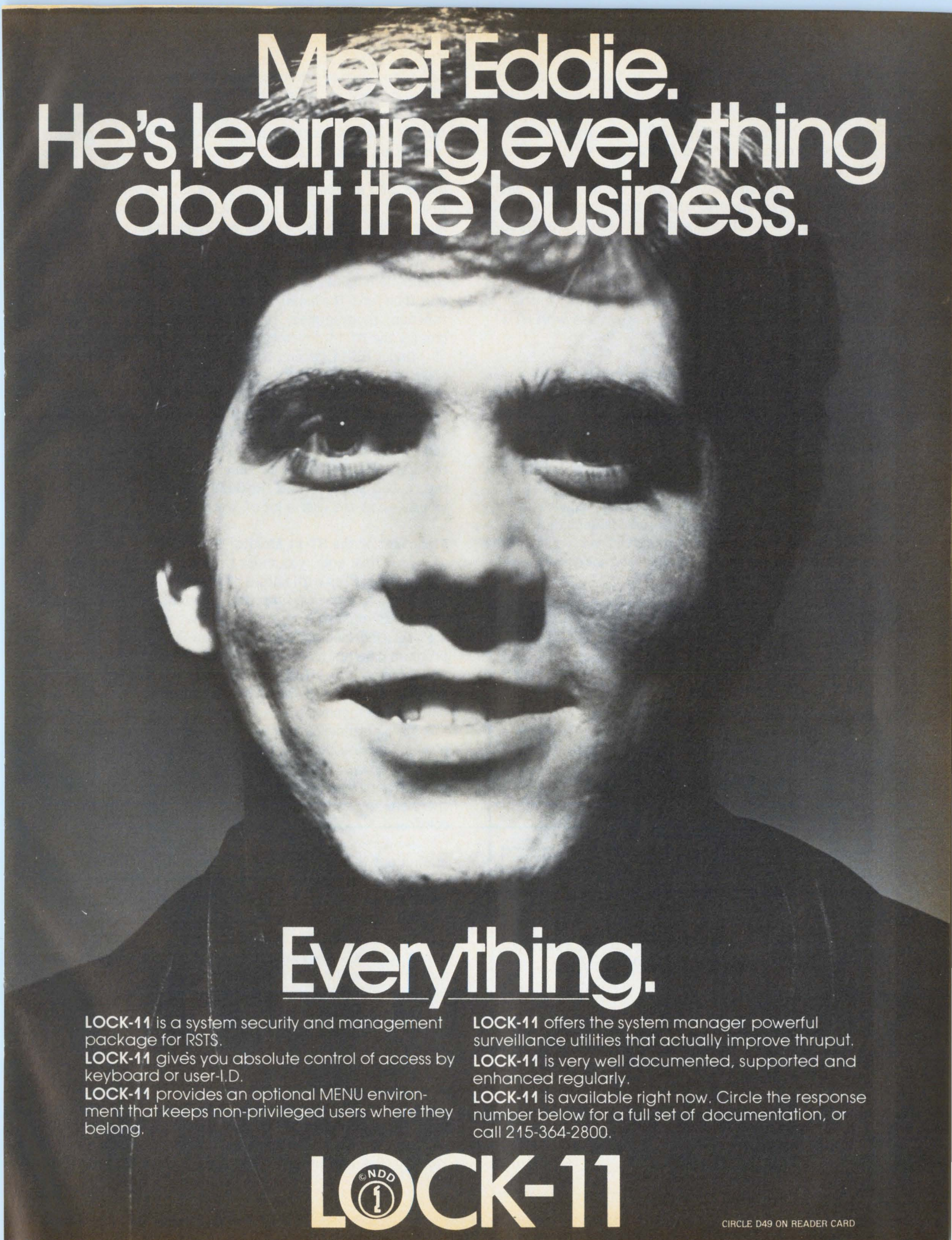
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The value of the H switch is the five high-order octal digits of the serial number. The value of the L switch is the low-order octal digits of the serial number. If either switch is omitted, the program assigns 77777 as the five related digits. The above example would produce a serial number of 56743210.

Various error messages might be generated which should be self-explanatory. Insure that the device is not write-protected. FWBSI works only with RL01/2 or RK06/7 disks. If you make a mistake and don't create the source file FWBSI.MAC correctly, it will tell you immediately when FWBSI is first run.

After running this step, start again at Step 1 in order to initialize your RL01/2 or RK06/7 disk for use with RT-11.

User-Written Disk Handlers

If you are planning to write a device handler for a new disk type, you might consider including bad block replacement. If you do so, under RT-11 version 4 you must also provide a utility to take the place of DUP in initialization of the disks.

Your utility must read and write every block of the disk to insure that it is not bad. The RT-11 .SPFUN (special function) programmed requests are used to do this without paying any attention to the bad block replacement table which might already be on the disk. If you are clever, you can time the reading and writing of each block so that some are skipped during each of a precalculated number of passes, so that the next block you want to access is under the read/write heads just when you want to access it. Some experimentation will be necessary in order to determine the optimal number of blocks to skip during each pass. You might also consider attempting to read or write only large quantities of blocks, and accessing block by block only when a large access fails, indicating one or more bad blocks inside the last large access. Both techniques will considerably improve initialization elapsed times.

After determining the contents of the bad block replacement table, your program must write it into block one, then force the handler to reread it using another special function programmed request. Finally, your program creates the RT-11 directory structure on the disk.

Under RT-11 version 5, it is possible to patch the DUP program to make that program aware of the user-specified device which supports bad block replacement. The patch is described in Chapter 2 of the RT-11 Version 5 Installation Guide. This patch informs the DUP program of the device code of the new device, and also whether all bad blocks are replaced (RL01/2 style) or only those bad blocks which return bad sector errors (RK06/7 style). This facility obviously saves the user a lot of work.

Placement of the RT-11 Monitor Files

As a final note, you must be careful where the RT-11 monitor files (files with names of the form RT-11xx.SYS) are placed on any device supporting bad block replacement. These files must NOT be placed so that any of their blocks are replacing blocks. Because of size limitations, the boot program does not have enough intelligence to put bad block replacement into effect during the boot process. Consequently, booting will fail in the attempt to read the bad block in the monitor file.

To determine if the monitor files straddle any bad blocks, first use the RT-11 keyboard monitor command

```
.DIR/BAD XXn:
```

to determine the physical locations of the bad blocks. If there are any bad blocks, use the RT-11 keyboard monitor command

```
.DIR/POS XXn:RT11*.SYS
```

to find out if any of these bad blocks occur in the RT-11 monitor files. If they do, you must move the monitor files to another area of the disk using the RT-11 keyboard monitor copy command

```
.COP/SYS XXn:RT11*.SYS SSn:*.XYZ
```

where XYZ is a file extension not used elsewhere on the disk. Then use the RT-11 keyboard monitor RENAME command to use up the area containing the bad blocks:

```
.RENAME/SYS XXn:RT11*.SYS XXn:*.NDG
```

and use a similar command again to recover the monitor files

```
.RENAME/SYS XXn(*.XYZ *.SYS)
```

Of course, if the new monitor files straddle bad blocks, you must repeat the above process (using suitable file extensions). You must also insure that future uses of the RT-11 keyboard monitor SQUEEZE command do not move the monitor files into an area where they again straddle bad blocks.

. . . continued on page 137

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RSX-11M TO RSX-11M-PLUS MIGRATION

By Allen A. Watson
Manager, System Technology
Bergen Evening Record, Hackensack, NJ
(Reprinted from Computers-R-Digital, Volume 4, Issue 12)

1.0 REASONS FOR GOING TO M-PLUS

1.1 Shadow Disk

Our main reason for migrating from RSX-11M to RSX-11M-PLUS was the added capability of what is called "shadow disk." We have been, and still are, developing several large applications that will be handling volatile and sensitive data: an advertising accounts receivable package, and a display advertising layout package. Some of it, such as the ad layout data, is critical to the daily production of the newspaper.

In the newspaper computing world we have a saying: "THERE IS NO TOMORROW." In most computing applications in the event of disaster it is possible, although not desirable, to do it tomorrow. Getting out payroll a day late may be expensive, it may cause a lot of discontent, but in the worst case it can be done. Producing Tuesday's newspaper on Wednesday, however, simply cannot be done. For a newspaper, there is no "tomorrow." For applications involved in the production of the paper, therefore, data backup is imperative, and recovery in case of disaster, such as a head crash, must be nearly instantaneous. Typically, in newspaper applications, five minutes is considered a maximum recovery time. It may be nice in movies about newspapers to have someone screaming "Stop the press!", but in real life stopping the press is about the last thing you ever want to do. To stop the press because the computer has lost data necessary to the production of the next pages would cost so much that you could buy a complete secondary computer with the money. In fact, almost every paper I am familiar with has totally redundant computer hardware for just that reason.

What we needed was dual recording of critical data on two identical disk packs, so that if a head crash occurred, all that would be necessary to recover would be to boot up from the second disk. That is what "shadow recording" is. A complete, up-to-the-second, mirror image copy of your disk is maintained on another disk mounted on another drive.

We briefly considered a transaction log type of system, where any updates to files would be logged onto a disk or a mag tape. This required a lot of support software: each application would have to handle its transaction logging, programs would have to be written to recover from transaction loss and periodically purge them, and so on. Any new appli-

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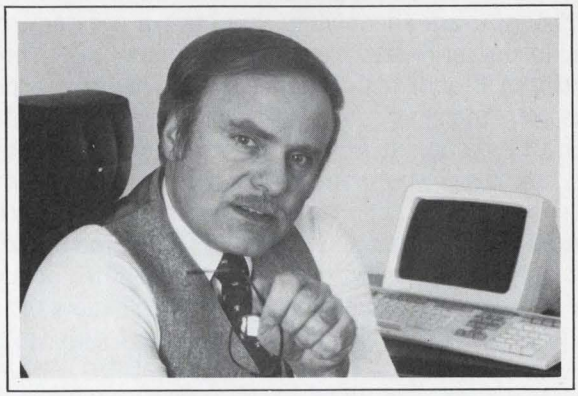

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cation would have to include support of transaction logging, making all the applications larger. We rejected this approach in favor of M-PLUS and shadow disk because shadow disk is transparent to the application and requires no additional code. A nice side benefit of shadow disk from the viewpoint of operations is that it eliminates the need to copy the disk you are shadowing; you have a constant, on-line copy. In our brief experience with shadow disk, we have found that it adds little overhead to the system, especially when you funnel the shadow disk through a separate controller using a unique ACP. Remember, however, that if you have four disks you want to shadow, you will need eight disk drives! If the ability to recover from a head crash in five minutes instead of an hour, or much more (you know what it would take at your site), is worth the price of another drive, you should consider using M-PLUS shadow disk.

At THE RECORD we have experimented with combining the virtual disk package from the RSX SIG tapes with shadow disk. This allows us to designate selected sets of files that have been assigned to virtual disks which are located on several disk drives, for shadowing on a comparable set of virtual disks that have been located on a single "shadow" drive. We have limited the files to be shadowed to the critical few instead of duplicating entire disk packs, and have been able to reduce the number of drives needed to shadow those files.

M-PLUS supports overlapped seeks for disk. This feature allows multiple disk units attached to a single controller to perform seeks (head movement) simultaneously, although only one data transfer can occur at any one time. Most advanced disk controllers support this feature, as ours do. Since we anticipated an operations environment where up to eight drives might be accessed through a single controller, it seemed to us that overlapped seeks would be a considerable help to disk throughput. In our current operations we rarely have more than two drives operating through a single controller, and in most cases we are operating on just one drive, so we have no concrete data yet on savings through overlapped seeks.

1.3 Supervisor Mode Libraries

Available only on 11/70's and 11/44's under M-PLUS, supervisor mode libraries are resident libraries that double a user task's virtual address space by mapping the instruction space of the processor's supervisor mode. That was a near quote from the Executive Reference Manual. For those of you haven't yet learned to speak DEC, let me give a rough translation. A task or program under RSX-11M is only allowed to have 32K (roughly 32,000) words of memory to run in because the hardware can't count any higher than that. Supervisor mode is like a second counter, allowing another 32K locations to be used. For a little memory overhead in your program and some run time overhead when your program has to switch modes to get at the stuff in the supervisor mode library, you can double your program size.

That was important to us because we are converting a number of programs from an IBM 370 with virtual memory to run on our 11/70. Most of them were just too big to run without overlaying and breaking them up into subtasks, with the attendant overhead in increased execution time. Supervisor mode libraries give us the ability to build bigger tasks. In addition, many of the DEC utilities can be built using a supervisor mode library for File Control Services (FCS). That makes those commonly used programs smaller, and for the larger ones that require a lot of overlaying under RSX-11M, allows DEC to reduce the overlaying, thus reducing the number of overlay calls from disk. In summary, the utilities are smaller and run faster. The option of building FCSFSL utilities is offered during SYSGEN, and I advise you to take it.

1.4 Secondary Pool

Under RSX-11M we had frequent system crashes when we ran out of pool. For you new users, "pool" is a space in the executive used by the system as a work area to contain data structures such as system lists, control blocks, and I/O packets. Every file that is open has a file control block in pool each installed task has a task control block; active tasks have task headers in pool; each terminal has a user control block, and so on. There's a lot of stuff in pool and only a limited space in the exec. When it fills up, the system crashes.

How many of you RSX users have experienced that problem? Before M-PLUS we tried lots of tricks to get more pool or to keep from crashing. We installed the Pool Monitor Task from the SIG tapes; we put in patches from Jim Downward at KMS Fusion that allowed us to run with fewer tasks installed; we put in a patch to the terminal database to reduce the number of SCB's for terminals. Each thing helped a little, then we'd run out of pool again as the load increased.

Under M-PLUS we have yet to come close to running out of pool space. One of the main reasons is secondary pool. Secondary pool is a memory partition that is outside of the executive, and it can be as large as you want. M-PLUS uses it for more permanent or less frequently used data structures, and thus frees up that space in primary pool. Task headers, for example, go there, so under M-PLUS there is almost no limit to the number of tasks you can install. We have a pool problem under M; no longer. We come up with over 11,000 words of primary pool. We'll run out of memory long before we run out of pool. PMT seems almost superfluous under M-PLUS. But we can (and will) buy more memory! You could never buy more pool.

1.5 Directive Common

Directive Common is another way you get more pool space. Some of the executive directives are moved into a common partition thus freeing up more space in the exec.

I.6 Multi-User Tasks

Our system has lots of users. We anticipate having up to 52 terminals on a single 11/70. That many users can fill up memory with tasks awfully fast. M-PLUS allows the building of multi-user tasks, in which a single copy of read-only portions of a task is shared by many users. Even on our development system, the multi-user versions of EDT and PIP have helped reduce checkpointing in the system. We are making some of our application tasks multi-user also.

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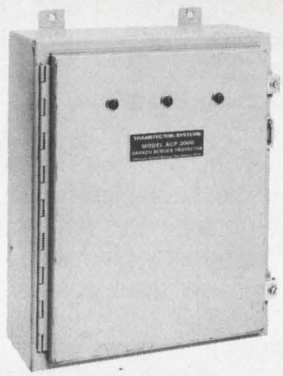

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1.7 Multistream Batch Processing

We wanted batch processing so that users could schedule long, time-consuming tasks to be done in off hours. Batch allows you to do this. In effect you submit a command file to the queue manager just like a print job: SUBMIT MY JOB/AFTER:17:00. Also, when development gets really heavy we can ask users to submit jobs to batch streams rather than running them directly, thus limiting the number of simultaneous compiles and task builds.

1.8 Task and User Accounting Capability

We expect our system to overload before long even under M-PLUS. When that happens we will be able to use the resource accounting facility to determine which tasks are overloading the system, and with what kind of activity: CPU, disk, QIO's, etc. It is possible that we may develop a charge-back system to our user departments.

2.0 TRANSITION PROCESS FROM M TO M+

I would say we had a rough transition, but largely because of two factors. First, we elected to migrate at exactly the time DEC was discontinuing version 1.0 and starting on version 2.0. For several months we couldn't get either version from them. Finally they delivered version 1.0; about six weeks later we got version 2.0. We had barely adjusted to version 1.0! Second, we had all non-DEC disks and disk controllers. It's very hard to SYSGEN a system when you can't run any of your disks on it. We ran our version 1.0 GEN from our RSX-11M 3.2 system, and then GEN'ed our version 2.0 using the version 1.0 system. Before starting the GEN, we had to modify SAVE, the DB driver, other utilities and the SYSGEN command files to compensate for our foreign controllers. It was frustrating because we spent weeks debugging code for the disk sub-system without being able to see the new system at all. We read the manuals and dreamed great dreams; meanwhile we couldn't even boot the thing. If I were back buying our system in the first place, I would include at least one standard DEC disk system for doing SYSGEN's if for no other reason.

One nice thing is that DEC had included very clear instructions on how to GEN a version 2.0 system from a version 1.0 base — just what we needed. They even have a special command file for doing it, letting you build the 2.0 versions of MAC, TKB and IND that you need for the GEN on your version 1.0 system. We did it and it works. In general the version 2.0 SYSGEN manual is much clearer, and the SYSGEN procedure is much simpler than any I have done before. Autoconfigure is a new thing DEC has added that eliminates the messiest part of SYSGEN: specifying CSR's and vectors for all your hardware. autoconfigure just goes out there, probes around the system to figure out what hardware is attached, and generates all that stuff for you. It then allows you to examine and edit the results in case it goofed or left out something it couldn't recognize. If you have a system put together by DEC with mostly DEC hardware, use autoconfigure; or if you know your CSR'S and vectors meet their standards, use it. Our CSR's and vectors are definitely non-standard even for the DEC gear (the system was put together by an OEM), and we found it more convenient not to use autoconfigure, so I can't say how it works.

3.0 PROBLEMS ENCOUNTERED IN SYSGEN

3.1 Bugs in Building the Executive

The command file SGNBE.CMD has a bug in it that DEC knows about. When the exec finishes task building the command file attempts to wait for the cross-reference to complete with the statement:

```
.IFINS CRF... .WAIT CRF...
```

For some reason this causes an error message saying 'SPAWN FAILURE' and the SYSGEN command file aborts. The only thing that fails is the indirect command file. The task build of RSX11M has worked fine. All you really need to do is make sure CRF has finished and continue with the GEN. I checked SGNBE.CMD, and the only remaining executable line was "TKB @DRIVERS". So I typed that in directly, waiting for it to complete, and then re-started the SYSGEN at the next phase after "Build the Executive and Drivers." Worked fine. You could modify GNBE.CMD (see note on SYSGEN command files below under "Hints from our Experience") by commenting out the line at fault and replacing it with a ".PAUSE". When it pauses, just check active tasks. If CRF . . . is not active, then resume. DEC software support suggested removing CRF . . . before starting the build of the exec, but that seemed counterproductive to me. This bug occurs only when building a 2.0 system from a 1.0 system, so you may not see it.

3.2 Getting Correct Versions of Non-Privileged Tasks

Pay close attention to the note on page 3-63 of the SYSGEN manual. If you make any changes to the task build files to select options on some of the non-privileged tasks, and you fail to move them from [1,54] to [3,54] after they are built, you won't get your tailored versions of those non-privileged tasks when you bring up the system. The versions of those tasks from the distribution tape are in [3,54]. The versions you build, for some reason, go into [1,54]. When SYSGEN creates SYSVMR.CMD file, it specifically installs non-privileged tasks from [3,54] so you get the DEC originals, not the ones with the options you so carefully chose. DEC should build non-privileged tasks into [3,54] if that's where they expect them to be, and I have complained to that effect in an SPR.

4.0 HELPING THE USERS ADJUST

Some of these things probably apply equally well to new users of RSX-11M version 4.0. In general the transition for the users of our system was painless, but not without some effort ahead of time and behind the scenes.

4.1 Getting Used to Digital Command Language

For someone coming to M-PLUS from M version 3.2, DCL is something new. We elected to put in DCL as the primary command line interpreter (CLI) and to modify the task build file (see below) to select the option to allow any unrecognized commands to fall through to MCR. If you don't do that, any user of DCL is going to be extremely annoyed when typing PIP fileA = fileB/RE elicits an "UNRECOGNIZED COMMAND" message. You can't get directly at anything through DCL, not even PIP, unless you enable the fall-through-to-MCR option in the task build. Overall falling

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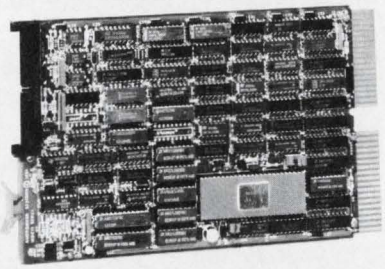

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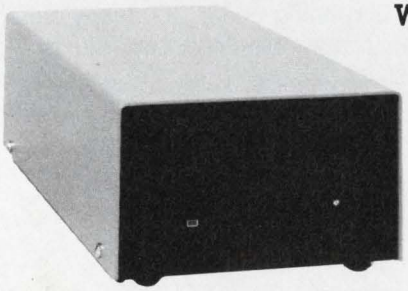

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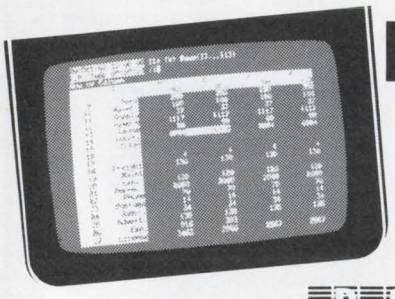

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through to MCR works fine; people used to MCR just go on using it as they always did and never know DCL is there until they get around to reading the new manuals. Almost. There are a few problem spots where MCR and DCL use the same command, as in SET, MOU, MAC, FOR, and INS. A user enters a familiar command like "MAC FILE=FILE" and is given the error message:

```
MACRO — Extraneous input
MAC FILE=FILE
```

That's DCL complaining, because its syntax is different. Simply alert your users that if familiar commands don't work, they should try them with a dot in front of them. For example ".MAC FILE=FILE" will work just fine. The dot tells DCL to schlep the command off to MCR without even looking at it. If they're going to do a lot of that sort of thing, they can set their terminals to MCR as primary CLI with set terminal MCR. In general, SET TERMINAL MCR and SET /DCL=TI: should be the first two new commands you teach your users if DCL is in your system.

4.2 Command File Execution

If a terminal is running under DCL many old command files won't work if they use MCR commands like "MAC FILE,FILE/-SP=FILE" because "MACRO" is a DCL command expecting DCL syntax. I happen to like DCL, so what I do is put this into my command files:

```
.setf DCL
.if <CLI> = "DCL" .sett DCL
.IFT DCL SET TERM MCR
        |
        |
contents of old command file
        |
        |
.ift DCL SET /DCL=TI:
```

That could be more generalized if you plan on multiple CLI's:

```
.SETT MCR
.ENABLE SUBSTITUTION
.SETS CLI <CLI> ! Save starting CLI !
.if CLI NE "MCR" .setf MCR
.iff MCR MCR SET /MCR=TI: !Assumes MCR command in all CLIs!
        |
        |
.iff MCR SET /'CLI'=TI: ! Restore starting CLI !
```

4.3 Hints to KMS CCL Users

We still use CCL. It works fine. We have three command line interpreters: DCL, MCR, and CCL. DCL comes first; any unrecognized commands fall through to MCR; finally, CCL is installed as CA. (catch-all) to handle anything MCR does not know. All I did was rebuild CCL.TSK on the new system, and since CCL is not privileged, even that was probably unnecessary. None of the Jim Downward patches to system routines were made; most of them exist in MPLUS as distributed. One Downward patch to MCR we miss was the one that forced it to pass everything to CCL (instead of kicking out things like "?" and "LI"). When we want to add a new command it is still ever so much easier to edit two or three lines into SYSCCL.CCL than to master the complex syntax required to build a DCL command table entry, edit the file, assemble it, and double task build DCL!

The /CMD parameter to RUN is not exactly like the old KMS /PRM parameter: it expects the task name in the first

four characters. In other words, it clobbers the first four characters you pass. You must say:

```
RUN $MAC/CMD="MAC FILE=FILE"     instead of
RUN $MAC/PRM="FILE=FILE"
```

The CMD parameter does not exist for INSTALL, as PRM did in the KMS mods. One strange annoyance is that you cannot pass parameters to an installed task from the RUN command using CMD; to use RUN/CMD the task must be non-installed.

4.4 New Introduction Manual

"The Introduction To RSX-11M-PLUS" book and the accompanying files in [200,1] are a great training aid for new users. I did find some of the examples in the book did not work; some files used in the text were missing, but were easy to provide. Mostly they were one-line text files used to illustrate several commands like TYPE and PRINT. Nothing major was missing. I suggest you run through the book yourself before handing it to a new user, and fix the things that don't work. Even your old hands should work through this because they will learn DCL and other stuff they probably never knew or have forgotten (e.g., EDT line edit mode for people who always use keypad). One outright error: the manual says the EDT command "T LAST" types the last line of a file; in fact it types the last line referenced. The command should be "T END-1".

4.5 Queue Manager and Error Logger

The Queue Manager and Error Logger commands have changed entirely from anything you ever knew. God knows they needed it, but be warned and spend some time looking through the documentation before turning the system loose on your users. You may want to write some memos to frequent users and computer operations personnel, or hold some retraining classes. At least alert them to the excellent HELP files and how to find them.

If you have any command files that are used to make error report generation easier, throw them out. They'll be useless. Be prepared to rewrite and to find that it is easier this time. I wrote a file called ERRORS.CMD for our operators to use (it will be in [333,100] on the SIG tape) that walks them through most of the options. The canned report option for the error log REPORT GENERATOR did not work. You are supposed to be able to enter:

```
RPT /RE:DAY
```

to get a full summary report on all today's errors, for example. It bombs. My ERRORS.CMD file could not make use of this switch, unfortunately. I have SPR'ed this; DEC, however, can not reproduce the problem.

5.0 HINTS FROM OUR EXPERIENCE

5.1 Multi-Path Access to Disks

Setting up procedures for proper handling of dual-ported disks, disks that in addition are accessible from two

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or three CPU's simultaneously, was very complex. We have three CPU's, three controllers, and six drives. The disks are each connected to two of the three controllers, and all three controllers are connected to all three CPU's. There are two paths to each disk from each CPU.

M-PLUS allows you to specify disk drives as dual-ported. Since that is what we have physically, it seemed to make sense to tell the software about it. It took us weeks to find out all the things that could go wrong. We found no actual bugs in the software, just mass confusion for us as users.

One rule of thumb: DON'T LIE TO THE SYSTEM. If you SAY there are two paths to a disk there damn well better BE two paths. You see, we have this nice switch panel that can put individual ports on a controller offline . . . Well, if the second path for DB2: is switched offline, and you try to MOUNT DB2:, mount will time out. If you're booting from DB2:, tasks will start getting load failures in STARTUP right after CON ONLINE ALL is executed (more on the CON tasks below).

We also found (with CDC drives and SI controllers) that dismounting a pack on one CPU could knock it offline for another CPU as well. We had one CPU booted from DB5:. A user on a second CPU mounted DB5:/NOWRITE (that's a new switch on MOUNT that is very useful), and when he was done, he dismounted DB5: like a good user should. Bang! Down went the first CPU. For some reason, even though our drives look like RP04's to RSX, the dismount command is trying to unload the disk! And for some reason the disk seems to recognize it even though it can't be unloaded from software (could be a hardware bug). We finally discovered that, to be safe, we should mount disks with a new switch, /LOCK=N, which sets the default for dismount to "no unload." That way users don't have to remember to use DMO DBn:/LOCK=N. We set up a MOUNT.CMD command file and have everyone use it to mount a disk so the right switches are always used.

Another switch useful in multi-path situation is /LRU=0. Whenever we mount a disk /NOWRITE we also add /LRU=0, which instructs RSX not to cache directories in memory but to always read from the disk. That may sound inefficient, but when we mount a disk /NOWRITE it is usually because it is mounted for writing from another system. Directories can get strangely out of sync when one system is writing to a directory and another thinks it has the directory cached in memory! What we really need is a mechanism that COMPLETELY PREVENTS a disk being mounted for writing from two systems at once. We have done that, of course, and the result is hundreds of multi-allocated blocks as each system blithely writes using its own copy of the bitmap of free blocks. One useless disk and lots of grouchy users. We are currently working on some mods to MOU and SAV to accomplish this.

5.2 CON, the System Reconfiguration Task

The System Reconfiguration task is both an enormous boon and a colossal pain. This task enables you to place devices in your configuration either on or offline by software command: CONFIGURE OFFLINE DBO:, for example. You can also display and even change CSR's and vectors! This affords great flexibility, but there is a whole new command set to learn.

The pain comes from what I said above: DON'T LIE TO THE SYSTEM. RSX-11M users are used to being able to do peculiar things like spinning down one disk and spinning up another in its place without dismounting it from the system. M-PLUS won't let you do that; the minute you touch the button it dismounts the drive automatically. This particular protection is, I suppose, good. But sometimes I want to lie to the system! Like when I blow a home block on an otherwise good disk and want to recover its files. I've kept a Version 3.2 pack around just so I can play that game.

A related difference is the fact that under M-PLUS any access to mag tape requires that the tape be mounted. To initialize a tape you can't just allocate yourself the drive and initialize; you allocate it, MOUNT it /FOREIGN, and then initialize. Same with BRU and other utilities that used to access unmounted tapes and disks under RSX-11M. No more. You have to MOUNT /FOREIGN.

In general M-PLUS forces you to be more careful about what you do with the hardware and to tell the system using CON before you do it. If you are going to switch an access path to disk offline, we first must CON it OFFLINE. Makes sense, but at first it creates strange situations for someone used to M.

5.3 Task Build Options

Before building non-privileged tasks, I recommend you search through all xxxBLD.BLD files in [1,20] for all the GBLPAT and GBLDEF lines to see for yourself what options you have in task building the various utilities. These are command files used by SYSGEN to create xxxBLD.CMD files in [1,24] for the related task builds. For example, PIPBLD.BLD contains switches to select options for PIP.

There is a point where SYSGEN pauses after creating the command files in [1,24] and asks if you want to edit any of them, and you could wait until then and then do your editing. However, if you re-run SYSGEN for any reason, you'll have to repeat the editing. In addition, you can, if you wish, build three versions of many utilities, one regular (overlaid), one using FCSRES, and one using FCSFSL. Then you have to edit three command files in [1,24]. If you edit the xxxBLD.BLD files in [1,20] before starting the non-privileged task part of SYSGEN, then your options will automatically be included in all three versions every time you do a GEN.

5.3.1 PIP — For example, PIP is advertised as having the option to preserve creation date on copies, but nowhere does it tell you that you must edit a global in the PIPBLD.BLD to obtain this option.

5.3.2. INDIRECT — The Indirect Command processor also has nifty options. For example, you can have it default to the system UIC (or another you designate) if the command file is not found in the user's UIC; once again however, you must edit the Build file to get this. IND is now called ICM just to confuse you.

5.3.3 DCL — DCL has a couple of options, most useful of which is allowing unrecognized commands to fall through to MCR. Edit [1,20]DCLBLD.BLD to get it.

5.3.4 Other tasks with options — Tasks I found having build file options:

DMP	CMP	AT.	LPP	MAC	PIP	PRT
QCL	QMG	RMD	SHA	TKB	ACN	BYE
HEL	LBR	RPT	SAV	DCL		

6.0 MISCELLANEOUS COMMENTS

The ability to broadcast to users by name is nifty: finds them even on multiple terminals. The sample DIR reports for Resource Accounting are excellent tools for producing your own customized reports. All of the accounting records are now accessible through Datatrieve.

In general, MPLUS is easier to manage for an unsophisticated user because it translates more of what you need to know into human-readable form. Be aware that under M-PLUS a task named "...XXX" NEVER RUNS; it is a prototype task only. When TTO runs it by saying "XXX", it gets a task called "XXXTO". If you have any command files that try to do ".WAIT ...XXX" they will no longer work. Such tasks are not intended for multi-terminal use and should be installed with task names not in the form "...XXX".

SIG programs we build under MPLUS (versions on SIG tape): SRD (multiuser, non-overlaid), TECO, UIC, LIST, GREP, COOKIE, RNO, DOC, DUNGEON, C(SCC), PREDAY, TYPE (renamed TIPE), TREK, TCF, BRUDIR, SRDCMD (CMD), ADVENT, RMC, LUT, USERMN, TRUNC, RATFOR, PACMAN. Most require no modification, only a few require other than minor mods to the build files. The HELP files on version 2.0 are fantastic, in some cases more accurate than the manuals. I wrote three TECO macros, HDX, HFL, EDH, and TEH (all with both TES and TEC extensions), to help me step through all of them and index what is there. See [333,100] on the current RSX tape. (The text of this article — possibly with updates after 15-OCT-82 — will be there too as M2MPTALK.DOC.)

[Editor's Note: The Sig Tape that Al refers to is that produced by the RSX SIG at the most recent DECUS Symposium, Fall 1982 (Anaheim)]

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- C ☐ *Unibus (11/24, 11/44, 11/70, 11/34, 11/40)
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- E ☐ *10 or 20
- F ☐ Non-DEC* _____ (specify)

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A B C D

USING A RESIDENT LIBRARY FOR COMMUNICATION BETWEEN JOBS

By Robert Grund, Street Software Technology

INTRODUCTION

Prior to the introduction of resident libraries, communication between jobs was typically performed by means of disk I/O or 'send/receive' sys calls or pseudo keyboards. All of these methods are inherently inefficient. Furthermore, a job which employs any of these methods might stall for an unpredictable amount of time until system resources become available.

With the introduction of resident libraries. It is possible to implement a send/receive protocol which is both efficient and which does not require the sender to wait for system resources such as small buffers, 'FIP' or disk. Furthermore, the sender and receivers are not required to wait for each other. The time period in which a receiver reads a message can overlap the time period during which the sender writes a new message.

DESIGN OVERVIEW

A resident library is used to construct a message queue. Only one job, the sender, has write access to the queue. One or more receivers have read only access to the queue. A protocol is needed to coordinate access to the queue. The protocol described here has the following properties:

1. The sender is allowed to execute independent of the receivers. A receiver will not stall the sender.
2. The receivers will only stall while waiting for a new message. A receiver will not stall another receiver.
3. The average rate at which a receiver extracts messages must not be less than the average rate at which the sender produces messages. Otherwise, the receiver will lose messages.

The BASIC PLUS 2 common statement is used to structure the message queue as an array. Successive messages are stored in consecutive rows in the array. Each row of the array consists of two parts. The first part is a sequence number which is increased by one for each message stored in the buffer. The second part contains the message. Once the queue becomes full, the next message is placed in the first row destroying any data which was there. In effect what we have is a race where the receivers chase the sender around a circle. The receivers are not allowed to overtake the sender. The sender is allowed to overtake a receiver in which case the receiver will lose data.

SENDER IMPLEMENTATION

```
1000    COM (MSGQUEUE) QSEQ(155%) , QDATA1(155%) , QDATA2(155%)
2000    QSEQ = 0.0      ! INITIAL SEQUENCE NUMBER VALUE
        \ QSIZE = 156.  ! QUEUE SIZE
                        .
                        .
                        .
5000    T% = FNQUEUEMSG( 10. , 20. )                              &
        ! QUEUE THE MESSAGE '10. , 20.' IN QDATA1() , QDATA2()
                        .
                        .
                        .
20000   DEF* FNQUEUEMSG( QDATA1 , QDATA2)                         &
        !&
        !&
        !&
        ! QUEUE A MESSAGE                                         &
        !&
        !&
        !&
        !
20010   QSEQ = QSEQ + 1.0                                         &
        ! MESSAGE SEQUENCE NUMBER                                 &
        \ L% = QSEQ - (INT(QSEQ/QSIZE)*QSIZE)                     &
        ! L% IS QUFUE LOCATION WHERE MESSAGED IS PLACED
20020   QSEQ(L%) = 0.0                                            &
        ! A NEW MESSAGE IS BEING PLACED IN QUEUE LOCATION L%      &
        \ QDATA1(L%) = QDATA1                                     &
        \ QDATA2(L%) = QDATA2
20030   QSEQ(L%) = QSEQ                                           &
        ! A NEW MESSAGE HAS BEEN PLACED IN QUEUE LOCATION L%
20040   FNQUEUEMSG = QSEQ                                         &
        \ FNEND
```

RECEIVER IMPLEMENTATION

```
1000    COM (MSGQUEUE) QSEQ(155%) , QDATA1(155%) , QDATA2(155%)
2000    QSEQ = 1.0      ! INITIAL VALUE OF SEQUENCE NUMBER        &
        \ QSIZE = 156.  ! QUEUE SIZE
                        .
                        .
                        .
5000    T% = FNGETMSG                                             &
        ! GET A MESSAGE IN QDATA1()  AND QDATA2()
                        .
                        .
                        .
20000   DEF* FNGETMSG                                             &
        !&
        !&
        !&
        ! GET A MESSAGE                                          &
        !&
        !&
        !&
        !
21010   L% = QSEQ - (INT(QSEQ/QSIZE)*QSIZE)                       &
        ! L% IS LOCATION OF MESSAGE IN QUEUE
21020   O.QSEQ = QSEQ(L%)                                         &
        \ IF O.QSEQ < QSEQ THEN                                   &
                SLEEP 1%                                          &
                \ GOTO 21020                                      &
                ! LOOP UNTIL A NEW MESSAGE IS AVAILABLE
21030   QDATA1 = QDATA1(L%)                                       &
        \ QDATA2 = QDATA2(L%)                                     &
        ! EXTRACT MESSAGE
21035   IF O.QSEQ <> Q.SEQ(L%) THEN                               &
                SLEEP 1%                                          &
                \ GOTO 21020                                      &
                ! DATA LOST! SORRY! TRY AGAIN!
21040   QSEQ = O.QSEQ + 1.                                        &
        \ FNGETMSG = QSEQ                                         &
        \ FNEND
```

CONCLUSION

The implementation described above was motivated by an application which computes yields for government securities from real-time prices. The prices are embedded in messages which are transmitted to the computer over a 2400 baud simplex line. The prices are extracted from the messages by a complex parser. The prices and the corresponding yields are stored in a data base which is accessible to a variety of display and/or computational programs. The first attempt at a solution used disk to store the data base. This turned out to be infeasible on a heavily loaded system. From time to time the program got 'stuck' in a long disk queue which resulted in loss of data from the 2400 baud simplex line. The second attempt at a solution used the resident library protocol described above. This turned out to be a feasible solution. Data loss has been almost eliminated. Furthermore, CPU usage was reduced and disk I/O was eliminated. This in turn caused a noticeable improvement in the overall response time of the system.

PORTACALC

. . . continued from page 92

NOTE:

If you get this program working on a non-PDP11, non-VAX, the author would appreciate a (machine readable) copy of the modified version.

BUGS:

The functions here are mostly tested, but some bugs may remain. FORTRAN formats are used and any format entered will be used. If you put something in that FORTRAN can't understand, you lose. Conversely, you can use things like O or Z formats for octal/hex or whatever you like. Formats A and L by themselves mean "display the formula itself"; anything else means "display the number." On entering numbers, any formula containing the characters ".","[","+", or "-" is treated as a numeric; anything else is treated as a formula. The DF command can fix this up if it's not what you want. Note too that the multi-argument functions:

SUM[args]	Sum
MAX[args]	Maximum
MIN[args]	Minimum
AVG[args]	Average
STD[args]	Standard Deviation

and the statement

IF[v1.RL.v2]true-statement|false-statement

must appear at the start of a formula or formula substatement (substatements are delimited by \ characters) and the value goes into the current variable cell (which is universally named P## if you want something location independent). It's a good idea to include an else statement in IFs since something gets put in otherwise.

PART 2 . . . in next issue.

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CIRCLE D192 ON READER CARD

THE ELEMENTS OF SOFTWARE SUPPORT: THE SOFTNESS OF SOFTWARE

By John M. Gram, Data Processing Design, Inc., Placentia, CA

In the last issue I began a series on supporting software products. To be perfectly honest, committing my ideas (and ideals) to print frightens me. My fear lies primarily in the gap that exists between what can be done in supporting software and my ability (or inability) to make it happen. I'm sure this is a common apprehension. In some cases, corporate restraints can also limit your accomplishments. But even if you were a superhuman with the greatest ability, too many difficulties would creep into your best efforts. Do not be discouraged. These efforts must be made, regardless of what impact company policies, or politics, may have upon them. Effort should be made to begin a dialogue, to encourage a vision for better products and education in their use, to make clearer appropriate roles for both client and vendor. While the difficult support issues are dealt with every day, the impossible ones take just a little longer. My hope is that this series will influence you to join me in attacking the problems related to the support of software.

As we begin this series we must consider the nature of the product and its means of distribution. Software has been appropriately named. It seems to be intangible, yet its value is without question. References to software are becoming commonplace. Even Sony has begun to market a laser disk for audio play, referring to the music on the "records" as software. Yet if you try to explain what software is to someone unfamiliar with computing you'll be amazed at how difficult it is. You might think that anything of value, something nearly intangible, must certainly be complicated to support. Or is it?

For years software was given away by manufacturers of computers. In the earlier days of computing no one would have bought a computer for its programmable potential. The relative expense and rarity of computers called for an up-and-running product. Software is, after all, necessary to make the mass of steel and silicone function. And yet, little software was available other than a basic operating system, a few utilities, and perhaps a FORTRAN compiler. As computers continue their migration from laboratories and research centers into everyday businesses, the demand that computers be adequately equipped with software increases. However, the software will not come without cost. Nor will the software cost be hidden in the hardware profit. As the demand for more sophisticated software increased, so did the demand for more powerful hardware to run it on. The increase in technological advances led to specialization and the division of hardware and software products. This attitude in the marketplace opened up new opportunties for companies specializing in software.

Digital has always seemed most interested in providing hardware. Typically, they rely on their distributors to add value to the hardware they sell. The added value is application software. This does not mean that Digital does not provide software; they do. However, their primary business is selling machines. And, for the most part, the software they provide is made up of operating systems, utilities and languages. Specific applications are largely left to independent distributors. As computers are becoming more commonplace, the quality and sophistication of software products continues to increase naturally through competitive marketing.

Manufacturers have begun to "unbundle" software from the purchase of equipment and purchase of the operating system. Some manufacturers even lease software (without option to purchase). Salaries of computer related professionals have soared, and the willingness to share software without cost has faded. Even the courts (and franchise tax boards) recognize software as a real product. As these trends began to develop, software houses began to flourish. Custom programming began to give way to quality packages, making the price of programming more affordable.

Equipment continues to become less expensive (in relation to capability) while in-house programming of software continues to increase in cost because of the manpower required and the salaries commanded. As smaller computers become more powerful and can handle larger programs and more data, the possibility of off-the-shelf packages that also meet specific requirements will dominate. Nevertheless, continuing requirements for operator training, on-screen instruction, readable documentation and access to support centers will be required.

Because software is easily sent through the mail, UPS, or overnight couriers, the temptation to change it regularly is appealing. From the perspective of the user, the ease of completely updating software leaves little excuse for errors existing in software for any extended period of time. After all, many representatives at user sites are experienced in maintaining programs — that's their job. In a matter of minutes they can detect failing software, analyze the origin of the problem, correct the error and place the new software into service. No words can capture the frustration these people feel when they lack source code for vendor provided software. And, unfortunately, solutions to problems cannot be provided by the vendor as quickly as an in-house effort for a home-grown product.

Dealing with customers who also sell and maintain software products can be exasperating. Especially difficult

is the discussion with those claiming that their software is more complicated than yours and they are called upon to provide immediate fixes. In some environments, such as manufacturing systems, immediate response is necessary. However, most vendors of such software will reluctantly admit that this type of software costs much more. The initial startup costs have been bundled into the cost of the software. And, maintenance costs are usually higher. No, it is never impossible to solve a software problem. By throwing enough money and effort at a problem it can be overcome. But everyone involved must evaluate the costs and ask themselves honestly how much they are willing to pay for what they require. In general, if all costs and trade-offs were known, less demand for site-specific changes of software would occur.

The Payoff of Software Support.

There are very tangible benefits to vendors who provide quality software support. The primary long term payoff is survival. Legitimate businesses that intend to stay in business must establish standards that they intend to live by. Why is quality support worthwhile? Several good reasons that should encourage software houses to emphasize a high level of support are: it promotes a better product, it creates a reputation that will sell new products to existing customers , it provides good references for new customers, it allows financial growth, and instills good customer relations.

Hopefully you're committed to the concept that support is necessary and desirable; there are definite payoffs. But how does a vendor finance the support effort? Actually, there are several methods. The most important consideration is to remember that some cost can be eliminated by anticipating and budgeting product support. By committing to support a product during the product planning stages you reduce more extreme costs involved in excessive patches and data recovery. Prevention is much less expensive than cure. Fighting fires is very expensive; it often means physically visiting the customer sight, and the expense of phone calls (both voice and dial-up). There are hidden costs in not supporting a product. Don't be deceived. While the costs may be difficult or impossible to calculate, they are very real and very great! If expenses must be incurred, why not spend them in planning and providing support before product release rather than afterwards.

Secondly, I think that vendors can (and should) include training costs in the maintenance cost of their products. At my company, we charge an annual fee for the support of our products. It's not an uncommon thing to do. In that support fee we include some training. This is beneficial because the educational process eliminates a lot of the need to fight fires. Training promotes more than a knowledge of the product; it also energizes those using the product to more imaginatively expand its use. Training can also encourage everyday users to read the documentation. Very often, users do not acquire the habit of reading documentation. Training does not substitute for judicious use of manuals, but it does eliminate much of the fear and provides instruction in their proper use. Well trained users reduce the liability in supporting a software product.

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For small software companies, costs can be reduced by using the same people for both initial training and the support effort. There may be times when this method strains the available resources — but it does provide an affordable beginning. And it has several benefits. To begin with, by sharing the on-site training and in-office telephone support responsibilities, you reduce the amount of traveling required by your staff. Additionally, your staff gains insight by performing these complementing responsibilities. Invaluable feedback about what to cover in future training sessions can eliminate support problems. While this method works well in early stages for smaller companies, it may make sense to separate them later as funding allows.

Another way to finance a support staff from humble beginnings is to sell your product through distributors and require them to provide training and support. We have distributors for our products world-wide. This has paid off in many ways. The agent who sells the product is responsible for the installation, the training and the support followup. We couldn't sell our software in some places without the distributor. While this is not necessary for all sales, customers often feel more secure when a representative is located near them. At times, more adequate training and support can be provided through a distributor in distant areas (especially in other countries). For some, this proximity is not a major consideration. In fact, some customers prefer to deal directly with a supplier rather than worry about coordinating through a third party.

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CIRCLE D213 ON READER CARD

There are drawbacks to distributor programs. Vendors must scrutinize potential distributors to insure that they will invest a reasonable amount of their "profit" into staff for supporting the product. A written agreement between the producer and the distributor is indispensable. There must be some avenue for checking up on the quality of service being provided. The aim should be for the distributor to furnish the same level of support or better than that which you offer. However, there should be some recourse if the distributor decides not to support the product. After all, support means more then just making the sale, it also means following through after the sale. Distributors do offer the distinct advantage of cutting down on the actual amount of financial commitment a vendor must make to develop a support staff — but careful selection of distributors is advised.

As for the consumer. Your consideration as a recipient of support is much less complicated, but no less important. Consideration for the customer often means support versus no support. You must realize that there are alternatives to support from the supplier. In many areas of the country freelance services are available for on site training. Local distributors will often perform some of the services. However, as with most things, there are trade-offs. For the most part, freelance services are not guaranteed. You get what you pay for, and you have no way of knowing what you'll really get beforehand. Then, too, the time honored users' group can benefit your staff greatly. Users' groups are handy, since they are located in your general area, but having employees attend sessions means time out of the office. And while you may consider this a worthwhile trade for production time, be aware that many users' groups are little more than company sanctioned gripe sessions. Your best alternative is the local distributor for the software. He has a direct responsibility to the supplier, and his own reputation, if he plans to stay in business. Again, you must decide if the trade-offs are worthwhile. The distributor's fees may be lower, and of course he is local, but he may also end his support by the supplier. In short, this means that you will receive little, if any, information about updates and new products from the supplier.

Conclusions.

Software is a business that can take advantage of the low cost of the distribution media. It really costs very little to provide a magnetic tape with updated software. However, the expense to develop enhancements, provide adequate testing, and prepare for distribution is substantial. Once it's completed, the incremental costs of providing that to customers is small. As vendors, let's take advantage of it. We'll sell more products and make happier customers. We must communicate to the users the advantages of sharing the costs of maintenance and enhancements; they must see that paying annual maintenance support insures a future for the product they've already bought.

In the next issue we will discuss planning and preparing for the support of a software product.

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☐ **DACHE 11M** is a memory disc block cache which increases system performance up to 70%. File access is visibly faster with the transparent action of the "in memory" block cache.

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PERFORMING MAGIC FOR RSX USERS

☐ **WIZ DISC 11M** is a software package allowing main system memory to be used as a solid state disc. Instantaneous access to files and overlayed programs located in the memory disc guarantees a dramatic increase in system performance.

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CLEVER SOLUTIONS TO TROUBLING PROBLEMS FOR RSX USERS.

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RELIEF FOR THE RSX SYSTEMS MANAGER

☐ **ACCOUNTS 11M** allows for the accurate recording of resource demands placed on a system and resource billing with individual report generation. Each account record, includes information on processor time, terminal session time, memory utilization and disc transfers. System managers can easily control costs as well as limit the use of system resources.

ICE 11m

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☐ An enhanced **ANSI-74 COBOL COMPILER** and runtime system with supporting programs. It offers unbelievable speed, compactness and special features at a price that is truly remarkable. **TIME-SHARING** COBOL is now available. **RJ-11 COBOL** runs on RT-11, TSX-PLUS, and RSTS/E operating systems. . . RSX and VMS coming soon.

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CIRCLE D67 ON READER CARD

MAPGRF

By Kelly Felkins, Police Data Systems, Dublin, CA

The MAPGRF program examines a map created by the task builder and generates a graph of that task. The graph consists of one column for each segment of the task, with the starting position and length of each program section and module relative to the total addressing space. The graph is similar to the drawings found in the Task Bulder manual, but contains much more information.

You may wonder how this graph is useful considering that all of this information is already available in the map file. There are several reasons. First of all, it is hard to visualize the structure of a task even though you may be familiar with task builder maps. Except for the section in the beginning that shows the overlay segments, the task builder map is simply data, not graphic. Also, the lines which describe sections and modules are not in order of increasing or decreasing addresses. The ODL file gives some idea of overlay structure, but references to libraries and other ODL files can cause confusion.

The graph can aid in overlay design. By displaying overlay segments in graph form, errors in ODL files are easily found. Deciding how to overlay, or finding modules to clean up in a task that exceeds memory is easier because the graph shows this information relative to the address space.

The MAPGRF program will run as is or can be compiled/TSK. To run the program, first make sure the map you want to graph is available. Then type:

RUN MAPGRF

The program responds with:

Enter MAP file name?

Enter the name of the map file to graph. The default extension is MAP. The program continues with:

Enter memory increment?

This is the number of bytes to use for each line of the graph. The larger the number the smaller and less detailed the graph. A good number to start with is 256. The program continues with:

W[ide] or N[arrow] terminal <N>?

Enter W for 132 column terminals or N for 80 column terminals.

At this point the program starts processing the map file. The name of each segment is printed as it is processed. When all segments have been processed, the program starts printing the graph. The graph is printed in sections that can be taped together for full effect.

This program works only on RSTS 7.2 but originally was developed on 7.1. For version 7.2, the taskbuilder map file format was changed from RMS sequential variable to RSTS terminal format files. Some other minor changes were made to the map file.

CIRCLE D207 ON READER CARD

```
$ ! MAPGRF.TXT 1/10/83 Kelly D. Felkins
BASIC

READY

OLD MAPGRF

READY

LIST
MAPGRF        13:55         10-Jan-83
1       !************************************************************ &
        !                                                            &
        !       MAPGRF.B2S                                           &
        !       Kelly D. Felkins        12/5/82                      &
        !                                                            &
        !       This program produces a graphic representation of a map &
        ! produced by the task builder.                              &
        !                                                            &
        !************************************************************ &

2       ON ERROR GOTO 19000                                          &

800     MAP (IN) IN.LINE$=57            ! RECORD INPUT FROM MAP FILE &
\       MAP (IN) IN.SECTION$=6, FILL$=24, IN.BASE$=6, FILL$=1,       &
                 IN.SIZE$=6, FILL$=8, IN.MODULE$=6                   &
\       MAP (IN) IN.SEGMENT$=8                                       &

810     MAP (WRK) WRK.RECORD$=14        ! RECORD IN WORK FILE        &
\       MAP (WRK) WRK.MODULE$=6, WRK.MODULE.FLAG$=1,                 &
                  WRK.SECTION.FLAG$=1, WRK.SECTION$=6                &
\       MAP (WRK) WRK.SEGMENT.BASE%, WRK.SEGMENT.TOP%, WRK.SEGMENT$=6 &

900     DIM #1, WRK$(128,1024)=14                                    &

1000    !************************************************************ &
        !                                                            &
        !       M A I N   C O D E                                    &
        !                                                            &
        !************************************************************ &

1010    ! INITIALIZATION ********************************************** &
        IN% = 2%                                                     &

1020    OPEN "MAPGRF.TMP" FOR OUTPUT AS FILE 1%, RECORDSIZE 520%*12% &

1030    LINPUT "Enter MAP file name";F$                              &
\       F$ = F$+".MAP" UNLESS INSTR(1%,F$,".")                       &
\       OPEN F$ FOR INPUT AS FILE IN%                                &

1040    INPUT "Enter memory increment";MEMORY.STEP%                  &
\       INPUT "W[ide] or N[arrow] terminal <N>";T$                   &
\       T$ = "N" UNLESS LEN(T$)                                      &
\       T$ = "N" IF T$<>"N" AND T$<>"W"                              &
\       COLUMNS% = 4% IF T$="N"                                      &
\       COLUMNS% = 8% IF T$="W"                                      &

2000    ! SEARCH FOR SEGMENT ***************************************** &
        INPUT LINE #IN%, IN.LINE$                                    &
\       INPUT LINE #IN%, IN.LINE$       ! SKIP OVER PAGE BREAK       &
                FOR I%=1% TO 5%                                      &
                IF IN.LINE$=FF                                       &
\       GOTO 2000 IF IN.SEGMENT$<>      ! SEARCH FOR SEGMENT START   &
                "*** Root" AND IN.SEGMENT$<>"*** Segm"               &

2010    ! PROCESS SEGMENT ******************************************** &
        GOTO 2020 IF SEGMENT%=0%                                     &
\       WRK.RECORD$ = WRK$(SEGMENT%,0%)                              &
\       WRK.SEGMENT.BASE% = SEGMENT.BASE%                            &
\       WRK.SEGMENT.TOP% = SEGMENT.TOP%                              &
\       WRK$(SEGMENT%,0%) = WRK.RECORD$                              &

2020    SEGMENT% = SEGMENT%+1%                                       &
\       SEGMENT.BASE%, SEGMENT.TOP% = 0%                             &
\       WRK.RECORD$ = ""                                             &
\       WRK$(SEGMENT%,I%) = WRK.RECORD$ ! INIT SEGMENT IN WRK FILE   &
                FOR I%=65536./MEMORY.STEP% TO 0% STEP -1%            &
\       WRK.SEGMENT.BASE%, WRK.SEGMENT.TOP% = 0%                     &
\       WRK.SEGMENT$ = MID$(IN.LINE$,INSTR(1%,IN.LINE$,":")+2%,6%)   &
\       WRK$(SEGMENT%,0%) = WRK.RECORD$ ! SAVE SEGMENT NAME          &
\       PRINT "Processing segment: ";WRK.SEGMENT$                    &
\       LINPUT #IN%, IN.LINE$           ! SKIP TO "SECTION" AREA     &
                FOR I%=1% TO 10%                                     &

2100    ! PROCESS "SECTION" SECTION ********************************** &
        INPUT LINE #IN%, IN.LINE$                                    &
\       INPUT LINE #IN%, IN.LINE$       ! SKIP OVER PAGE BREAK       &
                FOR I%=1% TO 5%                                      &
                IF IN.LINE$=FF                                       &
\       GOTO 2010                       ! STUMBLED ON TO A NEW SEGMENT &
                 IF IN.SEGMENT$="*** Root" OR IN.SEGMENT$="*** Segm" &
\       GOTO 2000 IF IN.LINE$=CR+LF     ! END OF "SECTION" SECTION   &

2110    SIZE = FNOCTDEC(IN.SIZE$)                                    &
\       GOTO 2100 UNLESS FNMOD(SIZE,MEMORY.STEP%)>0.                 &
\       BASE = FNOCTDEC(IN.BASE$)                                    &
\       BASE% = FNMOD(BASE,MEMORY.STEP%)                             &
\       TOP% = FNMOD(BASE+SIZE,MEMORY.STEP%)                         &
```


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CIRCLE D105 ON READER CARD

```
                                    ! LOAD TOP ADDRESS                  &
\       SEGMENT.BASE% = BASE% IF BASE%<SEGMENT.BASE% OR                 &
              SEGMENT.BASE%=0% UNLESS BASE%=0%                          &
\       SEGMENT.TOP% = TOP% IF SEGMENT.TOP%<TOP%                        &

2120    GOTO 2150 IF IN.SECTION$=""     ! LOOKING FOR A SECTION         &
\       FOR I%=BASE% TO TOP%-1%                                         &
\         WRK.RECORD$ = WRK$(SEGMENT%,I%)                               &

2130      WRK.SECTION$ = IN.SECTION$                                    &
              IF I%=BASE%                                               &
\         IF WRK.SECTION.FLAG$="" THEN                                  &
            WRK.SECTION.FLAG$ = "!"                                     &
          ELSE WRK.SECTION.FLAG$ = "*"                                  &

2140      WRK$(SEGMENT%,I%) = WRK.RECORD$                               &
\       NEXT I%                                                         &
\       GOTO 2100                       ! DO NEXT SECTION               &

2150    FOR I%=BASE% TO TOP%-1%         ! MUST BE A MODULE              &
\         WRK.RECORD$ = WRK$(SEGMENT%,I%)                               &

2160      WRK.MODULE$ = RIGHT$("      "+TRM$(IN.MODULE$),               &
              LEN(TRM$(IN.MODULE$)))                                    &
              IF I%=BASE%                                               &
\         IF WRK.MODULE.FLAG$="" THEN                                   &
            WRK.MODULE.FLAG$ = ":"                                      &
          ELSE WRK.MODULE.FLAG$ = "*"                                   &

2170      WRK$(SEGMENT%,I%) = WRK.RECORD$                               &
\       NEXT I%                                                         &
\       GOTO 2100                       ! DO NEXT MODULE                &

3000    ! PRINT THE REPORT ********************************************* &
        START.COLUMN% = 1%                                              &
\       END.COLUMN% = COLUMNS%                                          &
\       GOTO 3020                                                       &

3010    START.COLUMN% = END.COLUMN%+1%                                  &
\       END.COLUMN% = START.COLUMN%+COLUMNS%-1%                         &

3020    END.COLUMN% = SEGMENT% IF SEGMENT%<END.COLUMN%                  &
\       BASE%, TOP% = 0%                                                &
\       PRINT FF                                                        &
\       PRINT "       ";                                                &
\       FOR I%=START.COLUMN% TO END.COLUMN%                             &
\         WRK.RECORD$ = WRK$(I%,0%)                                     &
\         BASE% = WRK.SEGMENT.BASE% IF WRK.SEGMENT.BASE%<BASE% OR       &
              BASE%=0% UNLESS WRK.SEGMENT.BASE%=0%                      &
\         TOP% = WRK.SEGMENT.TOP% IF WRK.SEGMENT.TOP%>TOP%              &
\         PRINT USING "====''CCCCC====  ",TRM$(WRK.SEGMENT$);            &
\       NEXT I%                                                         &
\       PRINT                                                           &

3030    FOR I=BASE% TO TOP%                                             &
\         U$ = FORMAT$(I*MEMORY.STEP%,"#####  ")                        &
\         U$ = U$+WRK$(J%,I)+"  "                                       &
              FOR J%=START.COLUMN% TO END.COLUMN%                       &
\         PRINT TRM$(U$)                                                &
\       NEXT I                                                          &
\       GOTO 32000 IF END.COLUMN%=SEGMENT%                              &
\       GOTO 3010                                                       &

15000   !************************************************************ &
        !                                                             &
        !       F U N C T I O N S                                     &
        !                                                             &
        !************************************************************ &

15100   DEF FNOCTDEC (OC$)              ! CONVERT OCTAL STRING TO DECI- &
                                        ! MAL NUMERIC                  &
\       U$ = EDIT$(OC$,-1%)                                             &
\       U% = LEN(U$)                                                    &
\       DEC = 0.                                                        &
\       DEC = DEC+VAL(MID$(U$,U%-V%+1%,1%))*8.^(V%-1%)                  &
              FOR V%=1% TO U%                                           &
\       FNOCTDEC = DEC                                                  &
\       FNEND                                                           &

15200   DEF FNMOD(NUMB,BASE%) = INT((NUMB+BASE%/2.)/BASE%)              &
                                        ! ROUND NUMBER TO INTEGER WITH &
                                        ! NEW BASE                     &

19000   IF ERR=11% AND (ERL=2100% OR ERL=2000% OR ERL=2020%) THEN       &
          RESUME 3000                                                   &

19999   ON ERROR GOTO 0                                                 &

32000   CLOSE 1%                                                        &
!\      KILL "MAPGRF.TMP"                                               &

32767   END

READY

COM/TSK

READY

DCL
```

```
$ RUN MAPGRF
Enter MAP file name? DTR
Enter memory increment? 256
W[ide] or N[arrow] terminal <N>?
Processing segment: DTR
Processing segment: DD
Processing segment: CMPLR
Processing segment: PARSE
Processing segment: HE
Processing segment: AC
Processing segment: TE
Processing segment: RP
Processing segment: PA
Processing segment: INIT
Processing segment: RF
Processing segment: RUNTIM
Processing segment: ME
Processing segment: BE
Processing segment: RMS11
Processing segment: FP
Processing segment: RMSFAB
Processing segment: R0PRFN
Processing segment: R0DPYC
Processing segment: R1CLOS
Processing segment: R0OPFL
Processing segment: RMSCRE
Processing segment: R1CRCK
Processing segment: R0CRFL
Processing segment: R2WPLG
Processing segment: R3WPLG
Processing segment: R0ERFL
Processing segment: R0EXT0
Processing segment: RMOPIN
Processing segment: RMSRAB
Processing segment: RMSSEQ
Processing segment: RMSCD
Processing segment: RMSMIS
Processing segment: R2GUPD
Processing segment: RMSIDX
Processing segment: R3GET
Processing segment: R3PUT
Processing segment: R3PIXC
Processing segment: R3IUDR
Processing segment: R3IUDC
Processing segment: R3BSPL
Processing segment: R3BRRV
Processing segment: R3ALOC
Processing segment: R3ISID
Processing segment: R3ALOC
Processing segment: R3ISDI
Processing segment: R3UIDX
Processing segment: R3IKYI
Processing segment: R3ROOT
Processing segment: R3ALOC
Processing segment: R3MKID
Processing segment: R3UPDA
Processing segment: R3DELE
Processing segment: R3IUDR
Processing segment: R3IUDC
Processing segment: R3BSPL
Processing segment: R3BRRV
Processing segment: R3ALOC
Processing segment: R3ISID
Processing segment: R3ALOC
Processing segment: R3ISDI
Processing segment: R3UIDX
Processing segment: R3IKYI
Processing segment: R3ROOT
Processing segment: R3ALOC
Processing segment: R3MKID
```

```
      ==== DTR  ====  ====  DD  ====  ====CMPLR ====  ====PARSE ====
 1024          !. BLK.
 1280          !
 1536       AL:!AL
 1792          :!
 2048       CX:!CX
 2304     DIVD:!DIVD
 2560          :!
 2816          :!
 3072       FS:!FS
 3328          :!
 3584          :!
 3840          :!
 4096       IO:!IO
 4352          :!
 4608          :!
 4864       MS:!MS
 5120          :!
 5376       RA:!RA
 5632
 5888
 6144
 6400
 6656
 6912                          !RTDATA                          !RTDATA
 7168                          !                                !
 7424                          !                                !
 7680                          !                                !
```

```
 7936                    !                                  !
 8192                    !                                  !
 8448                    !                              DI:!
 8704                    !                              HT:!
 8960                    !                                 :!
 9216                    !                                 :!
 9472                    !                                 :!
 9728                    !                                 :!
 9984                    !                                 :!
10240                    !                                 :!
10496                    !                                 :!
10752                    !                                 :!
11008                    !                                 :!
11264                    !                                 :!
11520                    !                                 :!
11776                    !                                 :!
12032
12288
12544
12800
13056
13312
13568
13824
14080
14336
14592
14848
15104
15360
15616
15872
16128
16384
16640
16896
17152
17408
17664
17920
18176                DD:!DD          AS:!AS          CD:!CD
18432                  :!              :!              :!
18688                  :!              :!           DI:!DI
18944                  :!           CR:!CR             :!
19200                  :!              :!              :!
19456                  :!              :!              :!
19712                  :!              :!              :!
19968                  :!              :!              :!
20224                  :!              :!              :!
20480                  :!              :!              :!
20736                  :!              :!              :!
20992                  :!              :!              :!
21248                  :!              :!              :!
21504                  :!              :!           DI:!DIDATA
21760                DD:!DDDATA        :!           HT:!HT
22016                  :!              :!           HT:!HTTBL
22272                  :!              :!              :!
22528                  :!              :!              :!
22784                  :!              :!              :!
23040   IO:!IOOV       :!              :!              !IOOV
23296     :!         DD:!LITRL         :!              !
23552                  :!              :!
23808                DD:!STRING        :!           LX:!LX
24064                  :!              :!              :!
24320                  :!              :!              :!
24576                  :!              :!              :!
24832                                  :!              :!
25088                                  :!              :!
25344                                  :!           LX:!LXDATA
25600                                  :!           PR:!PR
25856                                  :!              :!
26112                                  :!              :!
26368                                  :!              :!
26624                                  :!              :!
26880                                  :!              :!
27136                                  :!              :!
27392                                  :!              :!
27648                                  CR:!CRDATA      PU:!PU
27904                                  :!              :!
28160                                  :!              !$$ALVC
28416                                  :!
28672                                  CR:!CRTBL
28928                                  PF:!PF
29184                                  :!
29440                                  :!
29696                                  :!
29952                                  :!
30208                                  :!
30464                                  :!
30720                                  :!
30976                                  :!
31232                                  :!
31488                                  :!
31744                                  :!
32000                                  :!
32256                                  :!
32512                                  :!
32768                                  :!
33024                                  PF:!PFDATA
33280                                  :!
33536                                  :!
33792                                  :!
34048                                  :!
34304                                  :!
34560                                  :!
34816                                  RC:!RC
35072                                  :!
35328                                  :!
35584                                  :!
35840     MS:!INIT                     :!              !INIT
36096     RM:!                         :!              !
36352        !                         SC:!SC           !
36608                                  :!
36864                                  :!
37120                                  SC:!SCDATA
37376                                  :!
37632                                  TC:!TC
37888
```

```
      ====  HE  ====  ====  AC  ====  ====  TE  ====  ====  RP  ====
28416     HE:!HE          AC:!AC      .TPARS:!. BLK.      PB:!PB
28672       :!              :!              :!              :!
28928     SH:!SH            :!            TE:!TE            :!
29184       :!              :!              :!              :!
29440       :!              :!              :!              :!
29696       :!              :!              :!              :!
29952       :!              :!              :!              :!
30208       :!              :!              :!              :!
30464       :!            AC:!ACDATA        :!              :!
30720       :!                              :!           PB:!PBDATA
30976       :!            AE:!AE            :!           RP:!RP
31232     SH:!SHDATA      AG:!AGTBL         :!              :!
31488       :!              :!              :!              :!
31744       :!            AH:!AH          TE:!$STATE        :!
32000                     AP:!AP            :!              :!
32256                     AP:!APTBL          !$$RESL        :!
32512                       :!                              :!
32768                     AT:!AT                            :!
33024                       :!                              :!
33280                       :!                              :!
33536                       :!                           RP:!RPTBL
33792                     AV:!AV
34048                       :!
34304                       :!
34560                       :!
34816                       :!
35072                     AC:!LITRL
35328                        !
35584
```

```
      ====  PA  ====  ==== INIT ====  ====  RF  ====  ====RUNTIM====
 6912                        !RTDATA
 7168                        !
 7424                        !
 7680                        !
 7936                        !
 8192                        !
 8448                        !
 8704                        !
 8960                        !
 9216                        !
 9472                        !
 9728                        !
 9984                        !
10240                        !
10496                        !
10752                        !
11008                        !
11264                        !
11520                        !
11776                        !
12032
12288
12544
12800
13056
13312
13568
13824
14080
14336
14592
14848
15104
15360
15616
15872
16128
16384
16640
16896
17152
17408
17664
17920
18176
18432                                                  AR:!AR
```

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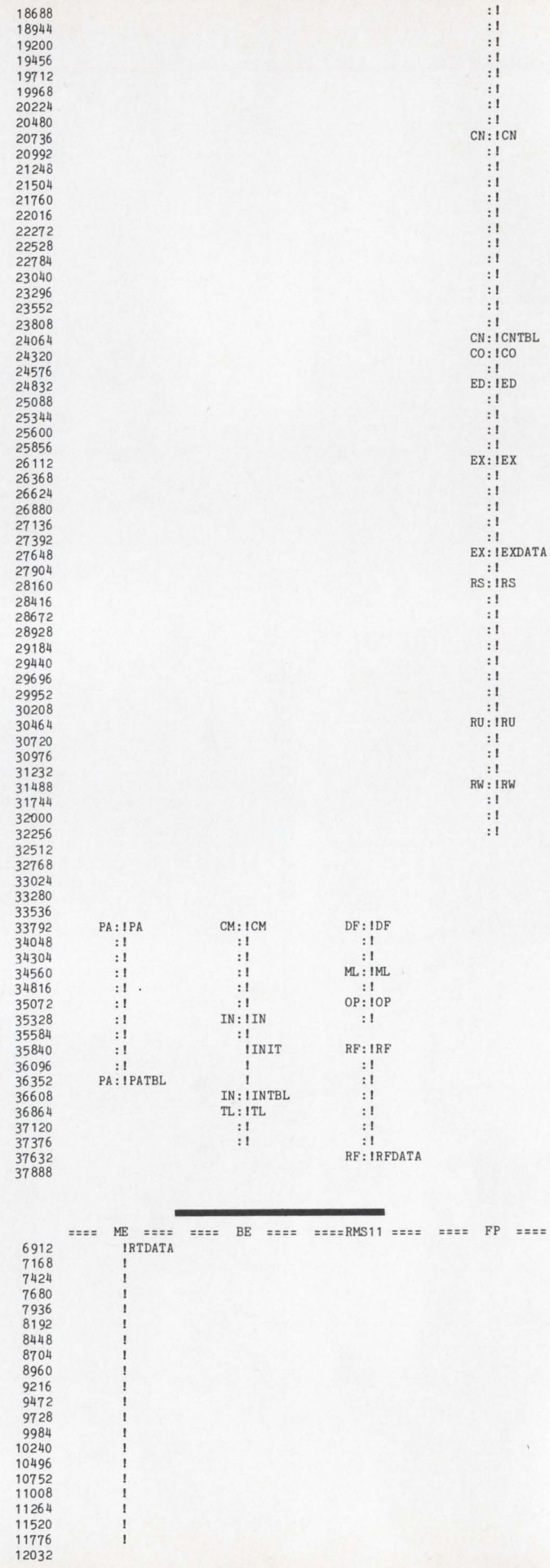
CIRCLE D136 ON READER CARD



```
12288
12544
12800
13056
13312
13568
13824
14080
14336
14592
14848
15104
15360
15616
15872
16128
16384
16640
16896
17152
17408
17664
17920
18176
18432
18688
18944
19200
19456
19712
19968
20224
20480
20736
20992
21248
21504
21760
22016
22272
22528
22784
23040
23296
23552
23808
24064
24320
24576
24832
25088
25344
25600
25856
26112
26368
26624
26880
27136
27392
27648
27904
28160
28416
28672
28928
29184
29440
29696
29952
30208
30464
30720
30976
31232
31488
31744
32000
32256
32512
32768
33024
33280
33536
33792
34048
34304
34560
34816
35072
35328
35584
35840
36096
36352
36608
36864
37120
37376   ME:!ME          BE:!BE
37632     :!              :!
37888     :!              :!
```

```
38144                                                    FP:!FP
38400                                                      :!
38656                                                      :!
38912                                                      :!
39168                                                      :!
39424                                                      :!
39680                                                      :!
39936                                                      :!
40192                                                      :!
40448                                                      :!
40704                                                      :!
40960

      ====RMSFAB====  ====ROPRFN====  ====RODPYC====  ====R1CLOS====
38144 ROCLCM:!ROCLCM
38400 ROREOP:!ROREOP
38656       :!
38912       :!
39168
39424               ROASLN:!ROASLN  RODPYC:!RODPYC  ROEXTD:!ROEXTD
39680               ROPRFN:!ROPRFN        :!        R1CLOS:!R1CLOS
39936               ROXPFN:!ROXPFN        :!        R1NXBK:!R1NXBK
```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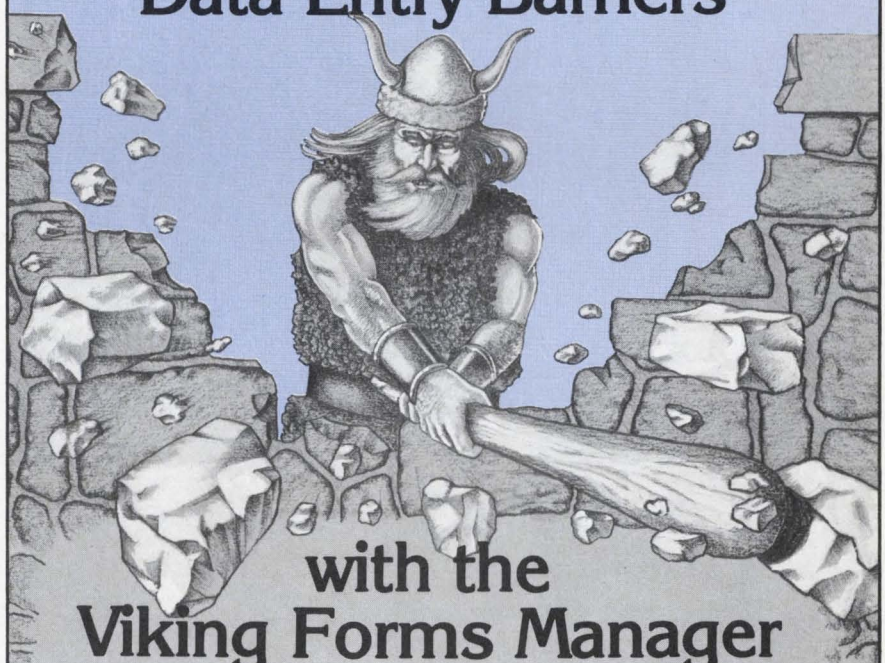

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CIRCLE D147 ON READER CARD

```
40192                    :!              :!          R1RLBK:!R1RLBK
40448                                    :!
40704
```

```
      ====R00PFL====  ====RMSCRE====  ====R1CRCK====  ====R0CRFL====
39168 R0MFNB:!R0MFNB                  R1CRCK:!R1CRCK
39424       :!                              :!       R0MFNB:!R0MFNB
39680                                 R2CRCK:!R2CRCK  R0RECR:!R0RECR
39936                                 R3CRCK:!R3CRCK        :!
40192                                       :!              :!
40448                                       :!              :!
40704
40960
```

```
      ====R2WPLG====  ====R3WPLG====  ====R0ERFL====  ====R0EXTO====
39168                                 R0ERFL:!R0ERFL
39424                                 R0MFNB:!R0MFNB  R0EXTD:!R0EXTD
39680 R2BFMT:!R2BFMT  R0EXTD:!R0EXTD                        :!
39936 R2WPLG:!R2WPLG  R3WPLG:!R3WPLG                  R0EXTO:!R0EXTO
40192       :!              :!                              :!
40448                       :!                              :!
40704                       :!                              :!
40960                       :!              R2BFMT:!R2BFMT
41216                       :!
41472                       :!
41728
```

```
      ====RMOPIN====  ====RMSRAB====  ====RMSSEQ====  ====RMSCD ====
38144                 R0FREE:!R0FREE
38400                       :!
38656
38912                                 R0EXTD:!R0EXTD
39168 R0INIT:!. BLK.                  R1GBLD:!R1GBLD
39424 R1OPFL:!R1OPFL                        :!
39680 R2OPFL:!R2OPFL                        :!
39936 R3RPLG:!R3RPLG                        :!
40192       :!                        R1GET:!R1GET
40448
40704                                 R1NXBK:!R1NXBK
40960                                 R1PBLD:!R1PBLD
41216                                       :!
41472                                       :!
41728                                 R1PSET:!R1PSET
41984                                 R1PUNR:!R1PUNR
42240                                 R1RLBK:!R1RLBK
42496                                 R1UBLD:!R1UBLD
42752
43008
43264                                                 R0CCLN:!R0CCLN
43520                                                 R1CONP:!R1CONP
43776                                                 R2CONP:!R2CONP
44032                                                 R3CONP:!R3CONP
44288
```

```
      ====RMSMIS====  ====R2GUPD====  ====RMSIDX====  ====R3GET ====
38912                 R0EXTD:!R0EXTD  R0CMKY:!R0CMKY
39168                 R2BFMT:!R2BFMT        :!
39424                                 R3FNDR:!R3FNDR
39680                 R2EXTD:!R2EXTD  R3FPAT:!R3FPAT
39936                 R2FIND:!R2FIND
40192                       :!        R3FROO:!R3FROO
40448                       :!
40704                  R2GET:!R2GET   R3SDBK:!R3SDBK
40960                 R2GSET:!R2GSET        :!
41216                 R2IOCK:!R2IOCK
41472                 R2PSET:!R2PSET                  R3FRKE:!R3FRKE
41728                  R2PUT:!R2PUT                         :!
41984                 R2UPDA:!R2UPDA                        :!
42240                                                 R3FRRV:!R3FRRV
42496
42752                                                  R3GET:!R3GET
43008 R0RWBI:!R0RWBI                                  R3GRPT:!R3GRPT
43264       :!                                        R3GTRE:!R3GTRE
43520                                                 R3POSR:!R3POSR
43776                                                       :!
44032                                                       :!
44288                                                       :!
44544
```

```
      ====R3PUT ====  ====R3PIXC====  ====R3IUDR====  ====R3IUDC====
41472 R3PSET:!R3PSET
41728  R3PUT:!R3PUT
41984       :!
42240       :!
42496                 R3DLSI:!R3DLSI  R3IUDR:!R3IUDR
42752                       :!              :!
43008                 R3FRRV:!R3FRRV        :!
43264                 R3PIXC:!R3PIXC
43520                                                 R3IUDC:!R3IUDC
43776                                                       :!
44032                                                       :!
44288                                                 R3IUDI:!R3IUDI
44544                                                       :!
44800
```

```
      ====R3BSPL====  ====R3BRRV====  ====R3ALOC====  ====R3ISID====
42496                                                 R3ISID:!R3ISID
42752                                                       :!
43008                                                       :!
43264
43520 R3BSPL:!R3BSPL  R3BRRV:!R3BRRV  R0EXTD:!R0EXTD
43776                       :!        R3ALOC:!R3ALOC
44032                 R3URRV:!R3URRV        :!
44288                                       :!
44544                                       :!
44800
```

```
      ====R3ALOC====  ====R3ISDI====  ====R3UIDX====  ====R3IKYI====
42496                                 R3IKEY:!R3IKEY
42752                                       :!
43008                                       :!
43264 R0EXTD:!R0EXTD  R3ISDI:!R3ISDI  R3UIDX:!R3UIDX
43520       :!              :!                        R3IKYI:!R3IKYI
43776 R3ALOC:!R3ALOC  R3SSPL:!R3SSPL                  R3KSPL:!R3KSPL
44032       :!                                              :!
44288       :!                                              :!
44544       :!
44800
```

```
      ====R3ROOT====  ====R3ALOC====  ====R3MKID====  ====R3UPDA====
41472                                                 R3UPDA:!R3UPDA
41728                                                       :!
41984                                                       :!
42240                                                 R3USET:!R3USET
42496                                 R0EXTD:!R0EXTD
42752                                 R3ALOC:!R3ALOC
43008                                       :!
43264                                       :!
43520 R3ROOT:!R3ROOT  R0EXTD:!R0EXTD        :!
43776                 R3ALOC:!R3ALOC  R3MKID:!R3MKID
44032                       :!              :!
44288                       :!              :!
44544                       :!
44800
```

```
      ====R3DELE====  ====R3IUDR====  ====R3IUDC====  ====R3BSPL====
42496 R3DELE:!R3DELE  R3IUDR:!R3IUDR
42752       :!              :!
43008 R3DLSI:!R3DLSI        :!
43264                       :!
43520 R3FRRV:!R3FRRV                  R3IUDC:!R3IUDC  R3BSPL:!R3BSPL
43776 R3PIXC:!R3PIXC                        :!              :!
44032 R3SKDL:!R3SKDL                        :!
44288                                 R3IUDI:!R3IUDI
44544                                       :!
44800
```

```
      ====R3BRRV====  ====R3ALOC====  ====R3ISID====  ====R3ALOC====
42496                                 R3ISID:!R3ISID
42752                                       :!
43008                                       :!
43264                                       :!
43520 R3BRRV:!R3BRRV  R0EXTD:!R0EXTD                  R0EXTD:!R0EXTD
43776       :!              :!                        R3ALOC:!R3ALOC
44032       :!        R3ALOC:!R3ALOC                        :!
44288 R3URRV:!R3URRV        :!                              :!
44544                       :!                              :!
44800
```

```
      ====R3ISDI====  ====R3UIDX====  ====R3IKYI====  ====R3ROOT====
42496                 R3IKEY:!R3IKEY
42752                       :!
43008                       :!
43264                 R3UIDX:!R3UIDX
43520 R3ISDI:!R3ISDI                  R3IKYI:!R3IKYI  R3ROOT:!R3ROOT
43776       :!                        R3KSPL:!R3KSPL        :!
44032 R3SSPL:!R3SSPL                        :!
44288                                       :!
44544                                       :!
44800
```

```
      ====R3ALOC====  ====R3MKID====
43520 R0EXTD:!R0EXTD        :!
43776       :!              :!
44032 R3ALOC:!R3ALOC  R3MKID:!R3MKID
44288       :!              :!
44544       :!              :!
44800
```

$

MACRO AND THE CLASSROOM

By Alan Hagerman
4th Semester Student
Williamsport Area Community College
Williamsport PA

Amidst almost every computer science curriculum is at least one class on assembler. Future applicaton programmers view it as a neccessary lower life form. People who like to deal with the simpler things in life (1's and 0's) get upset at the application programmer's opinion. At the Williamsport Area Community College we are offering MACRO-11 for the first time. I thought I might share some of the enlightening experience we enjoyed on . . . The Road to MACROMANIA.

One of the first decisions to be made was under which Run Time System we wanted to execute our MACRO. RSTS/E supports MACRO under both RT-11 and RSX. Both offer the same instruction set but each offers a different set of directives. RT-11 directives are aimed at I-O and monitor interaction through manipulating the FIRQB and the XRB. RSX directives are aimed at more powerful programming (library usage, AST control, etc.).

After very careful consideration of all factors involved and a lengthy deliberation, we chose to execute under RSX for one main reason. In our mostly futile attempt to do I-O to our CRT's, we located copies of two articles written by Bob "Macro man" Meyer on RSTS I-O which happened to use RSX. Much to our mental relief and Mr. Meyer's credibility, these routines worked!! (see the RSTS Professional, May 1980). These routines also indirectly solved another problem we had. How will our students be able to debug their MACRO programs? Because of time limitations and our inexperience we ruled out ODT. Our inexperience also ruled out attempting a dump MACRO. However, since we are under RSX, we have to use the task builder. So, after consulting the task builder manual, we decided to include the /PM switch. This will give our students a 'post-mortem dump'.(Gee, that sounds fatal!) For all of those who are interested, a post-mortem dump is an 'almost' snapshot of the user job area at the time that the program terminates abnormally. This dump is placed in an unformatted binary file called PMDxxx.PMD where xxx is the current job number. To view the contents of the .PMD file you must run a system program called PMDUMP. (See your RSTS Systems User's Guide for more information.) This formats the file and will generate another file of the same name but with a '.LST' extension. The '.LST' file contains your user job area in octal, your LUN table information, the stack, and all of the registers. This listing will give the student at least some of the information he needs to debug the program.

The content of a new course and the direction of the material depends mostly on the students' background. At W.A.C.C. most of our students have assembler in their second semester and thus only have one semester of high level language. They normally get their exposure to basic operating system principles in their third semester. Therefore at the time they take the course, the students have very little concept of the computer environment.(No virginia, it's not magic!!) This places our course in the precarious position of presen-

. . . continued on page 132

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CIRCLE D76 ON READER CARD

ADVANCED EDT - Part 3

By Jeffrey Gold, CITIBANK, NA, New York, NY

I found David Spencer's article "EDT Extended With An Initializer File" (DEC Professional, Vol. 1, No. 3 and Vol. 2, No. 1) both well written and informative. There is however, some additional information which I believe your readers would find valuable.

1.0 LOGICAL NAMES

EDT uses two logical names to locate the initializer file (EDTINI) and the help file (EDTHELP). The current defaults are:

```
EDTINI = SYS$DISK:EDTINI.EDT
EDTHELP = SYS$HELP:EDTHELP.HLB
```

You may redefine these using the DCL ASSIGN command. The advantages of doing this include:

1. You can place the files in any directory and call them anything you wish (i.e., ASSIGN SYS$MANAGER:SYSEDTINI.ALT EDTINI).
2. You do not need a separate copy of the initializer file in each sub-directory.
3. A group of people can access the same file by placing the ASSIGN statement in their LOGIN.COM files. The logical names may be defined group-wide or system-wide, too. This simplifies files management, as only a single copy of the file must be updated to effect a change.
4. You may have multiple initializer files, used for different purposes. The "active" copy may be changed by re-defining its logical name.

2.0 MODIFYING KEYPAD MODE HELP

Modifying the EDT help file was discussed in Part 2 of David Spencer's article, "How the EDTHELP.HLP file is organized."

2.1 The LIBRARIAN

EDT help text is kept in a help library, organized in modules. To modify the help text you must extract the correct module as a text file, modify the module using an editor (EDT of course!), and replace the module in the help library. Example:

```
$ Libr /EXT=KEYPAD /OUT=KEYPAD SYS$HELP:=EDTHELP.HLB
$ EDIT KEYPAD.HLP
$ LIBR /REPLACE SYS$HELP:EDTHELP.HLB KEYPAD.HLP
```

2.2 KEYPAD NUMBERING

Each key on the keypad and the keyboard is assigned a number. When adding or modifying text for a key, you must specify its number. The EDT Editor Manual displays the numbering scheme of the keypad only in Chapter 10: Redefining Keys. The complete numbering scheme is as follows:

RANGE	DESCRIPTION
00 - 21	keypad
^2 - 43	GOLD keypad
74	CTRL < Null A-Z [ ] ' / >
^0	GOLD < ASCII character set >

Example:

CNTLA/A is recognized by EDT as key 45, CNTL/B as key 46, GOLD-CTRL/A as key 76, and GOLD-A as key 136.

The keypad number is always used when searching through the EDT keypad help file. If you are in keypad help mode and hit CTRL/A, EDT will internally generate a search for the text "KEYPAD VT100 45." EDT V3.0 does have some limitations:

1. EDT will not translate certain characters in the 75-200 range into their key code equivalents. This includes: numbers (0-9) and lower case (a-z) characters.
2. Some control characters are passed to the terminal driver without translation: (CTRL-C CTRL-O CTRL-Q CTRL-S CTRL-Y ESCAPE).

2.3 ADDING OR MODIFYING KEYS

You must always specify the two digit key code, "CTRL A" cannot be used in place of "45" as in the DEFINE KEY command. Keypad help mode will not search for any key value above 74. Therefore, to document any GOLD-ASCII keys you must place them in a separate help library module. You might also document "GOLD-char" with the corresponding "CNTL-char".

3.0 PRESET KEYPAD DEFINITIONS

As a training aid I am including the preset key definitions. These may be examined using the SHOW KEY command.

3.1 EDT V3.0 DEFAULT VT100 KEYPAD

CODE	KEY	DEFINITION
	DEL key	D-C.
52	BACKSPACE	^H.
53	TAB key	^I.
54	LINE FEED	^J.
57	Return	^M.
00	0	L.
01	1	W.
02	2	EL.
03	3	C.
04	4	ADV.
05	5	BACK.
06	6	CUTSR.
07	7	PAGETOP.
08	8	(16L).
09	9	APPENDSR.
10	PF2 (RED)	HELP.
11	PF3 (GREY)	"".
12	UP ARROW	-V.
13	DOWN ARROW	+V.
14	RIGHT ARROW	+C.
15	LEFT ARROW	-C.
16	.	SEL.
17	PF4	D+NL.
18	-	DEW.

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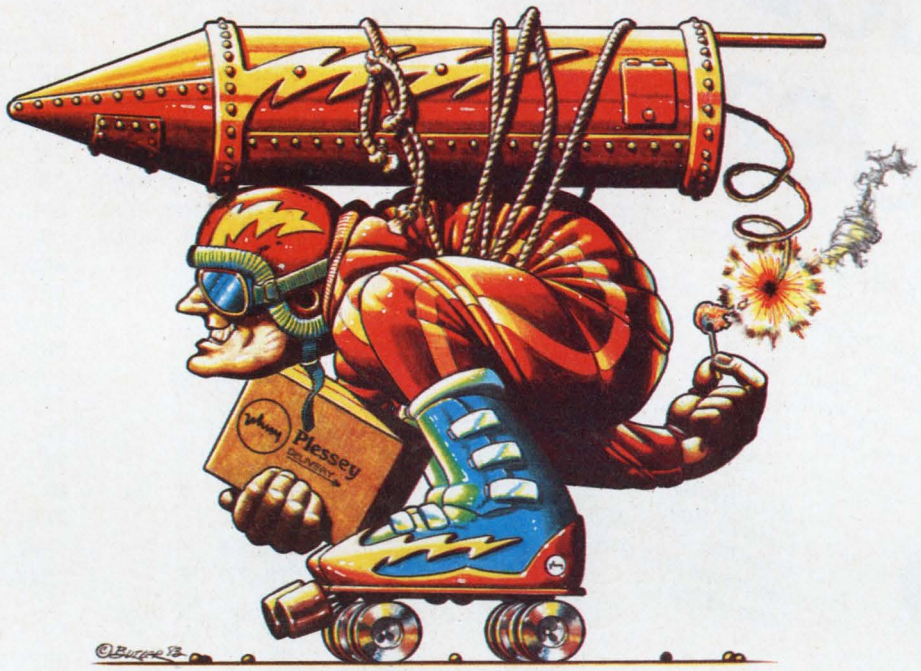

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CONTROLLER	EMULATION	COMPATIBLE DRIVES	FORMATTED CAPACITY
Q-BUS			
Floppy:			
PM-XCV21	RX02	Shugart/NEC/Qume. Single or double-density	512KB per drive (x2)
PM-XCV31	RX03	Shugart/NEC/Qume. Double-sided/double-density	1024KB per drive (x2)
Disc Cartridge/ SMD/MMD:			
PM-DCV06A	RK06	CDC Phoenix CMD Drive or Ampex DFR9xx Series (32, 64, or 96MB ea.)	Min: 28MB (2 logical RK06) Max: 8 logical RK06; up to 2 physical drives
PM-DCV02A	RM02	80MB CDC 9762 SMD/80 CDC 9730-80 MMD/ 160MB CDC 9730-160 MMD	Min: 67MB (1 logical RM02) Max: 2 physical drives/4 logical RM02 (268MB total)
	RM05	300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	Min: 256MB (1 logical RM05) Max: 2 physical drives/4 logical RM05 (1024MB total)
Fixed (Winchester):			
PM-FCV21	RL01/02	Industry-standard, Seagate technology interfaced 5.25" Winchester drives with buffered seek	Min: 10.4MB (1 RL02 or 2 RL01) Max: 41.6MB (4 physical drives/4 logical RL02) or any combination of RL01/02 up to 4 logical drives
Tape:			
PM-CCV11A	N/A	Cipher 'Quarterback'	20MB per 450-ft. cartridge
UNIBUS			
Floppy:			
PM-XC21	RX02	Shugart/NEC/Qume. Single or double density	512KB per drive (x2)
PM-XC31	RX03	Shugart/NEC/Qume. Double-sided/double-density	1024KB per drive (x2)
Disc Cartridge:			
PM-DC06A	RK06	CDC Phoenix CMD Drive or Ampex DFR932 Series (32, 64, or 96MB ea.)	Min: 28MB (2 logical RK06) Max: 8 logical RK06 with up to 4 physical drives
SMD (Removable)/ MMD (Fixed):			
PM-DC02A	RM02	80MB CDC 9762 SMD/80MB CDC 9730-80 MMD/ 160MB CDC 9730-160MMD	Min: 67MB (1 logical RM02) Max: 268MB (4 logical RM02)
	RM05	300MB CDC 9766 SMD/600MB CDC 9775 FMD/ (also any CDC-compatible SMD interface)	Min: 256MB (1 logical RM05) Max: 1024MB (4 logical RM05)
Tape:			
PM-TC11B	TM11	Kennedy or Pertec 1/2-inch, 9-track, reel-to-reel; 12.5 to 125ips; 800/1600bpi	4 Tape Transports per controller
VAX			
SMD (Removable) MMD (Fixed):			
PM-DCG03	RM03/ RM05/ RM80	80MB CDC 9762 SMD/160MB CDC 9730-160 MMD (2 logical RM03 or 1 logical RM80)/300MB CDC 9766 SMD (1 logical RM05)/ 474MB Fujitsu M2351 (3 logical RM80)/600MB CDC 9775 FMD (2 logical RM05)/(also any CDC-compatible, SMD interface)	Min: 67MB (1 logical RM03) Max: 2048MB (8 logical RM05) Supports up to 4 physical or 8 logical drives

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19	,	D+C.
21	ENTER	.
22	GOLD 0	(^M-C).
23	GOLD 1	CHGCSR.
24	GOLD 2	D+EL.
25	GOLD 3	ASC.
26	GOLD 4	ER.
27	GOLD 5	BR.
28	GOLD 6	PASTE.
29	GOLD 7	EXT ?'Command: '.
30	GOLD 8	FILLSR.
31	GOLD 9	CUTSR=DELETE PASTE.
32	GOLD PF2 (RED)	HELP.
33	GOLD PF3 (GREY)	^@?'Search for : '^@.
36	GOLD RIGHT ARRO	SHR.
37	GOLD LEFT ARROW	SHL.
38	GOLD.	RESET.
39	GOLD PF4	UNDL.
40	GOLD -	UNDW.
41	GOLD ,	UNDC.
43	GOLD ENTER	(CUTSR=DELETE PASTEKS"").
45	CTRL/A	TC.
48	CTRL/D	TD.
49	CTRL/E	TI.
52	CTRL/H	BL.
53	CTRL/I	TAB.
54	CTRL/J	DBW.
55	CTRL/K	DEFK.
56	CTRL/L	^L.
57	CTRL/M	^M.
62	CTRL/R	REF.
64	CTRL/T	TADJSR.
65	CTRL/U	DBL.
67	CTRL/W	REF.
70	CTRL/Z	EX.
136	GOLD A	TC.
139	GOLD D	TD.
140	GOLD E	TI.
155	GOLD T	TADJSR.
156	GOLD U	DBL.
158	GOLD W	REF.
161	GOLD Z	EX.

3.2 EDT V3.0 DEFAULT VT52 KEYPAD

CODE	KEY	DEFINITION
	DEL key	D-C
52	BACKSPACE	^H.
53	TAB KEY	^I.
54	LINE FEED	^J.
57	Return	^M.
00	0	L.
01	1	W.
02	2	EL.
03	3	CUTSR.
04	4	ADV.
05	5	BACK.
06	6	D+C.
07	7	PAGETOP.
08	8	"".
09	9	DEW.
10	PF2 (RED)	HELP.
11	PF3 (GREY)	D+NL.
12	UP ARROW	-V.
13	DOWN ARROW	+V.
14	RIGHT ARROW	+C.
15	LEFT ARROW	-C.
16	.	SEL.

. . . continued on page 133

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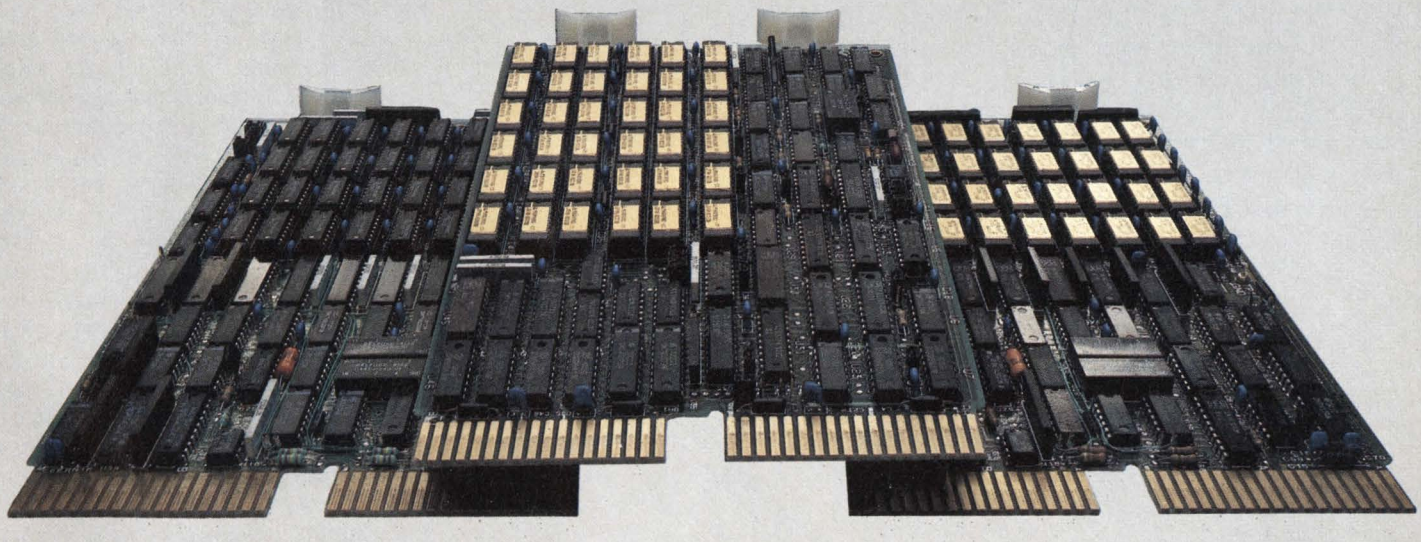

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Macro and the Classroom

. . . continued from page 127

ting easy-to-use routines which can establish basic assembler language concepts.

Since we now knew which RTS we were going to use, we attempted to develop initial program standards and procedures. Because of the overhead involved with the task builder, we use a BASIC-PLUS program which accepts the filename of the program and then builds and queues a control file for the batch processor. The control file calls the task builder and uses the /PM switch. After completion, a message notifying the user of its completion is printed on the system console. By doing this, we reduce the number of concurrent task builds and thus soften the blow to RSTS from the added task building. Each MACRO task build takes but a few minutes (in theory) so there should be very little inconvenience to our students. We use this same procedure for our RPG and COBOL and it works well, but with MACRO there is one small flaw. The MAC.TSK compiler does not detect any undefined symbols, but the task builder does. This would be no problem if the task building was being done by each student at his/her terminal because the error message would show on their screens. Since we are using the batch processor however, the error message will only show up in the .LOG file. This makes it necessary to keep this file. (We normally have a PIP to delete all unnecessary files contained in the control file.) We also have to train the students to look at the .LOG file for any task builder error messages.

The major hindrance to the initial course development was our lack of any experience. Only through contact with our friendly software reps and other colleges did we manage to get started. Armed with the routines by Mr. Meyer, the system manuals, and lots of aspirin, we were able to write and execute simple programs which communicated with the outside 'world'. However, we soon realized that these routines would not suffice in the actual class. To attempt explaining to our students something we barely understood (how to use the low job area) would only have placed fantasies of compilers in their heads. This decision then caused another problem to surface. Where should we place the MACROS we create? The first choice would be a library, but nobody here has ever built one. So the easiest place we could think of was our own prefix file, similiar to COMMON.MAC.

```
21      ENTER               .
22      GOLD 0              (^M-C).
23      GOLD 1              CHGCSR.
24      GOLD 2              D+EL.
25      GOLD 3              PASTE.
26      GOLD 4              ER.
27      GOLD 5              BR.
28      GOLD 6              UNDC.
29      GOLD 7              EXT ?'Command: '.
30      GOLD 8              ^@?'Search for: '^@.
31      GOLD 9              UNDW.
32      GOLD PF2            HELP.
33      GOLD PF3            UNDL.
34      GOLD UP ARROW       CUTSR=DELETE PASTE.
35      GOLD DOWN ARROW     (16L).
36      GOLD RIGHT ARRO     ASC.
37      GOLD LEFT ARROW     APPENDSR.
38      GOLD .              RESET
43      GOLD ENTER          (CUTSR=DELETE PASTEKS"").
45      CTRL/A              TC.
48      CTRL/D              TD.
49      CTRL/E              TI.
50      CTRL/F              FILLSR.
52      CTRL/H              BL.
53      CTRL/I              TAB.
54      CTRL/J              DBW.
55      CTRL/K              DEFK.
56      CTRL/L              ^L.
57      CTRL/M              ^M.
62      CTRL/R              REF.
64      CTRL/T              TADJSR.
65      CTRL/U              DBL.
67      CTRL/W              REF.
70      CTRL/Z              EX.
136     GOLD A              TC.
139     GOLD D              TD.
140     GOLD E              TI.
155     GOLD T              TADJSR.
156     GOLD U              DBL.
158     GOLD W              REF.
161     GOLD Z              EX.
```

4.0 CHANGES TO VOL.3

For those of you already using David Spencer's "Standard Initialization File Vol.3," I would like to suggest some minor modifications.

1. EDT V3.0 does not allow you to redefine CTRL/X or GOLD-CTRL/X using the "DEFINE KEY" command, although it is allowed using the CNTL/K (DEFK) keypad function. I have renamed these functions as CTRL/V and GOLD-CTRL/V.
2. DEF K 10 AS "?'Press GOLD-HELP for help. Press ENTER to continue'." This is done for first time users looking for help.

5.0 OTHER INITILIZATION FILES

Almost everyone has his "favorite" initialization file. I am including three that were originally prepared by John Sauter of DEC and printed in the VAX LANGUAGES HANDOUT from the 1981 Fall DECUS Symposium.

5.1 RATIONAL.EDT - DEFINE VT100/VT52 RATIONAL KEYPAD

```
!
! Common VT52 and VT100 Definitions
!
DEFINE KEY 0 AS '+L.'
DEFINE KEY 1 AS '(11L).'
DEFINE KEY 2 AS '-BL.'
DEFINE KEY 3 AS '+EL.'
DEFINE KEY 4 AS 'ADV.'
DEFINE KEY 5 AS '-W.'
DEFINE KEY 6 AS '+W.'
DEFINE KEY 7 AS 'BACK.'
DEFINE KEY 8 AS '-C.'
DEFINE KEY 9 AS '+C.'
DEFINE KEY 10 AS '.'
DEFINE KEY 11 AS "?'Search for : '."
DEFINE KEY 16 as 'D+L.'
DEFINE KEY GOLD 0 AS '(^M-C).'
DEFINE KEY GOLD 1 'SEN.'
DEFINE KEY GOLD 2 AS 'PAGETOP.'
DEFINE KEY GOLD 3 AS '(32767L32767L32767L) ADV.'
DEFINE KEY GOLD 4 AS 'RESET.'
DEFINE KEY GOLD 5 AS 'CUTSR.'
DEFINE KEY GOLD 6 AS 'APPENDSR.'
DEFINE KEY GOLD 7 AS 'SEL.'
DEFINE KEY GOLD 8 AS 'CUTSR PASTE.'
DEFINE KEY GOLD 9 AS 'PASTE.'
DEFINE KEY GOLD 10 AS '.'
DEFINE KEY GOLD 11 AS "SELI?'Replace with: '^ZCUTSR=REPLACESTRING KS + '' CUTSR
DEFINE KEY GOLD 16 AS '+CHGCSR.'
!
! VT100-specific Definitions
!
DEFINE KEY 17 AS '"".'
DEFINE KEY 18 AS 'D+C.'
DEFINE KEY 19 AS 'D+EW.'
DEFINE KEY 21 AS 'D+EL.'
DEFINE KEY GOLD 17 AS '(CUTSR=DELETESTRING PASTE=REPLACESTRING KS"").'
DEFINE KEY GOLD 18 AS 'CUTSR=DELETESTRING PASTE=REPLACESTRING.'
DEFINE KEY GOLD 19 AS 'UNDW.'
DEFINE KEY GOLD 21 AS 'UNDL.'
!
! VT52-specific Definitions
!
DEFINE KEY 12 as '"".'
DEFINE KEY 13 as 'D+C.'
DEFINE KEY 14 as 'D+EW.'
DEFINE KEY 15 AS 'D+EL.'
DEFINE KEY 21 AS 'V.'
DEFINE KEY GOLD 12 AS '(CUTSR=DELETESTRING PASTE=REPLACESTRING KS"").'
DEFINE KEY GOLD 13 AS 'CUTSR=DELETESTRING PASTE=REPLACESTRING.'
DEFINE KEY GOLD 14 AS 'UNDW.'
DEFINE KEY GOLD 15 AS 'UNDL.'
DEFINE KEY GOLD 21 AS '.'
!
SET ENTITY WORD ' <LF><VT><FF><CR>()[]{}<>+-*/|\&=^~`'
!
!  Begin full screen editing.
!
FIND=MAIN
SET MODE CHANGE
```

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CIRCLE D116 ON READER CARD

BENCHMARKING DEC AND DEC-COMPATIBLE HARDWARE SYSTEMS UNDER RSTS/E WITH YOUR APPLICATIONS

By J. Peter Bryce, System Support Team Inc., Vancouver, B.C. Canada

INTRODUCTION:

Any company considering a major hardware upgrade of CPU or disk capacity normally wants to have a good idea of just what the benefits of the proposed system are. Software houses are more interested in providing potential clients with performance per dollar figures for their specific applications on different CPU configurations. The following method was suggested by Kirk Bryde of Canadian Data and was refined by both of us while assisting EBS Data Processing, Inc. of Denver, Colorado to determine whether DEC or OEM CPU's (by such companies as ABLE and Monolithic) were better value in performance per dollar using the EBS ED-1100A Inventory Control package in a typical situation.

We performed these tests under the RSTS/E operating system, but with some minor adjustments for different performance gathering techniques and personal preference, the basic concept should work for any operating system (on pretty well any CPU). A complete understanding of system tuning techniques is assumed for purposes of brevity.

PLANNING:

The first item to be decided upon is what configurations you would like to test, for example:

LOADTEST	CONFIGURATION	DURATION	MAX. TERMINALS
1	DEC 11/23, ¾ mb, 1200 bd	20 min.	8 DZ
2	DEC 11/23, ¾ mb, 2400 bd	20 min.	8 DZ
3	DEC 11/23, 1 mb, *	20 min.	8 DZ
4	DEC 11/44, 1 mb, *	40 min.	16 DZ
5	DEC 11/44, 1 mb, *	40 min.	16 DH
6	DEC 11/44, ¾ mb, *	40 min.	16 *

*Indicates an item to be decided on the basis of earlier tests.

Looking at the list one can easily see two things, first that there are many, many permutations for comparison, and secondly that a lot of people are going to be needed to assist. Having drawn up your list, the next step is to ensure that the hardware for each test is available or will be available on the required date, which will take some advance coordination.

Sales personnel and/or user training personnel should then meet to work out the application loads for the tests. Establish the sequence of users to reflect the normal application process when planning the incremental load on the system.

As you can see, at the start of the test two statistic collection terminals begin at minute zero. Keyboard 0 uses the SYSTAT/S command to provide figures for CPU calculations every two minutes on the two minutes. Keyboard 12 is started at the same time; i.e., the last carriage return is hit to cause execution of the STATUS program at thirty second intervals, printing the results on the keyboard (a hard copy device) simulating an intermittent print job of short duration.

TERMINAL USAGE PLAN

MINUTE	KEYBOARD #	NAME	APPLICATION
0	0	Peter	SYSTAT
	12	John	STATUS collection
2	13	Harry	Order Entry response test
4	14	Fred	Stock Status response test
6	15	Mike	Order Entry
8	16	Carl	Accounts Receivable data entry
10	17	Chris	Keyboard Exerciser (simulated print job)
12	18	Dave	Order Entry
14	19	Simon	Accounts Payable data entry
16	—		(No new terminals to
18	—		permit loading to show
20	—		on graph.)

At minute 2, having had two minutes of statistics gathering to establish a comparative base line, the first response time test, an Order Entry screen will begin. The operator at this terminal will have an assistant operate a stopwatch and will perform the test as often as possible depending on system response. The results can then be recorded like this:

RESPONSE TEST

MINUTE	STOCK STATUS	ORDER ENTRY
2	3.5	—
	3.6	—
	3.4	—
4	3.8	6.8
	4.0	5.9
	4.2	6.4

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The other terminals then start at two minute intervals, maintaining the typical job mix of a real-life system. When all terminals have been added, statistics will be collected for several minutes to allow the graphs to show clearly the results of what should be a full load situation.

It's important that both senior management and all staff who are going to be concerned with the tests understand that unless the human factor of error is reduced, the graphs produced will be useless. This means that effectively, people must be programmed to perform exactly the same task at the same time on each test for comparisons to be made. Inevitably there will be occasions when someone will miss his cue or some unsuspected glitch will show up and cause a test to be restarted, but enthusiasm and encouragement will make up for these slips.

Now that the general plan has been established, the persons who are going to operate the terminals meet with the application analysts and sales staff to develop a typical set of data files which could even be a copy of live data if time is short. Each person must then be given the part numbers, customer numbers or other information necessary to perform the repetitive function needed. Inattention to this simple item can cause embarassing interlock problems on master files at random intervals which will throw the results askew. Ensure that the analysts understand the sequence of events and can guarantee consistent results; i.e., after entering five orders will an automatic job be spawned to perform inventory update?

Of course the database must be restored before each loadtest can begin, to take care of accumulated overheads from bucket-splitting etc., and remember that temporary files should also be deleted to avoid directory search increases.

THE LOADTEST:

Preparing for a test will take up to half an hour, so the participants should not arrive until all is ready. Check each terminal number by logging on, check the speed, keyboard number, and computer, then put each terminal to the main menu so that at the correct cue the user merely selects a menu option rather than going through LOGIN. Naturally all terminals should be within earshot if not eyesight of each other. A large clock with a seconds sweep hand should be used to set computer time to wall time; i.e., when the second hand is at twelve, hit RETURN on a UT TIME command which can only set hours and minutes.

As the terminal users arrive the coordinator should show them to their keyboard as shown on the Terminal Usage Plan. He or she should be positioned close to the clock, preferably where all participants can both see and hear him/her (such as standing on a desk).

It's a good idea to remind everyone of what the test is for, then to roll-call each person with his cue minute. Give a two minute warning after ensuring that all telephone interruptions will be minimized.

Times should be called out as "ten seconds to minute zero, five seconds, and mark!". To provide warnings, also give each user a thirty second warning — you'd be surprised

. . . continued on page 139

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CIRCLE D66 ON READER CARD

ROSS/V

```
        .TITLE  FWBSI Version 4.0
;+
; Function:     This  program  rewrites  the  "Factory  Written  Bad  Sector
;               Information" on RL01/2 or RK06/7 disk drives.
;
; Parameters:   The program is used like any other RT-11 utility as follows:
;
;               .R FWBSI
;               *DEV:/H:abcde/L:fghjk/Y
;
;               where
;
;               DEV:    is the name of the RL01/2 or  RK06/7  drive  containing
;                       the affected disk
;               /H      is  a  switch  identifying  the  five  high-order octal
;                       digits in the disk serial number; 'abcde' specifies
;                       those digits
;               /L      is a switch identifying the five low-order octal digits
;                       in the disk serial number; 'fghjk' specifies those
;                       digits
;               /Y      is an optional switch to suppress the prompting message
;                       that asks if the user is sure
;
;               The handler for DEV must be resident on the system disk.  This
;               program  is  assumed  to  be running under an RT-11 single job
;               monitor.
;
;               To assemble (with listing):
;
;               .R MACRO
;               *FWBSI,FWBSI/N:BEX/N:SYM/E:LC=FWBSI
;
;               To link (no map necessary):
;
;               .LINK FWBSI
;
;               Copyright (c) 1983 Logicaid Limited
;                                  and the Professional Press
;
;               Copying of this software is permitted only if the above
;               copyright message is included
;
;               No warranty of merchantability or fitness is expressed or
;               implied
;
        .PSECT  FWBSI,RW,I,GBL,REL,CON
        .PAGE
FWBSI:  NOP                             ;In case of unforeseen initialization
        NOP                             ;(Enough room for a JSR patch)
        CMP     #VAR033,#005600         ;Insure that the program is the correct
        BNE     FWSI01                  ;size
        MOV     #FWBSI,R0               ;Insure that user created program correctly
        CLR     R1                      ;
FWSI00: ADD     (R0)+,R1                ;
        CMP     R0,#VAR033              ;
        BNE     FWSI00                  ;
        CMP     R1,(R0)+                ;Well?
        BEQ     FWSI02                  ;Branch if so
FWSI01: MOV     #VAR010,VAR020          ;Set error text
        JSR     PC,FWSI#3               ;Display error
        CLR     R0                      ;and exit
        EMT     350                     ;
FWSI02: MOV     #001000,SP              ;Reset the stack
        JSR     PC,FWSI36               ;Initialize
        BR      FWSI04                  ;
FWSI03: MOV     #VAR002,R0              ;Identify us
        EMT     351                     ;
FWSI04: MOV     #VAR001,R5              ;Get input
        JSR     PC,FWSI35               ;
        TSTB    VAR014                  ;Any?
        BEQ     FWSI03                  ;Identify us if none
        MOV     #VAR014,R0              ;Insert a file name into the command
        MOV     #VAR013,R1              ;string for the CSI parser
        CLR     R2                      ;Flag end of device name not seen
FWSI05: TSTB    (R0)                    ;Have we reached end of line?
        BEQ     FWSI08                  ;Branch if so
        CMPB    (R0),#'/                ;Is this a switch specification?
        BNE     FWSI06                  ;Branch if not
        TST     R2                      ;Was a device name encountered?
        BEQ     FWSI11                  ;Branch if not (go straight to error)
FWSI06: CMPB    (R0),#':                ;Is this the end of the device name?
        BNE     FWSI07                  ;Branch if not
        TST     R2                      ;Already placed file name?
        BNE     FWSI07                  ;Branch if so
        INC     R2                      ;Else flag end of device name seen
FWSI07: MOVB    (R0)+,(R1)+             ;Save input character
        TST     R2                      ;Is this where the file name is placed?
        BLE     FWSI05                  ;Branch if not
        NEG     R2                      ;Mark file name placed
        MOVB    #'A,(R1)+               ;File name is 'A'
        BR      FWSI05                  ;
FWSI08: TST     R2                      ;Was a device encountered?
        BEQ     FWSI11                  ;Branch if not
        CLRB    (R1)                    ;End of the line for parser
        MOV     #VAR014,R2              ;Set up prompt
        MOV     #000004,R3              ;
        MOV     #VAR004,R4              ;
FWSI09: MOVB    (R2),(R4)+              ;
        CMPB    (R2)+,#':               ;
        BEQ     FWSI10                  ;
        DEC     R3                      ;
        BNE     FWSI09                  ;
FWSI10: MOV     SP,R5                   ;
        MOV     #VAR013,-(SP)           ;Parse input line
        MOV     #VAR016,-(SP)           ;
        MOV     #VAR018,-(SP)           ;
        MOV     #VAR013,-(SP)           ;
        EMT     345                     ;
        BCC     FWSI13                  ;Branch if parseable
FWSI11: MOV     #VAR005,VAR020          ;Invalid command
FWSI12: JSR     PC,FWSI#3               ;Display error
        BR      FWSI02                  ;Try again
FWSI13: TST     VAR016+36               ;Any device?
        BNE     FWSI15                  ;Branch if one
FWSI14: MOV     #VAR006,VAR020          ;Specify a device
        BR      FWSI12                  ;
FWSI15: CLR     R0                      ;Insure only a single file is specified
        BIS     VAR016,R0               ;
        BIS     VAR016+12,R0            ;
        BIS     VAR016+24,R0            ;
        BIS     VAR016+46,R0            ;
        BIS     VAR016+56,R0            ;
        BIS     VAR016+66,R0            ;
        BIS     VAR016+76,R0            ;
        BIS     VAR016+106,R0           ;
        TST     R0                      ;
        BNE     FWSI14                  ;Branch if more than one was specified
        MOV     #'L,R1                  ;Get low order serial number
        JSR     PC,FWSI29               ;
        BCS     FWSI16                  ;Branch if none
        BIC     #100000,R1              ;
        MOV     R1,VAR015+2             ;Save it
FWSI16: MOV     #'H,R1                  ;Get high order serial number
        JSR     PC,FWSI29               ;
        BCS     FWSI17                  ;Branch if none
        BIC     #100000,R1              ;
        MOV     R1,VAR015               ;Save it
FWSI17: MOV     #'Y,R1                  ;See if /Y was entered
        JSR     PC,FWSI29               ;
        BCS     FWSI18                  ;Branch if not
        INC     VAR024                  ;Mark that it was
FWSI18: MOV     #VAR007,VAR020          ;Assume invalid switch
        JSR     PC,FWSI23               ;Is there one?
        BCS     FWSI12                  ;Branch if so
        MOV     #001000,SP              ;Reset the stack
        MOV     #VAR009,R2              ;Load device handler
        MOV     #VAR016+36,R1           ;
        MOV     (R1),VAR019             ;
        JSR     PC,FWSI38               ;
        BCS     FWSI22                  ;Branch if unloadable
        MOV     #VAR026,R0              ;See if device is supported
        MOV     VAR027,R1               ;
FWSI19: CMPB    VAR017,(R0)             ;
        BEQ     FWSI20                  ;Branch if it is
        ADD     #000006,R0              ;
        DEC     R1                      ;
        BNE     FWSI19                  ;
        MOV     #VAR011,VAR020          ;Device not in tables
        BR      FWSI12                  ;and try again
FWSI20: MOV     R0,VAR023               ;Save table address of device
        TST     VAR024                  ;Was /Y entered?
        BNE     FWSI21                  ;Branch if it was
        MOV     #VAR004,R5              ;Else prompt for go ahead
        JSR     PC,FWSI35               ;
        TSTB    VAR014+1                ;Was a single character entered?
        BNE     FWSI22                  ;Branch if not
        CMPB    VAR014,#'Y              ;Was it Y?
        BNE     FWSI22                  ;Branch if not
FWSI21: JSR     PC,FWSI44               ;Create new "FWBSI" area
        BCC     FWSI22                  ;Restart if no error
        MOV     #VAR012,VAR020          ;Else display error
        JSR     PC,FWSI#3               ;
FWSI22: JMP     FWSI02                  ;and restart
        .PAGE
        .SBTTL  FWSI23: CHECK FOR PRESENCE OF INVALID SWITCH
FWSI23: MOV     R0,-(SP)                ;Save registers
        MOV     R2,-(SP)                ;
        MOV     SP,R2                   ;Address CSI input
        ADD     #000006,R2              ;
        MOV     (R2)+,R0                ;Get switch count
        BEQ     FWSI27                  ;Branch if none
FWSI24: MOVB    (R2),VAR008             ;Is there one?
        BEQ     FWSI25                  ;Branch if not
        MOV     #VAR007,VAR020          ;Set error message
        SEC                             ;Indicate error
        BR      FWSI28                  ;And return
FWSI25: INC     R2                      ;Forget switch type
        TSTB    (R2)+                   ;Was there a value?
        BGE     FWSI26                  ;Branch if not
        TST     (R2)+                   ;Else forget value
FWSI26: DEC     R0                      ;Do all switches
        BNE     FWSI24                  ;
FWSI27: CLC                             ;Mark no bad switch
FWSI28: MOV     (SP)+,R2                ;
        MOV     (SP)+,R0                ;
        RTS     PC                      ;
        .PAGE
        .SBTTL  FWSI29: FIND PRESENCE AND VALUE OF SWITCH
FWSI29: MOV     R0,-(SP)                ;Save registers
        MOV     R2,-(SP)                ;
        MOV     SP,R2                   ;
        ADD     #000006,R2              ;Point at switches
        MOV     (R2)+,R0                ;
        BEQ     FWSI33                  ;Branch if none
FWSI30: CMPB    (R2)+,R1                ;Desired switch?
        BNE     FWSI31                  ;Branch if not
        CLRB    177777(R2)              ;Zap valid switch
        MOV     #177777,R1              ;Assume no value
        TSTB    (R2)+                   ;Check assumption
        BGE     FWSI34                  ;Branch if no value
        MOV     (R2)+,R1                ;Save value
        BR      FWSI34                  ;And exit
FWSI31: TSTB    (R2)+                   ;Advance to next
        BGE     FWSI32                  ;
        TST     (R2)+                   ;
FWSI32: DEC     R0                      ;
        BNE     FWSI30                  ;
FWSI33: MOV     #177777,R1              ;No switch
        SEC                             ;
FWSI34: MOV     (SP)+,R2                ;Restore registers
        MOV     (SP)+,R0                ;
        RTS     PC                      ;and return
        .PAGE
        .SBTTL  FWSI35: GET LINE FROM CONSOLE, PROMPT ADDRESS IN R5
FWSI35: MOV     #VAR014,-(SP)           ;Set up GTLIN
        MOV     #000001,-(SP)           ;
        MOV     R5,-(SP)                ;
        CLR     -(SP)                   ;
        EMT     345                     ;Execute it
        RTS     PC                      ;Return
        .PAGE
        .SBTTL  FWSI36: INITIALIZE
```


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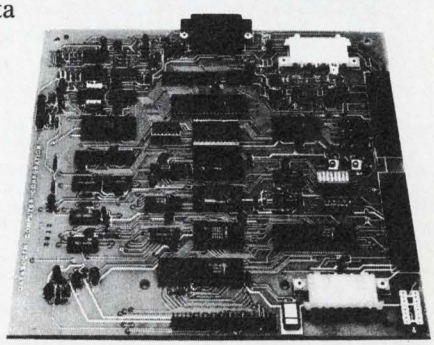

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```
FWSI36: EMT     352             ;Do a soft reset
        MOV     #177777,R0      ;Get available memory
        EMT     354             ;
        MOV     #002000,R0      ;Soft errors only
        EMT     374             ;
        MOV     #VAR033,VAR022  ;Next available memory
        MOV     #VAR004,R0      ;Initialize query
        MOV     #000040,R1      ;
        MOVB    R1,(R0)+        ;
        MOVB    R1,(R0)+        ;
        MOVB    R1,(R0)+        ;
        MOVB    R1,(R0)         ;
        CLR     VAR024          ;Mark that /Y was not entered
        MOV     #VAR015,R0      ;Initialize the buffer area
        MOV     #077777,(R0)+   ;Default serial number
        MOV     #077777,(R0)+   ;
        CLR     (R0)+           ;Mandatory zeroes
        CLR     (R0)+           ;
        MOV     #177777,R1      ;Remainder of buffer area
        MOV     #000774,R2      ;
FWSI37: MOV     R1,(R0)+        ;
        DEC     R2              ;
        BNE     FWSI37          ;
        CLR     (R0)+           ;RK06/7 extra word
        RTS     PC              ;
        .PAGE
        .SBTTL  FWSI38: LOAD HANDLER ADDRESSED BY R1
FWSI38: MOV     R1,R0           ;Do device status
        MOV     #VAR017,-(SP)   ;
        EMT     342             ;
        MOV     #VAR028,R0      ;Determine type of monitor
        EMT     375             ;
        BIT     #000001,R0      ;Is it extended memory?
        BEQ     FWSI41          ;Branch if not
        TST     VAR017+4        ;Handler loaded?
        BNE     FWSI42          ;Branch if so
FWSI39: MOV     #VAR009,VAR020  ;Else display error
        JSR     PC,FWSI43       ;
        SEC                     ;Mark error
FWSI40: RTS     PC              ;and exit
FWSI41: MOV     VAR022,-(SP)    ;Fetch handler
        MOV     R1,R0           ;
        EMT     343             ;
        BCS     FWSI39          ;Branch if unable
        MOV     R0,VAR022       ;Next available address
        BR      FWSI40          ;
FWSI42: CLC                     ;
        BR      FWSI40          ;
        .PAGE
        .SBTTL  FWSI43: REPORT ERROR
FWSI43: MOV     R0,-(SP)        ;Save registers
        MOV     #VAR003,R0      ;Error preamble
        EMT     351             ;
        MOV     VAR020,R0       ;Error text
        EMT     351             ;
        MOV     (SP)+,R0        ;
        RTS     PC              ;
        .PAGE
        .SBTTL  FWSI44: WRITE NEW "FWBSI" INFORMATION
FWSI44: MOV     #001400,R0      ;Avail channel
        EMT     374             ;
        MOV     #VAR029,R0      ;Lookup the device absolutely
        EMT     375             ;
        MOV     #VAR030,R0      ;Get the device size
        EMT     375             ;
        BCS     FWSI47          ;Branch if unable
        MOV     VAR023,R1       ;Address table entry for device
        CMP     VAR025,4(R1)    ;Is this device bigger?
        BLOS    FWSI45          ;Branch if not
        ADD     #000006,R1      ;Advance to double density entry
FWSI45: MOV     2(R1),VAR032    ;Starting block number
        MOV     4(R1),VAR021    ;and ending block number
FWSI46: MOV     #VAR031,R0      ;Write next pair of blocks
        EMT     375             ;
        BCS     FWSI47          ;Branch if unable
        ADD     #000002,VAR032  ;Bump block number by two
        CMP     VAR032,VAR021   ;At the end of the device yet?
        BNE     FWSI46          ;Branch if not
        MOV     #001400,R0      ;Avail the channel
        EMT     374             ;
        TST     (PC)+           ;Clear carry
FWSI47: SEC                     ;Mark unable to complete
        RTS     PC              ;and return
        .PAGE
        .SBTTL  STATIC DATA
        .ENABL  LC
VAR001: .ASCII  '*'
        .BYTE   200
VAR002: .ASCIZ  'FWBSI V04.0
VAR003: .ASCII  '?FWBSI-F-'
        .BYTE   200
VAR004: .ASCII  'XXX:/Reset FWBSI-Are you sure?'
        .BYTE   200             ;
VAR005: .ASCIZ  'Invalid command'
VAR006: .ASCIZ  'Only a single device may be specified'
VAR007: .ASCII  'The /'
VAR008: .ASCIZ  'x switch is invalid or redundant'
VAR009: .ASCIZ  'The device handler is not loaded'
VAR010: .ASCIZ  'The source file FWBSI.MAC was not created correctly'
VAR011: .ASCIZ  'The specified device is unsupported'
VAR012: .ASCIZ  'Unable to write on the specified device'
VAR013: .REPT   121             ;CSI text area (insure null for checksum)
        .BYTE   0               ;
        .ENDR                   ;
VAR014: .REPT   121             ;GTLIN text area (insure null for checksum)
        .BYTE   0               ;
        .ENDR                   ;
        .EVEN                   ;
VAR015: 077777                  ;High order serial number
        077777                  ;Low order serial number
        000000                  ;Zeroes
        000000                  ;(Not an alignment cartridge)
        .REPT   374             ;Remainder is all ones
        177777                  ;
        .ENDR                   ;
        .REPT   400             ;Second pair of sectors
        177777                  ;
        .ENDR                   ;
        000000                  ;Extra word for RK06/7 special functions
VAR016: .REPT   47              ;CSISPC input area (insure null for checksum)
        000000                  ;
        .ENDR                   ;
VAR017: 000000                  ;DSTATUS area (insure null for checksum)
        000000                  ;
        000000                  ;
        000000                  ;
VAR018: .RAD50  'ZZZZZZZZZZZZ'  ;
VAR019: .RAD50  'XXX         '  ;Device name
VAR020: 000000                  ;Address of error to transmit
VAR021: 000000                  ;Number of the end block
VAR022: VAR033                  ;Address of next available memory
VAR023: 177777                  ;Address of device in our table
VAR024: 000000                  ;Non-zero iff /Y entered
VAR025: 177777                  ;Returned device size
VAR026:                         ;Supported device table
                                ;Each entry is a single density entry
                                ;followed by the double density entry
                                ;The first word is RT-11 device type
                                ;Next word is FWBSI start block
                                ;Next word is block beyond FWBSI end
        000005                  ;RL01 entry
        023754                  ;
        024000                  ;
        000005                  ;RL02 entry
        047754                  ;
        050000                  ;
        000023                  ;RK06 entry
        064740                  ;
        064766                  ;
        000023                  ;RK07 entry
        151010                  ;
        151036                  ;
VAR027: <VAR027-VAR026>/6       ;Number of table entries
VAR028: .BYTE   0,34            ;GVAL to get configuration word
        000300                  ;
VAR029: .BYTE   0,1             ;To "lookup" the device
        VAR019                  ;
VAR030: .BYTE   0,32            ;Special function for device size
        000000                  ;
        VAR025                  ;
        000001                  ;
        .BYTE   377,373         ;
        000000                  ;
VAR031: .BYTE   0,32            ;Special function to write FWBSI
VAR032: 177777                  ;Number of the start block
        VAR015                  ;
        001000                  ;
        .BYTE   377,376         ;Write special function
        000000                  ;Wait for it
VAR033: 147563                  ;Where to load handlers
                                ;Initially contains checksum
        .END    FWBSI           ;
```

how many times a pressing need has caused someone to visit a restroom at the wrong time!

During the warm-up or even while the test is running, remind personnel that it's better to restart a test than to have inaccurate figures to base expensive decisions on. Mention that no blame will be attached to operator finger trouble (O.F.T.) promptly admitted to. Somebody mis-typing an account number may cause several additional screens to occur and unless owned up to problems such as this will be apparent as soon as the graphs are compared but may be almost impossible to pin down beyond the "something funny happened" stage.

Depending upon your plan it may be possible to run two or three loadtests consecutively without too long a delay for assisting personnel. A baud rate change on eight terminals can take two people ten minutes after practice; yes, it should be quicker, but the first time it took almost thirty minutes!

Allow sufficient time at the end of testing for the test data to be restored (don't forget that for good results, a restore must be done for any restart after minute two), terminal speeds to be set to normal, etc.. As a rule of thumb allow thirty minutes before and after testing with assisting staff required ten minutes before the start.

CORRELATING THE RESULTS:

At the end of each test, before anybody leaves the area, the coordinator should collect listings of SYSTAT, STATUS and response times, labelling them clearly , ensuring that any handwriting glitches are corrected while the data is fresh, and doing a quick check to see if there are any obvious incongruities that might cause a re-test.

If fast discussions are needed for the next test, such as whether a baud rate change is going to improve results, announce a coffee break for ten minutes and retire to a quiet place with the figures.

Preparing the results in management-presentable form will take up to four hours per test. Begin by transferring data to a form like this one:

LOADTEST 1 — DEC 11/23, ¾ MB, 1200 BD FEB 12/83 15:45

MINUTE	TOTAL KEYBOARD	CPU MIN. %	CPU Kb %	DISK I/O ACC/SEC %	TERM I/O CHARS %	STOCK RESP	ORDER RESP
0	1						
2	2						
4	3						
6	4						
8	5						
10	6						
12	7						
14	8						
16	8						
18	8						
20	8						

Management will almost always find the graph easier to work with, but for the best presentation this chart provides all graphic points as actual figures. The detailed technical discussion will start at the graph and work its way back to the statistics listing and SYSTAT listings which should be retained in binders for each test with the response time results in detail.

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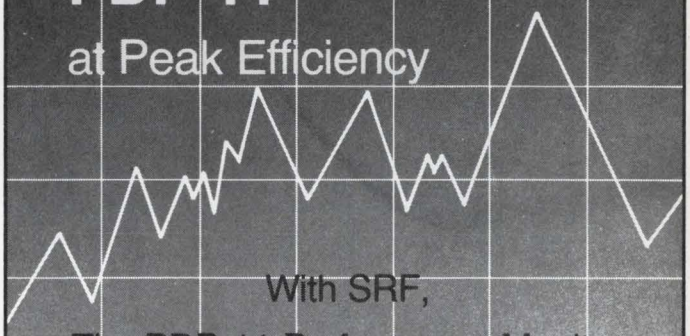

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To fill in the loadtest form take a calculator, or program and enter the figures as follows:

CPU minutes — Take the SYSTAT CPU times,accumulate them and subtract the previous two minute total. This gives the total CPU minutes and can then be expressed as a percentage of two minutes.

CPU Kb — Take the SYSTAT listing, calculate fixed memory overhead; i.e., monitor size, XBUF, core resident libraries, etc.. Add to that the memory used by each user job,ignoring swapped out system jobs such as ERRCPY, etc.. Express the total as a percentage of total available physical memory.

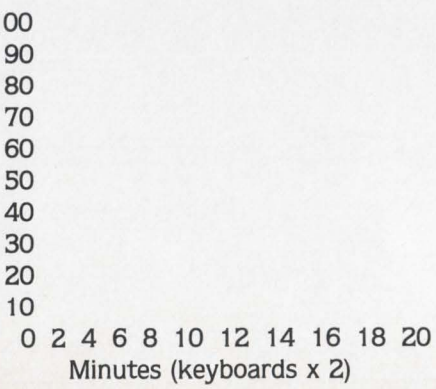
Disk I/O — Take the STATUS listing for each two minute period i.e., where the banner printed is within that period, accumulate total disk reads and writes on all drives for that period, then express as a percentage of the average number of accesses per second (one second divided by average accesses per second multiplied by the number of drives used).

Terminal I/O — Take the STATUS listing for each two minute period and accumulate total characters per second I/O, then express as a percentage of the accumulated baud rates for all terminals divided by ten to arrive at a graphic representation of DH or DZ load.

Stock Response — Take the Response Test results, accumulate the results that were completed in each two minute period and average them out.

Order Reponse — As above.

The graph can now be filled in using either colour or some other technique to highlight the six different sets of results:



Modify the calculations and graduations to provide the most visible spread for each line.

COMMENTS AND SUGGESTIONS:

Running loadtests is addictive. Bearing in mind the effort involved in each one, try to restrict yourself to the smallest number necessary. It's possible to spend weeks fine tuning a system to gain absolutely insignificant results on response times; after all, who cares if the computer is working 5% harder if the response time is the same, especially when reducing that 5% has taken eighty to a hundred man hours?

Before running a loadtest both your application and operating systems should be as tuned as they can be. A loadtest is no time to be testing the effects of a larger XBUF on response time; it's intended to highlight hardware characteristics only. The objective is to be able to report that System A has an acceptable response time with eight terminals, while System B was fully loaded at five. This kind of plain and simple result is something that everyone can understand, even manufacturers.

The subject of the most efficient terminal speed is one of endless discussion; the best advice I can give is to loadtest on a baud rate binary split. The results will be quite interesting.

The calculations are based on my experiences of what should cause a good visual result on the graph, and I'd be the first to admit that there are probably more effective ways of calculating disk load however the main result needed is the response time stretch as terminals are added. The other results are intended to provide pointers towards problem areas which can be closely investigated by technical personnel working directly with STATUS and other tools. The objective is to come up with something to show non-technical personnel such as senior management without getting too technical.

For those of you interested in the comparison of DEC, ABLE and Monolithic CPU's I can only say that if sufficient interest is generated I shall endeavour to obtain the appropriate permissions before printing the results.

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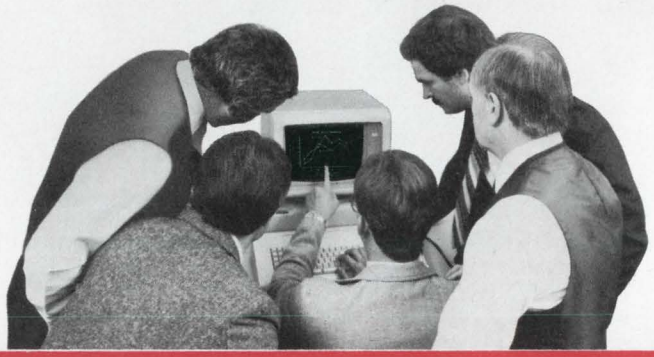

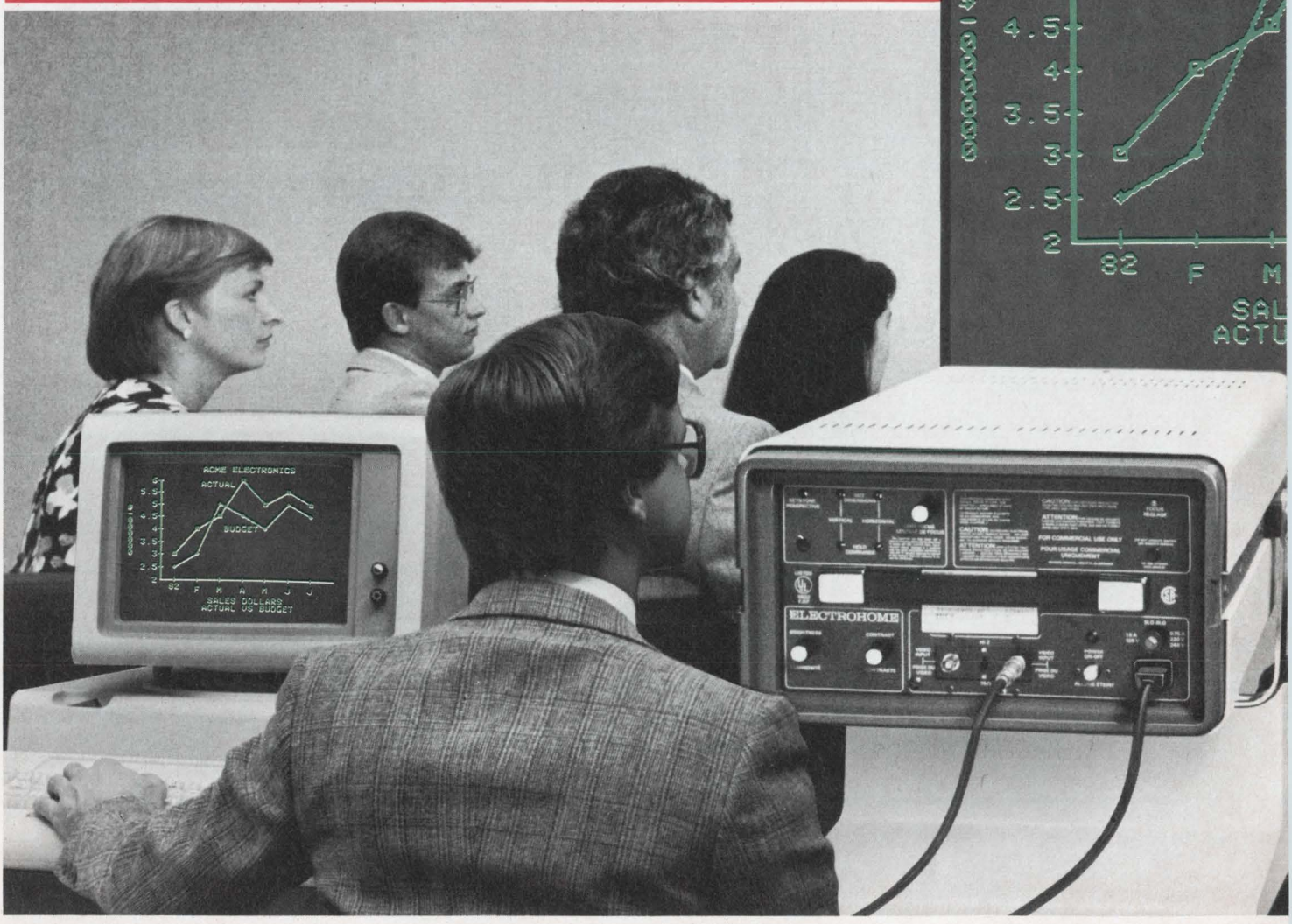

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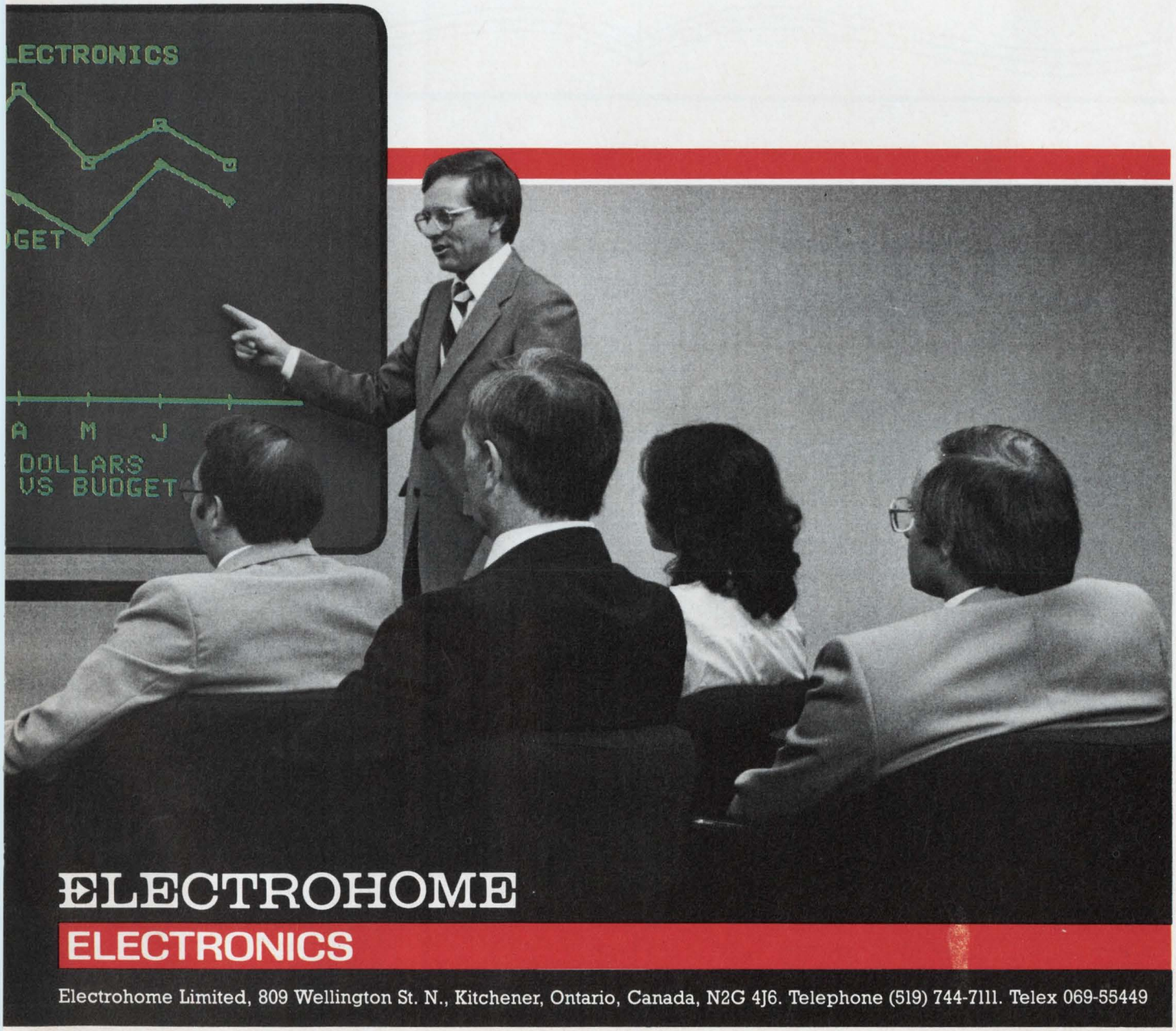

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The IMSL Library, with over 150,000 users, operates on all major computer systems. The Fortran subroutines cover the broad range of applied mathematics and statistics including areas such as Linear and Nonlinear Equations, Eigensystem Analysis, Interpolation, Differential Equations, Optimization, Analysis of Variance, Regression, Forecasting, Multivariate Statistics, Random Number Generation and special functions.

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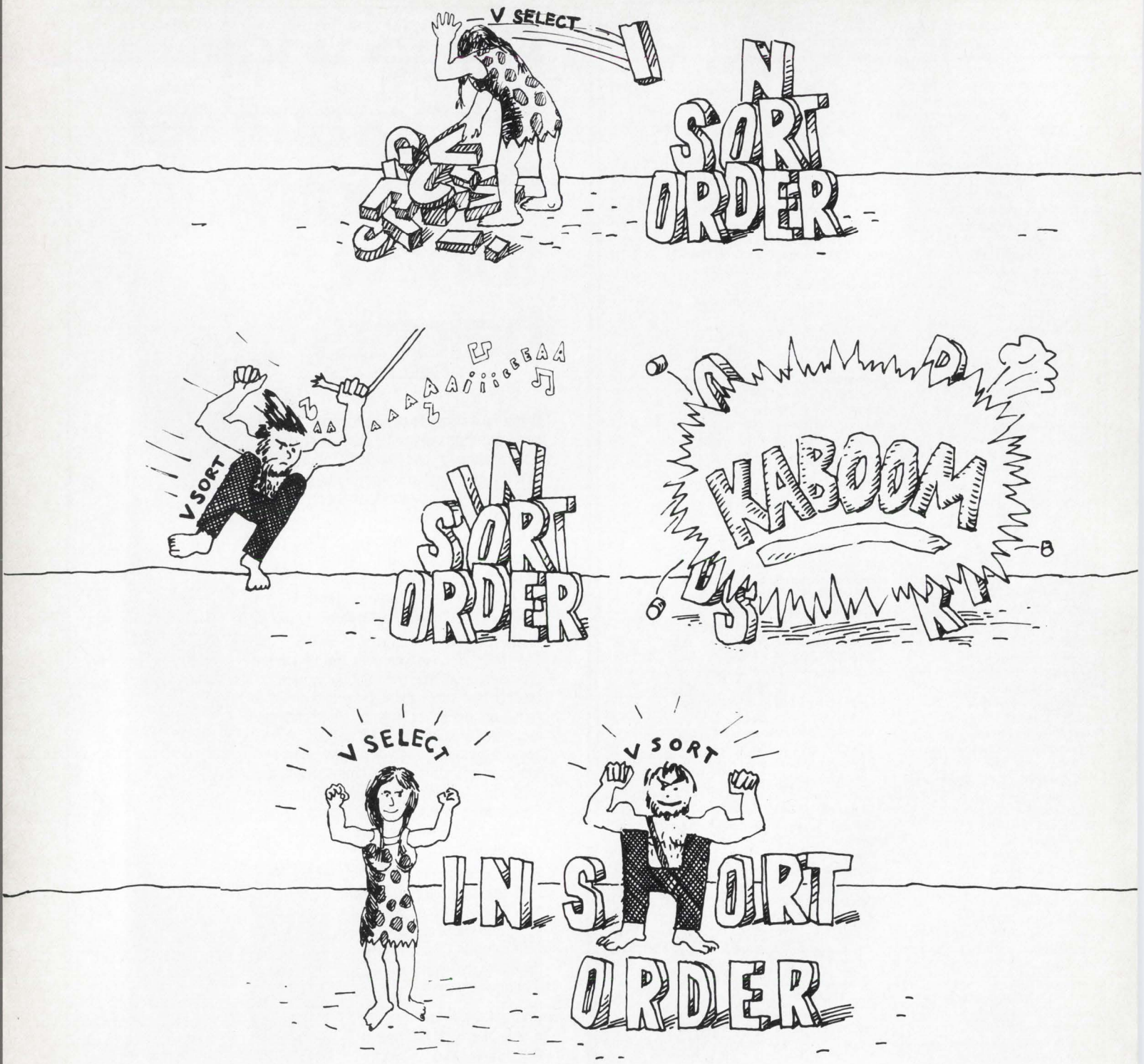
CIRCLE D162 ON READER CARD



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VSORT runs 3 to 7 times faster than the VAX-11 sort . . . and requires much less disk space.

VSELECT extracts and reformats records with comparable speed.

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CIRCLE D92 ON READER CARD

EG&H

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DEXPO INFO

NEW IDRIS IMPLEMENTATIONS FROM WHITESMITHS

Concord, MA — Whitesmiths, Ltd. has introduced three new implementations of Idris, its UNIX-compatible operating system, for DEC personal computers, DEC VAX computers, and the Motorola 68000 microprocessor with memory management software. The price for each version is only $550.

The company also announced that it endorses the additional system calls and library functions needed to conform to the standard for UNIX and UNIX-like operating systems recently proposed by UniForum, the commercial UNIX users' group. Now, not only is Idris one of the most transportable of operating systems, but it also enjoys the same level of source code interchangeability as the rest of the UNIX community.

Modeled closely after Bell Laboratories' UNIX operating system, Idris is a comprehensive, multi-user, multi-tasking operating system that provides a uniform environment across a broad spectrum of mainframe, mini-, and micro-computers.

Its smaller size and greater configurability make it more suitable than UNIX for desktop and dedicated real-time applications. It offers the ability to write truly portable applications, cross-support for a variety of machines, and a sophisticated set of software tools that include over 80 utilities.

A console device and at least one disk drive are typically required to support Idris. Other disks, multiplexors, and backup devices may be added to tailor Idris to a given hardware configuration.

All implementations of Idris are now sold under Whitesmiths new "licensing under copyright" concept. Using this approach, each software package is sold with a numbered and coded Authorization Seal that must be affixed to the computer authorized to run the software. No end-user license is required, thus lowering costs for OEMs and simplifying transfer of the ownership of the software.

The price of Idris with a C compiler and all utilities is $1100; without a compiler the price is $550. A "minimal" Idris host for turnkey operation is only $300. Substantial OEM discounts are available.

Whitesmiths, Ltd. develops and markets a wide range of computer systems software, including compilers, software tools, and its own portable operating system, Idris. Whitesmiths' products have earned a reputation for being reliable, portable, efficient, and cost effective. For more information contact Whitesmiths, Ltd., 97 Lowell Road, Concord, MA 01742. Tel. (617) 369-8499.

ROSS TO SHOW MAPS/PRO, NEW SOFTWARE FOR THE DEC PROFESSIONAL 350

Palo Alto, CA — Ross Systems will demonstrate MAPS/Pro, the new financial software for the DEC Professional 350, at DEXPO East '83 held at Henry W. Kiel Auditorium in St. Louis, May 22-24, 1983.

MAPS is Ross Systems' financial modeling package designed for an array of applications for the financial executives. Financial forecasting, budgeting, strategic business planning, personnel planning, tax analysis, and consolidations are just a few of the areas in which MAPS has been repeatedly successful. A full color graphics package is included with MAPS creating a perfect tool for faster, more accurate financial decision making. Used on Digital Equipments' PDP-11 and VAX-11 computers, MAPS is a language for decision support of non-programing executives.

The version of MAPS for the new DEC Professional 350, called MAPS-/Pro, contains all of the commands and capabilities of MAPS. MAPS/Pro also shares features and benefits of its forebear such as Interactive "friendliness," flexible reporting, integrated graphics, prompts, HELP messages, and a library of financial functions.

INTAC is Ross Systems' database management system, and is a powerful tool for organizing and reporting strategic data. Data entry, data

validation, updating, reporting and inquiry are all available in easy-to-use Business English. INTAC applications include financial information databases, headcount planning, accounting systems, asset/liability management, and much more. Contact Ross Systems, (415) 856-1100 for further information.

MICOM INTRODUCES CONCENTRATOR SWITCH

Chatsworth, CA — For data communications networks that need an inexpensive way to implement data switching and port contention functions, Micom Systems is introducing a new kind of intelligent networking product called the Micro860 Concentrator Switch. The new device connects up to eight Micro800/2 Data Concentrators, and operates as the logical hub of a network to allow any asynchronous channel on one concentrator to communicate with any other channel on that or any other concentrator — all under centralized control. (A Command Port and a Log Port are provided for network management functions.)

In effect, the Micro860 provides a number of add-on networking functions — add-on switching, channel contention, queueing, and centralized management — to what otherwise would be only a collection of point-to-point links. With the Concentrator Switch, users can increase the flexibility and expand the functions of their networks while actually reducing telephone line and communications hardware requirements.

Micro860 Concentrator Switches are available to support four or eight Micro800/2 Data Concentrators. The four-composite model is priced at $2,550, and the eight-composite version is $3,250. Deliveries are scheduled for 90 days after receipt of order. Contact Mark Vonarx, National Sales Manager, Micom Systems, Inc., (213) 998-8844 ext. 479.

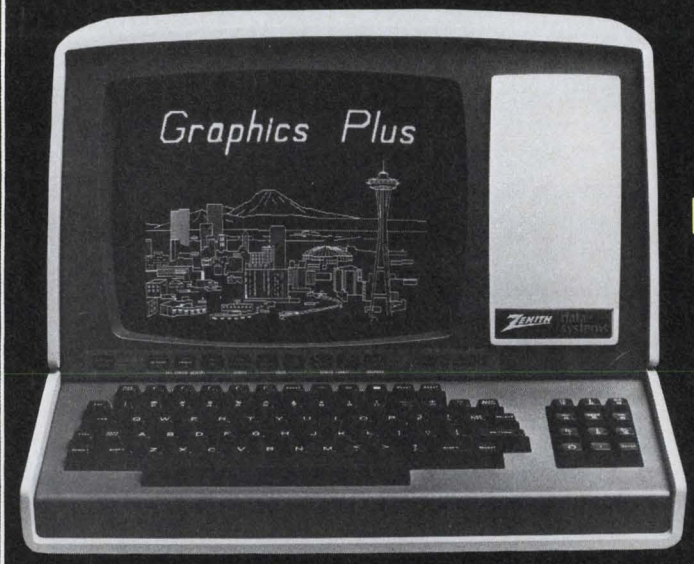
ANDROMEDA CUTS PRICE OF WINCHESTER

Canoga Park, CA — Because of volume based manufacturing efficiencies, LSI-11 systems house Andromeda Systems, Inc. has announced new price cuts, averaging 10% in many of their Winchester disk based products.

In addition, the WDC11 Winchester/floppy emulating controller is now available in a Winchester only configuration. The WDC11-xW may be specified to emulate DEC RK05, RL01/2 or RP02 disks. Single quantity price is $1750 with delivery stock to 30 days ARO. For further information contact Andromeda Systems, Inc., 9000 Eton Avenue, Canoga Park, CA 91304, (213) 709-7600, or see us at DEXPO Booth 320.

SAS INSTITUTE TO DISPLAY TEST VERSION UNDER VMS

Cary, NC — SAS Institute Inc. will display the Beta test version of the



GRAPHICS-PLUS is a field installable enhancement board for the popular Zenith[1] Z19 video terminal adding many powerful features found only on terminals costing much more. GRAPHICS-PLUS provides Tektronix[2] 4010 compatible vector drawing graphics, VT100[3] compatible 80 and 132 column display formats, off-screen scrolling memory, programmable function keys, "Plain English" menu-driven Set-up mode, and a host of other enhancements. Installation can be accomplished within 15 minutes using only a screwdriver.

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For Z19 Terminals
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- Tektronix[2] 4010 Compatible Graphics
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- Seven Page Off-Screen Text Memory
- Menu-driven "Plain English" Set-up Mode
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- Optional Hardcopy Port
- Simple Field Installation

1 TM Zenith
2 TM Tektronix
3 TM DEC

GP-19 Upgrade for Z19 Terminal	$ 849
Z19 Terminal With GP-19 Installed	$ 1495

Northwest Digital Systems
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CIRCLE D204 ON READER CARD

How to look like the DEC* STREAMING TAPE SYSTEM without really buying.

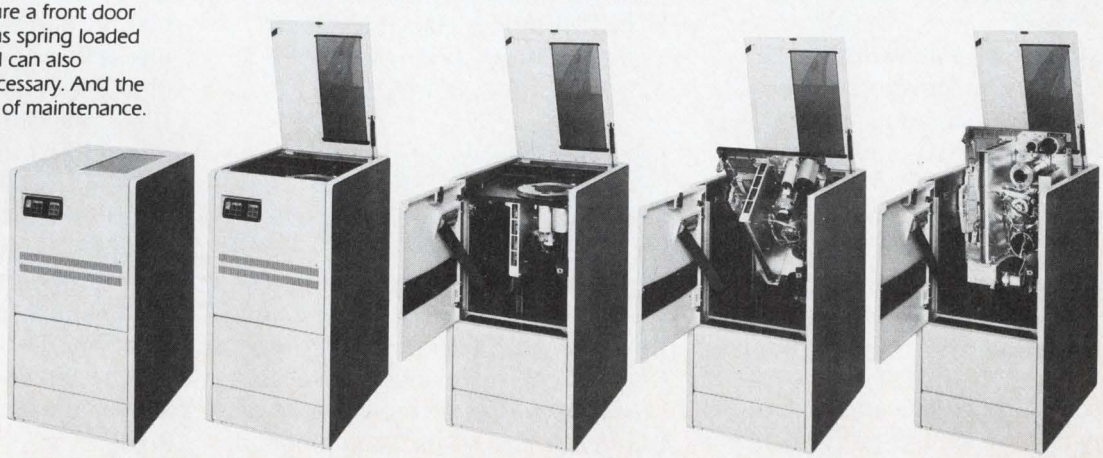
You don't have to buy the delivery delays and higher prices asked for the complete DEC TU 80 Streaming Tape subsystem. Our top loading Streamer Cabinet is identical in appearance to the standard DEC units, yet it is available immediately and costs about 20% less.

Besides being a perfect fit for the time and budget conscious designer, the Control Data family of Keystone start/stop tape drives can be horizontally mounted into our cabinet, too.

So why box yourself into a single supplier if you don't have to? For more than seven years we've given system designers a choice. After all, we like to make you look good too.

Get all the details today and ask about our complete line of DEC compatible products.

The Everest Cabinets feature a front door mounted control panel, gas spring loaded operator access cover, and can also accommodate a disk, if necessary. And the tape drive rotates for ease of maintenance.



*DEC is a trade mark of Digital Equipment Corporation

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CIRCLE D199 ON READER CARD

Portable SAS System in booths 632-634 at DEXPO/East. The Portable SAS System will run on Digital Equipment Corp.'s VAX™ 11/7xx series under VMS™. Included in the Beta test version, available for a 90-day free trial, will be:

- SAS®—for data management, statistical analysis, and report writing
- SAS/GRAPH™—for color graphics presentations
- SAS/FSP™—for interactive data entry, edit, retrieval, and letter writing applications.

After testing is completed and the production versions are available, the Institute's standard 30-day free trial for new software will apply. The Portable SAS System under VMS will also be available from Digital Equipment Corp. under a cooperative marketing agreement between Digital and the Institute.

First-year licenses for SAS from the Institute range from $5000-7500, depending on the machine being used. Yearly renewals are $2800. Additional SAS products are licensed separately. Call for additional information (919) 467-8000.

NORTHWEST DIGITAL SOFTWARE HAS NEW TUNING PACKAGE

Newport, WA — RPM, a new performance tuning package from Michael Mayfield and Northwest Digital Software, substantially extends the performance data collection capabilities of the RSTS/E monitor to provide the information needed to effectively tune system performance.

Additional overall performance data includes information on seek distance, file placement, small buffers, memory usage, file processor (FIP) usage, cache efficiency.

Additional performance data on programs includes CPU, FIP, memory, disk and cache usage, response time and swapping. Data on files includes disk and cache usage.

By collecting all this additional information on system performance, RPM is able to identify performance bottlenecks and show how to correct them. RPM is the only product that can do all this.

For more information, contact Northwest Digital Software, Inc. at Box 2-743, Spring Valley Road, Newport, WA 99156, (509) 447-2620 or see us at booth E, DEXPO East 83.

EG&H TO EXHIBIT KDSS

Lexington, MA — Evans Griffiths & Hart, Inc. announces the release of a VAX/VMS version of KDSS, its key-to-disk data entry software package. KDSS, a widley-used package which in 1980 received an ICP Million Dollar Award, has previously been available for use only on DEC PDP-11 computers, under either the RSTS/E or RSX-11M operating system. Now a version of KDSS compatible with the PDP-11 versions is available for use on any model of DEC's VAX-11 computer under the VAX/VMS operating system. KDSS, running concurrently with other applications on a PDP-11 or VAX-11 computer, permits the use of a portion of the resources of the system as a powerful and flexible multi-terminal data entry system.

VAX/VMS KDSS is available under a single-computer perpetual license for $9,000.00 (special rates are available for single-customer multiple-computer situations). One year of support is included in the license price. Support is available after that year for a yearly fee.

KDSS will be demonstrated at DEXPO/EAST 83 in St. Louis, Missouri, May 22-24, 1983.

For further information contact Evans Griffiths & Hart, Inc., 55 Waltham Street, Lexington, MA 02173. Tel: (617) 861-0670.

RELIANCE ELECTRIC OFFERS DEC PRODUCTS REPAIR BOOK

Cleveland, OH — A new four-page illustrated brochure describing how the Reliance Electric Digital Products Repair Center provides fast, reliable repair, exchange or replacement of PC Boards and related equipment is now available.

The file-size brochure points out that the Digital Products Repair Center is equipped to solve every possible kind of PC Board problem through the use of advanced, state-of-the-art equipment and instrument calibration procedures.

To obtain a copy of the New Digital Products Repair Center Brochure — H-2661-2 — write to Reliance Electric Company, 24701 Euclid Avenue, Cleveland, OH 44117.

NATIONAL INSTRUMENTS OFFERS INTERFACE

Austin, TX — The CPIB-796 is the latest addition to National Instrument's GATEWAY-488 family of Computer to IEEE-488 interfaces. This interface module makes it possible to transfer data between the Multibus and the IEEE-488 bus. This capability expands National Instrument's IEEE-488 product line which presently supports access from Digital Equipment Corporation and S-100 computers to the IEEE-488 Bus.

The design of the GPIB-796 interface was targeted towards providing IEEE-488 access to high-end Multibus systems based on 32-bit microprocessors such as the Motorola 68000, while maintaining a cost effective product that is compatible with 16 and 8-bit microprocessors such as the 8086 and the Z-80. The interface can be used as an IEEE-488 Talker, Listener or Controller and conforms to the proposed IEEE-796 bus specification.

National Instrument's software drivers for the GPIB-796 will support high level operating systems. The first software package for the interface is compatible with the UNIX operating system and will be offered as a support option.

Other IEEE-488 software modules will be written in C as well as assembly languages for the popular microprocessors used on Multibus systems such as 8086/8088 and Z80/8080. These driver modules will also be linked to the popular higher level languages beginning with BASIC.

Full documentation is provided with the interface in the form of a 160 page user's manual. A choice of

cable options include a short flat cable with a rear-panel-mount GPIB connector and a longer (2 or 4 meter) round cable with a standard GPIB connector. The GPIB-796 in single unit quantities is priced at $1295 with OEM discounts available on request. For further information contact Frances Drury at (800) 531-5066 (outside Texas) or (512) 250-9119. Delivery is from stock.

NEWMAN TO EXHIBIT

Ann Arbor, MI — Newman Computer Exchange will be an exhibitor at DEXPO EAST '83 (the Third National DEC-Compatible Exhibition, St. Louis Kiel Auditorium, May 22-24, 1983.) The multi-million-dollar firm is the nation's largest dealer in new and used DEC and Data General systems, processors and peripherals, including an extensive stock of PDP8 equipment. A charter DEXPO exhibitor, Newman markets late-model minicomputer equipment, by direct mail and telephone, to major corporations, universities, and government and military agencies.

Qualified personnel will staff the Newman booth (#201) to provide equipment appraisal and other firsthand information. Also available: catalogs, literature and free signup for mailing cycle, as well as the Newman "Blue Book" on converting surplus minicomputer equipment to cash. (These materials may also be requested direct from Newman Computer Exchange, P.O. Box 8610, Dept. P53J-DX, Ann Arbor, Michigan, 48107, (313) 994-3200.)

DISC TO INTRODUCE COMBINATION PACKAGE

Sacramento, CA — Digital Information Systems Corporation (DISC) will be exhibiting again at DEXPO.

At the show, DISC will be introducing to Systems Integrators and OEM's a combination package that includes DISC's DBL and S&H Computers Inc's TSX-Plus and RTSORT. The combination package costs integrators anywhere from $1420 for 5 copies to $1154 for 100 or more.

DBL is a structured source code compatible superset of Digital Equipment Corporation's DIBOL-11 language. DBL is currently available for DEC's RT-11, RSTS, RSX-11M and VAX/VMS environments as well as for S&H's TSX and TSX-Plus Time Sharing Extension to RT-11 on DEC minicomputers. DISC recently released DBL/VMS, the latest in the DBL series of compiler and runtime systems, for use in native mode under the VAX/VMS operating system. Early users of the product cite the in-line code and /BIND facilities as the major system performance enhancement features, which, when used with the structured extensions to the DIBOL-11 language provide an efficient and easily maintainable programming environment.

Additional product and pricing information may be obtained from DISC, 3336 Bradshaw Road, Suite 340, Sacramento, CA 95827, (916) 363-7385 or at their DEXPO EAST '83 booth #430.

VAX TRAINING FROM ESSENTIAL RESOURCES

New York, NY — Essential Resources, Inc., (ERI) a company devoted to training on DEC systems, is pleased to announce a new course offering: *VAX Operator Training.* This offering is derived from an extensive study of the VAX operations environment. The course is the newest addition to the growing list of courses offered for DEC Operating Systems, UNIX, Applications Languages, and Layered Software.

The three day course is provided at the client site, in the environment where the Operator will perform. The purpose of this course is to enhance the efficiency of the Operator by broadening his understanding of the VAX hardware, the VMS Operating System, and the system messages which require his attention. Creating and running command procedures is covered in depth.

All courses offered by ERI are custom tailored to the requirements of the client. A preliminary skills and task analysis is performed so that appropriate course modifications can be made. The total service is performed for a reasonable cost. This results in efficient training in terms of both time and money.

ERI will be available at DEXPO EAST 83, booth number 405, to discuss your training requirements. You may also contact them by phone at (212) 956-5988.

IMSL RELEASES EDITION 9 OF FORTRAN LIBRARY

Houston, TX — IMSL, Inc. has announced the release of Edition 9 of the IMSL Library for the Digital Equipment System, 10/20, VAX-11 Series, and PDP-11 Series. This version of the widely used Library has an additional 40 subroutines which bring the total to 540. Used internationally, it was designed for maximum accuracy and efficiency in mathematical and statistical problem solving.

The IMSL Library is a comprehensive set of FORTRAN subroutines which serve as building blocks that are used to save costly programming time in developing scientific and engineering application programs. They are arranged in 17 chapters, covering the total field of mathematics and statistics.

Major new subroutines for Edition 9 have been added in areas of basic statistics, differentiation, differential equations, quadrature, eigensystem analysis, random number generation, interpolation, approximation, smoothing, linear algebraic equations, special functions, utility functions, optimization, sorting, and zero and extremas.

For the Digital Equipment computer, the annual subscription rates for IMSL Library are $2,000 — $2,500 for initial subscriptions, and $1,500 — $2,000 for renewals. For universities, the subscription rate is discounted 40%. For additional information contact IMSL, Inc. Sixth Floor — NBC Building, 7500 Bellaire Blvd., Houston, Texas 77036, USA, telephone (713) 772-1927, outside Texas call toll free (800) 231-9842, or telex 79-1923 IMSL INC HOU.

NEW PRODUCTS

SOUTHERN SYSTEMS DEBUTS ION DEPOSITION PRINTER

Fort Lauderdale, FL — The first non-impact computer printer system based on ion deposition imaging has been introduced by Southern Systems Inc.

Called the Mecurion 1, the 60 page per minute, letter-quality printer system is both a lower-cost alternative to laser xerographic systems and a direct replacement for high-speed impact line printers.

At a single-unit price of about $60,000, Mercurion is some 50 percent less than comparable-speed non-impacts that use laser xerography. Mercurion's per-page operating costs also are projected to be about 50 percent less.

Mercurion 1 uses standard plain paper, 8½" by 11" as well as metric sizes. Either landscape or portrait format may be selected. An operator-friendly pushbutton control panel is used to set margins, to select various fonts (up to eight may be resident in the printer), to program number of copies (1 to 255), and to handle self-test.

Plug-compatible with all major mini and mainframe computers, Mercurion can replace an existing impact line printer *without operating system software changes.* Orders for delivery by first quarter 1983 are now being taken for Southern Systems' new Mercurion 1 which will be manufactured at the company's Clearwater, FL plant.

Southern Systems Inc., leads the add-on printer market, with more than 6,000 printer installations across the United States and in Europe. Southern Systems is located at 2841 Cypress Creek Road, Fort Lauderdale, FL 33309. (305) 979-1000, (800) 327-5602, Telex 522135.

HASP+ TM

The missing link.
PDP-11/VAX Interconnect to IBM, CDC, DEC and others — with 12 years field experience.

HASP+ has an International Who's Who customer list. You can join them on a no risk trial, PLUS a low, low price.

HASP+ is highly versatile. Can operate as a host or remote work station, supports auto-dial, and more. HASP+ uses standard DEC communications hardware.

VAX single systems, $5,500; 15 systems $2,500 each. PDP-11 prices slightly lower.

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EVEREST INTRODUCES STREAMER CABINET

Anaheim, CA — A lower cost alternative to the recently introduced DEC TU 80 streaming tape subsystem is being offered by Everest Electronic Equipment, who has designed an enclosure for Control Data's family of Keystone start/stop tape drives.

The top loading Everest Streamer Cabinet is identical in appearance and configuration to the standard VAX enclosure that houses the DEC TU 80 subsystems, yet it is priced about 20% less, according to Everest sales manager Charles Schroder.

The new Everest cabinet is designed to be compatible to all systems as an add-on unit as well as house the Control Data streaming tape that enables system designers with VAX-11/750 or VAX-11780 processing power to configure systems with low cost expansion capability.

The cabinet features a front door mounted control panel, gas spring loaded operator access cover, and horizontal mounting of the Control Data Keystone Tape Drive. In addition, there is a 10½ inch space below where the tape drive is mounted to accommodate a disk if desired and the drive rotates for ease of maintenance.

Headquartered in Southern California, Everest has been providing system designers with DEC compatible cabinets for more than seven years. For additional information on the streamer cabinet or any of the complete line of DEC compatible cabinets manufactured by Everest contact: Chuck Schroder, Sales Manager, 2100 E. Orangewood Avenue, Anaheim, California 92806. 714/634-2200.

PRODUCT UPDATES

BENCHMARK MONITOR FOR RSX

Calgary, Alberta, CANADA — The BENCHMARK MONITOR for RSX is

a software product which takes actual measurements in a running PDP-11 computer system in order to identify the utilization of its various components. These measurements can be used to determine the system load during a benchmark, to identify what can be done to get higher performance from a particular computer system, or to document available capacity in a system before increasing its workload.

The BENCHMARK MONITOR identifies which programs have the greatest impact on your PDP-11, and hence have the greatest potential for improvement. It also tells you whether you can expect faster disk accesses by moving files or reordering them.

The units in which all figures are reported have been specifically chosen to simplify the comparison of benchmarks of different durations with one another, as well as with manufacturers' device specifications. If you are interested in other performance figures, please ask us for the kind of report you would like.

The software requires only loadable device driver support, and can be installed in minutes, as no sysgen is necessary. No additional hardware is required. The BENCHMARK MONITOR is available for both versions 3.2 and 4.0 of RSX-11M, and pricing starts at $1000.00 per CPU. Contact Daniel Computing Systems, Inc., 351 Maitland Hill, NE, Calgary, Alberta T2A 5V4, (403) 273-2657.

GDI ANNOUNCES SERIAL COMMUNICATIONS PROCESSOR

Huntsville, AL — Designed to unburden PDP-11 / LSI-11 host computers from time-consuming serial input/output processing, GDI's SCP provides high speed buffered DMA to the host computer memory. The SCP is a single quad board with an on-board 2 MHz Motorola 6809 microprocessor and 60K bytes of local RAM. Two independent, full duplex transmitters/receivers provide program controlled I/O or DMA between host memory and local RAM. Asynchronous, byte synchronous or bit synchronous modes of operation are individually selectable for each of the two serial ports. SDLC/HDLC and CCITT X.25 compatible.

The 6809 is user programmable and is supplied with a PDP-11/LSI-11 based software development system that includes a 6809 assembler and down-line loader.

The SCP is priced at $2,495.00. Substantial quantity discounts are available. Delivery is 30 days ARO. For further information contact General Digital Industries, 7702 Governors Drive, Huntsville, AL 35805. Telephone (205) 837-8305.

TRANSTECTOR OFFERS OVERVOLTAGE PROTECTION

Post Falls, ID — Transtector Systems, the world's oldest and largest manufacturer of solid-state transient overvoltage protection equipment, offers a complete line of transient suppression systems designed specifically for use with Digital Computers. Systems range from small plug-in units to large panel protectors, all providing response times of five nanoseconds or less, low voltage clamping points and an automatic reset to the ready state.

Transtector products have been proven effective during 12 years of actual in-field service with DEC equipment, providing absolute protection against transient overvoltages — the most common cause of damage in solid-state electronic equipment. Those products available for DEC applications include:

1) The ACP3000 Panel Protector for use with the DEC PDP 11/44, PDP 11/70, VAX 750 and other systems using a dedicated branch panel;

2) The CPS150 Plug-In Protector for use with the DEC LSI 11/23, PDP 8, PDP 34 and other systems not

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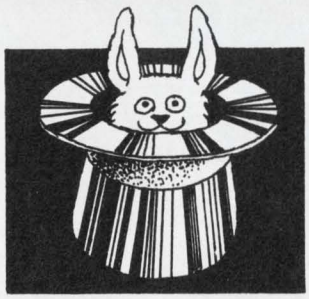

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requiring a dedicated panel for power supply;

3) The ACP100BL Plug-In Protector for use with the DEC LA and VT model terminals;

4) The Data/Signal Line Family of Protectors — LMP4, TSJ6 & 8, DLP3 and FSP 4000, for use with leased lines, dial-up modes, RS232, RS422 and current loop protection for DEC systems.

For complete details on these or other Transtector overvoltage protection devices, call toll free 1-800-635-2537.

DEC COMPATIBLE DISK DRIVES AT DEXPO

Santa Barbara, CA — Disc Tech One has introduced three new products in their line of 14" Winchester disc drives: an IBM — PC plug compatible 80 Megabyte disc drive subsystem and two DEC-compatible disc drives.

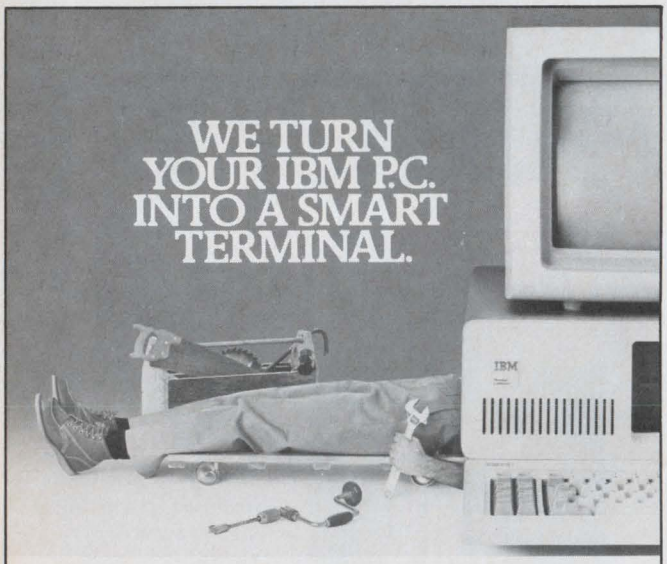
Disc Tech One has also introduced two higher-capacity DEC-compatible disc drives: an 80-Megabyte (Model 3306) and 160-Megabyte (Model 4160) disc drive. Model 3306 emulates Control Data's Model No. 9762 for the RMO-2 and has a 5-year proven reliability. Model 4160, which is compatible to two RA-80's, was designed by the same staff of engineers as the 3306. This DEC-compatible disc drive has all the same DTO features including the patented rotary positioner, clean air package, quiet performance, and compact rack-mountable size. The price for all DTO disc drives includes rails, SMD interface, and an integrated power supply. Disc Tech One, Inc. is located at 849 Ward Drive, Santa Barbara, California 93111.

PERIPHERAL PARTS SUPPORT OFFERS ALTERNATIVE

Cambridge, MA — Peripheral Parts Support, a company dedicated to providing maintenance organizations and End Users with alternative sources for repairing and replacing spare parts for Digital and other manufactured peripheral equipment, will be exhibiting at DEXPO EAST 83.

PPS, established in early 1982, provides End Users or companies maintaining peripheral equipment with off the shelf delivery of low cost Absolute Filters for most models of Disk Drives. In addition, PPS distributes Disk Packs and Cartridges as well as Disk Drive Alignment Tools and Static Eliminator Equipment for the high speed printer market. Also, a significant element in PPS' organization is the services provided for PCBA repair, Disk Head and Spindle Reconditioning, and Tape Head Repair.

PPS' main strategy is to "offer an alternative source for peripheral equipment users to turn to in order to improve upon service levels provided by OEM's and to lower the cost of maintenance in support of Disks, Printer and Tape products" which PPS feels they can offer to most peripheral equipment users. For further information contact Peripheral Parts Support, 110 Rindge Avenue Extension, Cambridge, MA, 02140, (617)-491-3041.



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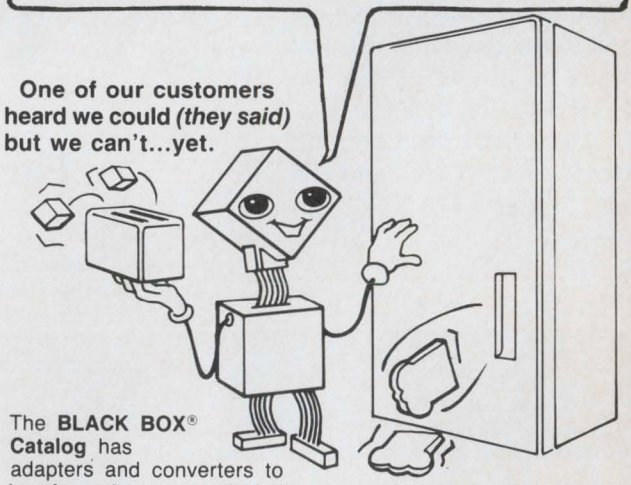

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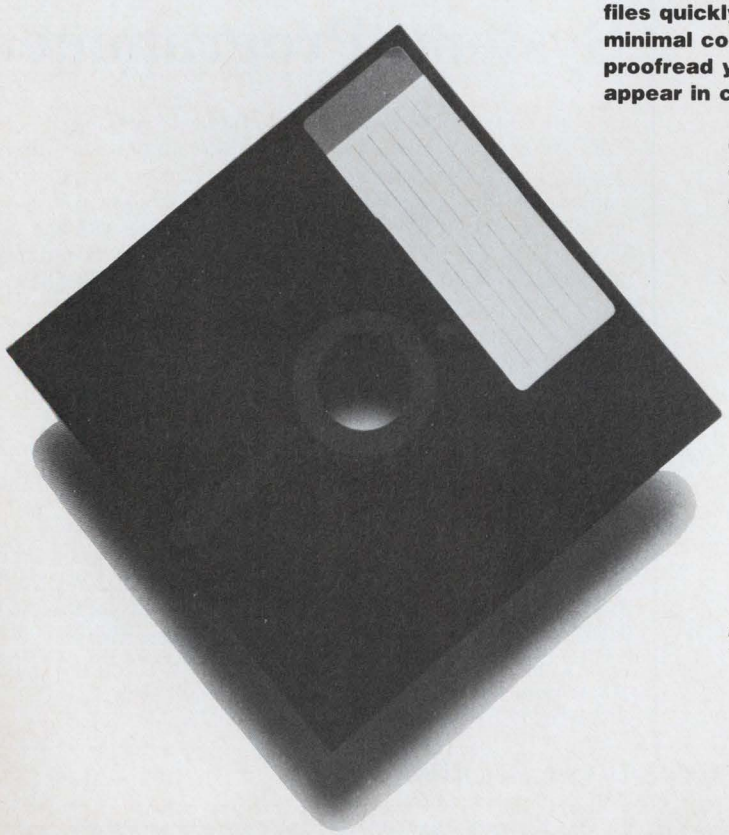

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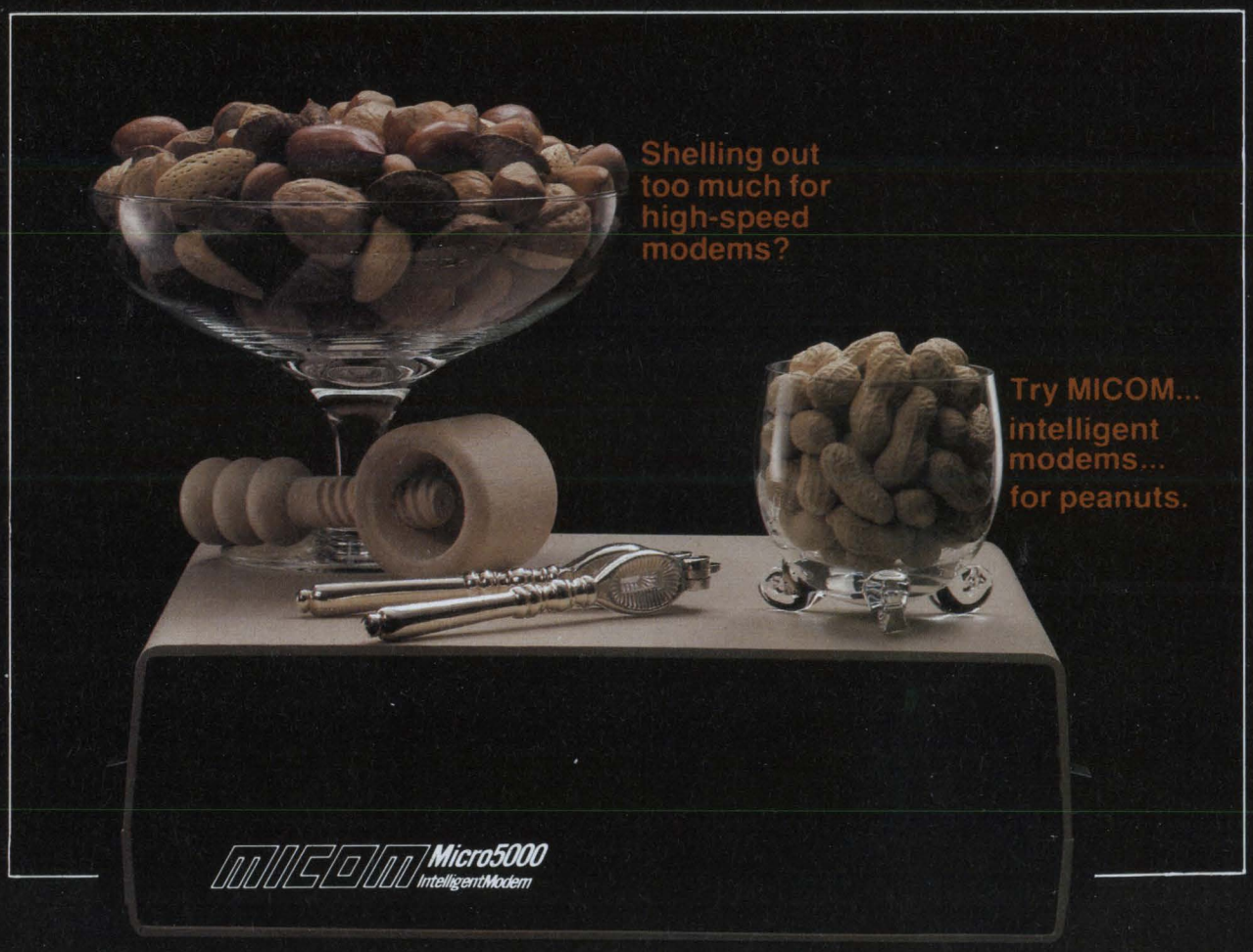

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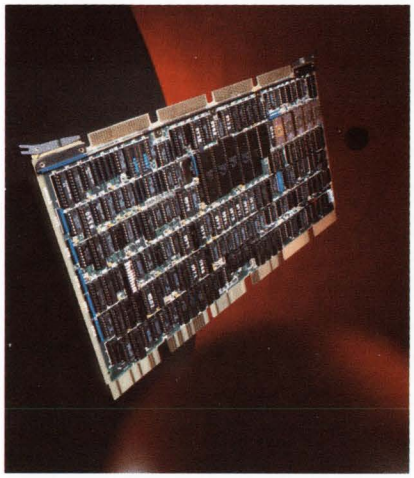

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