INSIDE:

- The RSTS/E Background
- The RSTS Crystal Ball
- FMS V1.5 for RSTS/E
- ENABLE/34 Another Point of View
- Resident Library Tips for DIBOL Users
- LSTLOG.MAC
- DN11 Autodialer 'Enable' Patch for INIT.SYS
- STRTUP/SPAWN
- BASIC-PLUS-2 Programs
- Sort Benchmarks on DEC 11/34 with RSTS/E
- TIPS & TECHNIQUES:
  - Beep-Beep for Garbage Collection
- The VAX-SCENE: Learning to Use the VAX Debugger
- Optimizing Background Usage
- Use[ful,less] BASIC PLUS 2 Software
- CALC.BAS
- DIBOL and MACRO: Oh, Yes, You Can!
- More...
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CIRCLE 72 ON READER CARD
Contents

THE RSTS/E BACKGROUND ........................................... 8
Michael H. Koplitz

"Pseudo" Keyboards?? What would I want them for? Now you can put them to use.

The RSTS CRYSTAL BALL — FMS V1.5 for RSTS/E .................. 14
Michael C. Greenspon

More than you ever needed to know about FMS. Lucky for us Michael keeps writing articles about how an expert uses RSTS: Thanks.

ENABLE/34 — ANOTHER POINT OF VIEW .............................. 22
Kevin Munday

The RSTS PROFESSIONAL itself is produced with the help of our "ENABLED" PDP-11/40. We think both this and the article published last issue give one picture of what it is like to work with this memory expansion device.

RESIDENT LIBRARY TIPS FOR DIBOL USERS ....................... 24
John Wolnisty

We have always said that resident libraries were one of the most significant additions to RSTS. If their uses are limited only by our imagination, here is food for your daydreams.

LSTLOG.MAC ....................................................... 28
David Patterson

What logicals your job or system has available is no longer a mystery. Now you can LSTLOG them!

DN11 AUTODIALER ‘ENABLE’ PATCH FOR INIT.SYS .................. 31
Jim Hobbs

"Hidden" code for your SYSGEN may need some help. The DN11 is an example. Don’t forget that these days there are alternatives to the DN11 in the form of moderns that use ESCAPE sequences to control their dialing. Several packages are also available to give the RSTS user the ability to “dial-out” and communicate with the outside world.

STRTP/SPAWN .................................................... 32
Steve Roy

Understanding how to use the RSTS protection scheme to give users just the “right” privileges without giving away too much. Using the SPAWN SYS call is a new way to control program usage.

BASIC-PLUS 2 PROGRAMS ........................................... 34
Kelvin Smith

Maybe we should call this “How to write better BASIC-PLUS 2 programs.” BASIC PLUS and BASIC-PLUS 2 are different languages and should be approached that way.

SORT BENCHMARKS ON DEC 11/34 WITH RSTS/E .................. 37
Robert L. Besner

How good? How fast? What should we avoid? All these questions are answered by benchmarking, which is why I have always liked this sort of article. While there are always some distortions with benchmarks, interesting and often useful information is there.

TIPS & TECHNIQUES — Beep Beep for Garbage Collection .......... 48
Steven Edwards

One way to “clean up” a program is to avoid unnecessary garbage collection. Now when our garbage is "collected" you can know about it.

LEARNING TO USE THE VAX DEBUGGER
(for those of you who make mistakes) .............................. 52
Bob Meyer

True compiled languages require different debugging techniques than old BASIC-PLUS. Using the VAX makes debugging funny. When code complies to “native mode” instructions it is almost like being back in BASIC-PLUS.

OPTIMIZING BACKGROUND USAGE ................................ 56
Michael Mayfield

When you understand exactly what is happening inside RSTS there are some very good things you can do to make your system run better. This small patch could significantly improve your throughput.

USE[ful,less] BASIC PLUS 2 SOFTWARE ........................... 58
Edward A. Heinrich

User utilities are good for everyone. Some may even be useful. Try these.

CALC.BAS ....................................................... 62
Craig Goodrich

Get rid of those calculators on your desk! RSTS is now your 12 memory calculator!

DIBOL AND MACRO — Oh, Yes, You Can! ......................... 66
M. Christopher Getting and Philip G. Anthony

DIBOL will soon be available on the RAINBOW 100 — Now even CP/M and micro computers will have this language. Back on PDP-11 you can mix and match your DIBOL. If you can use MACRO, can you use FORTRAN or BASIC-PLUS-2?

From the Editors ................................................. 4
Letters to the RSTS Pro .................................. 6
Dear RSTS Man ........................................... 36
News Releases ........................................... 72
Classifieds ............................................. 83
List of Advertisers ......................................... 82
SOFTWARE — A FLOPPY FUTURE

Dave Mallory

I have been thinking about software (as a business) and some of the futures that I can see...

First of all, a survey:

Price Range    Market          $ Expected
450-4200     mass merchant       $1,000,000
5000-42500   national advt      $1,000,000
55000-65000  vertical markets   $2,000,000
625000-75000 3-piece suits     $2,000,000

It seems that in every case, there is about the same amount of money to be made, and the market definition drives the price. I repeat that this is the current situation, not the future.

Whether you noticed or not, the world as we knew it has just changed. The change is not limited to steel-workers, auto assemblers and tire makers.

Just as new technologies and cheaper overhead have finished off the above industries as we know them, the existence (real or imagined) of a $10,000 PDP-11 under your desk and a spread sheet in your terminal (Rainbow or Pro) has changed the way our industry will operate in the future. Check out Lisa, 1.2.3 and the like. Take a good look...a very good look.

I note with interest that a VAX 750, configured to perform in 11/70 dimensions, costs today what the 11/70 cost in 1975. I guess that for a few more years, DEC will be able to sell big Caddies and Lincolns to the affluent few. After all, they have to get the billions invested in VMS back somehow.

The bulletin that I have for you today is that $3000 machines don’t use $10,000 software. Dollar-fifty gas does not run 8 mp chariots. (for long...)

Some questions (sans answers):
1) Will Computerworld and the like control all future software distribution?
2) Who will be able to afford the outlay to create software for mass markets since break-even will be at 5000 units per annum?
3) How do you do a new release or a maintenance update for an 885 package with 10,000 users?
4) Ain’t it fun to be alive?

From the Publishers...

THE RIGHT TOOL

Carl B. Marbach

With the correct tool some jobs that are otherwise impossible are easy. I learned that fact during summer work in a gasoline station. Changing drum brakes is a cinch with the brake tools, without them it is dangerous to fingers and other anatomical parts. Spark plugs can be changed easily if you have a long 7/8" socket and wrench, try it with an open end wrench and you’ll wind up with skinned knuckles.

With computers the same rule applies. Notice how programmers run to get the best tool; TECO still lives, EDT can’t be lived without and LINED. The PDP-10 original line oriented editor died. Other tools we use include cross reference programs, load maps and debuggers. We use the computer itself as a tool for programming.

What happens if you don’t have a tool you need? The job can usually be done but it takes longer and has more mishaps along the way. In the early versions of RSTS we didn’t have multi-language capability. Some independent software people solved that one, but it wasn’t as straightforward as it is now. Want to write FORTRAN? Now you can use the best of the PDP-11 compilers on RSTS, but this was not always the case. We need the best tools available because without them we cannot make the best use of our system.

Sometimes RSTS has lagged behind in providing needed tools. DECNET for RSTS was last to be implemented and Phase 4 is not likely to be available at all. RSX has I and D space set up so that a program can address an additional 64K. I have been told that doing the same for RSTS is possible, but it is not planned.

Needed features for BASIC-PLUS are not being added for lack of space (it is rumored to be within one or two bytes of its limit), RSTS is lagging again, but this time I think it is very serious.

DEC has put forward a new line of “personal” computers. Included in this line is the PROFESSIONAL series based on the PDP-11. Unfortunately, the operating system used on the Professionals is a derivative of RSX called POS (Professional Operating System). DEC is providing a “tool kit” for use on VAX and RSX for program development for software to be run on the Professional computers. NO RSTS TOOLKIT! Why? Is it too hard to do? I can write programs on RSTS for both VAX and RSX, why not the Professional? Is RSTS not important enough? A popular computer system for the personal computers in the marketplace today is CP/M (by Digital Research, Inc.) which most observers think was modeled after RSTS. According to DEC, they sold more RSTS systems last year than in any year prior to that. It is important. You and I know that.

We now have Version 8.0 soon to be released. It has things that I can’t imagine were important to many of us. How many really wanted a new directory structure? How many needed it? I have had reports that BASIC V2 (Version 2 of BASIC-PLUS 2) has many RSTS problems, not the least of which is a faulty installation procedure. Shops currently running BASIC-PLUS 2 can not just put the new product up and have it work; one commercial installation submitted six SPP’s in one day! They were told by telephone response that these might not be fixed until the next release which will ONLY run on V8.0 of RSTS.

What are our developers thinking about? We need tools! I have taken the position that integrating DEC’s new personal computers into our existing systems is critical to keeping us up to date. But, no tools! Can I write a BASIC-PLUS 2 program and run it on a Professional 350? I think I can, but I could do it better if the people who represent us at DEC would provide us with some of the things we really need in timely fashion. Why RSX and VAX and not RSTS. Scream. Holler. Yell.
BEFORE you add memory
(or anything else)
to increase system performance

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For More Information
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CIRCLE 108 ON READER CARD
LETTERS to the RSTS Pro ...

Send letters to: Letters to the RSTS Pro, P.O. Box 361, Pt. Washington, PA 19034-0361.

A short note that you may find suitable for the RSTS Professional letters column.

I was asked if it was possible to make the "DETACH" SYS call non-privileged. I said "No" but started looking and seem to have found a patch that allows it.

The patch is an adaptation of feature patch 3.5.4. That patch told how to make privileged, several non-privileged SYS calls. In essence, it told how to turn on a bit for each call in a table. My patch turns OFF that bit for the appropriate table entry. Here it is:

```
RUN $0NLPAT
Command File name? <cr> (RETURN for manual patching)
File to Patch? <cr> (LIMITED to patch installed
File found in account [0,1] monitor)
Module name? RSTS
Base address? $00000
Offset address? 7-000$050
Base Offset Old? New?
?????????????????? $AA??????
?????????????????? $C (Uppercase to exit)
```

The patch has been tried and tested on RSTS 7.0, 7.1, and 7.2. The "old" value that's changed varies from one release to another, and possibly from one version of a release to another. But the detach call does become non-privileged, so I must be doing something right. I also suspect that it will be relatively immune to changes in RSTS.

If anyone does choose to apply this patch, they may want to apply the sequence number part of the original (Base: $00000, Offset: O, set to: Q1200) to indicate that a "fiddle" has been done. They may also want to keep the "old" value just in case they want to put it back sometime (though setting that location to Q11 will do just as well).

Tom Britton, Sr. Systems Programmer
CBL Canterbury Limited
New Zealand

I liked Allan Woloshin's article on the Enable/34. However, there are some things that I would like to add, in the hope that it might assist some readers. We have a PDP-11/45 with 512Kw and an Enable/34, of course.

One disadvantage not mentioned is that data space is disabled by the Enable patches. This means fewer small buffers on your system, if that is a concern. Also, not only does the CPU not go any faster, it actually slows down! Technically, the CPU itself runs at the same speed, but the Enable slows memory access down. Someone from Able Computer mentioned a 10% reduction in memory speed. I have no benchmarks to prove or disprove this. I will say, however, that even a 10% reduction in memory speed is a vast improvement over being disk-bound.

I take issue with the statement that the Enable is difficult to install. The documentation is sufficient and we were up within a half-hour. Maybe this is a function of the difference between a PDP-11/34 and a PDP-11/45.

We, too, experienced some difficulties (after the Enable was installed) having to do with Tape Controller activity and bus termination. The worst part of the entire ordeal was not having any diagnostics. Supposedly, according to our friendly Able technician, they have finally released diagnostics. I'll believe it when I see it. I heard something similar over one year ago, but we never saw the software.

Overall, I was pleased with Able Computer's assistance and the dramatic performance increase after installing the Enable. If asked — "Are the headaches worth the extra memory?" — I would have to say an unhesistant, "Yes!" All of our Run Time Systems are now resident. We have resident libraries for the first time, more than a token XBUF, and almost no swapping.

My advice (if anyone wants it) is to add an Enable if you have 11/45 or some other 18 bit machine. If you have an 11/34, then sell the CPU and replace it with an 11/44 and extra memory. That would be more cost-effective. Depending on where you buy your parts, it may be outright less expensive.

As of last fall, we got an 11/70 to supplement our 11/45. The 11/70 is faster, it has CACHE and 1/2MB more memory (and therefore more XBUF). Yet, the 11/45 has followed right on its heels. From a user's standpoint — even with 30 jobs on the system — they cannot tell the difference between the 11/70. Compare that to one year ago, when it took five minutes to log-on without the Enable, and I think you'll understand my favorable attitude toward it.

Tom Britton, Sr. Systems Programmer
CBL Canterbury Limited
New Zealand

In any situation there are PROS and CONS. I'm glad to see that the ENABLE article (FEB '83) was presented with both. I'm sure as time goes on, any vendor can and does iron the bugs out of their hardware. But its important for anyone to be careful when purchasing hardware (even from DEC), since bugs are inevitable in new technology. Keep an eye out for my next article: "Buyer Beware!!"

Steve Roy
Diversified Consulting
Bloomfield, CT

Just a note to tell you how much I enjoyed your article on "Decus in Australia" in the December RSTS Pro. A very glowing report and, in contrast with many US visitors, you got (almost) all your facts right! A few points you might find of interest:

- The "bedroom communities" and "minor cities" you refer to, are indeed called "suburbs" locally.
- Canberra was actually created to be the Australian capital. The site for Canberra was chosen to be halfway between Sydney & Melbourne, to prevent rivalry.
- No graffiti in Melbourne? I've seen plenty — but then I haven't seen yours!
- One wallaby, two wallabies.
- The Koala is related to the Wombat and is definitely NOT a bear.
- Any chance of copies of some of the photos - particularly those of Chris, yourself, Carey (in the library booth) and myself?

I'm glad you enjoyed your visit to Australia & your participation in Decus. I certainly enjoyed making your acquaintance and benefiting from your (and Dave's) knowledge and experience.

Your editorial in the "RSTS Professional" of December 1982 ("If you want it you have to ask for it") was discussed at the December meeting of the Decus Australia Board. As a RSTS person and a representative from the world of commerce, I was asked to write to you on behalf of the whole Board, to express our appreciation.

We in Decus Australia have a wish to handle the "Commercialism" issue both realistically and responsibly. We are pleased that your editorial was written in that same spirit, presenting what we feel to be an accurate reflection of our attitude, to the RSTS community.

Jo Kuithof, Decus Australia

I started reading and enjoying the RSTS Professional about six months ago and I believe that there has been an article on the advantages of task-building Basic-Plus programmes against RSX using Digital's CSPCOM which is bundled into Version 7.0 and onwards.

Bearing in mind the volume of sites around the world which are still using Basic-Plus (as opposed to Basic-Plus +2) I do not think that it has been brought home to your readers the advantages which this process can bring.

We have developed an extensive accounting package known as INCA which consists of some 150 Basic-Plus programmes and recently completed the task-building of this suite. In order to obtain some measure of the gain from this process we ran two bench-mark tests, on our 11/34 running under RSTS V7.2, first under the .BAC programmes and then under the .TSK programmes. Each bench-mark consisted of a series of different operations (i.e. file merge, file update and print to spool file) and as it happened, under .BAC the elapsed time was 700 minutes and 701 minutes. Under .TSK the elapsed time was 450 minutes and 429 minutes respectively.

The run time statistics were even more impressive. Under .BAC they totalled 36,750 and 36,887 CPU seconds whereas under .TSK they only logged up 16,559 and 16,962 seconds.

...continued on page 70
EMULEX TALKS DEC

TAMING THE EAGLE...

High-speed disk drives, like the Fujitsu Eagle, on your Q-bus? You bet, with Emulex’s new SC03. This single-board controller supports full 22-bit addressing, boasts 14-sector buffering, and can handle 32 different combinations of drive configurations and much more—all for $2800 list.

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THROUGHPUT, THROUGHPUT, AND MORE THROUGHPUT...

Why should you VAX-750 and 780 users wait in a data traffic jam on the Unibus? An Emulex-controlled subsystem incorporating a CDC, Fujitsu, or other SMD disk drive can hook you right into the high-speed CMI or SBI bus.

Q-bus and Unibus environmentalists, take heart: You can plug an Emulex-packaged subsystem into Q-bus and Unibus models and gain efficiency—like no more infuriating, software-crunching “data lates.”

BUSY SIGNALS...

All you DMF-32 dependent VAXers can expand communications with the DMF-32 emulating F models of Emulex’s CS11 and CS21 communications MUXes. The F’s offer 16 to 48 remote modem-controlled lines, compared to two remote modem-controlled lines per DMF-32. Present CS11-21ers can upgrade to the F models via a $350 PROM change.

What’s more, Emulex hears that DMF-32’s are available from DEC only on certain VAX-11 models, and then only after a wait. The F’s are available now for all VAX-11s.

RECIPE FOR VAX STORAGE...

Take one Fujitsu Eagle, add one CDC Keystone streamer for backup, mix well with an Emulex disk controller and an Emulex tape coupler, and pour into a 42-inch DEC-compatible cabinet. The result: The PXD51 Series, a complete line of high-speed, high-reliability mass-storage subsystems that provide combined disk and tape capability.

Storage capacities: 349 to 414 MBytes. Prices from $26,150. Compare that to the competition, byte for byte.

FROM THE EMULEX FILE...

Emulex’s figures for the first half of FY ’83 are in: Revenues up 98 percent; earnings up 120 percent; earnings per share up 93 percent (that reflects our second public offering, completed in October). Emulex has reduced prices on selected Q-bus and Unibus products—SC02, SC04, TC01, SC21/V, and TC11. Special invitation: Next time you’re in Southern California, give us a call to schedule a visit to our new 70,000 square-foot home in Costa Mesa, and we’ll talk DEC there.
THE RSTS/E BACKGROUND

By Michael H. Koplitz

Background processing is used to allow a user to accomplish a task without tying up his terminal or his time. While a background process is running, the user can continue his efforts in other areas. RSTS/E allows a type of background processing with the BATCH system, which is part of the spooling package. APTK and ATPRO could be thought of as background processors, except that the terminal is tied up. Background, therefore, has not been available under RSTS/E until now.

THE PSEUDO KEYBOARD

To be able to create the illusion of background, the RSTS/E feature of the pseudo keyboard is used. A pseudo keyboard is a logical device which has all of the characteristics of a terminal, but there is not any physical terminal associated with it. The pseudo keyboard has both input and output buffers. Naturally, programs can access these buffers.

The number of pseudo keyboards is determined during SYSGEN time. RSTS/E assigns the device name PKn: to each pseudo keyboard and associates each with a keyboard unit number, KBn:. A physical keyboard is not allocated to the pseudo keyboards. Therefore if eight pseudo keyboards are generated during SYSGEN, the first non-pseudo keyboard would be KB9:.

Usage of a pseudo keyboard requires a controlling program. The pseudo keyboard will respond to RSTS/E commands the same as any other terminal on the system would. The actual input/output buffers for the pseudo keyboard are the input/output buffers from the controlling program. The controlling program will OPEN the pseudo keyboard on a RSTS/E channel. This causes input/output buffers to be created. These buffers are associated with the pseudo keyboard.

PSEUDO KEYBOARD OPERATIONS

The controlling job uses the pseudo keyboard (PKn:) to perform input and output operations to the controlled job. The controlled job accepts the commands and returns information to a keyboard number (KBn:). The controlled job does not know that it is dealing with a pseudo keyboard when it accesses KBn:.

USING A PSEUDO KEYBOARD

Utilization of a pseudo keyboard is done via the BASIC-PLUS or BASIC-PLUS-2 language. An "OPEN" statement is used to access a pseudo keyboard. The pseudo keyboard is treated like a file.

100 OPEN "PK1:" AS FILE #1%

This statement will open PK1: on channel one. PK1: will translate into KB3:. If KB3: is "opened" by the controlling job, an error will be generated. As far as the controlling job knows, KB3: is disabled.

Two errors can occur on the open statement. ?NOT A VALID DEVICE (ERR = 6) can occur if the pseudo keyboard specified does not exist on the system. If the pseudo keyboard requested is in use the error ?DEVICE NOT AVAILABLE is generated.

CREATING THE JOB

The pseudo keyboard must first be opened on a channel before the job can be created. The job is then created by placing a valid sign-on command in the output buffer of the pseudo keyboard channel. PRINT or PUT statements are used to place commands into the output buffer. Remember that the output buffer for the pseudo keyboard from the controlling job becomes the input buffer for the controlled job. For example, the following PRINT statement will invoke LOGIN.

10 PRINT #1%, RECORD 1%, "HELLO":CHRS(13%) ;

RSTS/E will generate a < CR> and < LF > for every record sent to the pseudo keyboard. Therefore, the PRINT statement MUST have the semicolon following it if a CHRS(13%) is appended to the statement. A PUT statement would therefore require the CHRS(13%).

A GET statement, discussed later, is used to retrieve the "#" from LOGIN. Then the account number and the password are transmitted to the pseudo keyboard. The entire login procedure can be condensed into one statement:

10 PRINT #1%, RECORD 1%, "HELLO 100,100;DEMO":CHRS(13%)

SENDING COMMANDS TO THE CONTROLLED JOB

The PRINT and PUT statements are used to send com-
WHAT YOU DON'T KNOW ABOUT YOUR DISKS IS COSTING YOU MONEY

If your disk looks like this, you're wasting system performance.

If your disk looks like this, you're using DISKIT.

When the job you're running requires reading the "red" file, it naturally happens faster on a well-ordered disk. Disks become "fragmented" as you use your computer. The system slows down. And that costs you money.

Now, you can restructure your disks and get back that lost performance (up to 50%) without spending a dime on new hardware. DISKIT is the original software system that makes this possible.

But don't confuse DISKIT with other system utilities, DISKIT is a complete "software tool kit" that optimizes your RSTS/E system.

DISKIT is:
- DSU — The utility which restructures the information on your disk, making data fast and easy to access.
- DIR — The incredible directory tool that finds files at the rate of 400 per second.
- RDR — Reorders disk directories 30 times faster than ever before possible.
- OPEN — Displays complete job statistics and file activity so you can see what your system is doing.
- DUS — The set of CALLable subroutines which pre-extend file directories, reducing fragmentation.

In today's tight economy, it's more important than ever to get the most out of your hardware investment. Call or write today and start getting your money's worth from your computer.
The controlled job must be in 1C or KB state for the command to be sent. The controlling job can force a command to the terminal even if the job is not in 1C or KB state. The RECORD clause in the PRINT and PUT statements informs RSTS/E how to respond to the command. The values and meanings of the RECORD clause are:

<table>
<thead>
<tr>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The system does not check the job status before sending data to the pseudo keyboard.</td>
</tr>
<tr>
<td>2</td>
<td>The system tests to determine whether the pseudo keyboard is at 1C or KB state. If not then ERR = 3, ?DEVICE IN USE, is generated.</td>
</tr>
<tr>
<td>4</td>
<td>The system does not send data to the pseudo keyboard but instead errs if the pseudo terminal is not ready to accept data. If no error occurs then control proceeds to the next statement in the controlling job's program.</td>
</tr>
<tr>
<td>8</td>
<td>The system waits for small buffers to become available for input if this bit is set. An error is generated if there are no small buffers available.</td>
</tr>
</tbody>
</table>

**RECEIVING INFORMATION FROM THE CONTROLLED JOB**

Information from the controlled job is obtained by using the GET statement in combination with the FIELD statement. The channel number for the GET and FIELD statement is the channel number that the pseudo keyboard is OPENed on.

GET #1%

This statement will retrieve data from the pseudo keyboard on channel one. The system will not stall the controlling program if there is not any data waiting to be returned. Instead the error, ?END OF FILE ON DEVICE (ERR = 11), is produced. If the controlled job produces output faster than the controlling job accepts it, then the controlled job goes into a TT (output wait) state.

The FIELD statement performed after a GET statement would be as follows:

FIELD #1%,RECOUNT AS A$

The output produced by the controlled job is stored in the variable AS. It must be remembered that A$ contains the <CR> and <LF> characters. Also A$ may not be full lines of output. Therefore when the output from the controlled job is displayed the carriage return must be omitted. For example:

PRINT A$

This would print the output from the controlled job correctly.

**PSEUDO.BAS — THE RSTS/E BACKGROUND PROGRAM**

Now that the method to utilize pseudo keyboards is understood, the RSTS/E background environment can be established. The program PSEUDO.BAS will perform the necessary tasks to create the RSTS/E background. PSEUDO.BAS is a combination of ATPK, BATCH, and PRO. PSEUDO.BAS understands command/control files from each of these processors.

To achieve a true background processor, PSEUDO.BAS must be able to operate in a detached mode. PSEUDO.BAS can indeed operate either while connected to a terminal or detached. PSEUDO.BAS is even smart enough to log the user back in at his terminal after it has detached. PSEUDO.BAS will also kill itself when it is finished with the background processing. This ensures that there are no detached hibernating jobs left on the system.

PSEUDO.BAS has two prompts, the first being for the command file name. An extension must be given; PSEUDO.BAS has no extension defaults. The command file can be a CMD or CTL or any other type of file. Again for the true background appearance, PSEUDO.BAS will allow the user to enter the commands at the terminal which are to be processed in background. To do this enter "**" to the command file question.

Two switches exist to this question. If the command file name is followed by a /DET, PSEUDO.BAS will detach. The user can then do whatever is desired. The other switch is /RET. With this switch, PSEUDO.BAS will log the user back in. Not using a switch indicates that PSEUDO.BAS is to run at the terminal. By not using /DET or /RET, PSEUDO.BAS will resemble ATPK.

The second prompt deals with the log file that PSEUDO.BAS will print the processing information and errors to. If a carriage return is entered in response to this question, the log file is the KB:. If KB: is specified then the job can not detach. Any disk file or device can be entered to this question. One switch exists to this prompt, and that is /TIME:xxx. A default of 120 minutes has been developed for the maximum amount of processing time allowed to the background job. The /TIME switch will override that number. The maximum amount of time to give the job is entered in minutes.

If PSEUDO.BAS is detaching, it will inform the user of this status. If PSEUDO.BAS is logging the user back in, then the user will be informed about this process.
I RUN PSEUDO

THIS PROGRAM IS A COMBINATION OF BATCH/ATPRO/ATPK

PROCESSORS. THIS PROGRAM WILL DO COMMAND FILE

TIME.START: INT(TIME(/QS)/60) !EXTEND HJDE, SET .c TRAPPING,

OPEN "KB:" AS FILE 12S

INPUT LINE COMMAND.FILE$

PRINT "Log file name?"

PRINT

PRINT "PSEUDO v1.0 Command file processor"

PRINT "To this input the command filename with extension is given.

A CTL file from batch may be used as the command file.

If a * is entered the commands to process will be inquired

for from the KB.

Two switches exist: DET - causes pseudo to detach.

RET - causes pseudo to detach then

re-log the user back in.

Log file name?

The default to this question is KB:. IF KB: is used then

PSEUDO can not detach.

Extension must be given.

One switch: TIME.xxx, where xxx is the time limit of the

process (in minutes), 120 minutes default.

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PRINT " Illegal switch"
150 INPUT #5, COMMAND.LINE$ 
|   COMMAND.LINE$ = CVT$(COMMAND.LINE$, bJ) 
|   ROUTINE ABOVE IS SET FOR 8 PSEUDO KEYBOARDS 

200 IF LEFT(MESSAGE.BACK$, 3J) = "LOG" 
|   GOTO 100 

260 GOTO 150 IF NO. LOGJ = 0 J 
|   X$ = SYS(CHR$(bJ) + CHR$(-bJ) 
|   X$ = SYS(CHR$(bJ) + CHR$(-bJ) 

300 PRINT #15, RECORD 1J, PASSWD$; CHR$(13J); !SEND OUT PASSWORD 

350 PRINT #15, "BYE F"; CHR$(13J); !SEND OFF PSEUDO KEYBOARD 
|   SLEEP 25 

400 IF FIELD #5, RECORD #5, ATTACH$ 
|   GOTO 350 

450 GOTO 310 
|   SEND A 'Z TO PSEUDO KEYBOARD 

500 RETURN ! END OF FUNCTION
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RELIANCE ELECTRIC
Greetings. This issue of the Crystal Ball features an overview of FMS V1.5 for RSTS, some undocumented FMS features, internals information, bugs, and hacks. Also included are some undocumented monitor features in RSTS V7.1 and later.

FMS

DEC's Forms Management System (FMS) serves as a terminal I/O front-end for application programs. FMS consists of three major components: the forms editor (FED), the forms utility and librarian (FUT), and the forms driver (FDV).

FED allows a programmer to interactively design the forms that the application will display and use to retrieve input. FED uses an EDT-like keypad layout to edit and assign attributes to a form. Since the programmer sees exactly what will be displayed, there is no guesswork with a form description language (such as INDENT's) and no need to use a screen layout form. This saves an extraordinary amount of programmer time (and frustration!).

FUT functions mainly as a librarian, allowing the programmer to concatenate and librarify a group of form files into one form library. FUT also prints hardcopy descriptions of a form file, including the actual screen image and attributes.

The forms driver (FDV) contains the code which implements the FMS calls and performs the actual terminal I/O. A portion of the forms driver is implemented in the RSTS monitor (the FMS option must be selected during SYSGEN), but the remainder must be linked with the application program, optionally as a resident library. The forms driver occupies a little under 4KW of code space.

FMS V1.5 ON RSTS

I recently completed a complex mailing list system for RSTS, using RMS and FMS from MACRO-11. Without FMS, the entire project would easily have taken 50% longer to write and debug. I was surprised and quite pleased to find that FMS is efficient, very flexible, and well documented. My compliments, DEC, on probably the best layered product since DTR.

Contrary to popular belief, FMS on RSTS is a relatively light system load. A number of programmers that I've talked to have heard horror stories of FMS V1.0 on RSX, and have falsely assumed that FMS on RSTS is just as piggy. The forms driver for FMS V1.0 (currently on VMS and RSX) uses single character input (the equivalent of the RSTS "one-shot" ODT option) and is contained entirely within the user task.

The user task is scheduled and run every time the operator hits a key. The RSTS implementation is newer, and quite different (hence the version number change) in that the low-level portion of the forms driver is part of the RSTS monitor. This reduces the input overhead for FMS to almost nil. It also means that the user task isn't executed until there is actually data to be processed, so it can be swapped out if needed.

FMS ENHANCEMENTS

The next release of FMS (version 2.0) is scheduled for late spring or early summer of 1983, and will include monitor support for RSX and VMS similar to RSTS's. Also, FMS V2.0 will feature a number of major enhancements, such as user-defined field validation routines and VT100 graphics support. Unfortunately, I needed this functionality six months ago. With a little hacking, kludgery, and clever use of the FMS calls, I persuaded FMS to perform as required. As far as I know, the following kludges only apply to RSTS FMS V1.5, since FMS V1.0 may use incompatible form definitions.

Problem:

FMS V1.5 does not support the VT100 line drawing character set, making it difficult or impossible to display effective boxes, borders, lines, etc.

Solution:

After a little experimentation, I determined that the forms driver (FDV) doesn't care about what is in the [displayed background] text portion of the form. I ODT'd a form file, and after a few minutes, the format of most of the file header and the text section became obvious. I manually patched in the escape sequence to set up the graphics character set, and the appropriate SIs and SOs to shift in and out of the graphics set. Miraculously, it worked the first time.

After patching a form file with ODT, it became impossible to edit the form image using FED, since I had inserted non-printing characters in the text section. FED assumes that the characters it outputs from the text section will print, and move the cursor appropriately. The non-printing
SIs and SOSs completely threw off FED's cursor positioning and movement, and caused the image to be displayed incorrectly, even though the forms driver showed the form perfectly.

After doctoring a couple of forms, I was getting pretty tired of using ODT. Also, if I wanted to make any changes, I had to re-patch the file, since I couldn't FEDit the munged file. After some lossage due to incorrectly hacking a form definition, I decided it was time to invent a better way to modify the form files.

The VT100 line drawing set is mapped into some of the lower case characters, such as "q", "x", etc. The lower case characters can, of course, be typed in with FED. All I had to do was write a program to hack the form file, and provide some way for the program to distinguish between normal and graphics mode characters. The easiest way to mark text on an FMS form is with VT100 video attributes. I chose to indicate graphics mode characters by assigning them all four AVO attributes (bold, underscore, blink, and reverse) — a combination which more obscures the text than highlights it, and would never be used. With a magical program to do my forms hacking, I could type up the form with FED, assign all four video attributes to graphics text, and let the program chomp away.

The program, Fl.B2S, (I'm not sure why I called it that — I think I typed "I" instead of "U" originally and never bothered changing it . . . ) is listed at the end of the article.

Please note that the resulting forms (with the graphics sequences) cannot be FEDited. I recommend keeping two copies (or two libraries) of forms that use graphics — one with the graphics text highlighted and FEDitable, the other Fl'd and displayable. Also, FUT may report strange error messages when trying to print descriptions of hacked forms. You should print your form descriptions from the normal, FEDitable forms. The forms driver has no problems, however, with Fl'd forms.

**Problem:**
My mailing list application replaced an existing system, which did its terminal input using echo control. The operators were accustomed to terminating fields with the RETURN or ENTER keys, not TAB. Unfortunately, FMS uses ENTER to terminate the entire form; i.e., "Ok, I am done with EVERYTHING on the screen" instead of just the current field. This would have caused many headaches for the operators, not to mention the poor old programmer who had to debug the thing. (When was the last time YOU hit the TAB key to terminate a command line? What a crock . . .)

**Solution:**
This seemed like a trivial hack — just go in and patch a couple of bytes in the forms driver. Wrong. The values were in the monitor's portion of the forms driver, and I didn't have sources to that. Just as I was about to disassemble the interesting stuff, I realized that I could translate the field terminators without any patching at all! This will require a little explaining, so
FMS has two basic calls to retrieve input from the terminal: GETALL and GET. (GETAF is not significantly different from GET for our purposes.) GETALL allows the operator to move the cursor anywhere on the form, fill in any or all of the needed information, and terminate the form. Ideally, executing a GETALL is similar to reading a record from a file — one call, and "boom!" — all of the fields are filled and returned in order. I have yet not found an (ideal . . .) application for which GETALL is suitable, because it does not allow for individual field validation, which is essential in almost all applications.

The GET call retrieves data for a single field. Additionally, FMS supplies a numeric code for the field terminator. The application program can process and validate the data in the field, and then execute a PFT (process field terminator) call to advance or backup to the appropriate field. PFT takes as an argument the terminator code to process.

My simple hack is to merely translate the terminator codes behind FMS's back. For example, the program executes a GET call, and the operator responds and terminates the field with the ENTER key. FMS returns the data, and the terminator code FTSNTR, which means "done with form." The program processes the returned data, translates the terminator to FTSNXT (advance to next field), and executes a PFT call. FMS advances its context to the next field on the form. Without patching, ENTER has successfully been translated to TAB. Unfortunately, this does create one minor problem . . .

Problem:
If ENTER is translated to TAB (next field), there is no terminator to indicate "end of form."

Problem:
FMS uses the VT100 arrow keys and PF keys for editing and control functions, and does not process control characters as field terminators. Application-defined function keys are, therefore, scarce. If the VT100 is in application keypad mode, FMS will process the keypad keys as terminators, however the operator will not be able to use the keypad keys for numeric input.

Solution:
For my application, only three function keys were needed: end of form, abort form, and a form-dependent key, usually used to jump around on the screen. The FMS release notes describe an FMS build option to enable four keys as FMS terminators. (The keys are PF4, Gold-PF4, Gold-Rightarrow, and Gold-Leftarrow.) The option can be enabled by setting the global symbol FTSUSR non-zero at taskbuild time, or, if you are using the FMS resident library, when the library is built. (More on this in a moment.)

I used PF4 for end of form, Gold-PF4 for abort form (with a confirm), and Gold-Rightarrow as the form dependent key. The same routine that translates FTSNTR to FTSNXT also translates the code for PF4 to FTSNTR, and the other keys to my own internal terminator codes.

For applications which require more than four function keys, but also need the numeric keypad, there are a number of solutions. The most elegant that I could think of involves the use of a second prefix key, and a little cheating. (Note: this should work in theory, but, since I have had no use for it, I have not tested it.)

First, build the program or the FMS reslib with FT$USR set non-zero (see below), so that the unused arrows and PF keys are available. Define the PF4 key as an alternate "Gold" key, let's say, "Silver." Normally, the VT100 should be in numeric keypad mode. When PF4 is pressed, FMS will return control to your program, which should enable application keypad mode on the terminal, and then re-get the current field. If the operator hits a keypad key, FMS will again return to your program, with the numeric code for the terminator. The program should turn off application keypad mode, and perform the special function associated with the Silver-foo key. This gives the program access to 13 function keys. By defining more prefix keys, (Gold-PF4, Gold-Rightarrow, etc.) you can create up to 52 function keys.

The program must "cheat" in order to switch to application keypad mode and back. Once the program has "attached" to the terminal, (in the FMS sense, not the RSTS sense) any normal RSTS terminal input will effectively "detach" the terminal. (This follows the same rules as other special terminal modes.) However, FMS mode is a special input mode only — outputting to a terminal open in FMS mode will not cancel FMS mode, provided the output is done on the correct channel (i.e., not channel 0). Therefore, you can output the needed escape sequences directly.

Problem:
The procedure for building a task with additional function key support (FT$USR set non-zero) is described in the FMS release notes. However, if the FDV resident library is built with this procedure, the additional function keys are not enabled.

Solution:
The FDV resident library has a null root segment, so that it can be clustered. The GBLDEF taskbuilder option defines the symbol FT$USR to be non-zero in the root segment, but not in the overlay segment where the actual code is.

One possible solution is to edit the ODL file and discard the null overlay root, but this will make the library unclusterable. Since the code only references the symbol in one place, I have chosen to patch the library. The following patch will enable additional function key support for the FMS reslib:

For the FDV reslib without debug support:

<table>
<thead>
<tr>
<th>File to patch?</th>
<th>FVWRES.LIB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base address?</td>
<td>#UVW</td>
</tr>
<tr>
<td>Offset address?</td>
<td>7012</td>
</tr>
<tr>
<td>Base Offset Old Key</td>
<td>7 if non-zero to enable</td>
</tr>
<tr>
<td>?????</td>
<td>007012 000000 7 1</td>
</tr>
<tr>
<td>?????</td>
<td>007014 001402 7 1</td>
</tr>
</tbody>
</table>

For the FDV reslib with debug support:

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</tr>
<tr>
<td>Offset address?</td>
<td>7012</td>
</tr>
<tr>
<td>Base Offset Old Key</td>
<td>7 if non-zero to enable</td>
</tr>
<tr>
<td>?????</td>
<td>007012 000000 7 1</td>
</tr>
<tr>
<td>?????</td>
<td>007014 001402 7 1</td>
</tr>
<tr>
<td>Uarrow C to exit</td>
<td>7 1</td>
</tr>
</tbody>
</table>
Problem:
Since the GETALL call does not allow for individual field validation, it is fairly useless. Executing individual GETs and PFTs to retrieve a form quickly becomes cumbersome in an application with many forms or fields.

Solution:
Version 2.0 of FMS will provide user-defined field validation routines, so that GETALL can be used effectively. It is a simple task to write a subroutine to simulate this under V1.5. The subroutine I used in my application is called GETFRM, and is listed at the end of the article, along with some support macros. If you are using FMS from a high-level language, you'll have to write your own subroutine. Since “high-level” languages are highly restrictive, highly piggy, etc., you might have some problems dispatching to the validation routines (i.e., variable subroutine calls). (Moral: write it in MACRO next time.)

As suggested in the FMS documentation, it is possible to use named data to describe the required field validation. For my purposes, this would have been overkill, and less efficient (of space and time). This method is, however, particularly effective, especially for complex applications or high-level languages.

I wasn't satisfied with the bagbiting macros that DEC supplied, so I hacked up some of my own (CALFMS, DOFMS, etc.). GETFRM uses these for its FMS calls. Unfortunately, they are rather long and can’t be printed here, but they are available on the monthly goodies tape.

FMS V1.5 BUGS
I have only found one serious FMS bug so far: overlaid forms do not clear the correct area on the screen. Instead of erasing the specified lines, FMS erases the top line several times. I had been using a kludge to get around the problem for some time, but a patch was recently made available to me. Special thanks to Mark Hartman for passing it on to me, and to the DEC FMS people, for their lightning-fast response to Mark’s SPR. The patch to the FMS phase of the monitor is listed below. Mark said that the patch is for V7.2 only, however it will probably work for V7.1. (I have not tested it — the offset address from $FMSSE may be different, and a different portion of patch space may need to be used.)

Monitor patch to fix FMS overlaid forms:

```plaintext
File to patch? <LF>
Module name? FMS
Base address? $FMSSE
Offset address? 4230
Base Offset Old New?
?????? 004230 ??????? ? FMSPAT+60
?????? 004232 ??????? ? 'Z
Offset address? 'Z
Base address? FMSPAT
Offset address? 60
Base Offset Old New?
?????? 000060 000000 ? 33633
?????? 000062 000000 ? 55633
?????? 000064 000000 ? 115562
?????? 000066 000000 ? 115470
```

As usual, I would appreciate any feedback you have on FMS, RSTS, or whatever. Although FMS has some minor problems and bugs, I found it to be very well suited to my application, and many other screen-based interactive systems. It is relatively low CPU overhead, not too piggy on space, and can save an immense amount of programmer time. FMS is highly flexible, and, with a little imagination, can help make an applications package consistent and good looking. FMS V2.0 will offer even more functionality and flexibility than the current release, and should be seriously considered for any new interactive applications. On a scale of 1 to 10, 10 being best, I give FMS a 9.2.

I’d like to thank the FMS people for the FMS magic session at the Anaheim DECUS. Although there were only about 150 people present (hidden in a small room behind the exhibit hall), it was one of the most lively and informative sessions of the week. Also, thanks for the FDV sources — they came in handy.

HIDDEN UU.MNT BITS
There are a number of undocumented mode bits for the RESOURCE MANAGEMENT and CHARGEBACK SYSTEM

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CIRCLE 170 ON READER CARD
Bit 10. is particularly useful — it allows mounting the pack even if the pack ID is unknown. Now you can ditch all of those stupid programs to print a NFS disk pack’s ID. Bits 11. and 12. control whether or not the NAME.SYS file will be used (if named directories have been gened into the monitor). Normally, NAME.SYS is not used on public disks other than the system disk, and is used on all private disks. You can override this by setting bits 11. and 12. appropriately.

Bits 6 and 7 control whether or not FIP writes or all writes will be checked. These bits correspond to UO.WCU in UNTOWN. Also, there are two additional undocumented bits in UNTOWN which control data and directory caching for a particular disk unit. If set correctly, data and directory caching can be enabled or disabled on a per-unit basis. (I remember this being one of the wishes at a past DECUS . . . it is already implemented to some extent.) Unfortunately, there is no call to modify these bits, so the only way to change them is by poking monitor memory.

CONCLUSION

If you aren’t up to keying in the programs, send $25.00 to IISI (Attn: MCG) and we’ll send you a tape of all of the Crystal Ball goodies. Please specify 300 or 1600bpi.

Much of the information printed in this column is the direct result of reader inquiries and comments. If you have a topic that you think would like to see explored in a future issue, communicate it to me, preferably in writing. I will attempt to investigate/document any RSTS subject, provided there is sufficient user interest (i.e., RESPONSE).

I hope you have enjoyed this installment of the RSTS Crystal Ball. I will continue to try to present information which is interesting and useful. If you have any questions, gripes, or suggestions, feel free to call or write to the address below. Until next time, happy hacking!

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CIRCLE 171 ON READER CARD
Define support macros for GETFORM

Image is:

- display form, set first field to get in call blocks

GETFORM [ABORT=abodir, SPEC=pfx, UPCODE:YES/NO]

abodir is a symbol to jump to if the form is aborted

pfx is a character prefix for the generated PICT and symbols. It should be used with all FIELD and TERM macros for

this GETFORM, and must not be used again in another GETFORM.

UPCODE:YES indicates that all data fields should be CVT$$'d to uppercase before calling the field processing routine. UPCODE:NO is the reverse.

If the form is terminated normally (with FORM), control will return

in-line, to the instruction after the GETFORM.

In order to perform individual field validation, use the FIELD macro:

FIELD name,pfx

ame is the name of the FMS field on the form to perform special validation for.

pfx is the same three character prefix used with the GETFORM macro.

Whenever a terminator is entered in the named field, control will be

passed to the instruction following the FIELD macro. (See GETFORM for more details...)

To perform special terminator checking, use the TERM macro:

TERM term,pfx

term is the numeric code for the FMS terminator to perform special checking on.

pfx is the same as above...

Whenever the "term" terminator is entered on the form, first the special field validation, if any, will be performed, and then if

terminator processing is still requested, control will pass to the

instruction following the TERM macro. (See GETFORM for more details...)

You should use the ENDFORM macro to table the termination fields.

ENDFORM pfx

pfx is the same three character prefix used with the GETFORM that

you are ending...

Have fun, 'hack, hack "[HCG]"

MACRO GETFORM ABORT,0,SPEC,UPCODE:YES

LIST

0

IF DIFF <UPCODE>,YES>

1

IF NB <SPEC>

CALLS GETFORM,B, (ABORT,FMSPEC,0)$

$.LIST

FMSPEC,F,4,B,OBJ,GM,CON

FMSPEC,.WORD 0,0

IF

EXIT GETFORM,B, (ABORT,0,0)$
Don't wait for the movie. The RSTS Internals Manual is here.

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Don't wait for the movie. The RSTS Internals Manual is here.
The ENABLE is a hardware/software product which allows an 18 bit PDP-11 to address 22 bits of memory. This means that a 128k RSTS system can now access four megabytes of memory (if one has that much physical memory in the machine). Such an expansion substantially increases system throughput by allowing all currently existing programs to remain memory resident. Disk swapping is substantially reduced. CPU speed becomes the only performance limiter.

The ENABLE is not intended to replace new or larger machines, but rather to upgrade existing systems when the ENABLE/34 ANOTHER POINT OF VIEW

By Kevin Munday
System Analyst, ABLE Computer

In the February issue of The RSTS/PROFESSIONAL, an article pointed out what were felt to be some deficiencies with ABLE's ENABLE. This is a response to that article.
budget does not support acquisition of a larger system or when the user wishes to optimize the existing investment. Installing the ENABLE is indeed not a simple five minute job, but it can be done in a relatively short period of time with the help of the manual. In addition, ABLE'S Technical Support Department is always willing to help with the installation over the phone, even to the point of talking a non-technical user through restrapping of memory boards for new addresses. ABLE has a toll-free number (800-854-9471) to facilitate this kind of help.

If one buys the ENABLE, there are other hardware commitments which must be made, such as expansion space, 22 bit memory, etc. ABLE offers an additional solution, the MEGABOX, which provides an ENABLE and 22 bit memory in a separate backplane (this subsystem requires very little installation). ENABLE does require patches to the operating system. When ABLE receives update listings from DEC (e.g., from V7.0 to V7.1), a new ENABLE patch is written within two weeks. The patch is field tested and then is available to ENABLE users. Total lag time is 45 days. ENABLE users who upgrade their operating system must contact ABLE to order the new patch.

The ENABLE has fairly tight specifications as to which devices are compatible with it on a UNIBUS. As a result, it is not a device which can go on every machine and this tends to limit the number of users who will find the ENABLE option viable.

If you do have problems with your system, ABLE is always glad to help coordinate any support efforts with DEC. But if they never receive a call from the customer, they can't do anything about it. In addition, it is easy to put the ENABLE in a mode where it is transparent to the system (18 bit as opposed to 22 bit) for testing to determine whether or not the problem lies with the ENABLE product. In any case, the customer should always feel free to call ABLE'S Technical Support Department before calling DEC.

As far as problems with the ENABLE hardware, there was at one time a problem with RSTS/E not handling parity memory properly due to the optional cache available with the ENABLE. This problem no longer exists.

The ENABLE patches are written specifically to avoid conflict with DEC patches. They do not, to ABLE'S knowledge, conflict with any DEC patch for RSTS/E. If a customer does find a conflict with DEC'S patches to RSTS/E, he should inform ABLE immediately so that the problem can be investigated and resolved.

Overall, the ENABLE performs better than originally designed. Users are discovering new applications, and the number of ENABLE/MEGABOX installations is rapidly expanding.

---

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CIRCLE 51 ON READER CARD
RESIDENT LIBRARY TIPS
FOR DIBOL USERS

By John Wolnisty, Beta Data Systems, Inc., Tucson, AZ

When it comes to utilizing the elegant facilities RSTS has available, DIBOL programmers have traditionally been left with the short end of the stick. Never being one to leave well enough alone, I became intrigued with the use of read/write resident libraries to share data among several concurrently running programs. Furthermore, the programs were in DIBOL. Version 4.5 of DIBOL supports resident library use, and in fact, the run time support is a resident library (previous versions were a run-time system) itself. Resident library support was added to allow use of the RMS resident library and little else. DIBOL does not use a standard subroutine linkage convention, so use of a resident library for user-written routines was not a prime consideration. Why a read/write resident library? The uses for such a structure are only limited to the programmer's imagination. I have implemented them in three different applications: a "real-time" file access program, a multi-user game and a mail-box program. To describe how this was implemented some DIBOL internals need to be explored first.

COMMON SECTIONS.
A COMMON section in DIBOL is similar to COMMON found in FORTRAN, in that variables defined in the COMMON are available to all the subroutines of the programs. One difference is that the names MUST be the same throughout the main program and subroutines and must be five characters or less. COMMON defined in the main program generates a global symbol consisting of the five characters of the name and a 's' appended to it. COMMON defined in a subroutine generates a global reference to the symbol of the same name. These references are all resolved by the task builder at link time. The following program, which serves no useful purpose except illustration, shows use of COMMON in a DIBOL program.

```
START ; This is a conventional DIBOL program using COMMON
COMMON DATA1
 CUST1, A400
 LOCKF, D1
 ITEMS, A50
 COMPA, A200
 RECNM, D5
PROC
 READ(1,CUST1,1)
 CUST1 = RETURN
SUBROUTINE PASS1
 COMMON DATA1
 CUST1, A400
 LOCKF, D1
 ITEMS, A50
 COMPA, A200
 RECNM, D5
PROC
 WRITE(1,CUST1,1)
 RETURN
```

Note in the map that the individual components of DATA1 are allocated in the same order as in the program. This may or may not be important. The name of the COMMON (if it was named) always is of zero length.

TRICKING DIBOL INTO USING A RESIDENT LIBRARY.
If all the subroutines do for a COMMON section is generate a global reference, it seems to reason that ANY global section with the proper name would resolve the reference. This is indeed true! Just remove the COMMON section from the main program, and insert a section of code with the proper global symbols in its place. Lets do that now.

Our original DIBOL program now becomes:

```
START ; This is the DIBOL program with COMMON removed
PROC
 OPEN(1,U,INFILE)
 READ(1,CUST1,1)
 XCALL PASS1
 XCALL PASS2
 WRITE(1,CUST1,1)
 STOP
SUBROUTINE PASS1
 ; The common section here will generate global references
 ; to the names within the common section. The presence of
 ; the common in the root resolves these references.
```
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*USER-MAIL is currently available for DEC computers using the RSTS/E and VMS operating systems. RSTS is a registered trademark of Digital Equipment Corporation. USER-MAIL is a trademark of Logic eXtension Resources.
struct a new COMMON. This must be done in MACRO, but is easy, even for non-MACRO types. It would look something like:

```
.PSECT DATA1$
DATA1$::
CUST1$:: .BLKB 400.
LOCKF$:: .BLKB 1.
ITEMS$:: .BLKB 50.
COMPASS$:: .BLKB 200.
RECNM$:: .BLKB 5.
.END
```

MAC this file, then task build as follows:

```
TKB>DATA/-HD, DATA=DATA
TKB>/
Enter Options:
TKB>STACK:O
TKB>PAR:DATA:160000:20000
TKB>/
```

Note: You can make it position independent if you want. DBLRES is position independent and will move where necessary.

Now make it into a resident library using MAKSIIL and answering the questions (mainly taking defaults after specifying the library name). You may now ADD the resident library with UTILITY with the following precautions: ADD with the RW attribute, set protection code as needed to allow the proper users write access (<=0 if you're not sure or don't care). ADD with STAY attribute.

**USING THE RESIDENT LIBRARY.**

We now take our previous program and re-task build as follows:

```
TKB>PROG=PROG, PASS1, PASS2
TKB>LB:DBLRES/2B
TKB>/
Enter Options:
TKB>RESLIB=LB:DBLRES/RO
TKB>RESLIB=[1,4]DATA/RW
TKB>/
```

Notice the lack of unresolved reference errors, as they were resolved to the resident library. The DIBOL program uses the COMMON area in the resident library exactly the same as it did before. There are several new features now. Any other DIBOL programs may specify this resident library during their task builds. When data is changed by one program accessing any variable in the resident library, that change becomes immediate in all programs using the library. This fact is extremely useful for sharing data among different programs, and only maintaining a single copy of the data. It also poses a problem: you may have to install a lock variable to flag that the data is currently being updated to synchronize the use of the library. Since an entire APR is used to map the library, you can use up to 8192 bytes of data in the resident library. Notice also that the bulk of your program, and in fact all code referencing the resident library, must be in a subroutine. You can code the entire program as a subroutine and have a dummy main routine to call it, if needed.

**SUMMARY.**

There are a variety of tricks to be done under RSTS DIBOL, but like the preceding, they are not always apparent to the casual observer. With a little digging, the DIBOL programmer can easily refute the smart-aleck BASIC-PLUS-2 programmer. STOP.

---

Problem: RSTS does not support fruit. I can connect my ORANGE and my GRAPE to the Unibus, but RSTS refuses to acknowledge it. This fruit is essential for feeding the hamster (the one who runs real fast on his treadmill, to keep the computer running) whenever the hamster runs out of hamster food. As a result, whenever I am running low on hamster food, the hamster slows down or stops running, instead of eating the fruit. Then my customers call and complain.

Isn’t there some way to support fruit on RSTS? Or possibly allow two hamsters to fit into the computer, taking shifts. RSTS could ring a bell every half hour to trade hamsters, so that each would have to take his fair turn and we wouldn’t have any goof-off hamsters.

Problem: RSTS does not boot on my TRS-80. I called DEC support about this, but they said that RSTS is only capable of running on a PDP-11 and could not be made to run on a TRS-80 without massive patches. Is this true? They said something about RSTS being a “Sales Aid,” and that the main reason RSTS was created is to help sales of PDP-11’s. I told them that I didn’t appreciate them making jokes with me, how can anything that costly be a Sales Aid?

That’s when they hung up on me.

Can’t you offer a feature in RSTS so that those of us without PDP-11s can use RSTS? Especially us with TRS-80’s and APPLEs. Thank you.
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CIRCLE 25 ON READER CARD
DEC has given us the ability to assign a number of things to a job that are not physical devices. These consist of a private library (the ' @' character), a default protection code, and up to four logical assignments, (three if any of them include PPN's). Besides the fact that more than three or four logicals would occasionally be handy in a development situation, the only real problem is that DEC gave us no way to find out what a job currently has assigned. In a development situation where you are using copies of your production data files on your development account for testing purposes this can be annoying. Since the only way to display the current settings for the current job. This is really or four logicals would occasionally be handy in a development situation, the only real problem is that DEC gave us no way to find out what a job currently has assigned. In a development situation where you are using copies of your production data files on your development account for testing purposes this can be annoying, since the only way to verify the assignments is to deassign everything and then realign them.

When I started using the private logicals for development on a regular basis, I decided to write a program to display the current settings for the current job. This is really not a terribly difficult task since the information is all kept in the job's low-core area (Systems Directives Manual, Section 2.4). All I had to do was format and print it. The following program does just that. I hope others will find it as useful as I have.

By David Patterson, Sivall's Inc., Odessa, TX

DEC has given us the ability to assign a number of things to a job that are not physical devices. These consist of a private library (the ' @' character), a default protection code, and up to four logical assignments, (three if any of them include PPN's). Besides the fact that more than three or four logicals would occasionally be handy in a development situation, the only real problem is that DEC gave us no way to find out what a job currently has assigned. In a development situation where you are using copies of your production data files on your development account for testing purposes this can be annoying, since the only way to verify the assignments is to deassign everything and then realign them.

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DATARAM. Your 1/2" drive connection.

It's easy to interface your 1/2" drive to a DEC computer. When you have connections.

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</tr>
</tbody>
</table>

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push r1
mov #arbl,r0
mov #arblr1
10$: clrbl (r0)+
sob r1,108
pop r1
pop r0
return

; these later.
; Address of the XRB.
; The length in bytes.
; Clear this byte.
; Until we're done.
; Get them back.
; Return to the caller.

fmtlog: push r2
push r0
mov #32,,r1
movb #0,(r0)+
sub #11,,r0
mov (r0)+,r1
radtos r1,r0
mov (r0)+,r1
raitos r1,r0
20$: cmpb 
inc r0
movb 
add #32,,r0
tak (r0)
bne 408$
30$: cmp (r0)+,r2
br 608$
40$: movb (r2)+,r2
movb (r2)+,r2
bit #777400,rl
beg 508$
bic #777400,(r2)
um$ (r0),rl
bis #777400,(r2)
50$: tat (r0)+
mov #1,,(r0)+
cmp #777777,aslog+30
bne 708$
mov (r3),r1
beq 708$
call fmtppn
70$: movb #19,(r0)+
movb #12,(r0)+
pop r2
return

; Format the current entry in the logical table
; (pointed to by r2) in to the output buffer (pointed to
; by r0).

; Format the word in R1 as a PPN ([nnn,nnn]) starting
; where R0 is pointing.

fmtppn: push r1
movb 
movb 
bic #777400,rl
num$ r1,r0
movb 
pop rl
bic #777400,rl
num$ r1,r0
movb 
return

; Format the number in R1 as a
; PPN where R0 points.
; }
; Clear the
; project number.
; [nnn]
; [nnn],
; Get the original back.
; Clear the programmer number.
; [nnn,nnn]
; [nnn,nnn]
; That's it.

Page 30

RSTS PROFESSIONAL. April 1983
DN11 AUTODIALER 'ENABLE' PATCH
FOR INIT.SYS

By Jim Hobbs, MIS #410, Adolph Coors Company, Golden, CO

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This patch enables the DN11 autodialer. Without modification of INIT.SYS an error of 14 (device hung write locked) is given when trying to print to channel that DN was opened upon.

After editing (use TECO, or control file becomes useless) SYSGEN.CTL to include DNDRV.OBJ, DNTBL.MAC and DNCFG.MAC as specified, run SYSBAT as usual. After patching monitor (if selected) INSTALL your newly created SIL. Ignore the 'Warning — no set up for device DN'. Use DEFAULT to establish your normal defaults.

Now at OPTION specify PATCH. The following is how we have enabled the DN11 for versions 7.0 and 7.2 (we never tried to implement 7.1).

Option: PATCH
File to patch? INIT.SYS
Base address? XN.PKT
Offset address? 10
Base Offset Old New?
046676 000010 074206 ? "Z"
Offset address? "Z"
Base address? 074206
Offset address? 42
Base Offset Old New?
072406 000042 073446 ? "Z"
Offset address? 22
Base Offset Old New?
072406 000022 012722 ? 012602
072406 000024 000004 ? 012712
072406 000026 012602 ? 000114
072406 000030 012712 ? 052712
072406 000032 000114 ? 002001
072406 000034 052712 ? 004536
072406 000036 0002001 ? 073446
072406 000040 004536 ? 005012
072406 000042 073446 ? 000207
072406 000044 000207 ? <LF>
072406 000046 012762 ? <LF>
072406 000050 177777 ? "Z"
Offset address? "Z"
Base address? "Z"
File to patch? "Z"

The critical information used for both version's modification is:

- FILE of INIT.SYS
- BASE of XN.PKT
- OFFSET of 10

"OLD" of BASE and OFFSET
OFFSET of 22

REPLACEMENT of OFFSET 36 with value of OFFSET 42

After patch is installed, boot system normally — auto dialer should now work.

If patch is installed incorrectly (or perhaps even as stated although doubtful), system may not boot due to 'initialization error'. Mount SYSGEN distribution, boot from it and COPY using SUPERCEDE YES for INIT.SYS file only. If other prior modifications of INIT.SYS have been made you may want to copy the existing file to another disk or tape.

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THE ELECTRONIC SPREADSHEET FOR ALL COMPUTERS
By Steve Roy, Bloomfield, CT

10000 GOTO 32000$ IF ERR=28$ OR ERR=11S AND ERL=1000$ 1 CTRL/C \\ OR ERR=11$ AND ERL=1000$ 1 CTRL/Z FROM KEYBOARD \\ RESUME 1020$ IF ERR=11$ 1 PK IS TOO SLOW \\ GOTO 19020$ UNLESS ERR=6$ AND ERL=1000$ 1 PK IN-USE ? \\ PE$=PKS+$1$ 1 STEP TO NEXT PK \\ RESUME 1000$ 19030 GOTO 19030$ IF ERR=6$ OR ERR=4$ 1 NO SPACE ON SYSTEM \\ RESUME 1000$ 19040 GOTO 19040$ IF ERL=1030$ AND ERR=5$ 1 CONTROLLED JOB GONE \\ RESUME 10020 GOTO 19020$ IF ERL=1030$ AND ERR=3$ 1 CONTROLLED JOB BUSY \\ PRINT "Unexpected Error ";ERR;"at line ";ERL;"in "STRTUP." 1 \\ PRINT "Returning to menu..." 1 \\ SLEEP $4$ \goto 32000$ 19030 PRINT "No room on system for STARTUP - Try again later..." 1 \\ SLEEP $4$ 32000 CHAIN "PROG:MENU" 32767 END

10 EXTEND 100 THIS PROGRAM IS THE CONTROLLING HALF OF A JOB STARTUP TEAM. 1 IT CAN BE INVOKED "SHELL" OR "CHAIND-TO" BY ANY USER 1 (DEPENDING ON ITS LOCATION AND PROTECTION CODE). THIS 1 PROGRAM CREATES A JOB, AND THEN UTILIZES THE "SPAWN" PROGRAM 1 TO FINISH THE CREATION PROCESS, AND CHAIN TO A USER PROGRAM. 1 TYPICALLY, THIS IS USEFUL FOR STARTING JOBS THAT DETACH, AND 1 SAVES HAVING TO ALLOW NON-PRIV USERS ACCESS TO PRIV ACCOUNTS. 1 ATPK CAN PROVIDE THIS STARTUP CAPABILITY FROM PRIV ACCOUNTS, 1 BUT SINCE THE "$LOGIN" COMMAND TO ATPK IS DISABLED FOR 1 NON-PRIV USERS, THEY CANNOT STARTUP JOBS OTHER THAN IN THEIR 1 OWN ACCOUNT. FURTHERMORE, IF THE STARTUP OF A SPOOLER, DATA- 1 BASED MANAGER, ETC. IS TO BE A MENU-DRIVEN CAPABILITY FOR ONE 1 OR MORE NON-PRIV USERS, THE MENU MUST BE RE-ENTERED AFTER 1 COMPLETION OF A STARTUP. THIS IS IMPOSSIBLE WITH ATK, SINCE 1 IT DIES WITH A "JOB LOGGED OUT" ERROR WHEN THE CONTROLLED 1 JOB DETACHES FOR NON-PRIV USERS.

1000 ON ERROR GOTO 19000$ 1 TRAP$:CHR$(6$)+CHR$(-7j) CONTROL/C TRAP 1 \t.cpp:TRAP$(TRAP$) \t.sys:TRAP$(TRAP$) \t.pe$:0S \t INITIAL PK NUMBER 1 PRINT "Database Manager Startup & Security Module" 1 PRINT * **** whatever messages you want go here **** 1 PRINT "[RETURN)" 1 INPUT $8$ 1 IF TYPICALLY, YOU WOULD HAVE SOME CODE HERE TO VERIFY THAT THE 1 USER INVOKING THIS PROGRAM IS, IN FACT, THE USER YOU WANT TO 1 BE DOING SO. PERHAPS PRINT A RANDOM SEED, AND REQUIRE A 1 RESPONSE BASED ON THE SEED (NUMBER, LETTERS, ETC). 1 FAILED RESPONSE SHOULD BE LOGGED IN A FILE, ALONG WITH ERL, 1 PPN, TIME, AND DATE. THEN, A SIMPLE GOTO 32000$ WILL RETURN 1 TO THE MENU.

10000 GOSUB 10000$ 1 GET A PSEUDO-KEYBOARD 1 IF IDENTIFY THE KB THAT IS ATTACHED TO THE PK THAT WE GOT... 1 $5$-ASCII(MID(SYSCHR$(60$)+CHR$(60$)+CHR$(51$),$15$,$15$))/2$ 1 I THE NEXT TWO FILENAMES-STRING-SCANS REFER TO THE "SPAWN" 1 PROGRAM, AND THE PROGRAM TO WHICH "SPAWN" MUST CHAIN. 1 T$I$:SYSCHR$(60$)+CHR$(-28$)+"PROG:SPAWN" 1 T$2$:SYSCHR$(60$)+CHR$(-25$)+"PROG:MANAGE" 1 I NEXT, CREATE A JOB (WHICH WILL RUN "SPAWN") AND TELL IT WHAT 1 IT NEEDS TO KNOW TO START AND CHAIN.

1000 EXTEND 1000 THIS IS WHERE WE WAIT FOR "SPAWN" TO CREATE A JOB. 1 ADDITIONALLY, THIS WILL ECHO ANYTHING PRINTED BY THE CHAINED 1 PROGRAM, ALERTING US TO ANY ERRORS ON ITS PART.

1030 I HERE WE CHECK TO SEE IF THE CONTROLLED JOB HAS DETACHED, 1 IS BUSY WORKING, OR IF IT HAS RETURNED TO A "C" STATE. 1 IF NO ERROR IS GENERATED, THE JOB HAS GONE TO A "C" STATE... 1 I ON CLOSING THE PK, ANY CONTROLLED JOB THAT HASN'T DETACHED 1 GETS KILLED... 1 ALL DONE W/PK 1 CLOSE $8$ 1 PRINT "Returning to menu..." 1 SLEEP $2$ 1 GOTO 32000$ 1 I WAIT FOR THEM TO READ

10300 I HERE WE OPEN A PSEUDO-KEYBOARD. 1 OPEN "PK:MEM$\{PKS\}" AS FILE $3$ 1 SUCCESSFUL OPEN
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BASIC-PLUS-2 PROGRAMS

By Kelvin Smith, Lawrence University (class of 1984), Appleton, WI

Lawrence University is in the process of putting all administrative functions onto RSTS. Programming is done almost entirely in BASIC-PLUS-2, to make use of RMS. We have recently replaced our venerable PDP 11/45 with an 11/70, which should, for a while at least, eliminate swapping (512K words memory instead of 128K), but while that restraint on size has been taken care of, the magic 31K user job maximum when running under the RSX emulator remains fully in effect. Over the past few years, we have learned quite a bit about how space is used in BP2 programs. Particularly when using the BP2COM or disappearing RSX run-time systems, everything counts to the utmost. By getting maps from the task-builder, you can see just how much particular language elements are saving or costing, in terms of program size.

Based on what we’ve found, here are some suggestions on how to put your programs on a reducing plan.

1) Eliminate wasteful functions. By “functions” I mean not user-defined functions, although those too should be used with care (GO-SUBs operate faster and use less space), but standard features of the BP2 language. Many features of the language are normally unnecessary and are very costly in terms of size. Perhaps the best example is string arithmetic. This prehistoric monster calls in almost 1800 bytes worth of code, so making it disappear would save nearly 1K of memory (and the function operates so slowly that you’ll probably speed up the program as well by avoiding it). Another function is the SYS call package. Any SYS call brings in the entire package, some 1600 bytes worth. It’s much better to use the functions CTRLC (CTRL/C trap), RCTRLO (reset CTRL/0), NOECHO and ECHO (disable and enable terminal echoing), FSS$ (file string scan), and ERT$ (error text), if those are all that you need, since they pull in only the code necessary for their operation. The set consisting of READ, INPUT, LIN-PUT, and INPUT LINE calls in 1002 bytes of code, which might induce you to put your input statements all in one subprogram overlay (or you can use GET and MOVE to avoid it). All the other functions have size costs, too: it might be a good idea, for programs that are tight on space, to run a cross-reference including references to functions, to see if there are any which can be easily eliminated (using an intermediate integer variable instead of the INT function, for example, saves almost 200 bytes).

2) Use RMS intelligently. The Record Management Services system is a fantastic help for operation of large data bases, but poor use of it can waste time and space for everyone on the system. One of the most basic guidelines is to use RMS only when you really need it: unless RMS transportability is necessary, replace RMS sequential and relative files with terminal-format and block I/O files (this applies even when indexed files are used). For the more adventurous, writing your own RMS overlay structure is a possibility. This can save considerable space if you aren’t using all the features of RMS and you don’t have (or don’t have enough program space to use) the RMSRES resident library—one overlay structure which I wrote, leaving in just the read code for indexed files, not only saved about 1K of memory, but also cut 70 blocks off the task file size. Note that you will have to change the ODL file for each program to call in your new RMS overlay descriptor file (DEC passes out a prototype, called RMS11.ODL, which allows you to go through step by step, picking out what tidbits of RMS you want). Note also that for unexplained reasons, you may get diagnostic “undefined segment” warning messages during your taskbuild. If you didn’t get them during taskbuilds with the standard RMS overlay descriptor, ignore them: in my work, they have never produced run-time problems.

3) All of these pale into insignificance, for those not blessed with a floating point processor, in the light of the floating point routines (value: almost 2000 bytes of code). Getting rid of all floating point operations from a program is both easier and harder than it sounds: it seems easy until you find out how many functions call in the floating point routines, at which time you’re likely to despair. Therefore, I’ll divide this section into two parts, one listing functions which refer to floating point operations, and the second detailing how to get around them.

(a) Of course, if you actually have a floating point variable in your program, either get rid of it or forget the whole thing — one variable, depending on your use of it, can be enough for the whole set of routines to be called in and placed in your task image by the task builder. However, many other operations also call the set: FORMATS, NUMS and NUM1$, ABS, and VAL are ones that you may not have known about. Also, the ERR and ERL variables should be compared with explicit integers (i.e., “IF ERR = 28%,” not “IF ERR = 28”), because the compiler isn’t smart enough to realize that any comparison on them would have to be with integers. (However, for other line-oriented operations—GOTO, COSUB, RESUME — a percent sign is unnecessary, since it is compiled as referring to a statement label.)

(b) Fortunately, help is available. ABS and VAL are the easiest to deal with — it isn’t documented anywhere except on the “reserved keywords list,” but we have discovered that integer versions of the two functions exist under the names of ABS% and VAL%.
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CIRCLE 177 ON READER CARD
DEAR RSTS MAN:

We are having a problem putting together a workable disaster recovery plan. We have a central data center in Columbus, Ohio that contains, among other things, one VAX 11/780, seven PDP 11/70's with three RP06's and one PDP 11/04 HASP Box per 11/70, and ten PDP 11/34's that are being used as communication nodes. Our central data center is linked to four remote centers around the country through our network of about 25,000 miles of communication lines. All of the machines are now, or will soon be, at full capacity. This includes computers that are located at our remote sites.

The problem that we are faced with is that of locating a cost effective backup facility that could be used in the event that we get hit with the "BIG DISASTER." Any suggestions?

W. Chisholm, Manager
Systems Assurance

Any suggestions?

DEAR RSTS MAN:

We here at ABS are quite proud of the fact that we use antique hardware (we have 4 PDP-11/40s) and software. We really get the mileage out of this stuff, but every so often we do find value in upgrading to newer technology.

For this reason, I felt it was time to investigate DEC's SORT-11 package as a replacement for the "XQWIK" family. True, SORT-11 does not run as fast as some commercially available products, but it sure beats "XQWIK, et al!" and it does have a rather complete record selection process. Bundled with the fact that it comes "free with the purchase of each RSTS" (our favorite feature), it appeared to be the logical step for us.

I have managed to make our "Type 2" block I/O files look like RNS sequential fixed-length record files by writing proper attributes. I've even managed to make the sort and selection process work on ASCII (Key type "C") fields. Here is my problem:

Apparently, SORT-11's Binary (Key type "B") fields are not equivalent to XQWIK's Integer (Key type "I") fields. Also, SORT-11's Floating-Point (Key type "F") does not match XQWIK's Floating-Point (Key type "F") format. Worse than that, DEC provided no upward compatibility to SORT-11 for data stored in CVT%$ or CVTF$ format.

I would like to know if there is any way to get SORT-11 to properly recognize data in CVT%$ and CVTF$ format? Are there undocumented key types? Has anybody devised a SORT-11 patch? Will DEC upgrade SORT-11 for these field types?

I hope there is a cure for this that can be made directly to SORT-11, in that pre and post file processors will defeat the purpose of using SORT-11 in the first place. Thanx for your help, and for the help of all the RSTS pros who are reading!

Bob Ashcraft
Applied Business Services

Dear Bob: I believe there was a DECUS library contribution that connected older file formats to SORT-11.

P.S. We're busy setting up our fourth & fifth '40's.

DEAR RSTS MAN:

Here at our company several of us have entertained a heated debate as to the effects of 9600 baud terminals on a RSTS/E system. Several articles and authorities on optimizing RSTS/E performance have stated that terminals running at high baud rates can seriously degrade overall system performance. The explanation given is that a terminal running at high speeds demands a very large share of total CPU time just to create the characters and output them to the terminal and also that the associated job requires a greater number of... continued on page 70.
## Sort Benchmarks on DEC 11/34 with RSTS/E

By Robert L. Besner, Dept. of National Defense, Ottawa, Ontario, Canada

### Introduction

The benchmark of sorting algorithms was conducted to evaluate the performance of these sorts on a PDP 11/34 using the RSTS/E operating system. In the study, performance is defined as a minimum of computer facilities to produce a measured amount of throughput.

Three types of benchmarks were:

a. integers with BASIC-PLUS code,

b. integers with BASIC-PLUS-2 code,

c. string fields with BASIC-PLUS-2 code.

Five algorithms used were:

1. Bubble
2. Shell
3. Heap
4. Quick
5. Hart

Note that all benchmark jobs were executed on a quiet system (single user, under Batch).

Appendix A contains integer sort algorithms; Appendix B contains string data sort code.

### 2. Algorithms coded in BASIC-PLUS sorting integers

This section is a benchmark of all algorithms coded in BASIC-PLUS. The unsorted array contains integers varying from 0 to 99 randomly generated.

#### 2.1 Bubble sort

**RUN DM1:NBBUBL.BAC**

This is a benchmark of the BUBBLE sort 24-Dec-81 02:31

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Number of Sorted Items</th>
<th>Sort Used</th>
<th>CPU Time</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>100 integers</td>
<td>142 KCT, 4.7 CPU SEC. AND 5 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>400 integers</td>
<td>2652 KCT, 66.3 CPU SEC. AND 67 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>800 integers</td>
<td>9632 KCT, 240.8 CPU SEC. AND 242 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.2 Shell sort

**RUN DM1:NSHSHELL.BAC**

This is a benchmark of the SHELL sort 24-Dec-81 02:36

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Number of Sorted Items</th>
<th>Sort Used</th>
<th>CPU Time</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>100 integers</td>
<td>44 KCT, 1.1 CPU SEC. AND 2 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>400 integers</td>
<td>272 KCT, 6.8 CPU SEC. AND 7 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>800 integers</td>
<td>696 KCT, 17.4 CPU SEC. AND 18 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>1600 integers</td>
<td>2430 KCT, 48.6 CPU SEC. AND 49 SEC.</td>
<td>Program Executed in 5 K of Main Memory</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.3 Heap sort

**RUN DM1:NHEAP.BAC**

This is a benchmark of the HEAP sort 24-Dec-81 02:50

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Number of Sorted Items</th>
<th>Sort Used</th>
<th>CPU Time</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>100 integers</td>
<td>40 KCT, 1.3 CPU SEC. AND 2 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>400 integers</td>
<td>260 KCT, 6.5 CPU SEC. AND 7 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>800 integers</td>
<td>576 KCT, 14.4 CPU SEC. AND 15 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>1600 integers</td>
<td>1600 KCT, 32 CPU SEC. AND 32 SEC.</td>
<td>Program Executed in 5 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>2400 integers</td>
<td>4921 KCT, 70.3 CPU SEC. AND 71 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
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<tr>
<td>f)</td>
<td>3200 integers</td>
<td>4921 KCT, 70.3 CPU SEC. AND 71 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
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</tr>
<tr>
<td>g)</td>
<td>4000 integers</td>
<td>1357 KCT, 194.1 CPU SEC. AND 195 SEC.</td>
<td>Program Executed in 5 K of Main Memory</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.4 Quick sort

**RUN DM1:NQUICK.BAC**

This is a benchmark of the QUICK sort 24-Dec-81 02:57

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Number of Sorted Items</th>
<th>Sort Used</th>
<th>CPU Time</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>100 integers</td>
<td>40 KCT, 1.3 CPU SEC. AND 2 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>400 integers</td>
<td>260 KCT, 6.5 CPU SEC. AND 7 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>800 integers</td>
<td>576 KCT, 14.4 CPU SEC. AND 15 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>1600 integers</td>
<td>1600 KCT, 32 CPU SEC. AND 32 SEC.</td>
<td>Program Executed in 5 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>2400 integers</td>
<td>4921 KCT, 70.3 CPU SEC. AND 71 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td>3200 integers</td>
<td>4921 KCT, 70.3 CPU SEC. AND 71 SEC.</td>
<td>Program Executed in 4 K of Main Memory</td>
<td></td>
</tr>
<tr>
<td>g)</td>
<td>4000 integers</td>
<td>1357 KCT, 194.1 CPU SEC. AND 195 SEC.</td>
<td>Program Executed in 5 K of Main Memory</td>
<td></td>
</tr>
</tbody>
</table>

RSTS PROFESSIONAL, April 1983
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The future has a way of becoming the present. Tymshare has made the future NOW, in announcing the first in a family of DEC® compatible disk subsystems. Tymshare Voyager Series disk subsystems offer the DEC computer user increased disk storage capacity, reduced space and power requirements, and attractive pricing alternatives.

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2.5 Hart sort

This is a benchmark of the HART sort 24-Dec-81 03:02

- a) NUMBER OF SORTED ITEMS = 100 INTEGERS
   SORT USED 73 K CT, 1.7 CPU SEC. AND 1 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 4 K OF MAIN MEMORY
- b) NUMBER OF SORTED ITEMS = 400 INTEGERS
   SORT USED 185 K CT, 3.7 CPU SEC. AND 4 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- c) NUMBER OF SORTED ITEMS = 800 INTEGERS
   SORT USED 310 K CT, 7.2 CPU SEC. AND 9 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 8 K OF MAIN MEMORY
- d) NUMBER OF SORTED ITEMS = 1600 INTEGERS
   SORT USED 5736 K CT, 47.8 CPU SEC. AND 48 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 12 K OF MAIN MEMORY
- e) NUMBER OF SORTED ITEMS = 3200 INTEGERS
   SORT USED 1239 K CT, 17.7 CPU SEC. AND 18 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 24 K OF MAIN MEMORY
- f) NUMBER OF SORTED ITEMS = 6400 INTEGERS
   SORT USED 2478 K CT, 35.2 CPU SEC. AND 39 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 48 K OF MAIN MEMORY
- g) NUMBER OF SORTED ITEMS = 12800 INTEGERS
   SORT USED 4956 K CT, 70.3 CPU SEC. AND 72 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 96 K OF MAIN MEMORY
- h) NUMBER OF SORTED ITEMS = 25600 INTEGERS
   SORT USED 9912 K CT, 140.6 CPU SEC. AND 144 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 192 K OF MAIN MEMORY

2.6 Comparison of algorithms

<table>
<thead>
<tr>
<th>Bubble</th>
<th>Shell</th>
<th>Heap</th>
<th>Quick</th>
<th>Hart</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>15</td>
<td>31</td>
<td>44</td>
<td>76</td>
</tr>
<tr>
<td>100 numbers</td>
<td>5 sec.</td>
<td>2 sec.</td>
<td>2 sec.</td>
<td>1 sec.</td>
</tr>
<tr>
<td>400 numbers</td>
<td>167 sec.</td>
<td>7 sec.</td>
<td>7 sec.</td>
<td>4 sec.</td>
</tr>
<tr>
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<td>49 sec.</td>
<td>32 sec.</td>
<td>21 sec.</td>
</tr>
<tr>
<td>2400 numbers</td>
<td>-</td>
<td>96 sec.</td>
<td>53 sec.</td>
<td>35 sec.</td>
</tr>
<tr>
<td>3200 numbers</td>
<td>-</td>
<td>151 sec.</td>
<td>71 sec.</td>
<td>50 sec.</td>
</tr>
<tr>
<td>4000 numbers</td>
<td>-</td>
<td>195 sec.</td>
<td>91 sec.</td>
<td>72 sec.</td>
</tr>
</tbody>
</table>

3. Algorithms coded in BASIC-PLUS-2 sorting integers

This section is a benchmark of all algorithms coded in BASIC-PLUS-2. The unsorted array contains integers varying from 0 to 99 randomly generated.

3.1 Bubble sort

This is a benchmark of the BUBBLE sort 15-Dec-81 03:24

- a) NUMBER OF SORTED ITEMS = 100 INTEGERS
   SORT USED 44 K CT, 1.1 CPU SEC. AND 2 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 4 K OF MAIN MEMORY
- b) NUMBER OF SORTED ITEMS = 400 INTEGERS
   SORT USED 185 K CT, 3.7 CPU SEC. AND 4 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- c) NUMBER OF SORTED ITEMS = 800 INTEGERS
   SORT USED 310 K CT, 7.2 CPU SEC. AND 9 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 8 K OF MAIN MEMORY
- d) NUMBER OF SORTED ITEMS = 1600 INTEGERS
   SORT USED 5736 K CT, 47.8 CPU SEC. AND 48 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 12 K OF MAIN MEMORY
- e) NUMBER OF SORTED ITEMS = 3200 INTEGERS
   SORT USED 1239 K CT, 17.7 CPU SEC. AND 18 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 24 K OF MAIN MEMORY
- f) NUMBER OF SORTED ITEMS = 6400 INTEGERS
   SORT USED 2478 K CT, 35.2 CPU SEC. AND 39 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 48 K OF MAIN MEMORY
- g) NUMBER OF SORTED ITEMS = 12800 INTEGERS
   SORT USED 4956 K CT, 70.3 CPU SEC. AND 72 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 96 K OF MAIN MEMORY
- h) NUMBER OF SORTED ITEMS = 25600 INTEGERS
   SORT USED 9912 K CT, 140.6 CPU SEC. AND 144 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 192 K OF MAIN MEMORY

3.2 Shell sort

This is a benchmark of the SHELL sort 15-Dec-81 03:26

- a) NUMBER OF SORTED ITEMS = 100 INTEGERS
   SORT USED 8 K CT, 0.2 CPU SEC. AND 1 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 4 K OF MAIN MEMORY
- b) NUMBER OF SORTED ITEMS = 400 INTEGERS
   SORT USED 55 K CT, 1.3 CPU SEC. AND 2 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- c) NUMBER OF SORTED ITEMS = 800 INTEGERS
   SORT USED 145 K CT, 2.9 CPU SEC. AND 3 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- d) NUMBER OF SORTED ITEMS = 1600 INTEGERS
   SORT USED 510 K CT, 8.5 CPU SEC. AND 9 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 6 K OF MAIN MEMORY
- e) NUMBER OF SORTED ITEMS = 3200 INTEGERS
   SORT USED 936 K CT, 15.6 CPU SEC. AND 16 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 8 K OF MAIN MEMORY
- f) NUMBER OF SORTED ITEMS = 6400 INTEGERS
   SORT USED 1715 K CT, 24.5 CPU SEC. AND 25 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 8 K OF MAIN MEMORY
- g) NUMBER OF SORTED ITEMS = 12800 INTEGERS
   SORT USED 3058 K CT, 56.2 CPU SEC. AND 61 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 9 K OF MAIN MEMORY
- h) NUMBER OF SORTED ITEMS = 25600 INTEGERS
   SORT USED 6016 K CT, 112.5 CPU SEC. AND 116 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 18 K OF MAIN MEMORY

3.3 Heap sort

This is a benchmark of the HEAP sort 15-Dec-81 03:28

- a) NUMBER OF SORTED ITEMS = 100 INTEGERS
   SORT USED 12 K CT, 3 CPU SEC. AND 1 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 4 K OF MAIN MEMORY
- b) NUMBER OF SORTED ITEMS = 400 INTEGERS
   SORT USED 70 K CT, 1.4 CPU SEC. AND 2 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- c) NUMBER OF SORTED ITEMS = 800 INTEGERS
   SORT USED 160 K CT, 3.2 CPU SEC. AND 4 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- d) NUMBER OF SORTED ITEMS = 1600 INTEGERS
   SORT USED 402 K CT, 6.7 CPU SEC. AND 7 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 6 K OF MAIN MEMORY
- e) NUMBER OF SORTED ITEMS = 3200 INTEGERS
   SORT USED 804 K CT, 13.1 CPU SEC. AND 14 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 7 K OF MAIN MEMORY
- f) NUMBER OF SORTED ITEMS = 6400 INTEGERS
   SORT USED 1608 K CT, 26.2 CPU SEC. AND 26 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 8 K OF MAIN MEMORY
- g) NUMBER OF SORTED ITEMS = 12800 INTEGERS
   SORT USED 3216 K CT, 52.4 CPU SEC. AND 53 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 9 K OF MAIN MEMORY
- h) NUMBER OF SORTED ITEMS = 25600 INTEGERS
   SORT USED 6432 K CT, 104.7 CPU SEC. AND 106 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 18 K OF MAIN MEMORY

3.4 Quick sort

This is a benchmark of the QUICK sort 15-Dec-81 03:30

- a) NUMBER OF SORTED ITEMS = 100 INTEGERS
   SORT USED 5 K CT, 1 CPU SEC. AND 1 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
- b) NUMBER OF SORTED ITEMS = 400 INTEGERS
   SORT USED 35 K CT, 0.7 CPU SEC. AND 1 SEC. (ELAPSED TIME)
   PROGRAM EXECUTED IN 5 K OF MAIN MEMORY
3.5 Hart sort

This is a benchmark of the HART sort 15-Dec-81 03:31

a) NUMBER OF SORTED ITEMS = 1000 INTEGERS
SORT USED 5 KCT, 1.1 CPU SEC. AND 11 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

b) NUMBER OF SORTED ITEMS = 4000 INTEGERS
SORT USED 40 KCT, 8 CPU SEC. AND 1 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

c) NUMBER OF SORTED ITEMS = 8000 INTEGERS
SORT USED 102 KCT, 1.7 CPU SEC. AND 2 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 6 K OF MAIN MEMORY

d) NUMBER OF SORTED ITEMS = 16000 INTEGERS
SORT USED 280 KCT, 3.5 CPU SEC. AND 4 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 8 K OF MAIN MEMORY

e) NUMBER OF SORTED ITEMS = 24000 INTEGERS
SORT USED 531 KCT, 5.9 CPU SEC. AND 6 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 9 K OF MAIN MEMORY

f) NUMBER OF SORTED ITEMS = 32000 INTEGERS
SORT USED 825 KCT, 7.5 CPU SEC. AND 8 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 11 K OF MAIN MEMORY

g) NUMBER OF SORTED ITEMS = 40000 INTEGERS
SORT USED 1092 KCT, 9.1 CPU SEC. AND 10 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 12 K OF MAIN MEMORY

h) NUMBER OF SORTED ITEMS = 48000 INTEGERS
SORT USED 1792 KCT, 12.8 CPU SEC. AND 13 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 14 K OF MAIN MEMORY

3.6 Comparison of algorithms

<table>
<thead>
<tr>
<th></th>
<th>Bubble</th>
<th>Shell</th>
<th>Heap</th>
<th>Quick</th>
<th>Hart</th>
</tr>
</thead>
<tbody>
<tr>
<td>number</td>
<td>8</td>
<td>15</td>
<td>31</td>
<td>44</td>
<td>76</td>
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<tr>
<td>statements</td>
<td>8 sec.</td>
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<td>3 sec.</td>
<td>6 sec.</td>
<td>2 sec.</td>
</tr>
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<td>1 sec.</td>
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</tr>
<tr>
<td>(4k)</td>
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<td>(5k)</td>
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<tr>
<td>400 numbers</td>
<td>15 sec.</td>
<td>2 sec.</td>
<td>2 sec.</td>
<td>1 sec.</td>
<td>1 sec.</td>
</tr>
<tr>
<td>(5k)</td>
<td>(5k)</td>
<td>(5k)</td>
<td>(5k)</td>
<td>(5k)</td>
<td></td>
</tr>
<tr>
<td>800 numbers</td>
<td>61 sec.</td>
<td>3 sec.</td>
<td>6 sec.</td>
<td>2 sec.</td>
<td>2 sec.</td>
</tr>
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<td>(5k)</td>
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<td>(5k)</td>
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<td>(5k)</td>
<td></td>
</tr>
<tr>
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<td>- 9 sec.</td>
<td>7 sec.</td>
<td>5 sec.</td>
<td>4 sec.</td>
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</tr>
<tr>
<td>(6k)</td>
<td>(6k)</td>
<td>(6k)</td>
<td>(6k)</td>
<td>(6k)</td>
<td></td>
</tr>
<tr>
<td>2400 numbers</td>
<td>- 6 sec.</td>
<td>11 sec.</td>
<td>7 sec.</td>
<td>6 sec.</td>
<td>6 sec.</td>
</tr>
<tr>
<td>(6k)</td>
<td>(7k)</td>
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<td>(7k)</td>
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</tr>
<tr>
<td>3200 numbers</td>
<td>- 25 sec.</td>
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<td>11 sec.</td>
<td>8 sec.</td>
<td>8 sec.</td>
</tr>
<tr>
<td>(7k)</td>
<td>(7k)</td>
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<td>(7k)</td>
<td>(7k)</td>
<td></td>
</tr>
<tr>
<td>4000 numbers</td>
<td>- 34 sec.</td>
<td>20 sec.</td>
<td>14 sec.</td>
<td>10 sec.</td>
<td>10 sec.</td>
</tr>
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<td>(8k)</td>
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</tr>
<tr>
<td>4800 numbers</td>
<td>- 61 sec.</td>
<td>24 sec.</td>
<td>16 sec.</td>
<td>15 sec.</td>
<td>15 sec.</td>
</tr>
<tr>
<td>(9k)</td>
<td>(9k)</td>
<td>(9k)</td>
<td>(9k)</td>
<td>(9k)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 shows the elapsed time in seconds required by each algorithm to sort "X" number of integers.

Table 2 shows the amount of KCTs required by each algorithm to sort "X" number of integers. KCT (Kilo-core-
ticks) is the memory usage factor per tenth of CPU seconds. One KCT is equal to the usage of 1K of memory for one tenth of a second. For example, a job that requires 10.5 CPU seconds and 15K of memory is using 1575 KCTs.

4. Algorithms coded in BASIC-PLUS-2 sorting string fields

This section is a benchmark of all algorithms coded in BASIC-PLUS-2. Each string field contains three characters
and each character contains a letter varying from 'A' to 'J' randomly generated.

No benchmark for the Hart algorithm is included in this section. The complexity of the algorithm and the large amount of memory space it requires make this algorithm not suited to sort string fields.

4.1 Bubble sort

**RUN DM1:BUBBL**

This is a benchmark of the BUBBLE sort 23-Dec-81 02:31

a) NUMBER OF SORTED ITEMS = 100 STRING FIELDS (3 CHAR)
SORT USED 210 KCT, 8.2 CPU SEC. AND 5 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

b) NUMBER OF SORTED ITEMS = 400 STRING FIELDS (3 CHAR)
SORT USED 4236 KCT, 70.8 CPU SEC. AND 71 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 6 K OF MAIN MEMORY

c) NUMBER OF SORTED ITEMS = 800 STRING FIELDS (3 CHAR)
SORT USED 18865 KCT, 289.5 CPU SEC. AND 271 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 7 K OF MAIN MEMORY

4.2 Shell sort

**RUN DM1:SHOEL**

This is a benchmark of the SHELL sort 23-Dec-81 02:37

a) NUMBER OF SORTED ITEMS = 100 STRING FIELDS (3 CHAR)
SORT USED 40 KCT, .8 CPU SEC. AND 1 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

b) NUMBER OF SORTED ITEMS = 400 STRING FIELDS (3 CHAR)
SORT USED 305 KCT, 5.1 CPU SEC. AND 6 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 6 K OF MAIN MEMORY

c) NUMBER OF SORTED ITEMS = 800 STRING FIELDS (3 CHAR)
SORT USED 875 KCT, 12.5 CPU SEC. AND 13 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 7 K OF MAIN MEMORY

d) NUMBER OF SORTED ITEMS = 1600 STRING FIELDS (3 CHAR)
SORT USED 3190 KCT, 31.9 CPU SEC. AND 32 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 10 K OF MAIN MEMORY

e) NUMBER OF SORTED ITEMS = 2400 STRING FIELDS (3 CHAR)
SORT USED 5686 KCT, 49 CPU SEC. AND 50 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 12 K OF MAIN MEMORY

f) NUMBER OF SORTED ITEMS = 3200 STRING FIELDS (3 CHAR)
SORT USED 12420 KCT, 82.8 CPU SEC. AND 83 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 15 K OF MAIN MEMORY

g) NUMBER OF SORTED ITEMS = 4000 STRING FIELDS (3 CHAR)
SORT USED 15930 KCT, 88.5 CPU SEC. AND 89 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 18 K OF MAIN MEMORY

4.3 Heap sort

**RUN DM1:HEAP**

This is a benchmark of the HEAP sort 23-Dec-81 02:44

a) NUMBER OF SORTED ITEMS = 100 STRING FIELDS (3 CHAR)
SORT USED 55 KCT, 1.1 CPU SEC. AND 2 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

b) NUMBER OF SORTED ITEMS = 400 STRING FIELDS (3 CHAR)
SORT USED 345 KCT, 5.8 CPU SEC. AND 6 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 6 K OF MAIN MEMORY

c) NUMBER OF SORTED ITEMS = 800 STRING FIELDS (3 CHAR)
SORT USED 1050 KCT, 15 CPU SEC. AND 15 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 7 K OF MAIN MEMORY

d) NUMBER OF SORTED ITEMS = 1600 STRING FIELDS (3 CHAR)
SORT USED 2950 KCT, 29.5 CPU SEC. AND 30 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 10 K OF MAIN MEMORY

e) NUMBER OF SORTED ITEMS = 2400 STRING FIELDS (3 CHAR)
SORT USED 6133 KCT, 51.1 CPU SEC. AND 52 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 13 K OF MAIN MEMORY

f) NUMBER OF SORTED ITEMS = 3200 STRING FIELDS (3 CHAR)
SORT USED 9735 KCT, 64.9 CPU SEC. AND 65 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 15 K OF MAIN MEMORY

g) NUMBER OF SORTED ITEMS = 4000 STRING FIELDS (3 CHAR)
SORT USED 16542 KCT, 91.9 CPU SEC. AND 93 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 18 K OF MAIN MEMORY

h) NUMBER OF SORTED ITEMS = 4800 STRING FIELDS (3 CHAR)
SORT USED 23604 KCT, 112.4 CPU SEC. AND 113 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 21 K OF MAIN MEMORY

4.4 Quick sort

**RUN DM1:QUICK**

This is a benchmark of the QUICK sort 23-Dec-81 02:50

a) NUMBER OF SORTED ITEMS = 100 STRING FIELDS (3 CHAR)
SORT USED 20 KCT, 4 CPU SEC. AND 1 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

b) NUMBER OF SORTED ITEMS = 400 STRING FIELDS (3 CHAR)
SORT USED 144 KCT, 2.4 CPU SEC. AND 3 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 5 K OF MAIN MEMORY

c) NUMBER OF SORTED ITEMS = 800 STRING FIELDS (3 CHAR)
SORT USED 343 KCT, 4.9 CPU SEC. AND 5 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 7 K OF MAIN MEMORY

d) NUMBER OF SORTED ITEMS = 1600 STRING FIELDS (3 CHAR)
SORT USED 1110 KCT, 11.1 CPU SEC. AND 12 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 10 K OF MAIN MEMORY

e) NUMBER OF SORTED ITEMS = 2400 STRING FIELDS (3 CHAR)
SORT USED 2416 KCT, 15.6 CPU SEC. AND 16 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 13 K OF MAIN MEMORY

f) NUMBER OF SORTED ITEMS = 3200 STRING FIELDS (3 CHAR)
SORT USED 3570 KCT, 23.8 CPU SEC. AND 25 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 15 K OF MAIN MEMORY

g) NUMBER OF SORTED ITEMS = 4000 STRING FIELDS (3 CHAR)
SORT USED 5724 KCT, 31.8 CPU SEC. AND 32 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 18 K OF MAIN MEMORY

h) NUMBER OF SORTED ITEMS = 4800 STRING FIELDS (3 CHAR)
SORT USED 8127 KCT, 38.7 CPU SEC. AND 39 SEC. (ELAPSED TIME)
PROGRAM EXECUTED IN 21 K OF MAIN MEMORY

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(specify)

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4.5 Comparison of algorithms

| number of   | Bubble | Shell | Heap  | Quick |
| statements | ------ | ------ | ------ | ------ |
| 100 string fields | 5 sec. | 2 sec. | 2 sec. | 1 sec. |
| 400 string fields | 71 sec. | 6 sec. | 6 sec. | 3 sec. |
| 800 string fields | 271 sec. | 13 sec. | 15 sec. | 5 sec. |
| 1600 string fields | - | 32 sec. | 30 sec. | 12 sec. |
| 2400 string fields | - | 50 sec. | 52 sec. | 19 sec. |
| 3200 string fields | - | 83 sec. | 65 sec. | 25 sec. |
| 4000 string fields | - | 89 sec. | 93 sec. | 32 sec. |
| 4800 string fields | - | 121 sec. | 111 sec. | 39 sec. |

Table 3 shows the elapsed time in seconds required by each algorithm to sort "X" number of string fields.

5. Conclusion

5.1 Numeric sorts

To sort large arrays (over 1500 records) the Hart algorithm is the fastest and if the response time is a very important criteria for the success of your application then it can be useful. But the Quick algorithm is the most efficient in all situations. For sorts varying from 800 to 4800 numbers, Quick requires only from 1 to 4 additional seconds on a quiet system and uses from 1k to 5K less memory.

On the other hand, if the size of your program is reaching its limit and if you can not afford the Quick sort then the Shell algorithm might be the solution to your problem. It is reasonably fast when used to sort small arrays and is only 15 statements long.

The Bubble sort should never be used.

5.2 String field sorts

It is very obvious that the Quick algorithm is by far the best one. The trade off between the length of the algorithm (Quick: 44 statements, Heap: 33 statements, Shell: 15 statements) is outclassed by the response time gain. Compared to the Heap algorithm, the Quick requires from 3 to 74 seconds less to sort from 400 to 4800 string fields on a quiet system.

Again the Bubble sort should never be used.

5.3 Programming languages

BASIC-PLUS-2 sorts identical to BASIC-PLUS demonstrated at least four times the speed. This must be attributed to the system time used in converting the BASIC-PLUS interpretive language to executable code. This observation concerns numeric array sorts only. No benchmarks were done on string fields sorts coded in BASIC-PLUS because of the large amount of memory space usually required by string fields sorts. BASIC-PLUS program can only grow to a maximum of 16K in comparison to 24K in BASIC-PLUS-2.

5.4 Miscellaneous observations

This study also demonstrated that it is 4 to 6 times faster to sort string field arrays loaded in a channel memory buffer than identical arrays loaded in any other memory portion of a program. The following examples show how it's done.

a) loading an array using the channel memory buffer.

```plaintext
10 SORT ITEMS=100 &
   REC.LEN=3
20 DIM A.ARRAY$(100%)
30 OPEN "FILE.SRT" FOR INPUT AS FILE1%, &
   RECORDSIZE SORT.ITEM% ' REC.LEN% &
   GET 111% &
   FOR I%=1% TO SORT.ITEM% &
   FIELD I%, (I% - 11) • REC.LEN% AS A.ARRAY$(I%), &
   REC.LEN% AS A.ARRAY$(I%)
   NEXT I% &
   
   NEXT I% &
```

b) loading an array in any other memory portion of a program.

```plaintext
10 SORT ITEMS=100% &
   REC.LEN=3%
20 DIM A.ARRAY$(100%)
30 FOR I%=1% TO SORT.ITEM% &
   FOR J%=1% TO REC.LEN% &
   A.ARRAY$(I%)=A.ARRAY$(I%)+STRING$(1%,INT(10%'RND)+65%) &
   NEXT J% &
   NEXT I% &
```

Sorting process is probably faster because while the complete string array elements are being physically and repeatedly moved around in memory for arrays loaded as example (b) only the address pointers of string array elements are changed in arrays loaded as example (a).

APPENDIX A

Algorithm 1 - Bubble Sort

```
1000 ******************
  **** INITIALIZATION ****
  ******* SORT.ITEM%=100%  
```
The most obvious algorithm is the Bubble Sort: for each item we replace the least value in the remaining items, interchanging so the least value "bubbles up" to the front.

Algorithm 2 - Shell Sort

A slight increase in program length brings a radical improvement in execution speed. The Shell Sort works like a Bubble Sort except that the comparison intervals decrease by powers of 2, so that initial exchanges tend to move items farther, much quicker than in the Bubble Sort.

Algorithm 3 - Heap Sort

The most obvious algorithm is the Bubble Sort: for each item we replace the least value in the remaining items, interchanging so the least value "bubbles up" to the front.
Quick Sort

```
17000 IF SORT.ARRAY(SORTED, ELEMENTS) < SORT.ARRAY(SORTED, ELEMENTS + 15) &
\ THEN SORTED, ELEMENTS = SORTED, ELEMENTS + 15 &
17060 IF CONTENT, WORK, ELEMENTS < SORT.ARRAY(WORK, ELEMENTS) &
\ THEN GO TO 17070 &
17070 W,ORK1=SORT.ARRAY(SORTED, ELEMENTS) &
\ SORT.ARRAY(SORTED, ELEMENTS) = SORT.ARRAY(WORK, ELEMENTS) &
\ SORT.ARRAY(WORK, ELEMENTS) = W,ORK1 &
\ GO TO 17040 &
17080 SORT.ARRAY(WORK, ELEMENTS) = CONTENT, WORK, ELEMENTS &
17090 GO TO 17010 &
17100 ***** END OF SORT *****
Algorithm 4 - Quick Sort
```

By introducing an auxiliary array SORT.ARRAY as a pushdown stack, a further speedup is possible. The Quick Sort recursively breaks the array SORT.ARRAY into pairs of subarrays such that all items in one subarray are less than or equal to all items in the other subarray.

Algorithm 5 - Hart Sort

```
10000 """
10000 INITIALIZATION """
10000 """
```

Hart Sort

```
```

```
Besides an auxiliary pushdown stack, Hart uses an array SORT.ARRAY2 of "links" which point to items in SORT.ARRAY1. Using an implicit balanced binary tree, Hart's algorithm sorts by doing a minimal number of comparisons. Hart includes the pushdown at the end of array SORT.ARRAY1.

APPENDIX B

Same as algorithms 1 through 5 of Appendix A except A.RRAY$ replaces A.RRAY% giving alpha sorts instead of numeric.

The smoothest path between RSTS/E and VAX / VMS just got smoother: there's a major new release of

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Call or write for the new ROSS/V technical summary, which describes all of ROSS/V's features.

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CIRCLE 176 ON READER CARD
BEEP-BEEP FOR GARBAGE COLLECTION

On RSTS, most programming is done in either BASIC-PLUS or BASIC-PLUS-2. Both of these programming languages support dynamic character strings. A dynamic string is a string whose space is allocated dynamically at run time. Each time a string assignment statement is executed, the language object time system (OTS) allocates space from the program's free space for the destination string. The space previously allocated to the destination string is not available for re-use until all of the free space has been exhausted and the OTS does some form of space reclamation or garbage collection. The resources expended to perform this garbage collection are resources that could be put to better use, like playing MTREK.

This is not news to most of us. Most of us are aware that the OTS is doing something but we don't know why or when. This article will give a brief and simplistic explanation of why the garbage collector is executed, and give you the tools you need to tell when the garbage collector is executed. This article will also address techniques to reduce the need for garbage collection.

Why

The in-memory layout of a BASIC program (minus runtime systems and resident libraries) is shown in figure A.

```
STRING SPACE
V
FREE SPACE
I/O BUFFER SPACE
CODE/DATA
```

FIGURE A

What this figure shows is that the dynamic string space expands down from the top of the program (from high memory addresses towards low memory addresses), and the I/O buffer space expands up. The free space is the amount of space not currently allocated to either I/O buffers or string space.

When a dynamic string assignment statement is executed, the OTS checks to see if there is enough free space to contain the destination string. If there is not enough free space, the OTS will call the garbage collector to reclaim deallocated space. After the garbage collection, if there still is not enough free space to contain the destination string, the OTS will request the operating system (RSTS) to increase the amount of memory allocated to this job. If the operating system cannot expand the program, the OTS will abort the program with a "Maximum memory exceeded" error. If the operating system can expand the program, the OTS will move the dynamic strings to the new top of memory, creating a larger free space. (See figures B — E.)

```
Program executes: A$ "HELLO THERE"
HELLO THERE
```

FIGURE B

```
Program executes: B$ "THIS IS A TEST"
HELLO THERE
```

FIGURE C

```
Program executes: A$"
(OTS marks A$ as deallocated)
```

FIGURE D

```
Program executes: C$ STRING$(50,64)
(C$ is too large for free space, OTS repacks dynamic strings, still not enough free space, OTS expands program, moves dynamic strings to new top of memory, allocates C$)
```

FIGURE E

When

The patches below (one for BASIC-PLUS and one for BASIC-PLUS-2) will tell us when the OTS does a garbage collection operation. The patches will cause the OTS to ring the terminal bell by printing a CONTROL-G each time the garbage collector is executed.
**BASIC-PLUS**

To install the patch to the BASIC-PLUS run-time system, copy your existing run-time system to a new file called BASBEL. This is the file that we will be patching.

```plaintext
File to patch? [0,1]BASBEL.RTS
Base address? ECONOM
Offset address? 0
```

To use this new run-time system, add the run-time system to the monitor tables, and then either switch into BASBEL to compile a program, or name an existing compiled file to BASBEL.

**BASIC-PLUS-2**

To install the patch to the BASIC-PLUS-2 OTS, extract the "SSTMSC" module from the OTS library, patch the object module, and DO NOT replace it in the OTS library.

```plaintext
BP2BEL: MOV R1,[SP] ; SAVE R1.
MOV #442,R1 ; ADDRESS OF XRB.
MOV #0,(R1) ; LENGTH OF BEL.
MOV #BEL,(R1) ; ADDRESS OF BEL.
.REPT 4
.COMPA C
.ERROR
.END
```

So what

Now that we can tell when a program is garbage collecting, what can we do about it? The first step is to identify the programs that are constantly calling the garbage collector. It is interesting to note that it’s not just the 16KW BASIC-PLUS or 31KW BASIC-PLUS-2 programs that constantly call the garbage collector. All programs that constantly allocate/deallocate dynamic strings will incur the wrath of the garbage collector. The frequency of calling the garbage collector is a function of the size of the free space and the frequency of string allocation. You can reduce the frequency of calling the garbage collector by either increasing the size of the free space, or reducing your program’s demands upon it.

Increasing the size of the free space can be accomplished by allocating a large string (several thousand bytes long) to force the program expansion, and then deallocating the string by assigning it to a null string (" "). In BASIC-PLUS-2 this can also be accomplished by using the task builder “EXTT5K” directive.

You can reduce your program’s demands upon free space by:

1. Using fixed length strings in BASIC-PLUS-2 by declaring the strings in a MAP/COMMON statement.
2. Pre-allocating strings and then using LSET/RSET to assign values.
3. Deallocating strings as soon as they are no longer needed. BASIC-PLUS-2 automatically deallocates all local dynamic strings when a sub-program is exited.
4. Coding programs so that they don’t build strings piece by piece.

Now, the next time you find yourself sitting in front of your terminal wondering why your BASIC program takes so long to run, you have the tools to see if dynamic string garbage collection is the cause.

---

RSTS PROFESSIONAL, April 1983 Page 49
DBL, a structured superset of DEC's DIBOL-11 Business Programming Language, is available in two new releases: **DBL/VMS** is available for VAX/VMS in native mode, emits in-line code, and is source code compatible with DIBOL-11 code. **DBL Runtimes** are available for most DEC PDP-11 operating systems as a runtime-only license. Call for minimum quantities and prices. DBL is available for RT-11, TSX/TSX-Plus, RSTS, RSX-11M/M-Plus, and VAX/VMS native mode.

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INSIDE:

Learning to Use the VAX Debugger
LEARNING TO USE
THE VAX DEBUGGER
(for those of you who
make mistakes . . .)

By Bob Meyer

The VAX debugger is probably one of my favorite
pieces of software on the whole system. (Yes, I’m one of
those weirdos who LIKES to write software.) If any of you
have used RSXODT on RSTS, RSX or IAS, you’re in for quite a
treat. This debugger is fully symbolic (meaning it knows
about variables, psects, labels, etc., in your program) and
understands the VAX instruction set: a feature which lets
you examine instructions in assembly language format, as
well as type in mnemonics to be assembled (on the spot) by
the debugger. (Neat!)

In this article we’ll talk about some of the basic debug­
ger commands and (as always) give some examples in
MACRO (is there anything else??)

First let’s consider a simple program (you may want to
key this in and try the examples that follow):

```
.TITLE DEBUG
.IDENT /0.0/

.PSECT IMPURE
NUM1: .WORD 1
NUM2: .WORD 2

.PSECT CODE
BOB: .WORD 0
MOVZWL NUM1,RO
10$:
INCW R0
CMPW R0,#10.
BLSS 10$
RET
.END BOB
```

(by the way, this ‘program’ isn’t meant to do anything
useful . . .)
Assemble this little beauty with:
$ MAC BOB/ENABLE=DEBUG
assuming you called it BOB.MAC (how flattering!). The
/ENABLE=DEBUG causes the assembler to place debugger
records in the object file containing names of symbols in
your program (and probably other things I know very little
about).

Then link:
$ LINK BOB/DEBUG
This links your image with the symbolic debugger.

When you run the program, the debugger will take con-
$ RUN BOB
VAX-11 DEBUG Version 2.3-5
%DEBUG-I-INITIAL, language is MACRO, module set to
'DEBUG' DBG>

Let's look at the EXAMINE command first. The
EXAMINE command allows us to look at anything in our vir-
tual workspace (this also includes various system routines if
you reference them.) EXAMINE has several modes in which
you can look at your program or data; the default mode is
hex:

DBG>E NUM1
DEBUG \ NUM1: 00020001
DBG>

In this example I've asked to 'Examine NUM1', which
contains a constant 1. (Note the EXAMINE command can be
abbreviated to 'E'.) The 'DEBUG' in the debugger's response
is the .TITLE of the current module. The NUM1 is the nearest
symbol to the location we're examining; the number that
follows is the value of NUM1. (Actually, since we're examin-
ing in LONGWORD mode by default, we're seeing NUM1 and
NUM2 back-to-back.)

Some options of the EXAMINE command are:

/OCTAL, /HEX, /DECIMAL

which cause the debugger to ACCEPT and DISPLAY all
numbers in the requested radix.

The options:

/BYTE, /WORD, /LONGWORD

specify the format to display the data in; for example:

DBG>E/WORD NUM1
DEBUG \ NUM1: 0001

DBG>E/BYTE NUM1
DEBUG \ NUM1: 01

DBG>E/LONG NUM1
DEBUG \ NUM1: 00020001

For more information contact:

On Track Systems, Inc.
P.O. Box 246
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Phone: 215/542-7008

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19 St Kevins Road
Dublin 8, Ireland

CIRCLE 11 ON READER CARD
The qualifiers OCTAL, DECIMAL, & HEX can be combined with BYTE, WORD, & LONGWORD as needed.

Perhaps the most useful form of the EXAMINE command is the /INSTRUCTION option:

DBG > E/IN BOB
DEBUG \ BOB: HALT

Issuing subsequent EXAMINE commands will cause the debugger to list sequential memory locations:

DBG > E/I
DEBUG \ CODE+ 01: HALT
DBG > E/I
DEBUG \ CODE+ 02: MOVZWL LI DEBUG \ NUM1.R0
DBG > E/I
DEBUG \ CODE+ 09: INCW RO

or to list a block of memory, specify the memory range separated by a colon ‘:’ —

DBG > E/I BOB:BOB+10
DEBUG \ BOB: HALT
DEBUG \ CODE+ 01: MOVZWL LI DEBUG \ NUM1.R0
DEBUG \ CODE+ 09: INCW RO
DEBUG \ CODE+ 0B: CMPW RO,#OA
DEBUG \ CODE+ 0E: BLSS DEBUG \ CODE+ 09
DEBUG \ CODE+ 10: RET
DBG >

(Some of the above numbers (CODE+ 01, etc.) may be inaccurate here.)

Other EXAMINE switches are:

/ASCII:n
Lists memory in ASCII format; n is the number of bytes to list (default is 16.) Assuming you have some ASCII text defined similar to this:

MSG: .ASCII /Macro men do it Faster!/

Typing the command:

DBG > E/AS:5

would print:

DEBUG \ MSG: Macro

/SYMBOL
Lists symbol names along with memory contents. This is the default.

/NOSYMBOL
Suppresses listing of symbol names, and prints the absolute (virtual) values instead:

DBG > E/I/NOSYM BOB:BOB + 10

Also, the command:

DBG > E PSW

will format and display the bits in the program status word.

The defaults in the EXAMINE (as well as DEPOSIT) commands can be changed using the SET MODE command. Some of the SET MODE commands are:

SET MODE INSTRUCTION Attempts to disassemble memory contents and display mnemonics.

SET MODE NOINSTRUCTION Displays memory in the current numeric mode (hex by default).

SET MODE OCTAL [or DECIMAL or HEX]
Establishes the default radix for input & output of non-symbolic data.

SET MODE SYMBOL Displays symbol names from the symbol table in the image instead of memory addresses.

SET MODE NOSYMBOL Displays (virtual) memory address of examined locations.

SET MODE WORD [or BYTE, or LONGWORD]
Displays all memory contents as words, bytes, or longwords, as specified.

The DEPOSIT command can be used to change the contents of memory in the user workspace. The DEPOSIT command takes most of the same switches as the EXAMINE command. Some examples of DEPOSIT follow:

DBG > D NUM1 = 5

Places the number 5 into location NUM1. (Remember, the default is hex unless you change it.)

DBG > D/OCT NUM1 = 10

Deposits an octal 10 (8.) into NUM1.

DBG > D/HEX/WORD NUM2 =OE

Places the hex value E (14.) in the location NUM2. Note that when depositing hex values A-F a leading zero is required so the debugger doesn’t try to interpret the letter as a symbol.

DBG > D/ASCII:6 MSG = 'Howdy!'

Places the specified string in memory starting at the
location 'MSG'. If the length of the string is greater than the number specified with the /ASCII:n switch, the string is padded to the right with spaces. The default length is 4 bytes.

DBG > D/I BOB = 'CLRW RO'

This command (DEPOSIT/INSTRUCTION) will 'assemble' the instruction (and operands) and place the result in the specified memory location (far out!). Keep in mind that when modifying instructions, you have to keep track of the instruction length(s). For example, replacing a three word instruction with a one word instruction leaves you with two words of trash (they wouldn't let me say 'crap' . . .) which can cause some pretty interesting results when the processor attempts to execute them. So, we NOP them: first we'll put the new instruction in:

DBG > D/I BOB = 'CLRW RO'

Then the NOPs:

DBG > D/I 'NOP'
DBG > D/I 'NOP'

To begin execution of your program, use the GO command:

DBG > GO

The debugger tells you where it's starting from:

Start at DEBUG \ CODE+00

and turns control over to the program. (Remember, the sample program doesn't actually do anything . . .)

The STEP command is useful for single stepping through the program and examining or changing values as you go:

DBG > STEP

The debugger prints:

Start at DEBUG \ CODE+02
Stepped to DEBUG \ CODE+09: INCW RO

telling you the address of the instruction to be executed, then the address and the assembly mnemonic of the instruction to be executed by the next STEP command. STEP can be shortened to just 'S'.

It might be advisable to get a feel for the debugger at a time when you don't really need it, rather than waiting until you have a real problem on your hands.

Well, I'll leave you with the words of my great, great, grandfather, Oswald Meyer, who said "That's not a bug, that's a feature!"

Enjoy.
Last issue I introduced a patch to the RSTS monitor that gave RSTS high priority, realtime response. This article will describe a patch for optimizing the use of low priority, background tasks.

The priority structure of RSTS allows you to specify that certain tasks are more important than others and should be allowed to run more often. Conversely, you can specify that certain programs are less important and should run less often.

By making it low enough priority, a program will only run if no other program on the system is runnable. This allows you to make use of computer time that would normally be wasted, supposedly without degrading the performance of other more important programs.

Unfortunately, it doesn’t really work that way. Once the low priority program starts to execute it is allowed to continue for its entire run burst, usually 1/10th of a second. If the higher priority tasks are performing a lot of I/O, the system can have lots of little inactive times. The background task will run for its entire run burst during each of these inactive times. This can significantly degrade the performance of the higher priority tasks.

The following patch allows a task running below priority -64 to immediately stop running when a higher priority task becomes runnable. Average response degradation is less than one millisecond.

This patch uses patch space that is allocated for possible monitor patches. Future monitor patches may require the same patch addresses. If this occurs, the realtime patch will have to be removed or moved to a different location in patch space. The patch is position independent and can be installed in any other area in patch space that is not in use.

The comments following the semi-colons are for information only and can be ignored while entering the patch. although they will not cause any problems if entered. <LF> is used to signify a linefeed. ???? is used to signify that any value is acceptable for this field.

As with all patches, be sure that the offset and old values are correct for each line before making any changes. If any of the old values is incorrect, abort the patch by typing IC.

```
RUN [1,2]ONLPAT
Command file name? LOWPRI.LOG=
File to_patch? <LF>
Module name? <LF>
Base address? PATCH+340
Offset address? 0
Base offset Old New?
???????? 000000 000000 ? 105737 ;Is a Job currently running
???????? 000002 000000 ? JOB ;No
???????? 000004 000000 ? 1414 ;Point to JDR for current Job
???????? 000006 000000 ? 13746 ;Point to JDR+JDFRI (job’s priority)
???????? 000010 000000 ? 62716 ;Point to JDB+JDFRI (job’s priority)
???????? 000012 000000 ? 34
???????? 000016 000000 ? 123627 ;Is current job low priority
???????? 000020 000000 ? -64. ;(priority threshold)
???????? 000022 000000 ? 2003 ;No
???????? 000024 000000 ? 52737 ;Schedule the I/O Job immediately
???????? 000026 000000 ? 20000
???????? 000030 000000 ? L3QUE2
???????? 000032 000000 ? 105737 ;Replace the patched instruction
???????? 000034 000000 ? JOB
???????? 000036 000000 ? 207 ;Return from patch
???????? 000040 000000 ? ^Z
Offset address? ^Z
Base address? IOFIN4
Offset address? 62
Base Offset Old New?
???????? 000062 105767 ? 4737 ;Enter patch
???????? 000064 ?????? ? PATCH+340 ;NOTE: New value must match patch base
???????? 000066 001003 ? ^C ;End of patch
```
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"The Bridge and a z-Board — the four best microcomputers I never bought!"
This article contains some routines for the Basic Plus 2 applications programmer. Although I myself prefer to play with the OS instead of applications (actually I'd rather be skiing, but...), in most companies applications programs are the bread and butter that pay the salaries. I have developed some routines coded in MACRO-11 and callable from BASIC PLUS 2. This article will provide a few that have been found useful and suggest some alternative ways of obtaining information normally only obtainable by doing SYS() calls. If you are not a MACRO programmer, please don't get scared and turn the page—all the routines are fairly simple and can be used just as if they were BASIC PLUS 2 subroutines.

**XCONTG.MAC**

Here is a favorite contradiction—'Good Disk Management' dictates that files be created contiguously. In real life though, dynamic files eventually become full, and if created contiguously, RSTS will generate a Protection Violation error message when it attempts to extend the file. This occurs because a bit is set in the file's directory entry (Bit 4 in USTAT), indicating that the file is contiguous. It used to be that when this occurred a user would call one of the programmers who would then use UTILTY to FLAG the file /NOCTG. While workable, this is not a desirable solution. Eventually the programmers become tired of spending their time flagging files so they no longer create them contiguous, and violate the 'Good Disk Management' rule. To get around this problem, I have written a MACRO routine that will do the dirty work of unsetting the contiguous bit in the directory entry if a Protection Violation error occurs on a PUT or UPDATE, and keeps the programming staff programming.

To use XCONTG, trap for an ERR = 10%, resume at a line number external to the error handler, and CALL XCONTG(CHANNEL%) where CHANNEL% is the channel number of the file you desire to flag as non-contiguous. Note that no errors are expected in XCONTG, but if any do occur, the error code will be returned in CHANNEL%.

```
23100 IF ERR = 10% THEN RESUME 29000
29000 PRINT #12$, 'File is Full - Extending ... Please Wait'
 \ CHANNELS = 15
 \ CHANNELS = 25 IF ERL = 1020
 \ CALL XCONTG(CHANNEL$)
 \ IF CHANNEL$ THEN PRINT #12$, 'XCONTG Error '; ERL$(CHANNEL$)
 \ GOTO 27277
 ELSE GOTO 1020 IF ERL = 1020
 \ GOTO 2000
 \ Print an informational message to the user
 \ Set up the channel number depending on where the error occurred
 \ Call XCONTG to unset contiguous bit
 \ If any errors returned then complain
 \ Else branch back into code
```

**CAP.MAC**

This is MACRO version of a routine developed by James F. Shaughnessy, Jr. (See 'Input Loop Programming Technique' in RSTS Professional Vol. 4, No. 1, February 1982). In data entry programs it is often desirable to allow the operator to enter data in lower case. It is also desirable to have the first letter of each word capitalized. Jim coded a routine that allows the operator to enter all the data in lower case and capitalizes the first letter in each word. I personally find this a very useful feature and the data entry operators seem to like it too, so I decided to convert it to MACRO.

**KBNUM.MAC**

Do you ever have the need to obtain either the current keyboard number and/or the installation name? You can do it by using the SYS() CALL to return error messages, but that requires a thread, $IESYS, that takes up 1194 bytes of address space. You can often write little MACRO routines that accomplish the same purpose as SYS() functions but require substantially less space. KBNUM.MAC is an example of such a routine. You may CALL KBNUM(KB%, $ CHAR) to return the current keyboard number and installation name, or CALL KBNUM(KB%) if you only want the keyboard number. Note that since MACRO programs cannot create strings, $IS must be defined in the calling routine prior to calling KBNUM.

**TTECHO.MAC**

There are occasions when you may wish to disable the echo control on a keyboard, for example, to take in a password. Once again I have gotten around the use of the SYS() call routine by a MACRO program that will enable or disable echo control on the keyboard opened on channel #12. TTECHO contains two entry points so that you may just do a call to either entry point without the need to pass any flags. You may modify it to operate on another channel by changing the
MOV #24, @#XRB + 6 to the desired channel number * 2.
To use TTECHO and disable echo control—CALL NOECHO.
To re-enable echo control—CALL ECHO.
In the .ODL file add the subroutine name TTECHO.

LOOK MA, 'No SYS() function'

Another way to eliminate some SYS() calls is to access virtual sections of your program and read what RSTS has put there. This, if you are not a MACRO programmer or have never used the VSECT directive, needs some explanation.

FIRQB — File Request Queue Block — is the main area used to exchange information between the monitor and the job for operations that involve file or device operations.

VSECT — a task builder directive that allows a user job to have direct access to a Virtual Section, or address, in the user's job area. It is currently undocumented in the RSTS/E Task Builder Manual, but it is documented in the RSX version. The format of the VSECT directive is as follows:

VSECT = MAPNAM:STARTLOC:LENGTH

where MAPNAM is the name of a buffer, i.e., a mapped buffer, STARTLOC is the starting virtual address, i.e., the FIRQB is at location 402 in a job using the . . . RSX runtime system, and LENGTH is the length to map. To access the FIRQB we would place in our BP2 program a map similar to this one:

700 MAP (FIRQB) FIRQB$, FUPINS$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$

(For a full description of the above naming scheme refer to Chapter 2 of the RSTS/E Systems Directives manual.)

Then in the .CMD file we add the following line:

VSECT = FIRQB:402:40

We can now access the FIRQB from BP2 just the same as if we were writing in MACRO. Now that you are familiar with the VSECT command, I'll give a few examples of how to use it. If you require the job number all you need to do is map the FIRQB, include a VSECT for it, and the job number is at your finger tips. RSTS always returns the current job number at FIRQB + 2. Even if your program does not do any monitor calls, the job number will be available since it is returned when the task is loaded from the disk on a RUN command.

700 MAP (FIRQB) FILL$ = 25,
710 JOB.NUM$ = ASCII(FQJOB$) / 25 ! Current job number

We can access core common in the same manner. Core common is used to exchange information between user programs and the monitor and the job. Core common is located at location 460(8), and is 200(8) bytes long. The first byte contains the length of the valid data in core common. The next 177(8) bytes contain the data. You can do some rather interesting things with core common. One is to use core common as an intermodule common area. You map it the way you would any shared data area but since you have 177(8) bytes of space always in the low section of the task you might as well take advantage of it. Consider the following BP2 example:

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700 MAP (FIRQB) FIRQB$, FUPINS$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$, FUPFIL$, FUPFON$, FUPNAM$, FUPRST$, FUPST$, FUPRES$

(For a full description of the above naming scheme refer to Chapter 2 of the RSTS/E Systems Directives manual.)

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700 MAP (FIRQB) FILL$ = 25,
710 JOB.NUM$ = ASCII(FQJOB$) / 25 ! Current job number

(Note that if this is all of the FIRQB you will need, you should modify the VSECT length to 3.)

RSTS PROFESSIONAL, April 1983
defines the job's privilege. By testing the appropriate bits of this word, we can ascertain the job's privilege.

Another location in the low section of a task that is useful is the KEYWORD at location 400 (8). The keyword defines the job's privilege. By testing the appropriate bits of this word, we can ascertain the job's privilege.

One word of warning concerning the use of the VSECT directive. It is available under V7.0—7.2 of the RSTS task builder. Since it is NOT documented, there is no guarantee that DEC will not remove it from a future implementation of the task builder. Also, although the above uses do, in fact, work and are implemented at other RSTS sites, I have never seen a DEC program use these techniques. (Then again I have seen very few DEC programs coded in BP2). Furthermore, the enclosed, program listings are believed to be correct, but the author takes no responsibility for any programming errors. I hope that you find these routines helpful.

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More programs are provided. I hope I have submitted the correct versions, but the enclosed, program listings are believed to be correct, but the author takes no responsibility for any programming errors. I hope that you find these routines helpful.
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**Mainline Processing**

```
20001 יצור בנמל

20010 inline

20011 Mainline Processing

20012 UNLTL 06

20013 PRINT IN.PTG;

20014 INPUT Z8;

20015 IN (Z8) + CVTRZ(28 -1);

20016 PRINT STRP.STK.IN(2); IF SCOPF$ =

20017 GOSUB 12001 Fix multi-character operators

20018 GOSUB 12001 Prune & store constants in input string

20019 GOSUB 12001 Convert input expression to polish notation

20020 GOSUB 11500 Display

20021 NEXT

20022 END OF PROGRAM

20023 END

20024 GOTO 32750

20025 to end

20026

20027 Programmer Defined Functions

20028 and Subroutines

20029

20030 Initialize Tables to determine precedence

20031

20032 JPT.S = 05

20033 OPJ.S = +26

20034 WEIGHT.J(STK.J, ZS) = 156 FOR ZS = ASCII("*"), TO ASCII("/")

20035 WEIGHT.J(IPS.J, ZS) = 156 FOR ZS = ASCII("*"), TO ASCII("/")

20036 READ 28 UNTIL 28 = **FINDLST**

20037 READ 24 = **FINDLST**

20038 WEIGHT.J(IN.J (LPT.J), ZS) = 25

20039 WEIGHT.J(IN.J (LPT.J), ZS) = 25

20040 READ 28

20041 NEXT

20042 Operators have usual meaning. $ = unary LOG10(), # = integer, # = in

20043 10131 Operator, stack weight, input str weight, jump table

20044

20045 DATA **FINDLST**

20046 51, 52, 53, 54

20047 55, 56, 57, 58

20048 **, 17, 18, 19

20049 -1, 20, -1, 21, -1, 22, 1, 23, 1

20050 1, 24, 1, 25, 1

20051 **, **, **, **, **

20052 **, **, **, **

20053 NEXT IPS

20054 RETURN

20055

20056 Convert input expression to polish notation

20057

20058 STACK.IN.J = 16

20059 STACK.IN.S) = ASCII("/"")

20060 IN.J + IN.S $ TO IN.$

20061 OUT.S(IN.$) = 06

20062 OPS = 16

20063 OPJ.S = 26

20064 CHANGE IN.S TO IN.$

20065 FOR IPS = 16 TO IPS(IN.$)

20066 IF WEIGHT.J(STK.IN(IPS), Stack(IN.S) = WEIGHT.J(IN.S, IPS)

20067 THEN GOSUB 10210

20068 ELSE

20069 IF WEIGHT.J(STK.IN(IPS), Stack(IN.S) = WEIGHT.J(IN.S, IPS)

20070 THEN GOSUB 10210

20071 ELSE

20072 IF WEIGHT.J(STK.IN(IPS), Stack(IN.S) = WEIGHT.J(IN.S, IPS)

20073 THEN GOSUB 10210

20074 NEXT IPS

20075 CHANGE OUT.S TO OUT.$

20076 PRINT "ERROR"; SP.; SP$ IF SP$ = 08

20077 RETURN

20078 Stk < Ips

20079 Stack.IN.J = 16

20080 Stack.IN.S) = ASCII("/"")

20081 RETURN

20082 Stk > Ips

20083 OPS = 16

20084 OUT.$(IPS) = 18

20085 OUT.S(IPS) = Stack.IN(IPS)

20086 OPS = 16

20087 SP$ = 16

20088 RETURN

20089 Stk = Ips

20090 OPS = 16

20091 OUT.$(IPS) = 18

20092 OUT.S(IPS) = Stack.IN(IPS)

20093 OPS = 16

20094 SP$ = 16

20095 RETURN

20096 Prune & store constants in input string

20097 Starts at end of RED(I) array & moves down

20098 Note: the "registers" are referred to as

20099 RED(ASCII("#", "Z")) AND 31$)

20100 RO in always set to PI.

20101 NUMERICS (constants) in the input expression are loaded starting

20102 IN 2C and working downward, so it is possible that a

20103 sufficiently complex expression might impinge into the

20104 "user" area (..,..,..,..). No check for this is performed.

20105 C.PTS = 715

20106 Init constant pointer

20107 RED.(ASCII("=") AND 31$) = PI

20108 TMP.N $, IN.2 $ = **init tap strings

20109 FOR IPS = 15 TO IPS(16)

20110 EVALUATE ZS, IPS(15)

20111 IF FENONERICS.ZS

20112 THEN TMP.N $, TRP.N $ = CH.

20113 ELSE IF ZS = TRP.N $, TMP.N $ = CH.

20114 RETURN

20115 DEF FENONERICS.ZS = (INSTR(15, "0123456789.", 15) = 16)

20116 Evaluate the postfix string

20117 POPS = -15

20118 Processing stack pointer

20119 MAT PREETCH.I = 26 I Zero fetched flags

20120 Fetch(IPS) = 06

20121 CHANGE OUT.S TO OUT.$

20122 FOR IPS = 15 TO IPS(16)

20123 IF IPS = IPS THEN GOSUB 11500

20124 ELSE

20125 ON IN.GOSUB

20126 11710

20127 11720

20128 11730

20129 11740

20130 11750

20131 11760

20132 11770

20133 11780

20134 11790

20135 11800

20136 11810

20137 NEXT IPS

20138 RESULT, RED.(ASCII("+")) AND 31$ = PFETCH(IFS)

20139 RETURN

20140 DEF PFETCH.(CH)

20141 IF FETCHED(IPS)

20142 THEN PREETCH. = PROG.(IPS)

20143 ELSE

20144 IPS = IPS + 16

20145 FETCHED.(IPS) = 15

20146 RETURN

20147 FEND

20148 RETURN

20149 Put ascii val of pointer into processing stack

20150 POPS = POPS + 15

20151 PROC.STK.(POPS) = RED(IPS)

20152 FETCHED(IPS) = 16

20153 RETURN

20154 17100 Fetch operands -- 11700 for 2 operands, 11705 for 1

20155 OP$ = OP$ + OP$ - 15

20156 11705 OP$ = OP$ + PFETCH.(POPS)

20157 RETURN

20158 117101 - Add

20159 GOSUB 11700

20160 PROC.STK.(POPS) = OP$ + OP$ - 15

20161 RETURN

20162 117201 - Subtract

20163 GOSUB 11700

20164 PROC.STK.(POPS) = OP$ - OP$ - 15

20165 RETURN

20166 117301 * Mul

20167 GOSUB 11700

20168 PROC.STK.(POPS) = OP$ - OP$ - 15

20169 RETURN

201701 " Exponentiation

20171 GOSUB 11700

20172 PROC.STK.(POPS) = OP$ - OP$ - 15

20173 RETURN

20174 RETURN

20175 RETURN

20176 ASSIGN

20177 GOSUB 11705

20178 FOPS = FOPS + 15

20179 + 15 = PROC.STK.(POPS)

20180 RED.(15$ AND 31$), PROC.STK.(POPS) = OP$ - 15

20181 FETCHED(POPS) = -15

20182 RETURN

Page 64

RSTS PROFESSIONAL. April 1983
15001 Display
13001
12001 Fix multi-character operators
11790 I
11780 I

18000 I
13099 I
12099 I

18070 I SY J O B B A S
18070 I


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DIBOL and MACRO: Oh, Yes, You Can!


Q: What language is used at more PDP-11 installations than any other?
A: DIBOL, according to DEC's published figures.

Q: What language has the least access to PDP-11 systems and gets the least support of any language distributed by DEC?
A: Here's a hint. Its name starts with "D" and ends with "L," and it's used at more PDP-11 installations than any other.

The fact is that DIBOL has major advantages for commercial applications over any other language DEC supports. Its predefinition of fields—and the ability to preload those fields—reduces CPU utilization at run time to well below that of BASIC-PLUS or BASIC-PLUS-2. Its record handling gives wide flexibility that other languages achieve only by using RMS, with its high CPU overhead, waste of disk space, and gigantic program size or complicated overlay structure. Program development with DIBOL takes less time than with BASIC, BP2, and DEC COBOL in DEC's own tests with experienced programmers.

Yet DIBOL has been the Ugly Duckling so far as DEC has been concerned. For years, DEC's listings of languages available on PDP-11s have excluded DIBOL. Most local DEC support centers don't have even one software specialist who speaks DIBOL. And perhaps most annoying to DIBOL users, there is no way from within DIBOL to perform functions that are taken for granted by BASIC and BP2 users, such as directory lookups, assigning and reassigning devices, reattaching to a terminal after a detach, even getting the job's own CPU time, device time, and KCTs for accounting purposes. (Admittedly, DEC is getting better about this. Digital just doesn't want to be put in the position of supporting a "nonstandard" language interface.)

And DEC doesn't want DIBOL users to do it for themselves, using MACRO-11 subroutines to enhance the language and provide hooks into the system. There's no equivalent to the section in the BASIC-PLUS-2 RSTS Users Guide that details BP2's calling sequences and internal structure. One knowledgeable Deckie said frankly that Digital just doesn't want to be put in the position of supporting a "nonstandard" language interface.

Well, it really isn't any more difficult under DIBOL than it is under BP2. In fact, it's simpler, since all DIBOL fields and literals are just alpha strings. Decimals are distinguished solely by the fact that the only characters DIBOL permits in them are the ASCII characters "0" through "9" and "p" through "y" the latter only in the rightmost byte to indicate that the number represented is negative. More about literals in a little bit.

Here's how it's done. Arguments are pushed onto a stack referenced by R5, just the way they are in BP2 and FORTRAN. Unlike those languages, though, DIBOL reverses the argument stack—information about the last argument is found lowest on the stack, then the next to last, and so on until the first argument is reached (see Figure 1).

In detail, the lowest word on the R5 argument stack, the one R5 points to, is the number of arguments times two (there are two words of information for each DIBOL argument). Next is the address of the first byte of the last argument. Then comes the length of the last argument. If the argument is an array name, the passed length is the length of one element of the array. Number of elements is not available. The high-order bit, bit 15, of this word is turned on to indicate a literal rather than a field or record handy to make sure you're not writing into a literal, which could give some surprising results. This convention explains the length limitation on DIBOL alpha fields. The sequence of address-length is repeated for each argument back to the first.

With this information, it's relatively easy to write a macro to retrieve any desired argument. The one we use is shown in Figure 2. It places the address of the first byte of the DIBOL argument in R0 by default and the length in R1, but this can be changed if those registers are in use by merely specifying two other registers in the macro call. The length is moved into R1 last to provide easy error checking against writing into a literal. The instruction

```
BMI LABEL
```

immediately following the macro transfers program execution to LABEL if a literal has been passed.

If one of the passed arguments is decimal, a further step may be necessary: conversion from ASCII to a binary value that MACRO-11 can handle on input, or from binary to ASCII on the way out. Such a conversion routine would be necessary, for instance, in a MACRO-11 subroutine to return the size of the last opened file. Fortunately for those of you who don't want to write your own, the system provides a series of conversion routines in SYSLIB.OLB, which is included on the distribution. They're detailed in the IAS/RXS-11 System Library Routines Reference Manual. One and two-word binary values are converted to ASCII via $SCDMG and $CDDMG, while an ASCII string can be transformed to one or two-word binary using $CDTB and .DD2CT. All of these require the programmer to keep track of negatives; they were designed for terminal input and output, not to help DIBOL users.

With all this in mind, we're ready to start interfacing MACRO-11 and DIBOL. GLEN in Figure 3 is a quick subroutine that emulates the BASIC/BP2 LEN function. It takes two arguments: the field to be examined, which may be alpha, decimal, or literal; and the return field, which must be decimal, five bytes long because of the demands of $SCBDMG. Such a subroutine can be called from within a DIBOL subroutine to determine whether a passed field is long enough to contain the information to be returned. All it does, of course, is examine the data on the R5 stack, convert the length word to ASCII, and pop it into the second-argument field.
Error handling may look confusing at first, but it simply traps the routine to the appropriate DIBOL error number — in this case Error 6, “Incorrect number of arguments,” or Error 8, “Writing into a literal” — and lets the DIBOL RTS or RESLIB issue its message. It then bombs the program with EMTs 50, to switch to the user’s default RTS, and 46, to exit to the system default RTS if 50 fails. Care should be taken with DIBOL error handling, though. Some errors can’t be handled this simply: specifically, we’ve had trouble with Error 31, “Argument wrong size.” It may be worthwhile to write your own “fatal error” handler that puts out your own error message (using the next subroutine) and issues EMTs 46 and 50.

Hooking into RSTS isn’t very much more difficult than this. The RSTS System Directives Manual provides full information on calling sequences for RSTS EMTs and .UOO subfunctions, along with a cross reference to the corresponding BASIC-PLUS function or SYS() call. In most cases, all that’s necessary is to load the appropriate bytes or words of FIRQB or XRB, as shown in the manual, and then issue a MACRO-11 EMT instruction. Figure 4 shows a slightly abbreviated version of one of our favorites, PRINT, a simple subroutine to permit output on Channel 0 — always open but normally forbidden to DIBOL users. We’ve used this one to decrease program size by not requiring an I/O buffer in memory for terminal output when the calling program is only issuing informational messages at various points in processing.

Finally, a couple of caveats. While PRINT is a perfectly usable subroutine, it has a limited purpose. In general, MACRO-11 subroutines should not be used for I/O, since there may be interference from DIBOL’s own I/O mechanisms — which are admirably suited to their purpose in any case. Specifically, we’ve found that a subroutine to read on Channel 0 produces somewhat undesirable results.

Second, DIBOL itself uses the first 1000-octal bytes of an executing program for its own purposes. Thus, a .UOO function that returns information in FIRQB or XRB will operate properly, but the information may no longer be there if a DIBOL statement intervenes between the MACRO subroutine’s asking RSTS for the data and the information’s being returned.

Third, users should be very careful about calling DIBOL subroutines from a MACRO subroutine. It’s completely possible to set up a stack within a MACRO program that would appear valid to the called DIBOL subroutine, but other structures within DIBOL may become corrupted in the process.

Last, a general-purpose warning: the DIBOL argument stack structure we’ve described is not supported by DEC and may never be. It’s unlikely that Digital will change things around at this late date — they’d have to rewrite a lot of code to do it — but they’ve done flaky things before now and may just decide at some point to switch this too. In line with their current policy of making everything look like

---

QUALITY SOFTWARE YOU CAN AFFORD!

Yes! ERGO Consulting extends its fabulous introductory offer to provide you with:

OPTIMIZATION:

DDO, a fast, macro-written UFD placement and extension and file clustsize optimization utility that runs disk-to-disk or disk-to-tape with Backup* or Saver**. All for only $500.†

RECONSTRUCTION:

DDR, a basic+ source utility to examine the MFD/UFD file structure without FIP, to evaluate and/or repair corrupted disks, or check UFD/File fragmentation, for a mere $400.†

7 - PLAYER SPACE BATTLE:

CTREK, a multi-user space wars game where 2 to 7 players, each at their own command terminal, compete on a common battlefield to provide the utmost in games competition. A steal at $200.†

ERGO Consulting
P.O. Box 8508
Fountain Valley, CA 92708
(714) 968-2133

*Trademark of DEC.
**Saver is an efficient file-structured backup program from (and trademark of) Data Processing Design.
†Prices quoted are for orders received before May 31, 1983 and for 9-track magtape. Other media slightly higher.

CIRCLE 169 ON READER CARD
VAX — even RSTS (what is DCL good for, anyway?) — it's barely possible that they might make up their minds to "unify" calling procedures. If they do, they certainly won't alter the BP2 calling sequence — and that leaves them only one option. So while these routines have been checked out through DIBOL V4.5, there's no guarantee that V4.6 or V5.0 will work the same way. Check out new releases for yourself before assuming that any user-provided MACRO subroutines will still work.

For all these warnings, we've found that MACRO-11 subroutines enhance DIBOL's capabilities immensely. They provide the user with options that can simplify the hardest job in the business — commercial programming — and permit the fullest use of RSTS's capabilities to get the work done. Enjoy!

![FIGURE 1. Layout of the DIBOL Argument Stack](image)

---

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![FIGURE 2. Macro to Return a DIBOL Argument](image)

---

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BACmac is a unique software tool, running under RSTS/E, which provides the following conversions:

- translation from Basic-Plus "compiled" back to Basic-Plus source code (only the comments will be missing)
- translation from Basic-Plus into Macro source code, which compiled under RSTS runs faster than Basic-Plus
- translation from Basic-Plus into Macro source code which may be compiled under RSTS for execution under RT11 — a migration facility
- translation from Basic-Plus into a RUN-TIME-SYSTEM. Now you can write an RTS in Basic-Plus. The ideal solution to memory thrashing due to "multi-copy" applications programs.

RSTS/E, RTI I, Macro-II and Basic-Plus are trademarks of Digital Equipment Corporation.

---

**CALC.BAS**...continued from page 65

```
TOGETHER = "\FILE (CTVS (NCHRS (CHRS (65) ) ) )
ZS = CHRS (64) + CHRS (256) + STRING (208, 25) )
I Set up file string
ZS = STRING (208, 25) )
COM = ASCII("YM"
PRG = ASCII("MYCH", 26)
RTS = ASCII ("MYCH", 26, 25)
PROG = ASCII ("MYCH", 26, 25)
RETR = ASCII("MYCH", 26, 25)

Note: The following checks for detached condition
by looking at the 128 bit of the job #.
If the job is detached, if S5 returns the one's complement of the #, therefore
if the 128 bit is set then a 128 bit above 127 in the system,
the 128 bit will indicate detachedness.
RSTS 7.0 doesn't allow info above 127 anyway.
If future releases do allow KB128 (unlikely),
this test may not be reliable.
At present, anyway, the RSTS Programming Manual
is mistaken in sec. 7.3.2.2 where it asserts
that you have to peek around (and therefore
have privilege) to determine detachedness.

RSTS 7.0...They've fixed it, but p.15-6 is misleading about byte 4 you can't ask
BASIC if it's negative. -- CG 16-Mar-82

---

BAC into RTS / BAC into MAC / BAC into BAS

**Two Word Version**

**Now Available**
Dear RSTS Man

small buffers to contain the characters being input and output. The figures cited were 500 microseconds CPU time per character output. That sounds incredibly high to me, but I do not know all that is involved with terminal I/O under RSTS.

We have a mixture of DZ's and DH's on our 3 machines (two 11/70's and one 11/45). For a while those on the programming staff who chose to do so and were also attached to a computer via a DH with its 30 character buffer, were allowed to run their terminals at 9600 baud. Now management has decided that to avoid performance degradation, we all shall run at less than 9600 baud, preferably 2400.

Unfortunately EDT is my favorite editor and running it at low speeds is like driving a Ferrari through an endless school zone. I enjoy EDT so much that I'm using it to produce this letter, even though I have WORD11 available to me.

Our business is a small time-sharing service bureau and therefore we are understandably disk-bound. How much of an affect does running terminals (and a small number of them at that) at high baud rates actually have? Could you also please explain the reaction between the CPU and DZ/DH on terminal I/O (especially regarding handling of interrupts)?

Thank you very much.

Hans Hazleton
Confused Programmer
Juneau, AK

Dear Confused: DZ's require the CPU for each character of both input and output. DH's on RSTS, require service for each input character, but only for every 30 characters of output. DH's could theoretically avoid single character input, but then they would have to be sensitive to delimiters. To avoid that problem, the silo limit is set to one character.

I have two recommendations:
1) Sell your DZ's and get DH's.
2) Settle on 4800 for tubes as a good compromise.

I have seen user satisfaction increase when changing from 9600 to 4800 simply because the 'stuttering' was eliminated.

LETTERS to the RSTS Pro...

Thus overall we an elapsed-time saving of 37.25% and a run-time saving of 54.75%. I trust that you will agree that statistics of this nature are worthwhile publishing.

It would be ungracious of me not to state that I could not have accomplished this conversion operation without the active support of Software Techniques Limited and their TASKIT product which decompiles the .BAC programmes to create a .B2S programme which is then converted by CSPCOM and TKB into the RSX tasks.

Jeffrey Seymour, Director
Pegasus Computer Processing

---RUN TIME---
OLD NEW SAVING
---RUN TIME---
OLD NEW SAVING

<table>
<thead>
<tr>
<th>RUN</th>
<th>OLD</th>
<th>NEW</th>
<th>SAVING</th>
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<tr>
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<td>145</td>
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<td>177</td>
<td>70</td>
<td>60.43</td>
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<td>176</td>
<td>13</td>
<td>24.47</td>
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<td>450</td>
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<td>GL 8:2</td>
<td>57</td>
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<td>47.36</td>
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</table>

Please find enclosed another "TECO" photo — unfortunately not very clear, and probably in the U.S., anyway: "TECO MONO KOOL". All sorts of paraphrasing is possible:

"KEEP COOL WITH TECO"
"COOL TECO"
"TECO
THE ONE TO KEEP COOL WITH"

Your magazine has been an invaluable aid for our small installation where the system manager has to be a "master" of all trades. However, many ideas have been gleaned from "RSTS Pro" for courses we run with our secondary students and evening adult classes, and to first keep things going a bit better than otherwise would be possible.

Hopefully I can persuade some of my students to get round soon to dropping you a line on some of the things they are doing with the help of RSTS/E.

Bernard Halpin, Centre Manager
BCC Computing Centre
Bunbury, W.A.
Thanks for the 'T' shirt. The "Novax II" is a device for interconnecting the switched to telephone network to a two-way radio circuit, half duplex over a single radio frequency. It has been advertised recently in amateur radio publications, and I have enclosed a copy of the ad.

Perhaps the most exciting thing is that the 'Novax II' is sold by C.D.C. (in this case, Current Development Corporation). When I first saw it, I thought maybe our friends from Minneapolis had figured out a way for me to emulate VMS on my 11/70!

I enjoy your publication, and look forward to each and every issue.

Paul E. Anderson, Vice President
GALLO SALES COMPANY, INC.

** Introducing our Latest Model — NOVAX II **

SIMPLEX / Duplex AUTOPATCH

NOVAx II

NOW TWO MODELS TO SERVE YOU BETTER

YOUR OWN PRIVATE AUTOPATCH

NOVAx II interfaces your standard 2-meter (220, 450 etc) Base station and telephone, using a high speed scan switching method to allow your IT from the backboard or desktop — automatically. Easy to install, fully modular. Fully expanding. See the views. Available. Interfaced with an ICOM (DX).

** Features **

- DTMF selectable one to eight
- Auto Answer On/Off
- LEDO.
- DOR.
- NO.
- Digital Display.
- Speaker selection in four.
- Memory Display.
- Zero Reset.
- No Operate.
- Memory Trim System (Cut, L1 only) NO.
- Remote Access with Speaker: YES.
- Remote Access with Monitor: YES.
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- Remote Access with Speaker: YES.

This is the answer to the question! See p. 32 of Last Issue.

I would like to add my accolades to the many others who have stated their excitement over your magazine.

In Volume 3, Number 3, September, 1981 there was a program for a Corrupt Disk which saved us untold hours of work. We got an "Irrevocably Corrupt Disk" at approximately 3:00 p.m.; the local Digital software office was contacted. Their response was that only the boys in Massachusetts could recover the disk. RDC was contacted and they had no idea how to recover the information on our disk.

"CORRUPT" was then remembered, located, run, and within one hour the corrupted directory structure was rebuilt.

Keep up the good work and keep those programs and articles coming. As a final thought, this magazine should be standard issue to all those Digital software experts who charge customers big bucks for analyzing and recommending.

Logan A. Ragan
Manager/Computer Services
Bridge Brand Food Services Ltd.
Alberta, CAN.

The Dec. '82 article by Michael H. Koplitz ("How Do You Read RSTS/E Monitor Tables?") was just what I've been looking for.

With it, I was able to write a program that would periodically examine the job tables to see if any privileged jobs are present. Being that I am in a high school environment, no one should be listed that I don't know about (Students do NOT have privileged accounts since certain school system administrative functions are done on our PDP 11/34).

Missing from my program is the ability to list the KB: at which the particular jobs are running. I don't believe there was anything in the article and subsequent program that explained how to do that. If someone could explain how to do that, it would be greatly appreciated.

Although the program I wrote is not (and was not intended to be) a "... Great Piece of Art . . .", I've included it.

** PEEKPR.RAS **

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Bridge Brand Food Services Ltd.
Alberta, CAN.

** Sample Print of SPY.PRI **

I would love to be able to add to the entries on LINE 2050 the KB: but I don't know how to do it.

The file "SPY.PRI" can be PIPEd out to paper when needed, and the program restarted to erase the old file and begin anew.

Fred Gervasoni
Joel Barlow High School
West Redding, CT
**DEXPO EAST ’83 PREVIEW**

To Accommodate Busy Attendees
St. Louis Decus Meetings, DEXPO East 83 Will Be Open Sunday, May 22

St. Louis, MO — In addition to providing free admission to registrants attending the DECUS (DEC-Compatible Industry Exposition) conference, DEXPO East 83 — The Third National DEC-Compatible Industry Exposition — will open Sunday, May 22, in order to provide DECUS registrants with unhurried access to the thousands of DEC-compatible products and services that will be on exhibit. DEXPO East 83 will be held at Kiel Auditorium in St. Louis, May 22-24.

"The show is meant to be the one event for everyone in the DEC-compatible community, a place where users and vendors can work together on problems and solutions. So it's up to us to make it easy for DECUS registrants to take an active role in the show and the future of our industry," observed Larry Hollander, president of Expoconsult International, Inc., organizers of the DEXPO shows.

"Once the DECUS meetings open, it will be difficult for the registrants to spend long stretches of time at the DEXPO East 83," he continued, "so we have arranged also for shuttle buses to speed them from the conference to the show and back again. Of course, we expect they'll want to attend some of the Product Forums, too." The Product Forums, which are free to all registered DEXPO visitors, provide in-depth, practical information on many of the newest DEC-compatibles to be found at the show. Approximately 60 vendor-sponsored presentations will be given during the three-day event. "Putting the latest DEC-compatible technology to work is what the Product Forums are all about," explained Hollander. "Visitors also like the fact that they can follow-up on the most intriguing presentations by visiting the speakers right in their booths." To date, the following 63 Product Forums have been scheduled:

### Sunday, May 22

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic/Sponsor</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00 p.m.</td>
<td>UNIX Emulation Under VMS Human Computing Resources</td>
<td>A</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>Soup-up Your VAX X and PDP-11’s Terminal Handling Performance</td>
<td>B</td>
</tr>
<tr>
<td>1:30 p.m.</td>
<td>The RIMS/MPG Application Program Generating System Information &amp; Systems Research</td>
<td>A</td>
</tr>
<tr>
<td>1:30 p.m.</td>
<td>The 68000 Microprocessor Applied to the Q-Bus World Ranaco Corporation</td>
<td>B</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>Data Analysis &amp; Statistics For Non-Programmers Minutab Project</td>
<td>B</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>High Resolution Color and Monochrome Dot Graphics Peripherals</td>
<td>B</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td>AIDE® — Computer Aided Software Development System OASYS, Inc.</td>
<td>A</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td>New Inexpensive VT100 Emulating Terminal with PLOT-10 and ReCiS Graphics Add-on</td>
<td>B</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>ProNET Ring Architectured Network Protein Associates, Inc.</td>
<td>A</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>Series 11 BusDriver for Direct Connection of Remote Terminal Clusters Micon Systems, Inc.</td>
<td>A</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Distributed Financial Management and Reporting With DEC Equipment Ross Systems, Inc.</td>
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<tr>
<td>3:30 p.m.</td>
<td>New Developments in High-Capacity Storage Technology Disc Technology Corp.</td>
<td>B</td>
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<tr>
<td>4:30 p.m.</td>
<td>EasyEntry Forms Design and Data Entry System Applied Information Systems, Inc.</td>
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<td>4:30 p.m.</td>
<td>DSC 200 Audio Data Conversion System Digital Sound Corporation</td>
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<tr>
<td>5:00 p.m.</td>
<td>Integrating Word and Data Processing Saturn Systems, Inc.</td>
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<tr>
<td>5:00 p.m.</td>
<td>Bubble Memory — How To Use It in SLI-11 Systems Rabbit 6000</td>
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<td>5:30 p.m.</td>
<td>Relational DBMS and its SQL, Plus User Friendly Interface Oracle Corporation</td>
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<tr>
<td>5:30 p.m.</td>
<td>High Speed Printers: Current Models and Future Possibilities American Computer Hardware Corporation</td>
<td>B</td>
</tr>
<tr>
<td>6:00 p.m.</td>
<td>DICECALC®, an &quot;Industrial Strength&quot; Electronic Spreadsheet for DEC Computers WHY Systems Inc.</td>
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<tr>
<td>6:00 p.m.</td>
<td>ABLE VMZ: New Intelligent Line Printer Controller AbleComputer</td>
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<tr>
<td>6:30 p.m.</td>
<td>Sphere: A Target Resident Interactive Realtime Programming Environment InfoSphere</td>
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### Monday, May 23 (continued)

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<thead>
<tr>
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<th>Room</th>
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<tr>
<td>11:30 a.m.</td>
<td>Magnum: An Integrated Relational DBMS For Production Applications Tryshare</td>
<td>A</td>
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<tr>
<td>11:30 a.m.</td>
<td>CP/M For Your LSI-11 or PDP-11 Decimation</td>
<td>B</td>
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<tr>
<td>12:00 noon</td>
<td>NET488 — File Transfer Package for DEC Computer Networks National Instruments</td>
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<td>12:00 noon</td>
<td>Alternatives To Manufacturers’ Service Grammar Data Systems Corporation A</td>
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<td>12:30 p.m.</td>
<td>Basis: A Proven Textual Application System Battle Software Products Center A</td>
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<td>12:30 p.m.</td>
<td>Digital’s New Rainbow -100 and Professional -300 Computers New England Digital Systems</td>
<td>B</td>
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<tr>
<td>1:00 p.m.</td>
<td>NASA’s Technology Transfer Program Cogni A</td>
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<tr>
<td>1:00 p.m.</td>
<td>Determining Your Training Requirements Task and Skills Analysis Essential Resources, Inc.</td>
<td>B</td>
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<tr>
<td>1:30 p.m.</td>
<td>System 1032: A Data Base Management System for the VAX Software House B</td>
<td></td>
</tr>
<tr>
<td>1:30 p.m.</td>
<td>New Supplies and Accessories for Personal Computers Computer Parts Exchange A</td>
<td></td>
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<tr>
<td>2:30 p.m.</td>
<td>Optimizing RSTS Performance with RPM, the RSTS Performance Monitor Northedge Digital Software</td>
<td>B</td>
</tr>
<tr>
<td>2:30 p.m.</td>
<td>New 22-bit Floppy Disk Controller and More Micro Technology, Inc. B</td>
<td></td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>Accent R. 4th Generation DBMS National Information Systems, Inc. A</td>
<td></td>
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<tr>
<td>3:00 p.m.</td>
<td>Protector’s Security Properties and its Approach to Threats Computor Corporation</td>
<td>B</td>
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<tr>
<td>3:30 p.m.</td>
<td>Accounting Software for VAX McCormack &amp; Dodge Corp. A</td>
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<tr>
<td>3:30 p.m.</td>
<td>Overtemperature Protection for DEC Computer Systems Nissan Systems B</td>
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<tr>
<td>4:00 p.m.</td>
<td>IBM Device Attachment Control Unit (DACU) IBM Corporation A</td>
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<td>4:00 p.m.</td>
<td>The Manufacturing Process of Rigid and Flexible Media National Information Corporation — Computer Products Division</td>
<td>A</td>
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<tr>
<td>4:30 p.m.</td>
<td>7 Ways to Justify Quality Business Graphics In Your Organization Software Vision</td>
<td>A</td>
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<tr>
<td>4:30 p.m.</td>
<td>Data Communications in the Local Area Network Tellone Corporation B</td>
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### Tuesday, May 24

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic/Sponsor</th>
<th>Room</th>
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<tr>
<td>11:00 a.m.</td>
<td>Data Base Concepts In Process Control And Laboratory Automation Kinetic Systems Corporation</td>
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<tr>
<td>11:00 a.m.</td>
<td>An Overview of UNIX Operating Systems Cambridge Digital Systems Div. of Compaq</td>
<td>B</td>
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<tr>
<td>11:30 a.m.</td>
<td>P-Stat: An Integrated Data Management, Data Display and Statistics Package P-Stat Inc.</td>
<td>A</td>
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<tr>
<td>11:30 a.m.</td>
<td>Full Office Automation for RT, TSX + , RSX, RSTS and VMS Computone Inc. : Mountain West Software</td>
<td>B</td>
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</table>
Tuesday, May 24 (continued)

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic/Sponsor</th>
<th>Room</th>
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<tbody>
<tr>
<td>12:00 noon</td>
<td>SS5-X: An Advanced Information Analysis System</td>
<td>A</td>
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<td>12:00 noon</td>
<td>SS5C, Inc.</td>
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<td>12:30 p.m.</td>
<td>4th Generation Relational Database Management System</td>
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<td>12:30 p.m.</td>
<td>New Non-Procedural Application Generator</td>
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<td>1:00 p.m.</td>
<td>Focus: An AI State-of-the-Art Inferencing Engine</td>
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<td>1:00 p.m.</td>
<td>SOFTOOL*: A Complete Change and Configuration Control</td>
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<td>1:30 p.m.</td>
<td>The SAS System of Products and Services</td>
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<td>1:30 p.m.</td>
<td>Interactive, Computer-Aided Application Generation Techniques</td>
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<td>1:30 p.m.</td>
<td>Bridge and Z-Board: The Best 4 Micro Computers Never Bought</td>
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<td>2:00 p.m.</td>
<td>System Management &amp; Performance Software</td>
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<tr>
<td>2:30 p.m.</td>
<td>Microprocessor Based Communication Nodes for DEC System-10's and 20's</td>
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<tr>
<td>3:00 p.m.</td>
<td>Software Product Advances for VMS</td>
<td>A</td>
</tr>
<tr>
<td>3:30 p.m.</td>
<td>Greater Productivity At Reduced Investment Through VAX/PDP 11 Productivity Tools plus DBMS</td>
<td>A</td>
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<tr>
<td>4:00 p.m.</td>
<td>Menu-Driven Business Graphics For VAX Users</td>
<td>B</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>Bar Code Generation &amp; Scanning Applications</td>
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Survey Finds Visitors To DEXPO East 83 Will See A Broad Range Of DEC-Compatible Hardware & Software Never Before On Exhibit

St. Louis, MO — Among the literally thousands of DEC-compatible products and services to be exhibited at DEXPO East 83 — the Third National DEC-Compatible Industry Exposition — will be several hundred hardware and software offerings that have never been shown before. According to a poll of current exhibitors, it is projected that new software offerings at the new software offerings — to be held at the Kiel Auditorium, St. Louis, May 22-24 — will actually outnumber the exhibitors showing software; for hardware, the average exhibitor will show at least two products never before on exhibit. The same survey found that visitors will have first-time access to a substantial array of new services as well.

With 200-250 vendors of DEC-compatibles expected to participate, the show is designed to be a complete information resource for owners, managers, users and dealers of DEC-based systems. This is evidenced by the growing number of "compatible-compatibles." These are DEC-compatible products created specifically for use with other DEC-compatibles. As a result, visitors to DEXPO East 83 will be able to fashion more versatile DEC systems than ever before.

New DEC-compatibles slated to debut at the show include an increasing number of software and hardware products for use with DEC's personal computers, programs for use in manufacturing and engineering environments, graphics, office automation, data communications, database management, productivity tools, voice recognition devices, analysis and forecasting systems and more.


EXHIBITOR LIST, AS OF MARCH 8, 1983.

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>PRODUCT DESCRIPTION</th>
<th>BOOTH</th>
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<tbody>
<tr>
<td>Able Computer</td>
<td>PDP, LSI &amp; VAX Enhancements</td>
<td>K</td>
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<tr>
<td>Absco Systems Corp.</td>
<td>Decision Support Software</td>
<td>423</td>
</tr>
<tr>
<td>Access Technology</td>
<td>LSI-11 Boxes/Interfaces/Systems</td>
<td>321</td>
</tr>
<tr>
<td>Advanced Management</td>
<td>DBMS-X-Action Proc/RPT Writer</td>
<td>305</td>
</tr>
<tr>
<td>Advanced Digital Office</td>
<td>BACMAC-RSTS-E Supercharger</td>
<td>101</td>
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<td>AGS Management Systems</td>
<td>Project Management Systems</td>
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<td>Air Filters for DEC Drives</td>
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<td>Amcor</td>
<td>DEC RSTS and VAX Software</td>
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<td>American Computer Group, Inc.</td>
<td>Dealer/Terminal Distributor</td>
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<td>American Computer Hardware</td>
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<td>Serial Matrix Impact Printers</td>
<td>419</td>
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<td>320</td>
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<td>PDP-11 &amp; VAX Systems Software</td>
<td>221-223</td>
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<td>Data Comm Diagnostic Equipment</td>
<td>434</td>
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<td>Automated Information Inc.</td>
<td>Compatible Disc &amp; Controllers</td>
<td>725</td>
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<td>Disk and Tape Subsystems</td>
<td>312</td>
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<td>Aydin Controls</td>
<td>Color Graphic Display Equipment</td>
<td>332</td>
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<td>Battelle Memorial Institute</td>
<td>Basin (CMS); Basx-DM (DBMS)</td>
<td>335</td>
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<tr>
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<td>Disk Subsystems/Controller</td>
<td>701-705</td>
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<td>237</td>
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<td>Solid-State Mass-Storage System</td>
<td>624</td>
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<td>Low Cost Systems &amp; Peripherals</td>
<td>615</td>
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<td>Cambex Corporation</td>
<td>DEC Memories, Solid State Disc</td>
<td>422</td>
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<td>DEC PDP-11 Based Systems</td>
<td>708</td>
</tr>
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<td>Care Information Systems</td>
<td>CARE/DSYSTEM</td>
<td>416</td>
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<td>CIE Terminals Inc.</td>
<td>Video Terminals Line Printers</td>
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<td>Software Utility Specialists</td>
<td>501</td>
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<td>Cobar</td>
<td>VT100/132 Emulating Terminals</td>
<td>124</td>
</tr>
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<td>Comdesign</td>
<td>TC-3 Concentrator</td>
<td>118</td>
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<tr>
<td>Computer</td>
<td>General Accounting Software</td>
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<td>Computer Hot Line</td>
<td>Advertising Publications</td>
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<td>Measurement/Control Subsystems</td>
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<td>513</td>
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<td>Datamation</td>
<td>Data System Design</td>
<td>704-706</td>
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<td>VAX Graphics Software</td>
<td>534</td>
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<td>Datacom Corporation</td>
<td>Systems, Memories &amp; Controllers</td>
<td>336</td>
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<td>DEC Professional Magazine</td>
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<td>CP/M for DEC-11 Computers</td>
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<td>Digital Management/Grampan</td>
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<td>Digital Engineering</td>
<td>Engineer's &quot;Working Journal&quot;</td>
<td>617-619</td>
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<td>Retro-graphics TM Enhancements</td>
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<td>DEC/DOS (System)</td>
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<td>Audio Conversion System</td>
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<td>Disc Tech One</td>
<td>DEC Compatible 14&quot; Disc Drives</td>
<td>707</td>
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<td>Distributed Logic Corp. (DILOG)</td>
<td>DEC CPC/Compatible Controllers</td>
<td>112-113</td>
</tr>
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<td>Third Party Maintenance</td>
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<td>Office Automation/Sys/Software</td>
<td>406</td>
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<td>Peripheral Controllers</td>
<td>524</td>
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<td>405</td>
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<td>Evans Griffiths &amp; Hart, Inc.</td>
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<td>313</td>
</tr>
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<td>FASBE Group, The</td>
<td>Financial Software Consulting</td>
<td>105</td>
</tr>
<tr>
<td>DEC, SMS, &amp; First Systems</td>
<td>DEC-11 Systems</td>
<td>325</td>
</tr>
<tr>
<td>GEIAC</td>
<td>Chargeback Performance Comm SW</td>
<td>317</td>
</tr>
<tr>
<td>Grant Technology Systems Corp.</td>
<td>Q-Bus Compatible I/O Boards</td>
<td>805</td>
</tr>
<tr>
<td>Grumman Data Systems</td>
<td>Hardware Maintenance Services</td>
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RSTS PROFESSIONAL, April 1983
<table>
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<tr>
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<td>626</td>
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<td>Highsmith, James L. &amp; Co.</td>
<td>DACU-OEM Attachment to IBM</td>
<td>107</td>
</tr>
<tr>
<td>IBM</td>
<td>MATHEMAT Fortran Library</td>
<td>737</td>
</tr>
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<td>IMSL</td>
<td>Program Generating System</td>
<td>504</td>
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<td>Falcon QBUS Realtime/DataComm</td>
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</tr>
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<td>Color Graphic Terminals</td>
<td>122</td>
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<td>Manufacturing &amp; Accounting Sys.</td>
<td>622</td>
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<td>Financial and Mfg. Software</td>
<td>716</td>
</tr>
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<td>VAX, DEC10/20, PC-300 Software</td>
<td>119</td>
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<td>Interactive Technology, Inc.</td>
<td>RDM Interactive Data Management</td>
<td>401</td>
</tr>
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<td>A</td>
<td>322</td>
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<td>Kineticsystems Corp.</td>
<td>CAMAC Based Systems &amp; Modules</td>
<td>316</td>
</tr>
<tr>
<td>Logicraft, Inc.</td>
<td>Assoc Word Processing Software</td>
<td>733</td>
</tr>
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<td>Mass Storage Facility</td>
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<td>Applications Software</td>
<td>102</td>
</tr>
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<td>MCBA</td>
<td>VAX Accounting Software</td>
<td>103</td>
</tr>
<tr>
<td>McCormack &amp; Dodge Corporation</td>
<td>Data &amp; Power Transparent Protect</td>
<td>527</td>
</tr>
<tr>
<td>MCC Electronics</td>
<td>Computer Interface Products</td>
<td>731</td>
</tr>
<tr>
<td>MDD Systems</td>
<td>Software Services/Consulting</td>
<td>635</td>
</tr>
<tr>
<td>Meridian Consulting</td>
<td>Datacom Products/Bus Driver</td>
<td>637</td>
</tr>
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<td>Micom Systems, Inc.</td>
<td>Hard/Soft Controller/Subsystem</td>
<td>637</td>
</tr>
<tr>
<td>Micro Technology, Inc.</td>
<td>VT100 Compatible Terminals</td>
<td>407</td>
</tr>
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<td>Micro-Term, Inc.</td>
<td>Systems Integrators' Magazine</td>
<td>431</td>
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<td>Software for Data Analysis</td>
<td>711</td>
</tr>
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<td>Mintab Project</td>
<td>Cache Memory and Com Interface</td>
<td>122</td>
</tr>
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<td>Mintronics Corporation</td>
<td>Monolithic Systems Corporation</td>
<td></td>
</tr>
<tr>
<td>Mountain West Software</td>
<td>Office Automation Software</td>
<td>607</td>
</tr>
<tr>
<td>Nashua</td>
<td>Flexible &amp; Rigid Media</td>
<td>111</td>
</tr>
<tr>
<td>Nassau Systems</td>
<td>Hi-Temp Protection Systems</td>
<td>819</td>
</tr>
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<td>National Information Systems</td>
<td>ACCENT R - 4th Generation DBMS</td>
<td>631</td>
</tr>
<tr>
<td>National Instruments</td>
<td>IBM-488 Interface</td>
<td>605</td>
</tr>
<tr>
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<td>LSI-11 System Build-ing Options</td>
<td>720</td>
</tr>
<tr>
<td>New England Digital Systems</td>
<td>Digitalc, Lex-11, Accounting SW</td>
<td>104</td>
</tr>
<tr>
<td>Newman Computer Exchange</td>
<td></td>
<td>201</td>
</tr>
<tr>
<td>North County Computer Svs Inc.</td>
<td>USER-11 RSTS/E &amp; VAX DBMS</td>
<td>108</td>
</tr>
<tr>
<td>Northern Technologies</td>
<td>712-714</td>
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</tr>
<tr>
<td>*Northwest Digital/Software</td>
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</tr>
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<td>Neplan, Inc.</td>
<td>Spread Sheet/Financial Modeling</td>
<td>700</td>
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<tr>
<td>Oasys Office Automation System</td>
<td>Software Development System</td>
<td>700</td>
</tr>
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<td>Omtool Corp.</td>
<td></td>
<td>835</td>
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<td>ORACLE Corporation</td>
<td>ORACLE * DBMS</td>
<td>425</td>
</tr>
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<td>Oregon Software</td>
<td>Pascal and Programming Tools</td>
<td>613</td>
</tr>
<tr>
<td>P-Stat, Inc.</td>
<td>Data Mgt. and Stat. Software</td>
<td>219</td>
</tr>
<tr>
<td>Pass</td>
<td>Hardware/Software/Service</td>
<td>618-620</td>
</tr>
<tr>
<td>Peed Publishing</td>
<td></td>
<td>520</td>
</tr>
<tr>
<td>Precept, Inc.</td>
<td>Handprint Recognition Terminal</td>
<td>127</td>
</tr>
<tr>
<td>彭宁顿系统, Inc.</td>
<td>软件工具/Us (U/VAX)</td>
<td>104</td>
</tr>
<tr>
<td>Pendelton Parts, Inc.</td>
<td>绝缘滤波/Repair Serv.</td>
<td>525</td>
</tr>
<tr>
<td>Periitech Corp.</td>
<td>高分辨率色谱图</td>
<td>623</td>
</tr>
<tr>
<td>Pesley Peripheral Systems</td>
<td>Q-Bus Systems &amp; Sub-Systems</td>
<td>207</td>
</tr>
<tr>
<td>Polygon Associates, Inc.</td>
<td>Communication Software</td>
<td>507</td>
</tr>
<tr>
<td>Professional Software Support</td>
<td>VIPLAN Electronic Spreadsheet</td>
<td>607</td>
</tr>
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<td>Proton Access, Inc.</td>
<td>DEC Host Breakthrough</td>
<td>517</td>
</tr>
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<td>Radco Sales Co.</td>
<td>Computer Spares Media Supplies</td>
<td>323</td>
</tr>
<tr>
<td>Ranyan Computer Environment</td>
<td>68000-Based Q-Bus Processor</td>
<td>630</td>
</tr>
<tr>
<td>Raxco, Inc.</td>
<td>Relational Database Technology</td>
<td>319</td>
</tr>
<tr>
<td>Reliance Electric Company</td>
<td>384</td>
<td></td>
</tr>
<tr>
<td>RGTI Systems Consulting</td>
<td>Relational Database Technology</td>
<td>125</td>
</tr>
<tr>
<td>Ross Systems</td>
<td>634</td>
<td></td>
</tr>
<tr>
<td>S &amp; H Computer Systems, Inc.</td>
<td>Passport, IBM</td>
<td>634</td>
</tr>
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<td>634</td>
</tr>
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<td>OMINBASE, ILS</td>
<td>512</td>
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<td>Array Processor/Dual P + Memory</td>
<td>519</td>
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<tr>
<td>Sky Computers, Inc.</td>
<td>Softool</td>
<td>516</td>
</tr>
<tr>
<td>Smith, C. D. &amp; Associates</td>
<td>Change &amp; Configuration Control</td>
<td>516</td>
</tr>
<tr>
<td>Softool</td>
<td>DEC 10.20 and VAX DBMS</td>
<td>400</td>
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<td>Software House</td>
<td>DEC IBM RE LINK to 56KB</td>
<td>125-126</td>
</tr>
<tr>
<td>Software Results</td>
<td>Interactive Bus Graphics</td>
<td>418</td>
</tr>
<tr>
<td>Software Vision</td>
<td>Information Analysis Software</td>
<td>611</td>
</tr>
<tr>
<td>Standard Engineering Corp.</td>
<td>522</td>
<td></td>
</tr>
<tr>
<td>Standard Memories/TrendData</td>
<td>Add-In-On Memories - Terminals</td>
<td>436</td>
</tr>
<tr>
<td>System Industries</td>
<td>Disk and Tape Storage Systems</td>
<td></td>
</tr>
<tr>
<td>System Industries</td>
<td>A.I. Software Products</td>
<td>506</td>
</tr>
<tr>
<td>Systems Cognition Corporation</td>
<td>Technical Magic, Inc.</td>
<td>723</td>
</tr>
<tr>
<td>Tektronix, Inc.</td>
<td>The Graphics Standard</td>
<td>733</td>
</tr>
<tr>
<td>Televised Systems, Inc.</td>
<td>CRT Display Terminals</td>
<td>612</td>
</tr>
<tr>
<td>Telltale Corporation</td>
<td>Data Communications Equipment</td>
<td>531</td>
</tr>
<tr>
<td>Tymshare, Database Systems Div.</td>
<td>Integrated Relational DBG</td>
<td>122</td>
</tr>
<tr>
<td>Tymshare, TCS</td>
<td>Hardware Support/Systems/Sales</td>
<td>621</td>
</tr>
<tr>
<td>U. S. Design Corp., USDIC</td>
<td>Winchester Storage Subsystem</td>
<td>304</td>
</tr>
<tr>
<td>*Universal Color Systems</td>
<td>Color Measurement Systems</td>
<td>115</td>
</tr>
<tr>
<td>Viking Computer Corporation</td>
<td>CRT Data Entry/Screen Design</td>
<td>304</td>
</tr>
<tr>
<td>Viking Software Services, Inc.</td>
<td>CPM Emulator</td>
<td>500</td>
</tr>
<tr>
<td>Virtual Microsystems</td>
<td>Computer-Assisted Translation</td>
<td>627</td>
</tr>
<tr>
<td>Weidner Communications Corp.</td>
<td>535</td>
<td></td>
</tr>
<tr>
<td>Western Peripherals</td>
<td>IDKRS: C&amp;X Compiler</td>
<td>621</td>
</tr>
<tr>
<td>Whitesmiths, Ltd.</td>
<td>Spreadsheet/Financial Analysis</td>
<td>612</td>
</tr>
<tr>
<td>WHY Systems, Incorporated</td>
<td>Manufacturing Software</td>
<td>412</td>
</tr>
<tr>
<td>XEROX</td>
<td>Controller for Disk and Tape</td>
<td>736</td>
</tr>
<tr>
<td>Xylogics, Inc.</td>
<td>Terminal Front/End &amp; Switch</td>
<td>415</td>
</tr>
<tr>
<td>Zia</td>
<td>RT/11-TXSD Software Tools</td>
<td>318</td>
</tr>
</tbody>
</table>

**EDITOR'S NOTE:** The following press releases are from companies who will exhibit their products or services at DEXPO East 83.


EasyEntry, the full screen forms and data entry system for the PDP-11 and VAX, will now run under Digital's P/OS operating system. EasyEntry allows professional users to quickly develop and implement full screen forms and data entry applications. With EasyEntry, the Professional 350 desktop computer can be used as an applications development system, as well as a data entry station which can be linked to a variety of host systems.

AIS will also announce runtime support for the AIS-PL/I compiler on the Professional 350 at DEXPO. Now PDP-11 and VAX users can develop ANSI Standard Subset G PL/I programs to be run on the Professional.

Demonstrations of EasyEntry and AIS-PL/I will be available at the AIS exhibit in Booths 221-223. Other DEC-compatible software featured in the exhibit will include the Burcom-11 PDP/Burroughs communications system, the WP Saturn word list processing system, and the SaturnCalc electronic spread sheet.

For more information, contact Applied Information Systems, Inc., 500 Eastowne Dr., Chapel Hill, NC 27514. (919) 942-7801.

Softool Will Demonstrate Change & Configuration Control Environment

The SOFTOOL® Programming Environment, available directly from DEC as well as from Softool Corporation, will be demonstrated.

CCC™, which is only available from Softool, is the one product that offers change control as well as configuration control. CCC™ automates the management of changes, and the management of different configurations (versions) of a software product. CCC™ can handle many things: source code, object code, documents, test data, etc. CCC™ provides comprehensive support that includes: automatic reconstruction of previous versions, reference reports, management reports, access control, archiving, compression, encryption and auto-
matic recovery. CCC™ can handle programs in Fortran, Cobol, Pascal, C, Ada®, Jovial, Assembly, etc. The SOFTOOL® Programming Environment is an integrated software development facility that automates the rapid generation of quality software. Starting from a design document, it will produce, typically, between 50% and 75% of the code needed. Then, it provides the tools necessary to automate checkout and quality assurance. The available tools include code generator, structured languages, source code and interface documenters, standards and portability auditor, error detectors, testing, and optimization aids.

For further details, contact Softool Corporation at 340 South Kellogg Ave., Goleta, CA 93117. Or telephone (805) 964-0560 or (213) 382-6302.

Mountain West Software Has 'Professional 300 Series' Office Automation Package

Mountain West Software/Compu-Tome, Inc. offers a complete office automation package for PDP/11's and VAX CT*OS is now available for the new DEC Professional 300 series, including the spelling corrector. The applications include a full featured word processing system, CT*OS Word Processing, CT*OS Spelling Corrector, Electronic Spreadsheet, Executronic Mail (TM), Communications, and a System Utility Package that includes, list file sort, printing of indexes, user index migration, and a facility for document recovery following system problems.

CT*OS (Compu-Tome Office System) features full editing capability, list processing, global search and replace, cut and paste, headers, footers, boiler plate libraries. Movement through documents by word paragraph, sentence, page, etc. Status line indicates page, line, column position, in addition to mode, document number, and account. Compu-Tome, Inc. will be soon be releasing version 5.0, that will include true multi-column compatibility, summation, table of contents, auto indexing and paragraph numbering, auto footnoting, bolding and underlining on the screen. Alternate characters, such as Greek, scientific and technical, can be displayed on the screen, depending on the user's needs.

CT*OS is now available for the DEC 300 Professional Series, with much of the same capabilities as on RSTS PROFESSIONAL. April 1983
the larger DEC systems. CT*OS files can be transferred easily, with our communications option, between PDP's or VAX computers and Professional series. CT*OS must be installed on both systems to utilize this capability.

For more information write Gina L Harris, Mountain West Software, 234 East Colorado Blvd., Pasadena, CA 91101.

Ross Systems Will Demonstrate
New Financial Software
For 'Professional 350'

ROSS Systems will demonstrate MAPS/Pro, the new financial software for the DEC Professional 350. MAPS is Ross Systems' financial modelling 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 Equipment's PDP-11 and VAX-11 computers, MAPS is a language for decision support of non-programming 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.

For more information contact Ross Systems, 1860 Embarcadero Rd., Suite 210, Palo Alto, CA 94303, (415) 856-1100.

New VTR Presentation From Care Information Systems

Care Information Systems, Inc. will introduce a new VTR presentation of the CARE/DM System.

The unique presentation is among the first step-by-step video demonstrations ever produced for sales and training use. The 45-minute VTR illustrates how the CARE/DM System software manages patient information, patient billing, insurance processing, collection management, scheduling/recall, and financial transactions. Care President, John Struckhoff also explains operating instructions and documentation as well as providing background about the product and the company.

According to Ernest Lang, Vice President, the VTR enables interested parties to receive the complete product story at their convenience and provides far more information than could be covered in a typical sales call.

The CARE/DM System operates with DEC PDP-11 and VAX Processors in RSTS/E and VMS environments. It is available on a time-shared basis, as an individual software package or as a complete system with DEC hardware.

For further information, contact: Care Information Systems, 3009 South Sixth Street, Springfield, IL 62703, (217) 522-CARE.

DISC Will Introduce Combination Package

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.

Winchester System Available From Data Systems Design

The DSD 890, a DEC-compatible 31.2 megabyte (Mb) Winchester system with 1/4-inch tape backup, is now available from Data Systems Design, Inc. It replaces three Digital Equipment Corporation (DEC) RL02 cartridge disks and a TS-11 1/2-inch tape.
The DSD 890 takes up to 80 percent less rack space and utilizes a 16.25-Mb, 1/4-inch tape for lower cost archival storage and media transportability. At $9,895 in single quantities, the DSD 890 offers full RL02 and TS-11 emulation, faster throughput and extra features for a price comparable to two RL02 units.

The DSD 890 is fully compatible with DEC LSI-11 (Q-bus) minicomputers, and operates with RT*, RSX*, TSX*, RSTS* and UNIX™ operating software. The 890 also supports 22-bit addressing and all of the handy DEC backup utilities, including BRU, DSC and PIP.

Other features include on-board bootstrap, 32-bit error correction, documentation to convert user software to 1/4-inch tape media and simultaneous Winchester and tape operation without throughput degradation.

The 890 operates in non-interleaved mode for a transfer rate of 364 kilobytes per second or about 15 percent faster than a single DEC RL02. However, users can elect to program two- or three-way interleaved operation for applications requiring less bus usage. The DSD 890's Winchester emulates three DEC RL02s, while the 890's 1/4-inch tape emulates the 1/2-inch TS-11 tape subsystem. This emulation, achieved through the 890's intelligent controller, allows the DEC operating software to communicate to the DSD Winchester and 1/4-inch tape as if they were DEC devices.

The 890's 1/4-inch standard cartridge tape drive has start/stop capability to provide transparent DEC software compatibility for tape backup and restore functions. The 1/4-inch tape cartridge can be shipped easily and takes up much less space than an RL02 disk pack. At a fraction of the price of an RL02 disk pack, the 1/4-inch tape cartridge is also a more economical means of archiving data.

DSD has enhanced its Hyper-Diagnostics™ by providing self-diagnostics and testing activated by a push button located behind a small door on the front bezel. A seven-segment display shows an error code if a faulty component is detected.

DSD also offers its overnight module exchange and economical warranty extension services, which are available through the company's nationwide sales and support network.

The 890 Winchester/tape system is housed in a small, 5 1/4-inch high rack-mount package and is attractively styled to complement a PDP-11/23 minicomputer.

Quantity prices for the 890 are available. Production units will be available in March, with delivery 30-45 days after receipt of order.

For more information contact Dianna Konrad, Data Systems Design, 2241 Lundy Avenue, San Jose, CA 95131, (408) 946-5800.
that if any one is knocked out by lightning, two others will still be operating to provide protection. Life expectancy for the Surge-Master units is conservatively estimated at 30 years.

Because the Surge-Master Heavy Duty Power Line Protectors are connected in shunt, rather than in series, they can be installed quickly and easily, with little or no interruption of power. When installed, using a service disconnect switch, maintenance and repair can be done without producing system “downtime”.

Models of the Surge-Master Heavy Duty Power Line Protectors are available for service panels rated from 100 to 3000 amps and higher; for 120, 240 and 480 VAC; and for single and three-phase power systems. All models are housed in a rugged NEMA 12 enclosure.

Availability stock to 30 days. Prices from $1692 to $96,380.

Protection from transients and surges on data lines entering main frame computers from as many as 20 outlying printers, terminals, or sensors is now available in a single 19” rack-mounted card cage from MCG Electronics, Inc. The card cage, designated DLP-40, can hold up to 20 cards, each capable of accommodating five lines. It is being exhibited for the first time.

Transients and surges re imposed on data lines by lightning, by switching surges, relays, solenoids, and heavy machinery; they can be coupled into the data lines directly, or through the AC power lines. All transients and surges cause some damage to semiconductor junctions, and this damage is cumulative so that it ultimately results in failure. A direct lightning strike, even many miles away, can do very serious damage.

The MCG system interfaces between the computer and the data line, and provides a sophisticated blend of high speed (nanoseconds) voltage limiting and brute force protection. It recovers immediately after each surge, in readiness for the next.

Plug-in cards are available to protect RS-232, RS-422, RS-423, 20ma loops, and dedicated line modems. Interface options include terminal strips, RS-232 connectors (DB-25s), and Mate-n-Lok connectors.

For further information contact William J. Purcell, MCG Electronics Inc., 160 Brook Avenue, Deer Park, NY 11729, (516) 586-5125.

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**National Instruments Has File Transfer Package For DEC Computer Networks**

By providing IEEE-488 hardware and software for DEC computers, National Instruments can furnish a complete package that will accomplish the file-transfer task using the IEEE-488 bus standard as the communications link. The computers linked together in the network may be made up of any combination of UNIBUS and Q-bus based processors. The NET488 network software is compatible with RSX-11, RT-11, VMS and UNIX operating systems.

The main advantage provided by NET488 is the ability to transfer files between different operating systems running in different DEC computers. The operator interface to the file transfer software consists of simple query responses. File transfers may be initiated from a user written application program.

A complete NET488 hardware/software package for a network of four Q-bus computers (with 50 meter separation) running the RT-11 operating system will cost approximately $15,000.

New National Instruments products that interface the IEEE-488 bus to S-100 computers (GPIB-696) and Multibus computers (GPIB-796) will give DEC users file transfer capability to these popular microprocessor bus structures.

For further information call Frances Drury at (800) 531-5066 (outside Texas) or (512) 250-9119.

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**Interactive Data Analysis Software for VAX and PDP-11's**

The Minitab Project will introduce its new publication, the Minitab Reference Manual at DEXPO East 83 in St. Louis, Missouri, May 22-24. The Minitab exhibit, Booth 711, will feature the Reference Manual and the pocket-sized Quick Reference Card, as well as on-line demonstrations of Minitab's VAX (VMS) and PDP-11 (RSTS/E) conversions.

Originally designed in 1972 for Penn State freshmen in introductory statistics courses, Minitab is now used by 1/3 of Fortune's Top 50, almost every major American university and hundreds of smaller organizations around the world. Applications such as forecasting trends, providing decision support, and cross-tabulating survey results are just a few of the ways Minitab can be useful.

Its features include flexible plotting, easy transformation and arithmetic, convenient data editing, comprehensive table-making, curve-fitting, plus a wide range of statistical and data manipulation procedures.

The VAX and PDP-11 conversions can be installed in minutes and consume no more resources than EDT. Minitab is supported on all models running under VMS, RT-11, TSX-PLUS, IAS, RSTS/E, RSX-11 and CTS-500. Tailored specifically for the DEC environment, Minitab allows full file specifications including DECnet nodenames and features an on-line direct access HELP facility. Installation is also routine on VAX-11 models running under UNIX and DEC 10's and 20's.

The new Reference Manual and Quick Reference Card are helpful additions to other available Minitab documentation: the Minitab Student Handbook, the Implementation Guide and the ABCs of EDA. Two newsletters are published several times a year. Subscriptions are free upon request.

For more information about the Minitab Reference Manual and the rest of the Minitab system, write to the Minitab Project, 215 Pond Laboratory, University Park, Pennsylvania 16802, USA.

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**S&H Computer Systems To Show Latest TSX-Plus**

S&H Computer Systems Inc., author of systems software for PDP-11's, will be demonstrating their latest and most powerful version of TSX-Plus.

Version 3.1 of TSX-Plus has enhancements over previous versions which include the ability to take full advantage of 22 bit addressing on the Q-bus and Unibus machines, which are capable of supporting 4mb of memory. Another new enhancement is the ability to support the abort entry point for device handlers.

For installations with 5 to 20 timesharing lines, the ability to access 4mb will increase execution speed considerably by reducing job wait time as well as reducing or even eliminating job swapping. This is accomplished by more users remaining in core, and high speed context swapping that requires no IO.

Version 3.1 also supports a real-time program support facility that allows multiple real-time programs to be run concurrently with normal
time-sharing operations. TSX-Plus also now provides a facility that allows one or more shared run-time systems or data areas to be mapped into the address space of multiple TSX-Plus time-sharing jobs.

Another recent feature of TSX-Plus is the ability to specify the maximum amount of memory TSX-Plus will be allowed to use. This enables the user to set an upper memory limit and all memory located above this limit will never be used by the operating system. This will allow the user to access the upper memory for overlaying programs via a user written handler.

In addition, TSX-Plus allows approximately 8-9kb of additional space for device handlers, system features or terminal lines, thereby increasing the flexibility of the system.

TSX-Plus also features a new real-time EMT which allows a program to set the user mode processor priority level. This can be used in a situation where it is necessary for a real-time program to block interrupts for a short period of time while it performs some critical operation.

Most RT-l1 programs can be used with TSX-Plus without change or even having to be relinked, TSX-Plus interfaces with standard RT-l1 device handlers (XM version) and supports RT-l1 utility programs such as PIP, DIR, DUP, MACRO, TECO, KED and K52. The FORMAT program is not supported.) Language processors available for use with TSX-Plus include COBOL-Plus, FORTRAN, BASIC, DBL and PASCAL-2. The TSX-Plus keyboard commands are an extended set of those provided by RT-l1. TSX-Plus system service calls (EMT'S) are compatible with those provided by RT-l1.

Other features offered by TSX-Plus include a transparent lineprinter spooling system, a real-time program support facility, data and directory caching facility, detached jobs, a log-on and usage accounting system, shared file access control, interjob message packet communication, command files with parameters, shared run-time facility, the ability for the user to define system commands, and a program performance monitor that will print a histogram showing where a running program is spending most of its time.

TSX-Plus requires a system with memory management, at least 128k bytes of memory and an RT-l1 license.

The price for TSX-Plus version 3.1 is $2,000. All users in support receive a copy of the new version for the cost of media, shipping and handling only. All supported users receive the bi-monthly S&H Software Bulletin which includes patches, reported bugs, new enhancements, future directions of TSX-Plus, and more.

Address domestic inquiries to Gary Manookian, and all other inquiries to Richard Dohrmann, at S&H Computer Systems, Inc. 1027 17th Ave. S., Nashville, TN 37212, (615) 327-3670 Telex 786577 answer back S&H NAS.

MCBA Will Highlight Product Costing Package

The MCBA (Mini-Computer Business Applications, Inc.) booth will highlight the company's newly-released Standard Product Costing (SPC) package. SPC is the latest addition to the MCBA Manufacturing System and sixteen integrated manufacturing, distribution, and accounting packages written DIBOL for PDP-11s running RT-11. MCBA's twelve new Manufacturing System packages now available under RSTS/E (Resource Sharing Time Sharing/Extended) will also be featured at the booth.

MCBA's Standard Product Costing is an interactive, comprehensive tool which accurately maintains standard (or estimated) costs for both manufacturing and accounting management. SPC maintains up-to-date costs for all products, parts, and service provided by a company. Deviations of current cost from planned objectives can be spotted immediately through the use of Standard Product Costing, MCBA claims, and problem areas can be identified for management attention. Since SPC integrates with MCBA's Inventory Management and Standard Product Routing packages, labor and material figures are automatically kept consistent. MCBA's SPC maintains both beginning-of-year (standard) and up-to-date (current) cost projects. Current purchase prices deviating from the standard material costs are highlighted on the Purchase Price Variance Report. "What if?" cost analysis can be done. Critical ratios like gross margin percentages and cost variances are provided. SPC requires MCBA's Inventory Management (l/M) and Bill of Material Processor (BOMP) packages. A source Code license for MCBA's RT-11 Standard Product Costing is $3,000 for one computer. Substantial discounts are available for resellers and multiple-CPU sites. The MCBA Manufacturing System packages in RSTS/E which will be introduced are: Customer Order Processing, Cost Management, Inventory Management, Manufacturing System, Product Costing, Quotation System, and Reporting System.
cessing, Accounts Receivable, Fixed
Assets and Depreciation, Purchase
Order and Receiving, General
Ledger, Inventory Management,
Accounts Payable, Payroll, Bill of
Material Processor, Job Costing,
Shop Floor Control, and Standard
Product Routing. Source code
licenses for each of the MCBA
Manufacturing System packages in
RSTS range from $2,500 to $4,000
for a single computer system. Multi-
ple use and reseller licenses are
available at substantial discounts.

The RSTS utilities used in the
MCBA packages take full advantage
of the power of RSTS, such as the
ability to handle up to 64 terminals
and to run programs in FORTRAN
and BASIC concurrent with business
packages in DIBOL. Yet the func-
tions of the new RSTS versions of
MCBA's packages are in most cases
identical to the RSTS/11 versions
MCBA claims that the compatibility
of the operational aspects of the
RSTS and RSTS/11 versions of MCBA's
packages makes moving from one
system to the other quite simple.

Whether transferring within a large
company, or moving up from a
timesharing service running RSTS to
an independent RT-11 system, users
can run the same MCBA packages
with which they are familiar, with
little retraining.

OEMs and resellers of MCBA pro-
ducts for DEC are invited to shop at
the MCBA booth at DEXPO to dis-
cuss their possible involvement in
the company's new support program.
Dubbed SPECTRUMS (Support Pro-
gram for Effective Communication
To Resellers Using MCBA Software),
the program is a radical departure
from MCBA's traditional operating
basis. Although MCBA has always
licensed its packages with source
code through distributors, OEMs,
ISOs, and other resellers, the com-
pany has never formalized its rela-
tionships with its resellers beyond
the licensing of the product. SPEC-
TRUMS has been introduced in order
to provide a closer, more structured
arrangement that will benefit both
the company and the resellers. The
program has multiple levels and is
similar in some respects to Digital's
and Hewlet-Packard's programs for
their OEMs and software suppliers.

Resellers who qualify for the second
level of MCBA's SPECTRUMS will be
granted "Referenced Reseller" status
and will be eligible to receive end-
user leads from MCBA. To qualify for
this status, resellers will be required
to submit an application and supply
MCBA with a complete financial
statement and references.

On hand at DEXPO to provide
consultation on the use of MCBA
packages in the manufacturing
marketplace will be MCBA's new
Manufacturing Market Specialist,
Ken Rowand. Rowand came to MCBA
recently with 35 years of experience
in manufacturing and computer-
based manufacturing system design.
He worked for Hughes Aircraft
Company in a variety of plant
management positions.

MCBA is headquartered at 2441
Hilal Avenue, Montrose, Californi-
91020; (213) 957-2900; Telex 194188.

SMMC BASIC For DEC PDP-11s
Available From Computer
Systems Development, Inc.

Computer Systems Development,
Inc. announced the immediate avail-
bility of SMMC BASIC on Digital
Equipment Corporation's PDP 11
system under the RSTS/E Operating
System. The development of SMMC
BASIC on the DEC system was a
joint effort of Computer Systems
Development, Inc. (CSD) and SMC
Software Systems, a division of
Science Management Corporation.

SMMC BASIC, an easy to use yet
powerful BUSINESS BASIC, is fully
compatible with software applica-
tions developed under Basic Four
BASIC. A broad range of mature
quality-tested software packages
have been installed in more than
15,000 sites during the past 10
years in the Basic Four community.
These packages are now available
under SMMC BASIC to the DEC-user
community.

SMMC BASIC is the only inter-
pretive language for PDP-11s that
allows users the flexibility of using
files under RMS-11K, DEC's record
management system. RMS files may
develop dynamically within a
program, and a program may have
up to ten indexed files open at the
same time. Other features of the
language are business math, exten-
sive built-in screen handling func-
tions, automatic conversion of
numeric data types, shareable pub-
lic programs, external calls with
recursion, and all data in common, if
desired.

SMMC BASIC will be distributed on
DEC equipment through Computer
Systems Development, Inc., an eight-
year-old software company specializ-
ing in application package
development for Digital Equipment
Corporation and Basic Four Corpo-
ration computers.

For more information contact Jon
Coleman, Computer Systems Devel-
opment, Inc., 140 Mayhew Way,
Suite 700, Pleasant Hill, CA 94523
(415) 930-9932.

Computer Systems Corp.
To Demonstrate Both
CALC-11 And CALC-11 Plus

Computer Systems Corporation
will be demonstrating both CALC-11
PLUS and CALC-11 and VAX oper-
ating the UNIX operating system.

The CALC products by Computer
Systems Corporation have had high
user acceptance. The flexibility and
reliability of these products are well
known in the market place. Both
products utilize the same sound
design concepts which were used
with the original CALC-11 product.

In addition to the extensive added
features, such as the very large
spreadsheet and paging capabilities
of the CALC-11 PLUS product, many
of the 'nice to have’ features have
been incorporated in this mature
product.

CALC-11 and CALC-11 PLUS are
designed to be used for both small
and large projects. CALC-11 may be
used on small spreadsheets (up to
3600 cells) whereas, CALC-11 may
be used on extremely large spread-
sheets. Spreadsheets created with
the quicker CALC-11, can be easily
transported to CALC-11 PLUS. This
combined use allows for a very
quick creation of individual sections
of a spreadsheet which can be incor-
porated into the much larger spread-
sheets with CALC-11 PLUS.

CALC-11 and CALC-11 PLUS are
packaged together at the single unit
price of $2,500 which includes war-
ranty and one year updates. Educa-
tional and volume discounts (along
with site, facility and corporate pric-
ing) are available.

For additional information contact
David Tortora, Computer Systems
Corporation, 5540 Rock Hampton
Court, Indianapolis, IN 46268,
(317) 672-7200. CALC Hotline: 1-

Nassau Systems To Exhibit
Overtemperature Protection
Hardware Accessory For DEC

Nassau Systems will be exhibiting
an Overtemperature Protection
Hardware Accessory for all Digital
Equipment Corporation Computer
Systems.

This will be the first trade show
display of an Overtemperature Pro-
tection Device specifically made for
all standard DEC Computer Sys-
tems. The product is designed to assist all DEC equipment OEM's and end users in preventing equipment damage from overtemperature conditions and has been endorsed by DEC Field Service for this purpose. The accessory provides a warning alarm and total system power shutdown at preset temperature limits designed to meet the environmental specifications in DEC computers and is equipped with the DEC standard power control and distribution systems, including all PDP11, VAX, DECSYSTEM-20 and DECSYSTEM-10 equipment.

For further information contact Nassau Systems, P.O. Box 19329 Cincinnati, OH 45219, (513) 231-1283.

IMSL Releases Edition 9 Of FORTRAN Library And Edition 4 Of TWODEPEP

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 number 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 applications. 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, eigenvalue system analysis, random number generation, interpolation, approximation, smoothing, linear algebraic equations, special functions, utility functions, optimization, sorting, and zero and extremas.

A staff of software design specialists develops and supports the IMSL Library for the Digital Equipment computers. Experts in mathematics, statistics, scientific computing, programming and computer science test each Library subroutine for accuracy, efficiency, and reliability. IMSL supplements the expertise of this staff with a Corporate Advisory Board comprising of world leaders in mathematics, statistics, and scientific computing.

For the Digital Equipment computer, the annual subscription rates for the 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%.

IMSL TWODEPEP, now in Edition 4, is an easy-to-use finite element program that solves time-dependent, steady state and eigenvalue problems in general two-dimensional regions. TWODEPEP is useful in areas such as plasticity, diffusion, minimal surfaces, potential energy, Schrodinger equations, heat conduction, fluid mechanics, and other such applications. By using a preprocessor to define problems in simple, readable format, TWODEPEP eliminates programming time and is accessible to those with minimal training in partial differential equations. Another feature, TWOPLOT, is a portable graphics package that draws scalar, vector, and stress fields.

TWODEPEP is available on the Digital Equipment System 10/20 and VAX-11 Series. The annual subscription rates for TWODEPEP are $2,000 for initial subscriptions, and $1,500 for renewals. For universities, the subscription rate is discounted 40%.

For additional information contact IMSL, Inc., Sixth Floor — NBC Building, 7500 Bellaire Blvd., Houston, TX 77036-5085, (713) 772-1927; outside Texas call toll free 1-800-231-9842, or telex 79-1923 IMSL INC HOU.

Newman Computer Exchange To Provide Appraisals

Newman Computer Exchange will be a prominent exhibitor. 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.

Newman markets late-model minicomputer equipment, by direct mail and telephone, to major corporations, universities, and government and military agencies.

Personnel will staff the Newman booth to provide equipment appraisal and other firsthand information. Also available: Catalogs, literature and free signup for mailing list, as well as the Newman "Blue Book" on converting surplus minicomputer equipment to cash.

For more information contact Newman Computer Exchange, P.O. Box 8610, Dept. PS3J-DX, Ann Arbor, MI, 48107 (313) 994-3200.

Northwest Digital Software To Unveil RPM—RSTS Performance Monitor

RPM is a new performance optimization package from Michael Mayfield and Northwest Digital Software. RPM can drastically improve total system performance by identifying problems and the problem areas within each program. RPM is the only product that can do all this.

System tuning with RPM uses a step by step "cookbook" approach. No knowledge of system tuning or monitor internals is required. Problem areas are identified using an automatic procedure which provides a report describing, in plain English, not numbers, where the system performance can be improved. It even makes suggestions for improvement.

On-line plotting, histograms and other reports can be used to further identify problem areas. Extended monitor data collection allows plotting of information not normally available, such as seek distance, disk usage, and cache, memory, file processor (FIP) and small buffer utilization.

The programs causing the problems are then identified and can be examined in extreme detail. Detailed examination of a program includes CPU usage, a count of I/O requests and disk overhead by channel and a count of monitor calls and disk overhead by call.

For more information, contact Northwest Digital Software, Inc. at Box 2-743, Spring Valley Road, Newport, WA 99156, (509) 447-2620.

California Computer Group Presents 'ULTRAVAX' System

VAX-11 users seeking higher performance and lower equipment costs can find both in the ULTRAVAX, a family of "optimized" minicomputer systems based on Digital Equipment Corporation's VAX-11 CPUs. ULTRAVAX is the most recent addition to the ULTRAMINI line of DEC-compatible systems recently introduced by California Computer Group, Inc. (CCG).

CCG now offers ULTRA 730 and ULTRA 750 as complete systems. In addition, VAX-compatible disk, tape and communication subsystems, marketed under the name ULTRAKIT, are available as upgrades for 11/760 and 11/782 CPUs and for 11/730 and 11/750 systems already in place.

ULTRAVAX systems (and ULTRA
KIT subsystems) substitute firmware-driven controllers on each Unibus, CMI-bus or SBI-bus for the more traditional, discrete logic-driven controllers used in DEC's standard configurations. These microprocessor-based controllers permit integration of peripherals with larger capacities, faster access and lower costs than DEC peripherals.

ULTRAVAX controllers comprise bipolar, bit-slice microprocessor designs incorporated onto single-board or single-board-extended packages that fit into available VAX backplane slots without modifications. All basic control, status and data transfer operations are implemented by microcode. ULTRAVAX controllers are software-transparent to VAX/VMS, UNIX and DEC diagnostics.

Microprocessor-based controller design provides VAX users a highly flexible means of tailoring their systems to changing applications. Functional improvements in the ULTRAVAX are accomplished by simple microcode changes in the PROM, instead of changing entire modules.

One ULTRA 750 CMI-bus disk controller, model CC750-X, features four on-board drive ports which allow any given drive to be set up on any port and changed at any time without reconfiguring the controller. As many as 32 different, predetermined drive combinations on the four disk ports may be operated together. Data is transferred in 32-bit parallel words via the CMI-bus, at serial rates up to 15 MHz.

In addition to providing flexibility, ULTRAVAX controllers enhance storage capacity and eliminate speed bottlenecks. For example, VAX 11/780 users with RA81 disk drives must interface them via the Unibus; the RA81's two-megabyte transfer rate is therefore constrained by the 800-kilobyte transfer rate of the Unibus. Furthermore, this scheme limits the user to 1.5 gigabytes of storage per controller. However, CCG's CDS474-X controller/desk subsystem interfaces directly to the 11/780's fast SBI-bus (or to the CMI-bus of the 11/750) and provides the user a true 1.8 megabyte per second transfer rate; a quiet, reliable disk drive (10,000 hours MTBF); and a storage capacity of 5.5 gigabytes per controller.

ULTRAVAX controllers also eliminate considerable hardware duplication. In DEC's Massbus, for example, some control logic hardware resides in the RH750 or RH780 adapter; the balance is incorporated into individual disk drives. This creates an unnecessary redundancy of control logic in multi-drive configurations, and an unnecessary cost to the user.

In the ULTRAVAX, however, a single disk controller functionally emulates the entire Massbus subsystem, and can control multiple drives running under RM03, RM05, RM80, RP06 or RP07 emulation. The ULTRA 750's CC750-X controller handles one to four disk drives; the CC770-X (part of 11/760 ULTRAKIT) handles one to eight disk drives or a combination of four disk and four magnetic tape drives.

As with mass storage, ULTRAVAX controllers also improve the efficiency and flexibility of multiplexed communications. DEC's DZ11 multiplexer, standard on all VAX systems, performs byte transfers at 9.6 kilobaud. Maximum input data buffering is 64 characters per 16 lines.

ULTRAVAX controllers enhance these performance levels by transferring whole words rather than bytes on DMA output, operating at 19.6 kilobaud. Input data buffering is expanded to 256 characters per 16 lines.

Unlike DEC's multiplexers which require up to nine backplane slots per 16 communication lines, and which are limited to one type of local transmission mode, ULTRAVAX communication controllers require only a single hex SPC slot for combinations of up to 128 remote and local communication lines emulating the user's choice of DZ11, DH11 and DMF32.

While the ULTRAVAX's price-to-performance ratio is significantly better than a standard VAX-11/730 or 11/750 in a smaller system configuration, its ratio further improves as the configuration becomes more complex.

The enhanced capabilities of ULTRAVAX and ULTRAKIT are available without sacrifice of DEC warranty coverage, service or support.

For further information, contact California Computer Group, Inc., 3303 Harbor Boulevard, Suite G-10, Costa Mesa, CA 92626 (800) 854-7488; in California: (714) 966-1661; telex 183519 CCG CSMA.

Interactive Info. Offers Resource Planning System

IMCS, a manufacturing resource planning system from Interactive Information Systems, Inc., is an integrated, on-line, interactive MRP II offering. IMCS includes state-of-the-art inventory, bill of materials, routings, material requirements planning, on-line master scheduling, shop floor control, input-output reporting, purchasing and capacity requirements planning.

IMCS is available in a BASIC PLUS version for the DEC PDP 11 family. It is also available in VAX NATIVE BASIC for the VAX family, utilizing Datatrieve, RMS and VMS features.

IFAS, a companion set to IMCS, is an interactive financial accounting system.

For further information contact: Interactive Information Systems, Inc., 10 Knollcrest Drive, Cincinnati, OH 45237, (513) 761-0132 or 5757 West Century Boulevard, Los Angeles, CA 90045, (213) 670-9340.
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RSTS/E INTERNALS MANUAL

The RSTS community has been clamoring for years for a book that details the inner workings of RSTS/E. Well, clamor no more. Michael Mayfield of Northwest Digital Software, and M Systems, the publisher of The RSTS Professional and The DEC Professional Magazines, have teamed up to produce the RSTS/E Monitor Internals Manual.

This manual describes the internal workings and data structures of the RSTS/E monitor. It also notes differences in the internal structures between version 7.1 and earlier versions of the monitor. Future updates will include changes for new versions of the monitor.

Information is available for all levels of users:

- Gain a basic understanding of the workings of the monitor for optimizing system performance.
- Information on disk structures allows recovery of data from corrupted disk packs.
- Special uses of runtime systems and resident libraries allow complex applications to be developed without degrading system performance.
- Write your own custom device drivers for that "foreign" device you need to add but thought you couldn't.

CONTENTS:

Chapter 1 describes the structures used by the monitor that are resident on disk. These include the directory structure, disk allocation tables, Save Image Library (SIL) formats, bootstrap formats and bad block mapping.

Chapter 2 describes the tables used within the monitor to control system resources and provide program services. These tables provide job, memory, file and device control, as well as program services such as interjob communication.

Chapter 3 contains information on writing and installing a custom device driver. It describes the entry points and information the driver must provide to the monitor as well as the subroutines and macros the monitor provides for the driver.

Chapter 4 contains information that enhances information already provided by Digital on writing custom resident libraries and runtime systems. It concentrates mainly on non-standard uses of resident libraries and runtime systems to increase system performance and functionality.

Appendix A provides six quick reference foldout charts:

- The directory structure.
- The monitor tables.
- Fixed memory locations and common data structures.
- Monitor subroutines.
- Device driver entry points.
- Device driver macros.

Appendix B provides examples of the peek sequences required to access most of the monitor tables. It also contains an example program that uses many of the monitor tables to display a job and open files status.

Appendix C provides an example device driver.

Appendix D provides an example runtime system that doubles as a menu system for restricting specified users to a menu of options.

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