MS-DOS
Overview, Part 1
MSPRO: MS-DOS on S-100

CP/M 2.2
Modifying Fortran-80
Mass Renaming

MP/M II
MP/M, Part 2
Date & Time Functions

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MS-DOS: An Overview, Part 1
by William G. Wong
This first article of a two-part series gives a general overview of MS-DOS, the enhancements to V2.0, and the support programs

MSPRO: MS-DOS on the S-100 Bus
by Andrew L. Bender
An adaptation of MS-DOS 2.0 for the CompuPro 8085/8088 dual processor and the Lomas LDP-72 Disk Controller boards

Enhancing MP/M II, Part 2
by Tom Clodfelter
Adding a multiuser login feature and a batch processor that allows programs to interact with each other through time sharing

Julian Date Conversion Functions
by Ron Fowler
Convert dates to and from Julian format for use by application programs running under CP/M Plus, MP/M II, and TurboDOS

Microsystems Reviews: “The Lightning One”
by Bruce Ratoff
A fast 8086 CPU with 8087 math coprocessor from Lomas Data Products running CP/M-86 and MS-DOS 2.0

Fortran-80: Simple changes for I/O
by Maynard Brandsma
Modifications to the disk-formatted read and write routines eliminate problems with carriage returns and line feeds

Microsystems Reviews: The Dual Systems SI04/DMA Serial I/O Board
by Ian Darwin
An intelligent 4-channel serial I/O processor with on-board FIFO buffer and support for XON/XOFF protocol, oriented to multiuser systems

MagicBind Supercedes Mailmerge
by Roger Schlobin
A review of MagicBind, a print formatter and merge-print facility that offers true proportional spacing and more features than MailMerge at the same price

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At the recent Comdex show Intel and Digital Research announced that they have signed a contract under which DRI is to port UNIX System V to the Intel 80286 and also provide a line of related software to run under the operating system. This represents a radical departure for DRI, since all of their previous operating systems were derived from CP/M. Further, only a year ago DRI had stated they intended not to bring out a UNIX operating system.

It also represents a radical change for Intel, which had previously contracted Microsoft to port System V to the 286. Rumor has it that Microsoft decided to drop the project in favor of other, more profitable undertakings. Microsoft has invested heavily in the development and refining of XENIX, their version of UNIX, which is basically UNIX V7 with the Berkeley and System III enhancements, and they have done more to popularize UNIX on microcomputers than anyone else has. Under the terms of the contract, Western Electric will own the operating system, and both Intel and DRI will market and support the software.

It is reported that the XENIX project has been only marginally profitable for Microsoft, and that the System V implementation turned out to be much more work than they had anticipated. Further, it is likely that Microsoft was not happy with Western Electric’s insistence that the port adhere strictly to the System V standard they had developed.

Thus Intel was left hanging and turned to DRI to get them out of the hole. With DRI’s extensive line of languages and software development tools, they represented the best alternative to Microsoft. Both Intel and Western Electric scrutinized DRI’s capabilities before the contract was signed.

Although DRI does its software development on a UNIX system, they lack any experience in the UNIX area, compared to several other software houses (e.g., UniSoft and Human Computing Resources) and it should therefore be very interesting to see how long it takes them to get this implementation out. There are rumors that DRI may acquire a small software house experienced in porting UNIX in order to get the expertise in-house quickly.

It is interesting to note that at the last NCC show in May, Western Electric, Intel, Motorola and National Semiconductor held a joint press conference to announce their commitment to port UNIX System V to the 286, 68000 and 16032 microprocessors. In the nine months that have gone by, no one has announced such a product, and we now learn that Intel has changed suppliers and is probably still more than six months away from releasing a product. Interestingly enough, UniSoft and Human Computing Resources have announced System V ports for the 68000, and HCR also has one for the 16032.

DRI has extensive experience with the C language, with implementations for 8086 and 68000 products. It is likely that after finishing the 286 System V implementation they will do a 68000 implementation. After all, Motorola has yet to bring out such an implementation, despite their contract with Western Electric.

DRI is apparently attempting to become the vendor for the standard System V UNIX for the 286 and possibly for other microprocessors such as the 68000. However, there are questions as to how successful this effort will be. After all, Microsoft and UniSoft have virtually all of the current OEM market sewed up, and there is little likelihood that these OEMs will change. Further, Microsoft introduced an improved performance version of XENIX for the 286 back in May, and Bill Gates has indicated that Microsoft will do their own implementation of System V. Microsoft has proved to be a very aggressive competitor. It is probable that their version will not be a strict Western Electric System implementation, but will most likely include the enhancements that Microsoft added to XENIX to make it more commercially marketable (e.g., improved user interface).

IBM is rumored to be developing their own operating system for their upcoming generation of 286-based workstations. Further, Western Electric’s UNIX-based systems are due shortly, and they are not likely to use DRI’s implementation. However, the market for languages and software development tools for these IBM and Western Electric systems could prove lucrative.

It is likely that DRI will offer a utility for their UNIX System V implementation that will allow the running or porting of standard CP/M software on these systems. Considering the wealth of CP/M software currently on the market and in the public domain, this would be a definite plus for DRI and for the UNIX community.

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numbers of UNIX systems were sold. This certainly does not compare to the sizes of the CP/M and MS-DOS system markets, which are both about a million licenses each. It is estimated that the UNIX market will probably double this year and by the end of next year rise to well over 300,000 systems, particularly as IBM and Western Electric move into the marketplace.

The DRI version of UNIX now presents another area in which Microsoft and DRI are competing head-to-head. Considering Microsoft's previous successes in these battles, one can question the wisdom of DRI's decision to open up the war on yet another front. To a certain extent DRI may be forming an alliance with AT&T comparable to Microsoft's alliance with IBM.

For an in-depth discussion of Digital Research's entry into the UNIX marketplace and strategies being used by Microsoft, Intel, IBM and Western Electric, I refer the reader to an excellent monthly newsletter published by Yates Ventures, 4962 El Camino Real, Suite 111, Los Altos CA 94022, (415) 964-0130. The newsletter is titled The Yates Perspective and a yearly subscription is $450.

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CIRCLE 53 ON READER SERVICE CARD
Commodore is rumored to be negotiating with Mark Williams Company, Chicago IL to use the latter's UNIX-like Coherent operating system on Commodore's Z8000-based 16-bit microcomputer, now in development. The minimum system is expected to include 128K of RAM and a 320K disk drive and sell for under $1,000. An 8088 plug-in card option is also expected, with versions of MS-DOS and CP/M-86 to run on it. Commodore is also rumored to be readying a portable computer employing a 16-line by 80-character liquid crystal display and wafer-tape drive. Texas Instruments is rumored to be working on a 68000 processor card for the desktop IBM PC-compatible system. TI is expected to include a UNIX-type operating system with the card.

New public domain software
SIG/M (Special Interest Group for Microcomputers, Amateur Computer Group of New Jersey, Inc.) has issued one new volume of public domain software, bringing their total up to 152 volumes. The new volume contains a disk drive alignment program for the 1793 FDC; it does not require an oscilloscope, but you do have to purchase a $30 test disk from Dysan. Also on the disk are updates for the DU, LDIR, SWEEP, TYPE and USQ utilities.

For complete information on SIG/M software, send $2.50 ($4 foreign) for printed catalog to: SIG/M, Box 97, Iselin, NJ 08830.

P/D Software, 4691 Dundas St. West, Islington, Ontario, Canada M9A 1A7 (416/239-2835) is distributing CPMUG and SIG/M software libraries in 25 different disk formats including 8", Apple, KayPro, Osborne, IBM and others. The software is available in prices ranging from $10-$20, depending on the disks required.

The New York Amateur Computer Club, Box 106, Church Street Station, NY, NY 10008, has released two new volumes of software for systems running MS-DOS and PC-DOS. The disks are $6 postpaid (add $3/order for foreign). A printed catalog is $10 ($15 foreign). The new volumes are:

<table>
<thead>
<tr>
<th>Volume</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>dBASE II order entry &amp; inventory control system (converted from SIG/M library)</td>
</tr>
<tr>
<td>44</td>
<td>Demographics display system for IBM-PC</td>
</tr>
</tbody>
</table>

DRI announces CP/M-86 version 3.1
Digital Research has announced that it expects to start shipping an enhanced version of CP/M-86 this month. The new version, designated 3.1, will add window-like structures to terminal screens. Further, it will be capable of running MS-DOS and IBM PC-DOS based software. The question now is: will Microsoft add the capability to run CP/M-86 software to MS-DOS and PC-DOS? The Microsoft MSX operating system for low-cost Z80-based home computers can run CP/M-80 software.

3M announces new magnetic medium
3M Corporation has announced a new, low-cost magnetic medium that they claim will allow "semi-rigid" 5.25" disks capable of storing 5 MB per side (10 MB total). The disks are expected to retail for about $10 in quantity and, like floppies, do not require a sealed environment. Commercial availability is still expected to be a year away.

It should be pointed out that Kodak's Spin Physics Group had previously announced a product with similar capabilities. However, the cost is expected to be higher.

In any event, we can expect that 1985 will see systems with removable-media disk drives storing 5 and 10 MB.

S-100 product directory in works
The annual Microsystems directory of IEEE-696/S-100 products is now being put together for publication in the May issue. In May of last year this directory listed 157 suppliers of approximately 500 IEEE-696/S-100 products. We have already discovered 33 new suppliers who have entered the marketplace and are not aware of any that have forsaken it. This is an increase of over 20% and it is likely that the number of products has increased by the same percentage, so that there are probably about 600 IEEE-696/S-100 products now being manufactured. This indicates that the S-100 marketplace is still active and growing.

If you are a supplier of such products and have not received a directory questionnaire form from us, please call us immediately and we will send one out to you.

Intel announces improved iAPX432
Intel has announced an improved version of its 32-bit iAPX432 microcomputer chip set. The chip set, which represents a radical departure in CPU architecture from Intel's 16-bit devices, has never gained market acceptance. There have been reports of disappointing performance, and no major computer manufacturer has adopted the devices.
Creating a micro and mini computer network has been costly and confusing. Communications hierarchy has prevented many types and various kinds of equipment from sharing information. Until now.

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News & Views
Continued from page 12
But Intel has made a commitment to the 432 architecture, which they consider a major step forward for knowledge-based systems. The new release of the device operates at a higher speed and handles instructions more efficiently. Intel claims it is twice as fast as the previous version. Additional enhancements have been made to reduce I/O overhead, and a virtual operating system has been developed that anticipates memory usage and supports 1 trillion bytes of virtual memory. As an additional incentive, Intel has reduced the prices of the chips. For example, the price for the general data processor has been cut from $450 to $160; almost within range of the hobbyist.

Adam Osborne forms software start-up venture
Adam Osborne has launched a new venture called “Software Seed Capital Corp.” to fund start-up software companies and market their products. Adam promises that SSCC, of which he is chairman and chief executive, will invest $10 to $15 million in these start-ups and hopes to have 50 to 60 programs on the market in about 12 months. SSCC will do the manufacturing, marketing and distribution, leaving the developers free to concentrate on software development.

Adam is still chairman of the board of Osborne Computer, which is still operating under Chapter 11 of the bankruptcy law. Adam claims that his day-to-day involvement in OC ended last February and “after that I really wasn’t certain of what was going on.” Further, he has stated that “with the damage done from March to September there’s really nothing left of the company I created.” And that “there’s not much point in me going in to pick up the pieces.” He described the OC situation as “a tragedy” that was “totally unnecessary” and that OC “went down the tubes when I brought someone else in to run it.” Here he was referring to Robert Jaunich, former president of Consolidated Foods, whom Adam hired to be president of OC.

OC is looking for someone to purchase the company. In the meantime, lawsuits have been filed against Adam Osborne, founder, and Robert Jaunich, president, charging misrepresentation of financial status when selling securities.

Personal CP/M comes to Z80
As rumored previously in this column, a chip has been announced by American Microsystems, Santa Clara CA that places the kernel for the Personal CP/M operating system in the same chip with a Z80 processor. AMI has a second-source agreement with Zilog and expects to start sampling by the end of next month. The chip is expected to be used in low-cost home computer systems.

Random news
Tandy has finally begun shipping CP/M for its Model IV computer, fully nine months after it first announced it.... Wayne Technology, Anaheim CA (714/772-5757) has introduced the “CoCo Coupler One” which makes it possible to run CP/M on the Radio Shack Color Computer. It is inserted between the computer’s cartridge port and disk controller.

Quotation of the month
“When you’re a little guy, you have to pay your own bills, but then you get more successful...”
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CIRCLE 190 ON READER SERVICE CARD
Subtle differences among the new releases give you more possibilities to choose from.

The latest releases of PC-DOS are versions 1.10 and 2.1. PC-DOS 1.10 is essentially the same as version 1.1, but has the GRAPHICS option available in version 2.1, along with some differences between 1.10 Basic and 1.00 Basic. The change in designation is very subtle. Most IBM compatibles have only implemented variations of MS-DOS 2.0. Practically all IBM clones have version 1.1 or an equivalent. Most of the popular commodity software systems are currently available on either PC-DOS 1.10 or 2.1, albeit dependent on the IBM screen attributes. Version 2.1 requires greater RAM.

PC-DOS 2.1 is version 2.0 with the added functions of addressing the dynamic color video on the IBM PCjr. PC-DOS 1.10 is intended for systems with smaller memory sizes, whereas 2.1, with its requirement for over 24K of RAM, is intended for systems that have larger memory. The paradox in all this is that the PCjr can only be used with version 2.1: its memory limit is 128K, the reason being the PCjr’s dependence on the relocatable color video.

IBM PC-DOS 1.10 uses a 320K double-sided double-density format. Version 2.1 can reference either 320K or 360K of double-sided and double-density disk storage as well as fixed disks.

Like CP/M, MS-DOS/PC-DOS has implicit or internal commands as well as explicit or external commands. They are similar in function and format to CP/M in many respects. This month we will compare PC-DOS 1.10 to CP/M 2.2. This is strictly an arbitrary selection: they are similar in many respects, but different in others. In CP/M, destination-file is specified before source-file. To rename a file in CP/M, the proper command is:

```
REN (new-name)=(original-name)
```

In MS-DOS/PC-DOS it is just the reverse. An equivalent example is:

```
PC-DOS CP/M 2.2 equivalent
```

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPY</td>
<td>copies one or more files (*)</td>
</tr>
<tr>
<td>DATE</td>
<td>displays and/or resets date</td>
</tr>
<tr>
<td>DEL</td>
<td>same as ERASE</td>
</tr>
<tr>
<td>DIR</td>
<td>lists directory</td>
</tr>
<tr>
<td>ERASE</td>
<td>deletes file</td>
</tr>
<tr>
<td>PAUSE</td>
<td>suspends system processing</td>
</tr>
<tr>
<td>REM</td>
<td>displays remarks within a batch file</td>
</tr>
<tr>
<td>RENAME</td>
<td>changes the name of a file</td>
</tr>
<tr>
<td>TIME</td>
<td>displays and/or resets time</td>
</tr>
<tr>
<td>TYPE</td>
<td>displays the contents of a file</td>
</tr>
<tr>
<td>SAVE</td>
<td>memory save</td>
</tr>
</tbody>
</table>

(*) PIP is an external CP/M command.

```
Table 1. Internal commands
```

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHKDSK</td>
<td>check disk</td>
</tr>
<tr>
<td>COMP</td>
<td>compare files</td>
</tr>
<tr>
<td>DISKCOMP</td>
<td>compare disk</td>
</tr>
<tr>
<td>DISKCOPY</td>
<td>copy disk</td>
</tr>
<tr>
<td>EXE2BIN</td>
<td>converts .EXE files to .COM (*)</td>
</tr>
<tr>
<td>FORMAT</td>
<td>initializes disk</td>
</tr>
<tr>
<td>GRAPHICS</td>
<td>screen print</td>
</tr>
<tr>
<td>MODE</td>
<td>sets mode of operation</td>
</tr>
<tr>
<td>SYS</td>
<td>transfers operating system</td>
</tr>
<tr>
<td>.BAT</td>
<td>batch file processing</td>
</tr>
<tr>
<td>.BAT</td>
<td>extended batch processing</td>
</tr>
<tr>
<td>.DUMP</td>
<td>file dump</td>
</tr>
</tbody>
</table>

(*) EXE2BIN converts relocatable binary to absolute binary code.

```
Table 2. External commands
```

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT</td>
<td>check disk</td>
</tr>
<tr>
<td>STAT</td>
<td>compare files</td>
</tr>
<tr>
<td>STAT</td>
<td>compare disk</td>
</tr>
<tr>
<td>STAT</td>
<td>copy disk</td>
</tr>
<tr>
<td>STAT</td>
<td>converts .EXE files to .COM (*)</td>
</tr>
<tr>
<td>STAT</td>
<td>initializes disk</td>
</tr>
<tr>
<td>STAT</td>
<td>screen print</td>
</tr>
<tr>
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</tr>
<tr>
<td>STAT</td>
<td>batch file processing</td>
</tr>
<tr>
<td>STAT</td>
<td>extended batch processing</td>
</tr>
<tr>
<td>STAT</td>
<td>file dump</td>
</tr>
</tbody>
</table>

(*) EXE2BIN converts relocatable binary to absolute binary code.
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• Sample CP/M* Bios routines are included for integration into any CP/M* system.
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The most common diskette problem is a directory ruined by a power glitch while the system has been idle. (The read/write heads are more likely to be on the directory track than any other.) Other frequently-seen problems involve archive diskettes. Often the signals on the recording medium simply weaken with time. This tends to hurt the higher-density inner tracks.

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CIRCLE 97 ON READER SERVICE CARD
The total command set of MS-DOS/PC-DOS 1.10 is richer than that of CP/M 2.2. However, MS-DOS/PC-DOS 1.10 and CP/M 2.2 require the lay person to understand the primitive structures of an operating system. MS-DOS/PC-DOS 2.1 and PC/M Plus provide for icon-driven formats, which in turn make them far easier to use. This will be discussed in future issues.

MS-DOS/PC-DOS, as offered, has file attributes different from those of CP/M. Each file under MS-DOS/PC-DOS has associated information in byte size, and date and time stamp of creation or last modification. An example of this is as follows:

**Table 3. Supplied systems**

<table>
<thead>
<tr>
<th>Command</th>
<th>MS-DOS</th>
<th>CP/M 2.2 equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEBUG</td>
<td>DDT</td>
<td>dynamic debugger</td>
</tr>
<tr>
<td>EDLIN</td>
<td>ED</td>
<td>line editor</td>
</tr>
<tr>
<td></td>
<td>ASM</td>
<td>assembler</td>
</tr>
<tr>
<td>LOAD</td>
<td>MOVCMP</td>
<td>converts .HEX to .COM</td>
</tr>
<tr>
<td>BASIC</td>
<td></td>
<td>generates CP/M sizing</td>
</tr>
<tr>
<td>BASIC</td>
<td></td>
<td>Basic interpreter</td>
</tr>
<tr>
<td>LINK</td>
<td></td>
<td>advanced Basic interpreter</td>
</tr>
</tbody>
</table>

(*) LINK binds .EXE files.

Under CP/M, a STAT command can be used to display information relevant to the number of blocks, size of file, number of extents and file attributes. With CP/M it is possible to display as well as alter information on file status, such as system or directory file, and read/write or read-only file status.

If only it were possible to have the file attribute options of CP/M with the full complement of MS-DOS/PC-DOS commands, including date and time stamp as part of the standard operating system!

Two Basic interpreters are supplied with PC-DOS, as well as demonstration programs written in Basic. These programs do make a good foundation for a better understanding of the Basic functions, and most people prefer them over the availability of an assembler as part of the distribution of system software.

CP/M, on the other hand, supplies an assembler along with the sample source programs (.ASM) on their distribution disk.

However, under CP/M, one will find that there is not 100% portability of code between the interpretive MBasic and the BASic Compiler. Microsoft did not discriminate between systems. This inconsistency exists under MS-DOS/PC-DOS as well. What makes it more difficult to understand is that the Basic compilers for MS-DOS are not compatible with those available under PC-DOS.

**Table 3. Supplied systems**

<table>
<thead>
<tr>
<th>Command</th>
<th>MS-DOS</th>
<th>CP/M 2.2 equivalent</th>
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If only it were possible to have the file attribute options of CP/M with the full complement of MS-DOS/PC-DOS commands, including date and time stamp as part of the standard operating system!

Two Basic interpreters are supplied with PC-DOS, as well as demonstration programs written in Basic. These programs do make a good foundation for a better understanding of the Basic functions, and most people prefer them over the availability of an assembler as part of the distribution of system software.

CP/M, on the other hand, supplies an assembler along with the sample source programs (.ASM) on their distribution disk.

However, under CP/M, one will find that there is not 100% portability of code between the interpretive MBasic and the BASic Compiler. Microsoft did not discriminate between systems. This inconsistency exists under MS-DOS/PC-DOS as well. What makes it more difficult to understand is that the Basic compilers for MS-DOS are not compatible with those available under PC-DOS.

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Several BIOS enhancements—from the early, quite basic, to the more sophisticated... by Chris Terry

The BIOS source code provided on the Digital Research CP/M distribution disk is set up for the Intel MDS (Micro Development System), and is seldom of any use to the purchaser. This same BIOS is built into the MOVCPM utility that allows system re-location to suit the available memory size. Further, the standard BIOS "tolerates, but does not use" the IOBYTE at location 0003.

Thus, in the early volumes of the CPMUG and SIG/M libraries, at a time when CP/M 1.3 was still in use, we find quite a number of BIOS enhancements. Some of these are quite basic; others are more sophisticated and include hard disk support.

Basic BIOS

CPMUG Vol. 1 contains VBIOS31, VBOOT31, and ASSIGN, all written by Jeff Kravitz for a system running an IMSAI disk controller, a ProTech VDM-1 memory-mapped video board, and an IMSAI SI02-2 serial I/O board. Its main value is for study, particularly of a simple video driver and the routines that use the codes in the IOBYTE to attach different physical devices to the four logical devices of CP/M (CON:, RDR:, PUN:, and LST:). All character I/O routines inspect the corresponding bits of the IOBYTE and despatch the character to the physical device currently specified. The ASSIGN transient program sets the codes in the IOBYTE according to keyboarded commands. These routines remain among the clearest and most effective for use of the IOBYTE under CP/M 1.3, 1.4 and 2.2, and well repay close study. CP/M Plus, of course, has built-in provision for far more elaborate I/O control.

CPMUG Vol. 25 contains early CBIOS, BOOT, COPY and FORMAT programs written by Tarbell staff for their single-density disk controller with Shugart 800 or Persci Dual 8" drives. All of these programs have been superseded by later versions, but they are well commented and again are worth close study if you want to learn the basics of writing a disk driver. Note, however, that the BIOS does not include access to the disk parameter tables, which were not brought out into the BIOS until the advent of CP/M 2.0.

Advanced BIOS

CPMUG Vol. 38 is interesting for two items. The first of these is a set of routines, with instructions, on how to integrate your own BIOS into the MOVCPM utility. You need MAC and SID to do this—it's a complex procedure for versions 1.3 and 1.4, and may need modification if you are using 2.2. It probably could be done nowadays much more easily with RMAC, which can generate both Relocatable (REL) and System Page Relocatable (SPR) code.

The second item of interest is DFOCO, a disk formatting and copy program for Tarbell or Delta double-density disk controllers. It can format or copy individual tracks in many different formats. Well commented and worth close study.

Until recently, disk controller manufacturers who also made CPU boards had a nasty habit of supplying their own operating system and putting all I/O routines in PROM on the CPU board to lock you into their system. SDS was one of these; thus we find several BIOS entries to allow the VersaFloppy II (a good, reliable controller) to run standard CP/M 2.2. One of these, for 8" and 5.25" floppy disks only, is to be found in SIG/M Vol. 26. Another, with support for XComp and SEAGATE-compatible hard disk, is in SIG/M Vol. 42. A BIOS that supports the DTC hard disk is to be found in SIG/M Vol. 50.

Anyone with a North Star Horizon system should look at CPMUG Vol. 82, which contains two North Star BIOS files, one of which has built-in drivers for the PMMI modem. The volume also contains various utilities. Cromemco users may be interested in SIG/M Vol. 41, which contains a BIOS for the Cromemco 16FDC and 4FDC disk controllers in a system running ACDOS, together with support utilities for CDOS.

Finally, an interesting BIOS submitted to SIG/M (but not released at the time of writing) implements Bob Lurie's scheme for increasing the capacity of a single-density disk from the nor-
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<table>
<thead>
<tr>
<th>Task</th>
<th>SUPER Time</th>
<th>dBASE II Time</th>
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<tbody>
<tr>
<td>Set up/Program</td>
<td>5:20 min.</td>
<td>12:18:00 hrs.</td>
</tr>
<tr>
<td>Input 100 records</td>
<td>50:29 min.</td>
<td>1:27:50 hrs.</td>
</tr>
<tr>
<td>Sort &amp; Print Labels</td>
<td>6:41 min.</td>
<td>4:18 min.</td>
</tr>
<tr>
<td>Totals</td>
<td>1:02:30 hrs.</td>
<td>13:50:08 hrs.</td>
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</table>

Notice that SUPER was faster at every task where your time is involved—and saving your time is probably the whole reason you bought a computer.

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PUBLIC DOMAIN
Continued from page 22
mal 243K to 354K (“Single-Density Disk Formatting” Microsystems, October 1983). Willis Howard has written a formatter to create standard tracks of 26 128-byte sectors, or system tracks of 29 128-byte sectors with data tracks of two 2432-byte sectors. A modified

Expand single-density storage to 354K.

SYSGEN and patch to MOVCPM are also included. The BIOS reads and writes either standard disks or dense disks in either drive, adjusting itself automatically. An article on this system will appear shortly in Microsystems.

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25
The UNIX Book

For want of a nail, the horse was lost. For want of a battle, the kingdom was lost. For want of a horse, the battle was lost. For want of a battle, the kingdom was lost.

And so it has been, all through history. Alas, what we have here is another valiant entry in the UNIXbook arena which will probably be lost for want of a seemingly minor detail. The UNIX Book by Mike Banahan and Andy Rutter (Wiley, 1983) is one of the few non-American books on UNIX, and its British flavor adds to, rather than detracts from, the book’s appeal. The authors seem to know the system quite well. They demonstrate use of the common system commands, the standard editor, shell programming, and the like. And this book conveys some sensible philosophy about UNIX.

“UNIX is a well-designed, usable operating system, but it can’t protect users from ill-conceived attempts to produce ‘enhancements.’” Some suppliers feel duty-bound to include their own souped-up editors with the UNIX systems they sell. Are they really doing you a favor?

“If you feel that you must use the flashy editor supplied with your particular system, give some careful thought to portability—both its and yours.... [The UNIX portable software] means that you don’t have to worry nearly so much about details of hardware that differ from one installation to the next. If you start using nonstandard software and don’t have a copy of its source code, you could be in trouble when you move from one piece of hardware to another. Users who know only a nonportable editor (by ‘portable’ we mean one that has been ported, not one that vendors say could be) are at a big disadvantage.”

In this remark the authors convey much significant advice for anyone using UNIX or looking around the UNIX marketplace (or any computer market, for that matter). Portability has both a theoretical and a practical side; if the code could be ported, but won’t be because the software vendor has some stake in a particular hardware vendor or system, then how portable is the program really? This points out the advantage of buying software that is known to be widely ported, not just portable.

The book is organized in a fairly natural manner. There is a brief introduction, a chapter on files, one on the standard editor, the filesystem, filters, text preparation, a chapter on C, one on UNIX processes, system libraries, and system administration. Their terminology will seem quaint; they call a filesystem a “filestore,” for example. And they use “SIO” for “stdio,” the standard I/O library. There is some advice which is interesting but not useful, such as “be wary of the UNIX ‘expert,” who may have learned the system so long ago that his knowledge is out of date.” Fine advice, but how does a novice tell whose knowledge is out of date and whose is in? And, at odds with the spirit of the above advice, “devour the listings of as many real programs as you can” to learn more about C. Folks, many of the “real programs” are real crocks. What you want to do to learn C is to find good program source code examples to learn from. The same page contains the admonition to “read the other books,” which is probably good advice, since some of the chapters in this book do little more than whet the appetite.

One of the things that UNIX is about is not retyping manuscripts once they’ve been proofread. (Although my column gets retyped once at present, this is a temporary—I hope—imposition caused by a change in typesetting services). All the UNIX tools assume that their files are text, so that you can process most any kind of text with the same tools. The phototypesetter software is no exception, and most other UNIX books have been prepared under UNIX using either the troff program or some other package (see below). The Banahan and Rutter book, alas, was apparently not typeset under UNIX. Somebody seems to have laboriously retypeset the entire book from the printouts produced under UNIX. The result, predictable where technical text is concerned, is a typographical disaster.

In this book you are expected to infer a lot from the examples given. But many of the examples are typeset poorly or incorrectly. Spaces appear and disappear; command names change, wrong quotes are used, and so on. There is sloppy typesetting of examples throughout, which leads me to believe that the book was typeset by somebody with no real understanding of UNIX. This is, I hate to say, the worst typesetting job I have seen in any technical book. Ever.

The hand typesetting is reflected in other areas as well. The UNIX Program-
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UNIX FILE
Continued from page 26

my Environment, which I reviewed last month, was prepared and typeset completely under UNIX, and has an excellent index (nine pages, three columns per page) although somebody renumbered the Roman numbers in the front matter after the index was done. The UNIX Book index is but two pages, two columns, large type. Many useful references are omitted from this index. But the appendices more than make up for the poor index. Tables of all the common commands, editor subcommands, shell syntax, a well-organized listing of the system calls and standard libraries, and so on—this is the reference material that you need when learning UNIX.

The authors claim that "very few UNIX sites have access to a typesetter," which is probably more accurate in Great Britain than in North America, where most large UNIX sites either own a typesetter or have access to one. So it's too bad that the authors of The UNIX Book were not able to make better arrangements for typesetting. Of course, a reputable publishing house such as Wiley should have been able to get with better arrangements. If they do so, and come out with a second edition that corrects the poor typesetting, then this book could serve as a good although slightly superficial introduction to UNIX. As it is, The UNIX Book has some very good points, but these are sunk by some very poor visual presentation.

Shell programming considered beneficial

In previous columns I gave a few examples of "shell programming." This time I'd like to comment on the shell as a programming language comparable to Basic, C, or PL/1 in its utility. The shell provides an interactive programming environment like that of Basic, with program structuring comparable to C or PL/1, variables (not limited to two character names!), immediate or stored file execution, file access, etc.

As one example, I needed a prompter for some data entry I am doing on another editing project. It collects bibliographic data (citation, author, date, etc.) on magazine articles. I first wrote it as a C program. This worked, but took lots of time to write and debug. Fortunately, I had to do some of the entry on a UNIX system which (temporarily) did not have enough memory to run the C compiler. Being forced to replace my C program with a shell file made me think a lot about shell files as programs. I was able to replace more than a hundred lines of C with about 30 lines of shell command file. It worked the first time (unlike the C program, which took several tries to get right). Not only that, but after running it for a while I decided to change some parameters. This involved simply editing the shell file; no recompilation step was needed to try out my changes.

I recommend this exercise for any aspiring UNIX programmer. Forego use of the C compiler for two weeks, and do everything as a series of shell files. During this time, learn some of the finer points of shell, awk, sh, pr, nroff and adb (or sdb). During the time my home system was without C, I developed a (nonspoiled) version of lpr which converted backspaces to overscribes and did tab expansion (using only awk and stty), several versions of the bibliography prompter mentioned above, an awk file to generate another awk file to read in and check a database, and other programs.

As well, at work we have replaced several C programs by shell files. To some programmers, this sounds like a step backwards (although it inarguably results in fewer lines of code to maintain!). Part of the UNIX philosophy consists of using the right tool for the right purpose. To me, this includes not inventing a new tool for which a perfectly good one exists. Of course there are tradeoffs between building new tools and using existing ones. My awk-based lpr would not be used on an overloaded timesharing system (but overloaded timesharing systems are supposed to be the ebb tide of the past). Part of the problem with some currently available UNIXes is that their maintainers did not familiarize themselves fully with the existing UNIX tools. Instead, they built a bunch of new tools or disfigured existing ones, rather than building tools out of combinations of standard utilities. The "new tools" approach complicates UNIX both for the end user and for subsequent developers; the use of existing tools in new ways enriches UNIX without building up new mythologies.

The use of existing tools in new ways enriches UNIX without building up new mythologies.

Typesetting from UNIX

UNIX has traditionally been used for preparing material to be typeset directly from computer-readable copy. This text can be checked by various spell checking programs. The UNIX Book was a typesetter's delight. The "new tools" approach complicates UNIX both for the end user and for subsequent developers; the use of existing tools in new ways enriches UNIX without building up new mythologies.

If you want to buy a typesetter, you might consider buying a used C/A/T. They are sometimes available on the used equipment market. There also exists a serial interface which you'll probably need unless you have a Unibus VAX-11 or PDP-11 system. You'll be investing in really obsolete technology, but the troff which comes with your UNIX will know how to talk to it. You'll also need a photochemical processor to develop and fix the paper output—this will probably cost a few thousand more. And you'll need to develop a whole new realm of expertise to get good results.

Instead of a C/A/T, you might buy a more modern typesetter. Brent Byer of Textware in Cambridge, MA, sells a couple of packages for small UNIX systems. Both take the output from the standard troff and recast it for particular devices. Tpost transforms the CAT files into a format suitable for newer machines such as the Compugraphic MCS8400 with a serial interface. One of our customers at work has Tplus and an 8400. While it was not simple to set up, the results have seemed satisfactory to date. Textware also sells Tplus, which makes troff drive a daisywheel printer such as a Diablo, NEC Spinwriter, or the like. Tplus represents the output as best it can on a device with fixed type size but variable motion. For normal
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UNIX FILE
Continued from page 28

Another approach involves Bell Lab's new troff, also called Typesetter Troff or Device Independent Troff (the latter is pronounced "ditroff"); the former is better not pronounced. This is a major revision of troff that can be adapted to many new devices, including both typesetters and daisywheel printers. Unfortunately for the small-system owner, AT&T (Bell, Western Electric) only licenses ditroff in source form, and it's a several thousand dollars. They have a binary sublicense, which would allow OEMs to sell ditroff to end users in binary form for $200 in royalties, but the major porters of UNIX have so far passed over this opportunity (hint, hint).

If you are not taken with troff, you might look at a couple of other packages. Knuth's TeX package can be had for UNIX, as can the SCRIBE package from Unixlogics. Both are rather newer designs than troff, and have about the power of troff with one of its standard macro packages. Both drive a range of devices, including daisywheel typewriters and phototypesetters, from the same input. However, they are much more verbose, and generally offer you much less freedom of action. They are difficult to write preprocessors for. And because they do not expect preprocessors, because they try to be all things to all people, they may be quite large programs. I am familiar with all three, but I have only used troff seriously. Perhaps I'll revisit the topic if and when I've made some real use of them. I doubt I shall use them, though, since SCRIBE babbles on so, while doing even its simplest thing, that it gives new overtones to the term "full-screen software."

There are thus several approaches if you want to do your own typesetting. And if you want somebody else to do it, you have a variety of other ways to proceed. Some typesetting shops will accept troff input files; others will accept output files. There are important issues regarding typefaces and different widths; I suggest you talk these over with your local typesetting firm. Many large cities now have typesetting houses which know what you're talking about. If you can't find anybody in your home town, drop me a line and I'll try to put you in touch with somebody nearby.

Watch for my comments on the UNIX conference in January in the next column, as well as more on "shell programming" and some information on networking. Also, next month's issue of Microsystems will have a directory of UNIX software. Watch for it!

The UNIX File looks at many aspects of the UNIX operating system. If you have comments or questions about UNIX or this column, feel free to write to me at the University of Toronto, Computing Services (UTCS), 255 Huron St., Toronto, Ontario, Canada M5S 1A1. If you have UNIX mail access to the USENET network, you can contact me at "devax@licestaff.
The opinions presented here are my own, and not necessarily those of the University of Toronto or of UTCS. —IAN F. DARWIN
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No matter how dependable your S-100 machine is, it is still susceptible to power failures and line dropouts. A well-designed power supply can save you if the dropout is short enough, but no filter can protect your system for more than a few seconds.

The best solution, of course, is an Uninterruptible Power Supply, but a UPS is also the most expensive. You could also use a good-sized DC-to-AC power converter, then buy a bunch of car batteries and then an AC-powered battery charger and hook them all up, but if you're like me, you'd probably have to sell your S100 frame to get enough money and make enough room for all that stuff. Plus, most "wet" batteries produce hazardous gasses when they are charged, and no one wants a room full of hydrogen gas and sulfuric acid fumes.

My own S-100 system runs 24 hours/day as an RCPM or RMPM, and suffers from line dropouts once or twice each week which, in the past, have caused a lot of grief. The worst problem was that the dropouts were often just long enough to cause the system to "glitch," but not quite long enough for the system to sense a power failure and automatically re-boot.

The solution, which has worked well for the past several months, was to replace the S-100 power supply with batteries. Surprisingly, it is easy to get inexpensive high-capacity sealed batteries in exactly the right voltages for an S-100 system. Five medium-sized "GEL-CELL" type 8-volt batteries, with a capacity of about 2 AMP/hours each, were used in my system: two batteries each for +16V and -16V, and one for the +8V line.

Because power regulation is performed on each individual circuit card in an S-100 system, the power supply voltages to the S-100 bus are not nearly as critical as they are in most other systems where the power supplies usually drive sensitive TTL devices directly. Therefore the battery voltages can vary significantly, as long as they are high enough to drive the S-100 cards' regulators.

Installing the batteries is easy, too, since they can just be attached to the S-100 bus power inputs. Because of their inherent low impedance, they also provide some additional filtering for the power supply. A three-pole power switch must also be added to allow the machine to be powered on and off.

After the batteries are installed, the machine's original power supply is still needed, but now it functions both as a primary S-100 power source and as a battery charger. Should the AC power line fail or drop out for a short time, the batteries will continue to run the system for as long as they are capable.

Of course, there are some parts of the system that can't be run by batteries, such as cooling fans and AC floppy disk drive motors, but many systems (including mine) have DC drive motors and use convection cooling. If your system has to have AC power to run these things, and you still want it to be able to run during a power failure, then you can always use a UPS or try a DC-to-AC power converter, but they will cost a great deal more than simple batteries.

If you want to be able to run the system entirely on batteries instead of just having it stay "alive" during a power failure, you will probably have to add additional batteries to supply the +12V or +24V lines for the disk drives. All my system does during a blackout is interrupt to a power line test routine and stay there until line voltage is restored, so the disk drives don't need to operate until the AC comes back on.

Phantoming and banking

Several readers have written asking the difference between "phantoming" and "banking" memory. Next month's S-100 Bus will discuss these two S-100 phenomenon as they exist in the IEEE-696 standard, and will include some easy ways to add them to any S-100 system. But to quickly answer the readers' questions, phantoming, in terms of the S-100 bus, is performed by just asserting a bus line (called PHANTOM*) that disables one memory block so another may temporarily exist in that block's address space.

Many disk-based systems use phantoming to switch in a boot-up ROM to load an operating system, then switch the ROM back out so that the operating system can have 64K of RAM.
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The IEEE-696 S-100 bus also allows extended addressing (that is, up to 24 bits of addressing) that could be used by an 8-bit processor like the Z80 only if it were treated as bank-selected memory. Unfortunately, because the Z80 can only directly control 16 address bits, extended addressing is of little use unless some nonstandard provision is made for a block of “common” memory—in other words, bank selecting. It is interesting to note that 8-bit operating systems like CP/M Plus and MP/M that require multiple banks of memory cannot operate with extended addressing for the very same reason.

Bank selecting, phantoming, and extended addressing can all live comfortably together in the same S-100 system, although it is unlikely that there
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S-100 BUS
Continued from page 34
would ever be a need for both bank switching and extended addressing at the same time, since either method will allow more memory than any single S-100 frame could ever hold (at least until next year).

Future topics
Along with next month’s phantoming and bank selecting examples, future S-100 Bus columns will include the much promised North Star bus pin-out comparison, more IEEE-696 standard “tutorials,” and simple S-100 interfaces like an S-100 to SASI or SCSI controller interface. However, I depend on reader feedback to set the direction of this column. I encourage reader participation in “The S-100 Bus,” and look forward to your mail and calls. If you would like to see any particular facet of the S-100 bus discussed here, please let me know.

This column is intended as a forum on S-100 bus topics. Readers are encouraged to send in questions on the S-100 bus, which I will attempt to answer. Please write to: Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48203.

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Dear Mr. Libes,

Steven Fisher's article "PIP Data Between Computers" (Microsystems, July 1983) performs a great service to CP/M users and provides insight into an important, but poorly documented, program. He indicates that his approach will work on machines whose CBIOS (Customized Basic Input/Output System) does not implement the reader or punch BDOS functions. Unfortunately, he does not fully describe the procedure for using the console port to transmit files. His suggestion to change BDOS function numbers 3 (reader) and 4 (punch) to 1 (console input) and 2 (console output), respectively, does not work properly.

There are three major problems whose discussion may save other users many frustrating hours.

1. BDOS function 1 (console input) in CP/M version 2.2 echoes the byte received from the "console" port. When this port is attached to a CRT, this echo permits the user to see what was typed. However, when this port is attached to a computer running a program with Mr. Fisher's sequential read/write handshaking protocol, the echo produces undesirable side effects. In a situation with a CompuPro/Godbout Interfacer-4 board transmitting to a Teletek Systemaster, the side effect is for the first character of the original file to be propagated throughout the received file as every other character. This can be explained by the echo of BDOS function 1 and the I/O buffers in the Godbout and Teletek.

The easiest solution to this problem is to use BDOS function 6 (Direct Console I/O) for reading. This function does not echo and uses the value of register E to set reading, as shown in Listing 1.

2. The second problem is more difficult to repair. When PIP completes its file manipulation, it performs a warm boot and returns control to the CCP. Under normal circumstances, this condition is conveyed to the user with the familiar CP/M prompt: A>. What could be more natural? However, when another computer running Mr. Fisher's handshaking protocol is attached to the "console" port, the prompt is transmitted and duly echoed by the receiving computer's CCP, or executing PIPIO program. The sending computer's CCP receives this, fails to find a program (COM file) by that name and sends a response intended for a CRT but which becomes more input to the receiving computer.

LISTING 1

RCV:
NVI E,OFFH
MVI C,06
CALL BDOS
STA 0109
;A HAS CHAR, STORE IT FOR PIP

LISTING 2

LOCATION INSTRUCTION
0100H JMP 0200
0103H JMP 010A
0106H JMP 0150
0109H NOP

;JUMP TO TIME DELAY
;JUMP TO RECEIVE
;JUMP TO SEND
;CHAR FOR PIP.COM

;READ AND WRITE
;ROUTINES

0200H LXI H,FFFF
0203H DCX H

;HL HAS # OF WAITS
;16 BIT DECREMENT

;READ
;COMPARE H AND L

0240H JNZ 0203
0250H MVI A,0CE
0252H STA 0101
0255H MVI A,04
0257H STA 0102
025AH JMP 0100

;LOOP UNTIL WAIT DONE
;REPLACE PIP'S
;ORIGINAL JUMP LOCATION

;GO TO IT

41
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CIRCLE 215 ON READER SERVICE CARD
Continued from page 41

computer. These transmissions of “A”, “>”, “?”, etc., continue ad infinitum.

One solution is to disconnect the cables connecting the two computers, but, aside from the inelegance of this approach, we found that often the receiving computer had failed to close its file at that point and the transmitted file was lost. Our solution was to check every character sent for Control-Z (end of file) and, following its transmission, to alter the appropriate memory locations in the CBIOS of the sending computer so as to route subsequent console output to a harmless device such as a printer.

Two problems with this are (a) the sending computer hangs, and (b) the memory locations to alter are specific to a particular CBIOS, and therefore the program cannot be used on other systems.

3. Using the console means changing cables, but the sending computer begins transmission as soon as PIP.COM and the ASCII file are loaded into memory. On disks with short directories, this requires a high degree of hand-eye coordination to complete the cable change in time. We used a time delay which, because of line noise due to cable changes, incorporated Direct I/O reads. Forcing PIP to perform an initial wait requires the code shown in Listing 2.

The problem of implementing PIP’s INP: and OUT: functions using a console turned out to be much more difficult than we anticipated. Moreover, our solutions required system-specific manipulations that defeated our attempts to produce transportable code.

Perhaps other users have produced better solutions to these problems; if so, we certainly hope they publicize them.

James W. Haefner and Scott E. Kelso
Department of Biology
George Mason University
Fairfax, VA 22030

Dear Mr. Libes,

Having read the article on MP/M 8-16 in Microsystems (January 1984), I thought you might be privy to the solution for implementing WordStar 3.2 on the Altos 8600-12 under MP/M-86 2.11F0. Every 10 minutes or so the machine locks up—no error message or anything; more frequently with more users; sometimes with just one! I have sent away for updates to WordStar and MP/M-86. Meanwhile, Altos doesn’t know how to fix it and MicroPro swears it works. I’ve had my hardware checked out and I’ve used new copies of my originals. I’ve tried making the memory partitions larger (and smaller). Among others, I’ve made the following GENSYS responses:

```
3.2 total character control works: 16 enable compatibility attributes:
(is then SET * OVER & W.S.O)

Temporary File drive B (my hard disk)
Maximum locked records per process = 14
Total locked records in system = 40
Number of extra process descriptions = 60
Maximum paragraphs per process = 600
Number of extra memory description = 60

2000 1800 3800 1600 4000 8000
5000 8000 5000 8000 6000 8000
6800 8000 7000 8000 7800 8000

With the exception of item #1 and the 8000 memory segments, the numbers above are all larger than the default numbers. Any help you can give me would be worthy of publication, for sure—I’ve heard similar complaints from other people.
```

Jeb Bonsteel
Data Manager

Southern Maryland Health Systems Agency
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Clinton, MD 20735

Editor’s note:

If any reader has encountered similar problems, or has suggestions for a solution, a letter would be very much appreciated.

Dear Mr. Libes,

I would like to take issue with the glowing review of Nevada Fortran, written by David L. Dupuy, which appeared in the November 1983 issue. My own experience with that compiler (I have version 2.2) is less than satisfactory. Besides its limitations, which the reviewer notes in passing, it has far more serious problems that were left unmentioned. The most glaring of these is the total lack of context in any error messages. A recent compilation of one of my programs produced this:

```
*** ERROR *** Unidentifiable Statement

No context, no line number, nothing. In order to debug my programs, I have been forced to introduce deliberate er-

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in order to isolate the location of the real ones. Perhaps Mr. Dupuy is beyond the stage of writing code which contains errors; for me, this one problem makes the compiler essentially unusable.

There are other irritations in Nevada Fortran—for example, the fact that when reading in formatted data, input of characters which are inappropriate (i.e., letters when digits are expected) often causes the program to crash, spewing several lines of incoherent error messages to the screen before it dies. Also, Mr. Dupuy reports cheerfully that Nevada Fortran actually beats interpretive Microsoft Basic for speed. What a relief that should be to prospective buyers!

There are other annoyances, but of the kind I expect in a $29.95 product. It is the major error-handling problems which are so devastating, especially given that many buyers may know no other language but Basic and may attempt to use this expensive opportunity to learn Fortran. Good luck to them.

Lastly, I found it distressing that the review, which ended with instructions on how to purchase Nevada Fortran, followed by Ellis Computing's response to the few criticisms Dupuy did mention (they sure respond quickly to a review), was then followed on the next page by a full-page ad for Nevada Fortran and other compilers. While computing systems have traditionally tread the fine line between product promotion and fair criticism, this was too much for my stomach. Microsystems owes more to its readership than the gleeful pushing of mediocre products, while I am spending real money on a real compiler. It's worth it.

Dr. Dupuy replies:

(1) Obscure error messages: the error handling in the compiler could certainly be better. In retrospect, that would have been worth mentioning. I did not have significant problems tracking down errors, so I did not consider it a problem. But for $29 I did not expect it to measure up to a DEC compiler. My usual technique for debugging is to write a "five-liner" if I am unsure of the effects of a given few lines of source code, and debug these small modules separately.

(2) Reading formatted data: as far as I am aware, any Fortran will have problems if a formatted read statement encounters inappropriate data. Some Fortrans (Microsoft?) assign zeros and keep going, and that's worse! You then have a problem and don't know it. I got two error messages with Nevada Fortran while entering alphabetic data on an F format: (a) Runtime error: ILL CHAR, and that seems like an informative error; (b) Program was executing line ???? in routine MAIN. In this error message, I presumed there was a provision in the set-up options that I overlooked to have the question marks replaced by the actual line number, but I didn't attempt to search this out. For most data input, the free form ACCEPT works well. In general, I found the error messages were adequate, especially with the details in the manual nearby.

I personally have no objections to an ad near a review article. That's a question that could be included on a questionnaire to subscribers, if Microsystems puts out another questionnaire.

David L. DuPuy
Assoc. Professor
Virginia Military Institute
Lexington, VA 24450

Dear Mr. Libes,

Andrew Bender's article on adapting older S-100 machines (November 1983) for extended memory was timely and well presented. However, he felt a little short by assuming that the Z80 is limited to a byte at a time when moving data between banks.

It is true that the Z80 cannot move data directly between banks without some extra hardware, but data can be
moved more swiftly by than a single byte at a time. The method I used when implementing CP/M Plus was to set aside a 128-byte buffer in the common area of memory. This allows me to use the Z80 block move instruction to transfer blocks of data at a time, and since I needed exactly 128 bytes of memory for auto disk selection, its use wasn't wasted. Although, since CP/M Plus is relocated to 1K boundaries, the average system probably has at least this much memory wasted anyway.

The procedure necessary to transfer data between banks goes like this: select the source bank, block move 128 bytes into the common buffer, select the destination bank, and finally move the 128-byte buffer to the destination.

If a large amount of memory is to be transferred between banks, such as the CCP, using this method will greatly speed the operation.

Robert Blum
5536 Colbert Trail
Norcross, GA 30092

Dear Mr. Libes,

I am somewhat disturbed at the number of people who present, in a public fashion, an overly simplistic view of the memory management problem in an S-100 system, particularly in connection with CP/M Plus or MP/M. I was prompted to take action, in the form of this letter, by the last-straw effect when I read Andrew Bender's article, "Extended Memory Management for Older S-100 Computers," in the November 1983 issue of Microsystems. While the article is well written and well presented as far as it goes, it covers only the surface of the problem; and the solution presented, in the form of an actual circuit, is thereby inadequate except in the most advantageous of circumstances.

There are two problems which were not addressed in this particular article, and in others I have seen. The first is relatively simple and easily solved, but is nonetheless extremely important in all but the simplest of systems. This problem relates to the use of DMA (Direct Memory Access) devices.

When it has control of the bus, a DMA device must place the addresses it wishes to access onto the bus; this includes, for IEEE-696 compatible devices, the extended address lines. However, many extended addressing circuits presented do not take this into account and constantly assert the upper address lines. There will be no problem in systems with no DMA devices, but since there is a simple solution, it should be incorporated from the beginning to allow for the future addition of DMA devices. The S-100 bus provides a signal known as ADSB* (Address Disable).

This signal is used in the transfer of control to a temporary master (DMA device) in order to disable the address lines of the permanent master (CPU). The output of an extended address latch should be gated by this signal. In Bender's Figure 1, the following changes should be made:

1) DS1 and MD should be tied to ground.
2) DS2 should be attached to ADSB*.
3) OS6* should go through an inverter then to STB.

The second, and more serious, problem is that of the "common memory" required by CP/M Plus and similar operating systems. The existence of this problem was only implied by the Bender article.

It was also implied that the problem would be dealt with by the memory boards themselves. While this may sometimes be the case, it will not always be so, especially with 64K and larger boards. In any event, it needs to be considered, so that it may be dealt with somewhere.

The problem is basically this: switching between banks of memory affects not only access of data, but access of program instructions as well. A solution to this problem is to have a section of the 64K address space refer to the same physical memory no matter which

(Continued on page 138)
MS-DOS 2.0, the enhanced version of 1.1, brings significant improvements in speed and functionality. It also corrects some problems...

by William G. Wong
MS-DOS 2.0 is Microsoft's enhanced version of MS-DOS 1.1, which was made famous on the IBM PC as DOS 1.1. The new version is available on the IBM PC as DOS 2.0, along with a number of other 8088/8086 based machines. DOS 2.0 provides a significant number of improvements over its predecessor in terms of speed and functionality. It also corrects a number of problems encountered in 1.1.

This series on MS-DOS 2.0 will be divided into three articles in order to describe the inner workings in more detail. Part 1 is a general overview, discussing the major improvements and support programs. The new tree-structured file directory system is also explored. Part 2 will touch on the more intimate details of MS-DOS 2.0, including the program's interface and program file structure. Part 3 will cover field-installable device drivers.

Practically speaking, MS-DOS 2.0 is a superset of MS-DOS 1.x. For this reason, this review treats MS-DOS 2.0 as the set of enhancements added to the existing DOS 1.x. Some programs will run only under MS-DOS 1.x, and not under 2.0. This is usually because they access specific locations within the operating system that have changed or are eliminated in the new version. Copy-protected programs are typically in this class, since they bypass the normal system function call procedures.

PC-DOS 2.0 is IBM's rendition of MS-DOS 2.0. This article addresses the generic aspects of MS-DOS, but does not extend to a number of additional programs available with PC-DOS such as GRAPHICS, which allows screen graphics to be sent to the printer, or CLS, which is used to clear the screen. These programs tend to be hardware specific.

This article is divided into three sections. The first section describes the new support programs supplied with DOS 2.0. The second section addresses the UNIX-style command line I/O redirection facility. The third section contains details on the multi-level file system also derived from UNIX, including the programs used to support it.

**New support programs**

**VERSION.** When starting out it is always nice to know where the starting point is. To accomplish this, MS-DOS provides the version command, which simply prints out what version of MS-DOS is running. This will become more important as the number of revisions increases. Right now it just prints out version 2.00.

**CONFIG.SYS.** Although the new configuration file is not really a program in the conventional sense, it is probably the most important new support feature in MS-DOS 2.0. The configuration file is names CONFIG.SYS and is read by MS-DOS when the system is first initialized. The following is a sample configuration file:

```plaintext
BREAK=OFF
BUFFERS=2
FILES=8
DEVICE=ANSI.SYS
SHELL=COMMAND.COM
```

The **BREAK** option tells MS-DOS whether to check from the control-break key only during console I/O calls (OFF, default) or during all MS-DOS calls (ON). The latter is useful in stopping programs such as compilers, which do little console I/O. The **BUFFERS** option sets the number of 512-byte disk buffers to be used by the system. Data which is read or written to a disk passes through these buffers. MS-DOS is intelligent enough to keep track of what is in the buffers so that it will not have to access a disk if the information already resides in one of these buffers. Dramatic speedups can occur when using more buffers, especially when database programs are used. Of course, each buffer added reduces the amount of program space by a corresponding amount.

The **FILES** option specifies the maximum number of file "handles" that can be used at one time. Handles are 16-bit binary values that refer to a file accessed using the new MS-DOS UNIX-style system calls. These will be described in more detail in Part 2. The **FILES** option has no effect on the number of files that can be accessed using the conventional file control block (FCB). The **DEVICE** option is used to load device drivers as part of the operating system, thereby making them available to the user. The new drivers can be used to access new peripherals or enhance access to existing peripherals. **ANSI.SYS** is a sample device driver supplied with PC-DOS 2.0, the IBM version of MS-DOS 2.0, which replaces the standard console driver. It enhances the console support by adding ANSI-compatible control functions, but the biggest advantage of the **DEVICE** option is that hardware vendors can now supply (with their hardware such as hard disks or local area networks) device drivers that do not modify the operating system directly, as was done with 1.x. Also, changing device drivers is now simply a matter of changing the CONFIG.SYS file.

Finally, there is the **SHELL** option. This allows the default shell, COMMAND.COM, to be replaced with a new user interface. The new shell can be more or less powerful than the default shell, depending upon the designer. It is now possible to present a menu-driven system to the user, who may never know that the base system is MS-DOS.

**BACKUP.** Although hard disk support with tape or cartridge disk backup has been available for MS-DOS systems, floppy disks are still the backup method for most systems. MS-DOS 2.0 now includes two new programs to help standardize this backup process. These programs are appropriately called **BACKUP** and **RESTORE.** As with most 2.0 software, there are a host of options using cryptic switches. For example, the following command line:

```plaintext
BACKUP C: \WORKFILE\SOURCE -A: /S /M /A: <D:02-01-83
```

will use floppy drive A: to back up all files from drive C: in the directory WORKFILE with the filename SOURCE and any extension. All subdirectories (/S) will be included. Only files that have been modified (/M) will be copied, and the date associated with the file must be equal to or greater than February 1st, 1983 (/D:02-01-83). The new backup files will be added (/A) to any that already exist on the floppy. The syntax for **RESTORE** is similar.

**RECOVER.** Although directory corruption is rare when a system runs properly, there are times when the system may crash—for example, when lightning strikes a nearby powerline. The **RECOVER** program gives some help in the event that the directory has been zapped. It will read the disk directory and try to reconstruct files. The resulting files are a multiplicity of the block size used with the disk, so there may be additional garbage at the
MS-DOS
Continued from page 47
end of a file. Text files restored in this
fashion can usually be fixed up with the
aid of a word processor. The recovery
process is not always complete, but at
least there is now a prayer.

ASSIGN. Speaking of prayers, it
has always been frustrating to use appli­
cation programs that have been written
to run only on specific disk configura­
tions, and to find that these do not
match the one on hand. The ASSIGN
command has been added to alleviate
some of these problems. ASSIGN al­

dows logical drive names to be assigned
to any physical drive. It is even possible
to have multiple logical drives assigned
to one physical drive. What use is this?
Well, consider a home finance program
that is written in assembler so it cannot
be modified. It assumes that support
programs will be on drive A: and data
files on drive B: This works great with
two floppy drives, but we want to use
drive E: which is a brand new hard disk.
What to do? Enter:

ASSIGN A=E, B=E, C=A, D=B

and presto, the hard disk looks like
drives A: and B: and the floppies can
still be accessed as C: and D: The appli­
cation now runs fine, and the whole pro­
cess was done without too much
heartache.

VERIFY. The VERIFY is another
command which helps to reduce the
problems encountered with disk-based
systems. Setting VERIFY ON makes
MS-DOS read back all data which is
written to a disk to make sure that the
information really has been written. Al­
though most disk systems are very reli­
able, many organizations require the
more dependable operation provided by
VERIFY. Most applications do not
have this type of option, but, fortunately,
MS-DOS 2.0 does. It can also be
turned on and off at anytime as needed.

CTTY. Microsoft's enhancements
are not confined to the disk area. The
CTTY program has been added for
those people who like to use more than
one console—e.g., a CRT display for
normal text processing and a printing
terminal for recording the output of a
particular program. It is even possible
to communicate with a remote terminal
through a modem, since CTTY accepts
any character-oriented device as a pa­
rameter.

PRINT. The PRINT program is
another nondisk enhancement that ev­
eryone has been waiting for. It provides
a background print spooling facility to
MS-DOS. Without it, you can watch
your $5,000 computer sit and print for
hours. Now it is possible to let it print
and still use the machine for other pur­
poses. The current incarnation allows
up to 10 files to be placed into the print
queue. Just make sure that you do not
delete, rename or alter any files to be
printed, remove the disk containing the
files, or use the printer via a program—but what did you expect out of
a single-tasking system? Even so,
PRINT is an extremely useful option
and probably the one which will get the
most use.

BATCH. Finally, there is an en­
hanced batch processing facility, again
akin to that of UNIX. Batch files are
text files that can be created by most
word processors. They are essentially
programs with a limited vocabulary.
The following batch program is an ex­
ample of what the new batch file sup­
port can do.

REM This is a sample batch file
which will print on the
REM console each file on drive A:
REM file type. The command line
may contain any number
REM of file types or the command
SWITCH. The latter
REM will allow you to change the

\[ \text{FIGURE 1.} \]
display of the command file when it is run. In this case, turning ECHO off will let the system print all the lines up to and including the ECHO OFF line. The remaining portion of the batch file will not be printed; however, data printed by the PAUSE and TYPE programs will be displayed. ECHO can also be used to print any string (except ON or OFF) on the screen, too.

Moving down the program, the BREAK command performs the same operation as in the CONFIG.SYS file mentioned earlier. Next there are the IF and GOTO/label commands. These are the major additions to the batch file support. IF allows various conditions to be tested, the command following being executed only if the condition is true. The current conditions are limited to single string comparisons, checking to see if a file exists, and checking the result code from the previous program. In this case, the program is checking the first parameter (%1) to see if it is not the string SWITCH, in which case the GOTO command is executed. The GOTO command is followed by a "label" that must appear somewhere in the batch file preceded by a colon (:) which must be in the first column. Program execution will then shift to the line after the one containing the label. If the first parameter (%1) is SWITCH, the GOTO will not be executed and processing will continue on the line after the IF command; otherwise, the PROGRAM will GOTO label SKIP.

Next there is the PAUSE command, which prints the text following it and waits for a character. This allows the user to control the execution of the batch file. The PAUSE command in the example is used to let the user change disks before proceeding. The GOTO command is used to logically move all the parameters on the initial command line one place to the left, throwing away the one initially on the left end. For example, assume the sample batch file is named LISTEXT and the following command line was used to start the batch file.

```
LISTEXT ASM LST SYM SWITCH BAK END
```

Table 1 shows the values of the parameters initially and after executing a number of SHIFT commands. Note that the name of the batch file is initially parameter 0 (%0).

Note how the SHIFT function is used in this example. The first parameter (%0) is used through each iteration of the loop to hold either the filetype or one of the commands (SWITCH or DONE). The SHIFT function is used later to get the next command or filetype. The SHIFT function can also be used to access parameters in excess of the 10 (%0-%9) allowed by MS-DOS. For example, the sample batch program can take any number of arguments as long as they fit in one command line.

The FOR function is another very useful tool that is used in the sample program. The third parameter in parentheses can be a set of ambiguous filenames using the wildcard characters "*" and "?" separated by commas. FOR assigns the batch file variable (%%F), a matching unambiguous filename from the directory which matches a name in the set and then executes the command following DO, which usually contains the variable in one or more positions. This process is repeated until all matching names in the directory have been found and used. In this particular example, the batch file program will type all the files whose extension matches one of the parameters.

Batch files are extremely useful, and the MS-DOS implementation is very powerful. It can replace quite a bit of typing with one command line.

**Command line I/O redirection**

Command line I/O redirection is a facility used in UNIX which has been moved to MS-DOS. It allows a user to specify the source or destination of character data from a program when it is started from a command line. By default the source is the keyboard and the destination is the display screen; however, MS-DOS now allows these to be any text file.

There are a number of things to keep in mind, because the scheme is not foolproof. For example, programs must use the standard system input and output routines and must examine the command line with care. Also, MS-DOS will hang if a program is waiting for input after the end of the file has been reached. However, these are not always major concerns. The programs supplied with MS-DOS support the I/O redirection, as will many others. Now we’ll talk about how and why it works.

The redirection is specified in one of two ways. The first is to place in front of a filename one of three prefixes: "<", ">", or ">". The first (<) indicates that the file is to be used as the standard input source. The other two indicate that the file is to be used as the standard output. These differ in the way that the
output file is manipulated. The “>” prefix will create a new file or overwrite an existing one. The “>>” prefix will append the new information to the end of an existing file; otherwise it creates a new file. The following are some examples using these prefixes. Note that, since MS-DOS allows devices as filenames, it is possible to say “direct output to the printer (PRN).”

```plaintext
DIR >PRN
DIR >ORILIST
SORT >UNSORTED.TXT >SORTED.TXT
SORT >EXTRA.DAT >>SORTED.TXT
TYPE FOOTER.TXT >>SORTED.TXT
```

The second way to specify redirection is to use what has been called a “pipe.” In this case, more than one program is started with one command line. UNIX does this in parallel, but MS-DOS does it sequentially. The character “|” is used to separate the commands. For example:

```plaintext
DIR | FIND '".ASM"' | SORT > LIST.ASM
```

In this example the three programs are DIR, FIND, and SORT. This one command line is equivalent to the following five command lines, which are much more confusing:

```plaintext
DIR >PIPE0.$$$
FIND '".ASM"' >PIPE1.$$$
ERASE %PIPE0.$$$
SORT <PIPE1.$$$ >LIST.ASM
ERASE %PIPE1.$$$
```

Essentially, “|” connects the standard output file of the program to its left to the standard input file of the program to its right. In MS-DOS, this file is an actual file placed on the default drive. In UNIX, the programs are connected directly together and no disk space is required. Even so, using pipes with MS-DOS can save a lot of typing and make commands much easier to understand.

Another thing to note is that MS-DOS does not support multipole designations for the standard input and output files. Therefore, the “>” and “>>” file prefixes should not be used to the left of a pipe (“|”) and the “<” file prefix should not be used to the right. Also, there should not be multiple occurrences of any redirection characters within a command.

Programs written especially for use with pipes are called “filters.” A filter program is one which uses the standard input to generate data for the standard output, using parameters on the command line. MS-DOS comes with three filters: FIND, SORT, and MORE. FIND takes a parameter string in double quotes. Any text line containing the string will be sent to the standard output file. SORT reads each input line and sends these lines to the standard output in ascending order. MORE reads the standard input file and prints out one screenfull at a time, waiting for keyboard input after typing “—MORE—” at the bottom of the screen.

I/O redirection and filters are tools that programmers will like to use. They can be applied to applications especially when coupled with the batch file facility. Most people using general applications will not need or understand the power of these features; however, they are nice to have around.

**MS-DOS 2.0 hierarchical file system**

Although the idea behind the hierarchical file system has been around for quite some time, there have been a limited number of implementations on micro-based systems. MS-DOS now includes the support for all disk-based systems. Each disk drive has a “root” directory that has no name. This “root” directory can contain either data files or subdirectory files. Data files are those we have all come to know and love. The subdirectory files are the enhancement. Instead of containing data, these files are directories just like the “root.” They can contain data files as well as subdirectories.

Figure 1 shows a graphical view of a multilevel file system. Note that each logical disk drive has a “root,” which means that a multidrive system does not have just one tree but a whole forest. In fact, hard disks which are partitioned into many logical disks have their own groove of trees.

Although there is no theoretical limit on the number of drives or the depth of a tree, MS-DOS 2.0 does place some practical limits on both. MS-DOS 2.0 limits the number of logical disk drives to 63, and it limits the “path” name to 63 characters. A path name is the list of directory names and the name of the file in the lowest subdirectory. The names are separated by a backslash (\). The following are examples of path names.

```plaintext
\SYSTEM\GRAPHICS\DEMOS \ACCOUNT\NEW\SUMMARY.LST \SALES\REPORTS\REGION1\EAST.BAK
```

All filenames have the same format as in MS-DOS 1.x—i.e., a filename of up to eight characters, followed by an optional period (.) and file extension up to three characters long, for a total of 12 characters. This means you almost get four levels of subdirectories if all the filenames are of maximum length. Since they are typically much shorter, you can count on about seven levels, which is usually more than anyone ever uses.

MS-DOS also allows the parent directory and the current directory to be used in path names. These directories are referred to using two periods (..) for the parent and one period (.) for the current directory. These names are used just as normal subdirectory names.

MS-DOS has a number of commands to support the hierarchical directory system. MKDIR is used to create subdirectories, while RMDIR is used to remove them. RMDIR can be used only if the subdirectory is empty. CHDIR is used to change the current default directory on the default drive. TREE is used...

### Table 1. Parameter values

<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Initial value</th>
<th>One shift</th>
<th>Two shift</th>
<th>Three shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>%0</td>
<td>LISTEXT</td>
<td>AMS</td>
<td>LIST</td>
<td>SYM</td>
</tr>
<tr>
<td>%1</td>
<td>ASM</td>
<td>LST</td>
<td>SYM</td>
<td>SWITCH</td>
</tr>
<tr>
<td>%2</td>
<td>LST</td>
<td>SYM</td>
<td>SWITCH</td>
<td>BAK</td>
</tr>
<tr>
<td>%3</td>
<td>SYM</td>
<td>SWITCH</td>
<td>BAK</td>
<td>DONE</td>
</tr>
<tr>
<td>%4</td>
<td>SWITCH</td>
<td>BAK</td>
<td>DONE</td>
<td></td>
</tr>
<tr>
<td>%5</td>
<td>BAK</td>
<td>DONE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>%6</td>
<td>DONE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
to display the directory at multiple levels, whereas DIR only displays one level.

The multilevel directory system does complicate matters slightly, since programs are often partitioned in a fashion other than by the way they are used. For example, all the compiler files may be in one subdirectory, while general programs are in another and linker programs in a third. Trying to use all three at the same time means that the default directory must be changed when accessing a different program, which can be quite tedious. MS-DOS supplies a list of directories to search if a program is not found in the current directory. The PATH command is used to solve this problem. The parameters to PATH are a list of directories to search if a program is not found in the current directory. The following is an example to fix the aforementioned situation:

```
PATH A:\SYSTEM, B:\COMP\L\ER\PASCAL, B: L\INKER
```

Note that drive names may be included with the PATH parameters, allowing programs to be split over a number of different drives. This is especially useful for floppy-based systems, and it also comes in handy for hard disk-based systems.

Although MS-DOS 1.x disks can be used with MS-DOS 2.0, the reverse is not true, because 1.x does not support the multilevel file structure. The remaining portion of this section deals with the new data structures on the disk used by MS-DOS 2.0 to support subdirectories and also partitioned hard disks. Note that the latter implementation is taken from the IBM PC-DO S 2.0 implementation, which may differ from other implementations. However, it is a good reference point to work from.

A physical disk may be partitioned into one or more logical disks. Each logical disk contains one logical multilevel directory system. This is implemented by partitioning the disk into the variable size sections, shown below.

MS-DOS disks are allocated in 512-byte blocks, and each section is made up of one or more of these blocks. All sections are a fixed size for a particular file allocation and do not vary. Data files and subdirectories are located in the Data Area and allocated dynamically. This process is discussed later in more detail.

The Boot Section on the boot disk is used only when the system is first initialized, and is accessed by the boot program normally located in read-only memory (ROM). This section usually contains an extended boot program which knows the MS-DOS disk structure and how to load the main resident parts of MS-DOS contained in the files DOS.COM (Disk Operation System) and BIO.COM (Basic I/O system). These, in turn, check the configuration file, CONFIG.SYS, and load the shell program, which is usually COMMAND.COM. In theory, only one disk need have the Boot Section. However, in practice, all disks have the Boot Section allocated for the sake of consistency.

There are two File Allocation Tables (FATs) for redundancy. They are normally identical except when they are being updated or if they have been corrupted in some fashion. Keeping a redundant copy of this table allows the RECOVER program to be more efficient when trying to restore a corrupted disk. Only one copy of the FAT is kept in memory by MS-DOS for each disk, and the two copies on the physical disk are updated one after the other, as required.

The FAT is referenced by the "root" directory and its subdirectories. Each file has a directory entry in either the "root" directory or one of the subdirectories. This entry refers to the FAT, which has a one-to-one mapping between it and the data area. Each directory entry is 32 bytes in length and has the format shown in Table 2.

| Boot Section |
| File Allocation Table 1 |
| File Allocation Table 2 |
| "Root" Directory |
| Data Area |

is used to indicate whether the directory entry can be used for a new file (00 and E5) or whether it is allocated as a directory entry (2E) or as a normal file entry. There are two indicators for unused entries for efficiency reasons. The directory is initially filled with zeros (00 is one of the flags) and the directory is always filled from the front to the back, making first use of entries flagged with E5 for new files. Therefore, directory searches can terminate whenever an entry with a zero flag is found, since no files can be allocated past this point. The references to the parent directory are used to support the ".." path facility.

All files are dynamically allocated, and the FAT is used to keep track of the allocation. The FAT is organized as an array of 12-bit entries (1.5 bytes/entry). The first two entries (3 bytes) are reserved for the disk description. In these entries, the last two bytes are always OFFF hex; the first byte is described as shown in Table 3.

All remaining FAT entries are used to designate free space or allocation for a particular file. Actually, reserving the first two entries wastes no space, since this is used for the "root" directory area. Each FAT entry corresponds to one "cluster" in the Data Area. Ownership of an FAT entry by a file indicates that the matching "cluster" in the Data Area is part of that file. The FAT index in the directory entry for a file indexes the first FAT entry for the file. This entry contains the index of the next FAT entry for the file and so on. The last FAT entry in this chain contains a value from FF8 hex to FFF hex. Any data record in a file can be found by computing the "cluster" number from the data and then searching the file's allocation chain in the FAT to find the appropriate "cluster." The data is contained in the sectors of the corresponding disk area.

MS-DOS keeps track of unallocated clusters by placing a 000 hex in the entry. Bad sectors that will generate hardware errors are flagged with an FF7 hex so they will not be used. Figure 2 shows a portion of a sample FAT with allocated, unallocated and bad sector entries.

The term "clusters" has been used in the previous discussion but not really defined. Essentially, a cluster is a fixed-size block of disk sectors. A cluster may be one or more disk sectors, depending upon the implementation. Hard disks tend to have larger clusters than floppy disks because of their greater storage capacity. The disk capacity comes into play because the maximum number of entries in an FAT is 4,096 (less reserved locations 000, 002 and FF0-FFF hex). The cluster size is therefore usually larg-
MS-DOS
Continued from page 51
er than the disk capacity divided by 4,096. The maximum size of a FAT is 6,144 bytes, or 12 512-byte sectors assuming all 4,096 entries are needed.

Increasing the size of a file entails finding a free cluster and adding it to the end of the file's FAT chain. A file is deleted by changing each entry in its FAT chain to zero and placing an E5 hex in the directory entry.

Note that the cluster size is essentially the minimum file allocation size. Even if a file uses only one byte for its data, it is allocated one cluster, and the unused space cannot be accessed by another file. Even so, the ability to dynamically extend the size of a file greatly outweighs any possible waste of space.

One interesting point about the hierarchical file system under MS-DOS 2.0 is that there no longer seems to be any restriction on the number of files a disk may contain, assuming there is sufficient space. Although the "root" directory is a fixed size, all subdirectories are normal files whose length can be dynamically extended. Therefore there is no limit on the number of files a subdirectory can contain; however, a limit is imposed by the FAT structure; this limit is not always mentioned. Remember that the FAT is limited to 4,096 entries, and any file must use at least one FAT entry. Since 18 are reserved for various purposes, that leaves 4,078 entries. This means that you can have 4,078 files that each use one cluster, one file that uses all 4,078 clusters, or something in between. In any case, this limit will be encountered only on a hard disk with a large Data Area—but beware!

MS-DOS 2.0 can be told to use a number of buffers for disk caching by using parameters in the CONFIG.SYS file as mentioned before. It uses these buffers for data and directory information as well as the FAT tables. This means that a system with few buffers can still access a hard disk with a large directory and FAT. Increasing the number of buffers means that more of the directory and FAT can be resident. This makes MS-DOS 2.0 fast when accessing sequential files because the location of subsequent clusters can be found by looking at the memory-resident FAT. Unfortunately, the FAT access method falters under random access use, especially when a number of disk drives are in use at the same time and few buffers are available.

The random access mode means that subsequent file references can be made at any point in the file. Finding this point must always be done by sequentially searching the FAT. Since a large file usually requires a large FAT, randomly accessing the FAT means that a large number of buffers are needed or a number of additional disk accesses are needed to find the desired cluster. This time/space tradeoff can be critical in some large database applications. In these instances, it may be helpful to buy more memory and increase the number of buffers available to MS-DOS.

Overall, the new file system represents a major improvement over MS-DOS 1.x. It is more flexible and easier to use than its predecessor and offers a number of tradeoffs that can be made by the user. We will have to wait and see if MS-DOS 3.0 removes some of the limitations in MS-DOS 2.0.

Summary
MS-DOS 2.0 as a whole is a major improvement over 1.x. Its implementation on the IBM PC has made it a de facto standard to which most major manufacturers conform. Most of the enhancements will be exploited only by the designers and programmers, but users will benefit by the improvements in the applications provided by 2.0. Part 2 will discuss how to gain access to these enhancements at the program level.

William G. Wong, 902B Merritt Drive, Somerville, NJ 08876

Table 2. Directory entry formats

<table>
<thead>
<tr>
<th>Offset</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
<td>Filename, of which the first byte is a status flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Byte 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>00 hex</td>
<td>Entry never used</td>
<td></td>
</tr>
<tr>
<td>E5 hex</td>
<td>Entry erased</td>
<td></td>
</tr>
<tr>
<td>2E hex</td>
<td>Directory entry; if the next byte is also a 2E hex, the FAT index points to the parent directory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>other</td>
<td>First character of the filename</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Offset</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>1</td>
<td>File attribute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bit</td>
</tr>
<tr>
<td>0</td>
<td>Read only</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Hidden file</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>System file</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Filename is volume label (only in &quot;root&quot; directory)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Subdirectory</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Not archived</td>
<td></td>
</tr>
<tr>
<td>6-7</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Offset</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>2</td>
<td>Time of creation or last update</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bits</td>
</tr>
<tr>
<td>0-4</td>
<td>Two-second increments</td>
<td></td>
</tr>
<tr>
<td>5-10</td>
<td>Minutes (0-59)</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>Hours (0-23)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Offset</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>2</td>
<td>Date of creation or last update</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bits</td>
</tr>
<tr>
<td>0-3</td>
<td>Day (1-31)</td>
<td></td>
</tr>
<tr>
<td>5-8</td>
<td>Month (1-12)</td>
<td></td>
</tr>
<tr>
<td>12-15</td>
<td>Year offset from 1980</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Offset</th>
<th>Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>2</td>
<td>FAT index</td>
</tr>
<tr>
<td>28</td>
<td>4</td>
<td>File size in bytes (least significant byte first)</td>
</tr>
</tbody>
</table>

Table 3. Disk description byte

<table>
<thead>
<tr>
<th>Hex value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF</td>
<td>Double-sided 8 sectors/track disk</td>
</tr>
<tr>
<td>FE</td>
<td>Single-sided 8 sectors/track disk</td>
</tr>
<tr>
<td>FD</td>
<td>Double-sided 9 sectors/track disk</td>
</tr>
<tr>
<td>FC</td>
<td>Single-sided 9 sectors/track disk</td>
</tr>
<tr>
<td>F8</td>
<td>Fixed hard disk</td>
</tr>
</tbody>
</table>
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DEALER INQUIRIES WELCOME.
Recently MS-DOS has been honored by Digital Research in an indirect fashion: they have made their software compatible with MS-DOS. This is not a bad idea because MS-DOS is to the 8086/88 what CP/M is to the 8080/85/Z80. Recently I had the opportunity to test the Godbout 8086/87 CPU board. I brought up CP/M-86 under that system and tested it. A few weeks later I got a review copy of MSPRO, an MS-DOS adapted for an S-100 system using the CompuPro 8085/88 CPU. The adaptation is by Computer House. It includes a new PROM for the Godbout Disk-1 Controller, a modified Lomas Data Products LDP-72 Disk Controller Board, a 5 1/4" disk drive with a cable to connect it to the LDP-72, as well as Microsoft’s MS-DOS and documentation. In case you don’t already own one, the GO 86 PROM used to initiate operation of the 8085/88 board is also included.

**System considerations**

The Lomas disk controller board (DP-72) can drive both 8" and 5 1/4" disks at the same time. Thus it is possible to only a Lomas LDP-72 in a system with mixed disk sizes. Computer House has modified the LDP-72 so that it works properly with MS-DOS. The modifications consist of some new wire jumpers on the board and a new IC in a spare socket. The new PROM for the Godbout Disk-1 board allows you to boot with either MS-DOS or CP/M. I could cross boot any system I wanted to without problems: CP/M-86, CP/M-80 and MS-DOS all came up properly with the new PROM.

You are expected to supply the CompuPro 8085/88 system with enough memory (at least 192K if you want to do anything serious with the system) a System Support Board for console I/O, and a clock as well as the address for the GO-86 PROM. If you want to use a printer—and who doesn’t—you will need an Interfacer 3 or 4 card, which I do not own.

That is a lot of hardware. I had done business with Computer House before and they sent all of this stuff to me for evaluation, which they expected me to do in three weeks. Alas, I make my living doing other things, so I couldn’t possibly do an evaluation properly in that time.
I thought it would take me at least one week to get the hardware up and running but I was wrong—it took 20 minutes. One thin manual contained step-by-step instructions for getting the system up and running without a nervous breakdown. Not only did the system run after the steps were followed, but the manual didn’t read like "Advanced Topics in Brain Surgery." One thing you must do is set the switches on your Disk-1 controller card to indicate that you are using the System Support Board serial port as the console device. The manual doesn’t say so, but the first thing you should do when your MSPRO system is up and running is to make a backup disk. I almost forgot this basic safety procedure and might have been left with a non-bootable system.

MS-DOS 2.0 has many features not present in the first 1.0 system. It offers multilevel named directories, a rudimentary system of pipes and filters, I/O redirection and what will probably be a very powerful queuing mechanism for I/O requests. None of the I/O dispatching routines are yet implemented—but they will be, and when they are MS-DOS will have the capability for multiprocessing and concurrent operations. MS-DOS 2.0 is a bit like XENIX, Microsoft’s version of UNIX.

The system did exactly what the manual said it would, and I had a running MSPRO/MS-DOS version 2.0, except I couldn’t print anything. I looked for the assembly language driver routines and installation material which, according to the manual, were supposed to be included and—you’re right—they were not there.

There was a file on the disk which described the device drivers and how they work under MS-DOS. There were instructions for writing the drivers, and I listed them out over and over on my CRT, reading them until I had an idea on how to write a printer driver for my Interfacer 1. I must admit there were some unclear areas which I resolved with Chris Cochrane, the person who wrote the MSPRO drivers. Once these areas were cleared up, the print driver was installed in several more marathon debugging sessions lasting at least nine hours.

I was glad to have this experience because suffering builds character! I had to read the manuals carefully. There are no instructions in any of the manuals as to how you are to interface with MS-DOS from a user program. I know that in MS-DOS 1.2 you use interrupt 21 and some other interrupts, but that is not even mentioned in the 2.0 manuals. Absent also are the necessary data structures to communicate with MS-DOS.

**MS-DOS is a bit like XENIX, Microsoft’s version of UNIX.**

Later, the folks at Computer House confided that this was the very first version 2.0 MS-DOS system that they had shipped and that the manuals were not in "sync" with the system. This is not great, but if you want the latest working system, it is tolerable.

**The editor and assembler**

EDLIN, a thinly disguised version of ED, was equally irritating. There are lofty descriptions of how EDLIN is powerful (translates to "almost unusable") and useful. I suppose that when it is the only editor you have, it is all of these things. There are better editors, but I didn’t have any of them, so I did all my work with EDLIN and was not above the muttering of an occasional obscenity. EDLIN works with some mysterious function keys which are not described. The MS-DOS manual suggested trying the keys on the keyboard to find those keys that subserved the special functions. Lots of luck! Why didn’t they just give the sequences so that I wouldn’t have to waste my time? So much for EDLIN.

MASM is the 8086 version of M-80 and is well documented and implement-ed. It works well and provides a wide range of useful directives (pseudo-operations). There is a macro facility that works like the Intel assembler macro generator in MAC and M-80, the 8080 assemblers. A wide range of listing directives allow for convenient debugging of not only macro-generated code but also the variable-length instructions that can cause problems if the operands are not defined properly. Strict adherence to the Intel mnemonics makes this assembler a proper development tool. Digital Research’s assemblers (RASM86 and AS86) do not support macros nor the complete set of Intel mnemonics—they cheat on FAR and NEAR calls and returns.

**Writing MS-DOS device drivers**

I assembled my driver with MASM. I was surprised at the speed of MASM. It was running under MS-DOS and was at least 20% faster than AS86 running under CP/M-86. It is bigger than bigger than AS86, but who buys a "small" 8086 system? The system requires that the I/O drivers be in .EXE format so you have to process them with MLINK—the linkage editor. LINK converts relocatable .OBJ files into .EXE files. An .EXE file is an absolute memory image of a program with enough information to allow for some positioning in memory when it is loaded. This was fast, too, but then again there were no other relocatables being collected.

After creating my print drive in .EXE format, I just needed to link it into the device driver chain by mentioning it in the CONFIG.SYS file. I did this and to my surprise (and I am sure to yours, too) it didn’t work. Because CONFIG.SYS is processed during booting, the system would not come up. Thanks to the miracle of backup copies I could boot my backup disk, rewrite my CONFIG.SYS and continue my development.
MSPRO
Continued from page 55
Adding any additional I/O drivers to MS-DOS 2.0 means that you will have a separate file for every additional driver or complex of drivers installed. This could mean a lot of driver files in a complex system. For example, if you add a hard disk, a semiconductor drive and another printer, you will need three more files. There is no BIOS as in CP/M, so that customizing your existing hardware is not trivial. As an example, I wanted to bring up my console on the Interfacer 1 rather than the System Support Board. Forget that, it's built into MS-DOS. Each nonresident I/O driver is installed during booting by the system initialization function. This program reads a configuration file and in-

Set the switches on the Disk-1 controller card to indicate you are using the System Support Board serial port.

stalls each I/O device as specified in CONFIG.SYS, which is an ASCII directive file. If a device is installed from CONFIG.SYS that has the same name as a resident device, the device configured in CONFIG.SYS overrides the resident device.

Reading the instructions in DEVRIV.DOC—a file of documentation on the disk—is supposed to impart sufficient knowledge to allow anyone to write a driver and install it. There is one drawback—if a driver is installed, it is hard to test. If it cannot be installed, the system either bypasses the driver or just hangs up. For those of you seeking sleepless nights, read no more; just try it on your own. If you want to save time, I have included a skeleton driver (Listing 1) and the following advice:

1. Code the entire driver in the code segment bank.
2. ASSUME CS:CSEG.
3. Pay little attention to the driv
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AUGUSTA, Ada subset compiler from Computer Linguistics for Z-80 CP/M 2.2 systems, $90.00

“Starting FORTH” tutorial by Brodie, softcover, $16.00.

INTEL 8087 Numeric Coprocessor, $250.00

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MS PRO

Continued from page 56

in the initialization section about returning the last address in the driver in DS:DX.

System performance

I made some speed tests with MS PRO. It is fast. It is about 30% faster than MS-DOS 1.2 running on a PC. It is at least this much faster than concurrent CP/M for the PC with only one task.

Reading IBM PC disks is a big advantage of MS PRO. So what? Most of this software is so dependent on the PC that it won’t run properly on any other machine. Yes, there is quite a bit that is not PC-dependent, but then again most of that is in multiple formats. I used the little disk only a few times. My MS PRO disk was only single sided, so I couldn’t read any of my files from my office PC. I understand that Computer House offers a double-sided drive for a few bucks more.

Conclusion

In summation I rate the implementation of MS PRO (MS-DOS by Computer House) as good. It would be much

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Benchmark data based on EightQueens in “Algorithms + Data Structures + Programs” by N.Wirth, run on an IBM PC.

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My system is: 8 bit     16 bit
Operating system: CP/M 80     
CP/M 86  MS DOS  PC DOS
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Enhancing MP/M II: A Batch Processor

You can assign different passwords to each file. You can also set a default password for yourself that the system will attempt to use with any files that are password protected. There are many situations in which this type of file protection is good, but it is no substitute for keeping unwanted people out of the system entirely. Since you cannot password protect resident system processes, MP/M allows them to be run without any form of protection. There is also the danger that the default password will still be set to that of the previous user, leaving the system wide open. I desired a system that could keep all unwanted users from logging in. It would assign to the user the correct user number, on the correct disk drive, with the correct default password for his application. Finally, it would even have the ability to start an application program associated with the login.

For my first attempt at providing this service, I wrote a resident system process that attached to all consoles after system boot. Under normal circumstances the Terminal Message Process (TMP) is attached to each console when the system boots. The TMP is the pro-
cess that accepts your command line and sends it to the system. If you want a program to take control instead, it is only necessary to write a Resident System Process (RSP) that has a higher run priority than the TMP. This could then be made to detach from a console only after you logged into the system and to attach to your console when you logged out.

While this method works, it has several drawbacks. In the first place it takes up additional space in the common memory area. It also gives you no control over what the user does once he is logged in. I realized that the best place for this function was within the TMP itself. This way the TMP would have some control over the commands that the user issues, allowing different levels of privileged operation.

If you are not logged in, the TMP should accept only a login request. Once you are logged in, the TMP would have the first crack at checking your command line. If it saw something it did not like, it just wouldn't pass it on. This is a simple concept. That is, it is simple if you have the source to the TMP. Needless to say, I didn't have the source, so I wrote Digital Research to ask if I could buy it. Now, I won't say that they were rude (well, maybe close), but the answer was NO.

The MP 1M II manual, although much better than that of 1.0, does not tell how to write a TMP. I had to know how the TMP was connected to the system. It took several months of investigation before I learned enough about how the TMP works to be able to write a replacement. My special TMP, soon to be a UNIX-like shell, is not the main topic of this installment. It is, however, important that you be aware of it when demonstrating BATCH. You are about to see MP/M do things that it is not supposed to do. If you are a MP/M user, you may not even recognize your operating system.

If you are familiar with CP/M's SUBMIT and XSUB, you may be surprised to find out that MP/M's submit facility is nowhere near as elaborate. There are several SUBMIT replacements available now, but most will not work correctly under MP/M. Even the ones that would work under MP/M fell short of what I wanted. I wanted a true batch facility with which I could run a job or series of jobs in background without tying up a terminal. I also wanted to be able to save the output from that job in a way that would show me when it ran, how long it took, and what it did.

The big secret of the solution to my problem came from a trick that I learned from several DEC operating systems. The cleverness lies in the concept of a virtual console. A virtual console is a software console that the system cannot tell from a hardware one. It does not really exist, but there is a driver and a TMP supporting it just as if it were. Tie in the virtual console concept with MP/M's very nice message queue data structures, and you already have half of a background batch system.

The idea is that the system has a console driver that does I/O to an from queues instead of a physical device. A program can then read the desired input for the virtual console from a disk file, and it can record the consoles output to another file or device. There are a few catches, but that is the basic idea, and we will cover the problems as we get to them.

In order to provide virtual console drivers, it is necessary for you to modify your XIOS. The XIOS is the BIOS equivalent for MP/M. The modifications are simple, so there is nothing to be afraid of. You should be able to accomplish them even if you have not done much assembly level programming. It is necessary, however, to have the source to your XIOS. I am working on a new method, that will allow virtual consoles even if you do not have the XIOS source. To modify your XIOS, just follow the examples.

Listing 1 shows an example of the MP/M console driver jump tables. Simply find the jump tables in your XIOS and add the additional data statements with the labels of your virtual consoles. Remember also to change the constant that is the maximum number of con-
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soles your XIOS supports to reflect the new number. This constant is usually called NMBCNS. Remember that the system is not to know that this virtual console doesn't actually exist. In fact, it does "exist" now.

Listing 2 is an example of the actual driver code for the virtual console. You may insert it directly into your XIOS in the same area as your normal console drivers. The required data structures for the queues are also included. It is necessary that these data structures reside above the common base point in a banked system. Please note the one tricky thing that is different about these drivers: The virtual console status routine should always return flagged so that no character is available. This should allow most programs to run in batch mode.

Having the external status routine return not ready will allow most programs to run unchanged on the virtual console. A screen editor might not run correctly though, and we don't want the program to throw away our input.

Input queue structure

c4inq: dw 0 ; queue link
      db 0 ; msg length
      dw 1 ; msg length
      dw 1 ; number of msgs

Listing 1. MP/M console driver jump tables

This is a normal MP/M console I/O jump table. There is nothing unusual here. Just add the jumps to your additional (Virtual) consoles.

Listing 2. Driver code for the virtual console

Console #4 is a virtual console.

Virtual consoles are transmit and receive queues that feed the data into the system as if they were actually console devices. They are generally feed by programs reading from and writing to disk files. For the present the console status always returns not ready so that input is only there if the program request it. This should allow most programs to run in batch mode.

These special break codes will usually throw away any noncontrol characters. Since the input for the virtual console comes from a file, we need true file-sized type-ahead, and we don't want the program to throw away our input.

Having the external status routine return not ready will allow most programs to run unchanged on the virtual console. A screen editor might not run correctly though, and the system will not respond to a "D (detach) or "C (abort) in the same manner. These limitations will not impede the performance

MP/M II is for a nonhostile environment. Its file protection cannot keep unwanted users out entirely.
MP/M II
Continued from page 65

of a background process, however.

The modifications to this console driver make it much more powerful than the CP/M SUBMIT and XSUB method. Under CP/M you can feed input to a program run under SUBMIT, but there are severe limitations. With XSUB the program will only receive the input from the SUBMIT file if the program is doing line-buffered inputs through CP/M BDOS call #10. MP/M also has a SUBMIT program, but it has no XSUB facility at all.

The last modification to the XI OS is in the SYSTEMINIT routine. This simple modification, shown in Listing 3, ensures that the system will properly create the queues required. Now assemble your new XI OS and regenerate your system as per the MP/M II manual instructions. Remember that you have more consoles now. When all of this is done, a status display for your system should look something like Listing 4.

Now it is time to write a batch handler program to feed the virtual consoles. The listing with this article is a simple one written in C. Its only purpose is to demonstrate how the BATCH processor works. A similar batch processor could be written in almost any language. I chose C because I am familiar with it, and it relates very well to system data structures and pointers to structures.

Listing 3. SYSTEMINIT routine modification

You should insert this (or similar) code in at the tail end of your system init routine in the XI OS. This is necessary so that the system will create the Virtual Console I/O queues. I have two Virtual consoles in my system (4 & 5).

```assembly
mvi c, makeque
lxr d, c4inq Vc4: call xdos
mvi c, makeque
lxr d, c40utq Vc4: call xdos
mvi c, makeque
lxr d, mxvc4: call xdos
mvi c, makeque
lxr d, c5inq Vc5: call xdos
mvi c, makeque
lxr d, c50utq Vc5: call xdos
mvi c, makeque
lxr d, mxvc5: call xdos
```

Listing 4. Status display

```
**** MP/M II V2.0 Status Display ****
Top of memory = FFFFH
Number of consoles = 06
Debugger breakpoint restart # = 06
Stack is swapped on BDOS calls
Memory is bank switched
BDOS disk file management is bank switched
Z80 complementary registers managed by dispatcher
Ready Process(es):
MP/MSTAT [1] Idle
Process(es) being:
[Sched] [Sched] [0]
[SPool] [SPOOL] [0]
[CP10] [c1] [1]
[ATTACH] [ATTACH] [Vc5] [5] <--- TMP for virtual console #5
[Vc241n] [Vc241n] [Vc4] [4] <--- TMP for virtual console #4
Process(es) waiting:
Delayed Process(es):
Polling Process(es):
```

If you want to pass control to a program instead of to the TMP, simply write an RSP with a higher run priority.
control codes. When it finds a tilde (˜) in a control file, it will gobble it up and convert the next character into a control character. This was done to make it easier to edit the control file used to drive the batch stream. It does not yet have variables or flow control, but it still serves me well. By the time you read this I should have a batch language processor in place of this demonstration program. Remember that the program in Listing 5a is only a simple example to show how BATCH works. Listing 5b shows the include file that contains the necessary system data structure for the BATCH program.

Now turn your attention to Listing 6 for an example of a batch control file. This one is named TEST.CTL—an original enough name to suit our present needs. The first part of the control file consists of the necessary character strings to log into my system. A ~ G is necessary to get the system's attention; it then expects a user name and password. These steps would not be necessary in normal MP/M. Also note some of the other commands like WHO, TIME, DATE, etc. Many of these are new intrinsic commands. They reside in my own TMP. Some of my other MP/M systems works will also be briefly demonstrated during the course of the batch run.

The Basic shown is my own interpreter designed around MP/M realtime and multiuser capabilities. Though it is still a very simple interpreter at this point, it is developing well. My goal has been to make it compatible with DEC Basic Plus with added realtime features.

PS (Process Status) is another in-
interesting utility that I have written for MP/M II. It can serve as a replacement for MPMSTAT, although I continue to use them both. PS offers more information about running programs than MPMSTAT does.

Listing 7 is an example of how to run the BATCH program. I use a WHO command before and after the batch invocation in order to show you how the batch user gets logged into the system. You will note that the BATCH program itself still belongs to me, but the things it runs belong to the virtual console. Afterwards, I check my PS program to find that BATCH is no longer running. I may now check the output from the batch operation. It can be found in the file TEST.LOG. A listing of the output may be seen in Listing 8.

When a program wants service from the operating system, it executes a system call. This system call causes the system to dispatch the process. When a process is dispatched, this means that the operating system determines what type of system service the program requested and what resources it needs, then places it on a processing list for those resources. This has the effect of blocking the program from executing until the requested resource is available. The system then checks the status of all processes on its resource list to see if any are ready to be moved to the ready list. If any processes are due to be moved to the ready list, it does so and then picks the program with the greatest priority from the ready list and executes it. For example, let's say that our program wants an input character. First it...
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The system's console driver does I/O to and from queues instead of to and from a physical device.

blocked from execution if no character is available. If a character is available, it will be returned to our program. Our program will now run until it makes another system call or a system tick occurs.

With our special virtual consoles there are a few more steps to go through, but the procedure is similar. As before, our program wants an input character, so it must make an operating system call for the system to dispatch it. When it is time for the system to execute the program call again, it will cause the program to execute the read queue call in the console input routine. This will again cause the system to dispatch our process and force it to wait for execution.
Having the external status routine return a not ready status will allow most programs to run unchanged on the virtual console.

then gets to run until it makes another system call or a system tick occurs.

Simple? Fortunately the system keeps track of all of this, and you don't have to. All this was meant to give you an idea of how a system that allows only one task at a time to actually execute through time sharing lets two or more programs interact concurrently. Diagram 1 shows the relationship of the virtual console queues during batch operation.

Future versions of BATCH will contain many advanced features. For instance, with a few simple modifications to the XDOS, it will be possible to use program return codes to make decisions during a batch process.

There are many more interesting things to be done with MP/M. I hope that I have stimulated your interest in some of them.

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☐ C.O.D. (2500AD pays C.O.D. charges)
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**PROTOCOLS** — Switch selectable XON/XOFF, ETX/ACK, ENQ/ACK, Reverse Channel (Busy/Ready) either polarity, or parallel.

**PARALLEL OUTPUT** — Standard Centronics interface signals, 8 Data, Busy & Strobe.

**S-100 (IEEE 696) INTERFACE** — No wait states required on any system. Switch selectable I/O address can be set to ANY one of the 256 possible addresses. Extremely simple to use. Simply monitor the Busy status bit and send data to Spool-Z-Q when not busy. All protocols, etc. are taken care of already.

**MEMORY TYPE AND EXPANSION** — Spool-Z-Q 100 uses industry standard 64K type 54K RAM chips. Sizes available are 32K, 64K, 128K, 192, and 256K characters. Every Spool-Z-Q 100 is fully socketed for 256K and may be expanded by just plugging in chips.

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**Listing 6. Example of a batch control file**

```
0(type testctl<cr>)
CDB
SECRET
PS

# define P.StObject 131 /* Poll device request */
# define IFI Wow 132 /* Flag wait request */
# define PAGE 133 /* Page set request */
# define MAKE 134 /* Make queue request */
# define DLT 135 /* Open queue request */
# define DETACH 136 /* Close queue request */
# define READ 137 /* Conditional read queue request */
# define WRITE 138 /* Write queue request */
# define COND 139 /* Conditional write queue request */
# define Q DELAY 140 /* Delay system ticks */
# define Q DISPATCH 141 /* Release time slice */
# define TERM 142 /* Terminate current process */
# define ATTACH 143 /* Attach process */
# define DETACH 144 /* Detach process */
# define SEND 145 /* Send command line to cli */
# define CALLEE 146 /* Call resident system procedure */
# define Pệm 147 /* Process descriptor address */
# define ATTACHQ 148 /* Attach list device */
# define DETACHQ 149 /* Detach list device */
# define SETQ 150 /* Set list device */
# define CONDQ 151 /* Conditional attach list */
# define COND Q 152 /* Conditional attach console */
# define ALL Q 153 /* Return MP/M version number */
# define GETCL 154 /* Get system data page address */
# define GETPID 155 /* Get current process */
# define GETLPD 156 /* Get process priority */
# define GETCONS 157 /* Get console device */
# define GETSP 158 /* Get system time */
# define GETPPB 159 /* Get system time */
# define GETPPA 160 /* Get system time */
# define GETCONS 161 /* Get system time */
# define GETMAC 162 /* Get system time */
# define GETQ 163 /* Return process descriptor address */
# define GETLST 164 /* Return list number */

/* end of mp.h */
```

---

**MP/M II**

Continued from page 71

```
Listing 6. Example of a batch control file
```

---

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MP/M II
Continued from page 74

Now we are detached from the basic program. Let’s take a quick look with PS and then with MPMSTAT.

Now I will attach to the basic program and find out what the answer was.

Now we are back in TMP mode.

Listing 7. How the BATCH program runs

User-Name : TOM CLODFELTER
Password:
Welcome to MP/M II V2.1 at 17:59:50 Tue 01-Mar-1983
OCPdir<cr>
Directory for User 0:
C: TEST  CTL
System Files Exist
OCPtime<cr>
Time: 18:00:30 Tue 01-Mar-1983
OCWho<cr>
****** MP/M II V2.1 Login Summary ******
Console [0] is logged in as [ OPERATOR ]
Console [1] is logged in as [ TOM CLODFELTER ]
OCPbatch -d1 test.ctl test.log<cr>
****** MP/M II V2.1 Login Summary ******
Console [0] is logged in as [ OPERATOR ]
Console [1] is logged in as [ TOM CLODFELTER ]
Console [4] is logged in as [ DEMO ]
OCPmpmstat<cr>
****** MP/M II V2.0 Status Display ******
Top of memory = FFFFH
Number of consoles = 06
Debugger breakpoint restart # = 06
Stack is swapped on BDOS calls
Memory is bank switched
BDOS disk file management is bank switched
280 zen compulsory registers managed by dispatcher
Ready Process(es):
Process(es) Doing:
Sched Sched [0]
SPOOL Spool [0]
C110 c11 [0]
ATTACH ATTACH [0] [0]
Vc5in Vc5in [5]
Process(es) NoIag:
Vc4out [0]
Delayed Process(es):
Polling Process(es):
Process(es) Flag Waiting:
O1 - Tick
O2 - Clock
Flag(s) Set:
O3
Queue(s):
MPMSTAT Sched STOPSPLR SPOOL Spool C110 ATTACH MX44c
MDisk MVx5 Vc4out Vc5in MVx4 Vc4in Vc5in
MPProc
Process(es) Attached to Consoles:
[0] - Tmp0
[1] - MPMSTAT
[2] - Tmp3
[3] - Tmp3
[4] - PS
[5] - Tmp5
--- BATCH is running PS on console #4
Process(es) Waiting for Consoles:
[0] - Tmp0
[1] - Tmp1
--- The TMP is waiting for PS to finish on #4
Process(es) Attached to Printers:
[0] - Unattached
[1] - Unattached
Process(es) Waiting for Printers:

Memory Allocation:

Base = 000OH Size = 0200H Bank = 00H Allocated to MP/M-80 [0]
Base = 0000H Size = 0000H Bank = 01H * Free *
Base = 0000H Size = 0000H Bank = 02H * Free *
Base = 0000H Size = 0000H Bank = 03H * Free *
Base = 0000H Size = 0000H Bank = 04H Allocated to PS [4] ----

0>time<cr>

Time: 18:03:10 OC>ps<cr>

OC>time<cr>

OC>

Time: 18:02:24 Tue 01-Mar-1983

OC>ps<cr>

OC>

OC>who<cr> --- Check to see that BATCH logged off

Console 0 is logged in as [ OPERATOR ]

Console 1 is logged in as [ TOM CLODFELTER ] --- DEMO is off

Directory for User 0:

C: TEST CTL TEST

Listing 8. Output of the batch operation

18:01:02: $JOB TEST.LOG

18:01:02: MP/M II V2.1

18:01:02: Welcome to MP/M II V2.1 at 18:01:02 Tue 01-Mar-1983

18:01:02: .LOG <--- The log file is now ready

18:01:03: 4C>; Let's see who else is on this system.

18:01:03: 4C>; Welcome to MP/M II V2.1 at 18:01:07 Tue 01-Mar-1983

18:01:03: 4C>; Now find out what time it is.

18:01:06: 4C>; So far all of the commands that I have used are handled

18:01:09: 4C>; in my special TMP.

18:01:12: 4Cps

18:01:12: PID TTY TIME CMD

18:01:13: 164615 tty4 0 PS

18:01:13: 164701 tty4 0 Tmp

18:01:13: 165704 tty4 0 c1l

18:01:13: 166700 tty4 0 Tmp

18:01:13: 176700 tty4 0 Tmp

DATA-LOCK

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18:02:13 Ready

18:02:14 REM we will enter a short program into basic from batch.
18:02:15 20 DETACH: REM this will cause the program to run detached.

18:02:16 10 REM we will enter a short program into basic from batch.
18:02:17 30 FOR X
18:02:18 40 DETACH: REM this will cause the program to run detached.
18:02:19 50 PRINT "the answer is ";X;"." 
18:02:20 60 END

18:02:18 Ready

18:02:19 DETACH: REM this will cause the program to run detached.

18:02:22 Process(es) Attached to Printers: 18:02:23 [0] - Unattached 

18:02:25 Process(es) Waiting for Printers: 18:02:26 [0] - Unattached 

18:02:28 Process(es) Attached to Consoles: 18:02:29 [0] - TmpO 18:02:30 1 - Tmp1 18:02:31 2 - Tmp2 18:02:32 3 - Tmp3 18:02:33 4 - MPMSTAT 18:02:34 5 - Tmp5


18:02:39 REM now I will exit basic
18:02:40 READY
18:02:41 DETACH: REM this will cause the program to run detached.

18:02:42 Ready

18:02:43 DETACH: REM this will cause the program to run detached.

18:02:44 ATTACH: BASIC
18:02:45 THE ANSWER IS 1000.

18:02:46 ATTACH: BASIC
18:02:47 ATTACH: BASIC

18:02:48 DETACH: BASIC
18:02:49 DETACH: BASIC
18:02:50 DETACH: BASIC

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18:04:20 DETACH: BASIC
In the November 1983 Microsystems, reader Arthur Zatarain bemoaned the difficulty in making use of the time and date formats provided by Digital Research's MP/M and Software 2000's TurboDOS in applications software. Mr. Zatarain's letter suggests that the awkward, modified Julian date provided by both systems may be responsible for the absence of time and date support in languages and programs that run under both of these operating systems, and concludes with a request for source code illustrating conversion techniques between the "tight" operating system formats and the more readable (at least by human beings) character-string formats.

Mr. Zatarain is right; there is indeed very little software around, public domain or commercial, that makes use of these functions. If this lack is indeed due to the difficulty in format conversions, perhaps the routines presented in this article will be of some use to systems and applications programmers who would like to exploit the time and date functions that these operating systems provide.

Format of the time/date specification

There have been variations in the function number as well as the data structure and parameter passing conventions among the different releases of both operating systems. For example, MP/M release 1 used a single system call (number 155), and the time and date returned by the system included seconds. This system call was retained in MP/M release 2, but a new system call (number 105) was added, whose only difference was that the "seconds" field was omitted. This same system call was finally added to the single-user CP/M with the release of CPM Plus. In all three releases, a pointer is passed (in DE) to a data structure in memory ordered as follows:

2-byte Julian date field
1-byte hours field
1-byte minutes field
1-byte seconds field (ignored in system call #105)

The 2-byte Julian date field is defined as the number of days elapsed since 1 January, 1978; hours, minutes and seconds are specified as binary-coded decimal (BCD) values.

Meanwhile, early releases of TurboDOS were totally incompatible: a different function call was used (number 84), the values for hours, minutes
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and seconds were binary rather than BCD, and the Julian date was based on 1 January 1948. Finally, the parameters were all returned in the registers, rather than in a date block held in memory.

TurboDOS release 1.2 attempted to gain some MP/M compatibility. Among the changes was the addition of a fully MP/M-compatible get date/time call: number 105. No support was provided for MP/M's call 155 (the one that supports the "seconds" field); however, the system did keep its MP/M-incompatible function 4 in order to retain support for the software developed for early TurboDOS releases.

Finally, TurboDOS release 1.3 effects a "split" of system calls: those which are MP/M-compatible are called in the usual way (via the jump instruction at location 5), while TurboDOS-only system calls are available by calling location 50 (hex) with a new set of function codes. Luckily, the MP/M-compatible function #105 is still available via a call to location 5; this is the only system call that is available through both operating systems (and CP/M Plus) with identical calling procedures (excluding the early TurboDOS releases, of course), and will be the one employed here.

**Some notes about the listings**

All of the example listings presented here are written for the old TDL/XITAN assembler. This assembler still lives (although TDL and XITAN are long gone), and is now called the CDL (Computer Design Labs) assembler. This assembler is fully Z80-compatible but uses a mnemonic set that bears more resemblance to Intel mnemonics than to the Zilog Z80 set. Most of the mnemonics will be familiar to anyone familiar with the Intel set, and the Z80 instructions that add addressing modes to existing 8080 instructions have a construction similar to the Intel convention. For example, store-BC-direct is SBCD; this is similar to the Intel SHLD. Instructions such as NEG and SHLD, which have no 8080 analogy, are taken directly from the Zilog set.

Each of the subroutines resides as an object module in my relocatable system library. When I need to use one in a program, I simply declare it "external," and call it freely. When I link the program, my linkage editor searches the system library and includes those subroutines referenced in my main program, freeing me from the tedium of re-writing a subroutine each time I use it in a program. Hence, you'll see some ex-

---

**LISTING 1**

```
IDENT |PREDATE |105/17/82
```

```
; ROUTINE TO PRINT DATE IN FORM OF
; MM/DD/YY ON Console via TYPE
; ENTRY, HL = DATE SPEC (WITH YEAR
; FIELD ASSEMBLY RELATIVE)
; ENTRY PREDATE

0000' 06 |PRDATE| PUSH B |SAVE WORKING REGS

0001' FF |PRDATE| PUSH B |FETCH YEAR

0007' 1F |PRDATE| MOV W, A |MAKE A 0

000F' 6F |PRDATE| MOV B, A |MAKE B 0

0011' 08 |PRDATE| MOV C, A |MAKE C 0

0013' 18 |PRDATE| MOV D, A |MAKE D 0

0015' 28 |PRDATE| MOV E, A |MAKE E 0

0017' 38 |PRDATE| MOV H, A |MAKE H 0

0019' 48 |PRDATE| MOV L, A |MAKE L 0

001B' 58 |PRDATE| MOV M, A |MAKE M 0

001D' 68 |PRDATE| MOV N, A |MAKE N 0

001F' 78 |PRDATE| MOV V, A |MAKE V 0

0021' 88 |PRDATE| MOV W, A |MAKE W 0

0023' 98 |PRDATE| MOV Z, A |MAKE Z 0

0025' A8 |PRDATE| MOV SP, A |MAKE SP 0

0027' B8 |PRDATE| MOV IO, A |MAKE IO 0

0029' C8 |PRDATE| MOV IX, A |MAKE IX 0

002B' D8 |PRDATE| MOV IX, A |MAKE IX 0

002D' E8 |PRDATE| MOV IX, A |MAKE IX 0

002F' F8 |PRDATE| MOV IX, A |MAKE IX 0

0031' 01 |PRDATE| MVI A, 0 |MAKE A 0

0033' 0F |PRDATE| CALL DECODER |PRINT IN DECIMAL

0035' 31 |PRDATE| CALL DECODER |PRINT IN DECIMAL

0037' 59 |PRDATE| RET

0021' 20 |PRDATE| XOR H |RETURN
```

---

**LISTING 2**

```
IDENT |PRDATE |105/15/82
```

```
; SUBROUTINE TO PRINT A IN DECIMAL FOLLOWED BY "/

0000' 07 |PRDATE| MOV H, 0 |SIMPLE PRTIME 05/15/82

0001' FF |PRDATE| MOV H, 0 |SIMPLE PRTIME 05/15/82

0007' FF |PRDATE| MOV W, 0 |MAKE A 0

000F' FF |PRDATE| MOV B, 0 |MAKE B 0

0011' FF |PRDATE| MOV C, 0 |MAKE C 0

0013' FF |PRDATE| MOV D, 0 |MAKE D 0

0015' FF |PRDATE| MOV E, 0 |MAKE E 0

0017' FF |PRDATE| MOV H, 0 |MAKE H 0

0019' FF |PRDATE| MOV L, 0 |MAKE L 0

001B' FF |PRDATE| MOV M, 0 |MAKE M 0

001D' FF |PRDATE| MOV N, 0 |MAKE N 0

001F' FF |PRDATE| MOV V, 0 |MAKE V 0

0021' FF |PRDATE| MOV W, 0 |MAKE W 0

0023' FF |PRDATE| MOV Z, 0 |MAKE Z 0

0025' FF |PRDATE| MOV SP, 0 |MAKE SP 0

0027' FF |PRDATE| MOV IO, 0 |MAKE IO 0

0029' FF |PRDATE| MOV IX, 0 |MAKE IX 0

002B' FF |PRDATE| MOV IX, 0 |MAKE IX 0

002D' FF |PRDATE| MOV IX, 0 |MAKE IX 0

002F' FF |PRDATE| MOV IX, 0 |MAKE IX 0

0031' FF |PRDATE| MVI A, 0 |MAKE A 0

0033' FF |PRDATE| CALL DECODER |PRINT IN DECIMAL

0035' FF |PRDATE| CALL DECODER |PRINT IN DECIMAL

0037' FF |PRDATE| RET

0021' FF |PRDATE| XOR H |RETURN
```

---

**LISTING 3**

```
IDENT |PARSDT |105/20/82
```

```
; SUBROUTINE TO PARSE DATE FROM AN INPUT STRING @HL
; (FORM=MM/DD/YY) RETURN JULIAN DATE
; (RETURN=-1 IF NO ERRORS)

0000' E0 |PARSDT| PUSH D |SAVE DATE POINTER

0001' 6F |PARSDT| CALL ...PARS |CALL SUBROUTINE TO PARSE

0007' E1 |PARSDT| POP H |FETCH DATE FROM STRUCT

000F' 6F |PARSDT| MOV M, H |MAKE M 0

0011' FF |PARSDT| MOV D, H |MAKE D 0

0013' FF |PARSDT| MOV K, H |MAKE K 0

0015' FF |PARSDT| MOV A, H |MAKE A 0

0017' FF |PARSDT| MOV L, H |MAKE L 0

0019' FF |PARSDT| MOV M, H |MAKE M 0

001B' FF |PARSDT| MOV L, H |MAKE L 0

001D' FF |PARSDT| MOV M, H |MAKE M 0

001F' FF |PARSDT| MOV L, H |MAKE L 0

0021' FF |PARSDT| MVI A, 0 |MAKE A 0

0023' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

0025' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

0027' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

0029' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

002B' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

002D' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

002F' FF |PARSDT| CALL DECODER |CONVERT FROM DECIMAL

0031' FF |PARSDT| MVI A, 0 |MAKE A 0

0033' FF |PARSDT| CALL DECODER |PRINT IN DECIMAL

0035' FF |PARSDT| CALL DECODER |PRINT IN DECIMAL

0037' FF |PARSDT| RET

0021' FF |PARSDT| XOR H |RETURN
```
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JULIAN DATES
Continued from page 82
ternal references in the listings—these are denoted by a pound sign at the end of the name of the reference.
These externals are defined within their own modules as globals (also called “public”) using the .ENTRY pseudo-op.
For example, the program line
CALL DECOUT#
implies that the routine DECOUT resides outside of the current module. In its own module, DECOUT might begin like this:
ENTRY DECOUT
DECOUT: PUSH H

The .IDENT statement at the beginning of each module gives the module a name. Some linkers use this module name to build module-load maps to assist the programmer in locating his code sections during debugging.

TurboDOS 1.3 allows both MP/M and TurboDOS system calls.
JULIAN DATES
Continued from page 85
Note that the ordering of the modules does not correspond to the order in which they are presented in the text. Since they are part of a relocatable library, I've ordered them such that all external references are forward, allowing the library to be linked in a single pass of the linkage editor.

Printing the date
Listings 1 and 2 are routines for printing the date and time, respectively, from a date/time structure pointed to by HL. This structure is identical to that returned by MP/M function #105. Thus, a typical calling sequence looks like this:

LXI D, DBLOCK ; pass pointer to structure
PUSH D

Several modules can be contained in a single file.

Note that the routine TYPE is called from both modules (and from several others in the various listings). This global routine must resides in the calling program and should print the character passed in register A on the console, while preserving all registers other than A. Supplementary routines DECOTB (decimal output byte) and PRTBCD (BCD output byte) are provided in Listing 10.

The most noteworthy aspect of these routines is the conversion of the
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JULIAN DATES
Continued from page 86
MP/M-format Julian date to a string of the form mm/dd/yy. This tedious job is performed by the routine FMJUL (from Julian) in Listing 6. FMJUL is called with the Julian date in HL, and with DE pointing to a 3-byte output area that will hold the converted date in binary form. PRDATE then simply prints the decimal digits returned by FMJUL.

Another routine I'll describe shortly does the opposite of FMJUL (converts BCD dates to modified-Julian), and is called TOJUL. Both FMJUL and TOJUL use an external table of days per month (MTBL), which you'll find in Listing 7.

Date arithmetic

I'm including two other routines from my library, both of which do some calculations based on time specifications.

The library saved me from the tedium of rewriting a subroutine.

The first of these is ET (Elapsed Time; see Listing 8)—this routine calculates the difference between two date/time specifications. The "oldest" (earliest chronologically) is passed in the HL register pair, while the more recent is passed in DE. A pointer is passed in BC to a 3-byte area that will hold the result (see the listing for the format of this result area). This routine is valid for up to 9,999 hours and 59 minutes of elapsed time, and may be extended to even larger amounts of time with a little effort.

Incidently, this routine should provide some justification for the format chosen by Digital Research in the original MP/M. Arithmetic manipulation of dates is much easier with a numeric form of date. If the system provided the date in the form of an ASCII string, additional conversion work would be necessary to convert the date to a number.

The second routine is called ADDTIM (Listing 9), and is designed as a companion to ET. ADDTIM calcu-
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JULIAN DATES
Continued from page 90

The routine PARSTM (Listing 4) parses the time from the input string passed as a pointer in HL; also passed to this routine is a pointer in DE to an MP/M-format date/time buffer, which will hold the parsed time. This buffer is modified slightly from the MP/M function #105 format (in fact, it is more compatible with MP/M function #155); it must be one byte longer than normal in order to include the "seconds" field. Since this routine was originally written for MP/M function #155, I allowed the presence of seconds in the time string. In fact, if seconds are not specified (they are, as I said, optional), this byte will be zeroed.

PARSTM also uses a support routine, this one for BCD input (BCDIN). This routine may be found in the common subroutines module in Listing 10.

These routines might be useful in a remotely accessible MP/M system.

Strings attached?

A good deal of recently released semi-public-domain software has carried the stipulation that the user not sell the software, or otherwise profit from it. I don't believe that such things as reusable subroutines, such as those presented in this article, should be limited this way. For that reason, the routines presented in this article may be used with no strings attached. If you'd like to include this stuff in your next big commercial project, feel free; I'd be flattered (mind you, if you feel obligated to send me a complimentary copy of your package, I'll not object!). I'd like to see a lot more software, commercial and public domain, exploit the time and date capabilities of these new operating systems.

Mr. Zatarain, did I answer your question?

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The truck driver struggled single-handedly with a massive wooden crate. I at first mistakenly assumed it was destined for some nearby furniture store, the thought never crossing my mind for a moment that it might actually be intended for me. After all, 8086-based computers are supposed to be puny little things like the IBM PC, right? Well, I guess not, at least in this case, for the Lomas Data Products LDP-2 turns out to be neither PC-like nor puny.

Boards supplied
Lomas Data Products was one of the first vendors to advertise 8086 and 8088 CPU boards for the S-100 bus when those processor chips became available a few years ago. The system Lomas provided for evaluation was based on their “Lightning One” CPU board, equipped with an 8086 main processor and an 8087 math coprocessor. While the 8086 supplied is capable of running at an 8 MHz clock rate, the board came set up to operate with a 5 MHz clock, since that is the fastest available speed for the accompanying 8087 chip. I also received the Lomas LDP72 floppy disk controller, the “Hazitall” multifunction I/O card, and the RAM67 128K static RAM card. The board set was housed in an Integrand 800-series cabinet, along with a pair of Qume DT-8 8” dual-sided floppy drives and a 10-slot S-100 cardcage. Since no terminal was provided, I plugged in a TeleVideo 925 which happened to be on hand at the moment.

CPU
The Lomas “Lightning One” is a rather interesting CPU card with a great many options. First of all, it will handle either an 8-bit 8088 or a 16-bit 8086 as the main processor chip. By selecting the proper chip, the user can opt for full compatibility with existing 8-bit memories and peripherals, or build a true 16-bit system with 16-bit memory for maximum speed. Jumper options are provided to run the CPU board with a 4, 5, 8 or 10 MHz main clock, so the board can be set up for all the currently available chip speeds. The “Lightning One” provides sockets for the addition of an 8087 math processor and an 8089 I/O processor. The board we tested had the 8087, but not the 8089, which Lomas uses only in their multiuser systems. In
addition to all this CPU power, there is an 8259A interrupt controller and two 28-pin sockets capable of accommodating two 2716, 2732 or 2764 EPROMs. Using two 2764s, you could have up to 16K of on-board firmware.

**Disk controller and I/O**

The Lomas LDP72 floppy disk controller is based on the Intel 8272 dual-density floppy controller chip. With appropriate software, it will accommodate any mix of up to four 8" and 5¼" single- or double-sided drives. Connectors for both drives sizes are provided at the top edge of the card. Our test system had two 8" drives, and the software was set up to allow for an optional 5¼" drive as a third drive. Three formats are supported on the 8" drives: single-sided single-density (SSSD), single-sided double-density (SSDD), and double-sided double-density (DSDD). The storage capacities for each format on CP/M-86 and MS-DOS are:

<table>
<thead>
<tr>
<th>Format</th>
<th>CP/M-86</th>
<th>MS-DOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSSD</td>
<td>243K</td>
<td>24K</td>
</tr>
<tr>
<td>SSDD</td>
<td>600K</td>
<td>1200K</td>
</tr>
<tr>
<td>DSDD</td>
<td>1221K</td>
<td></td>
</tr>
</tbody>
</table>

Performing the rest of the I/O chores in this system is the aptly named "Hazitall" system support card. It contains two serial ports with software-selectable baud rates up to 9600 baud. Each port supports the major RS-232 handshake lines for asynchronous devices, and one of the ports may also be operated in synchronous mode. There is also a strobed parallel output port (usually configured as a Centronics-style printer interface), a strobed parallel input port, a programmable realtime interrupt (no software provided), a clock/calendar chip with battery backup (supported in the supplied MS-DOS implementation, but not in CP/M-86), a Winchester disk controller support port (intended to interface with a Western Digital WD1000 series hard disk controller), and an empty socket for an Intel 8231 or 8232 math processor. This last item would not normally be used with an 8086 or 8088, since the 8087 does a better job. However, it might be useful if you were to run the Hazitall board with an 8080, 8085 or Z80 processor.

**Memory**

The Lomas RAM67 is a 128K memory card, built using low-power, high-speed CMOS static memory chips. Due to the low power consumption, it is possible to order a special version of this board with battery backup to yield a fairly large nonvolatile memory system. A half-populated (64K) version is also available. The 128K version can be addressed on any 128K boundary, while the 64K version can be addressed on any 64K boundary. Both versions respond to the S-100 phantom line. It is also possible to disable a section of the board to avoid conflict with another memory device. Eight-bit and 16-bit wide data transfers are handled automatically using the S-100 xTRQ signal. The claimed access time of 130 ns should be fast enough to run with any existing 8- or 16-bit processor.

**Software and documentation**

The software provided by Lomas consisted of evaluation copies of their implementations of CP/M-86 version 1.1 and MS-DOS version 2.0. In order to have some programming languages to try on the system, Microsystems contacted Digital Research, Inc., who graciously provided copies of PL/I-86, CB-86 (a native code compiler for CBasic), and their new Personal Basic interpreter. This is where the first snag appeared: the standard release format these days for all CP/M-86 and MS-DOS compatible software is the 5¼" disk. While the Lomas documentation states that a 5" drive may be added to the system, the test system contained only 8" drives. Luckily, my lab also houses an 8" CP/M-80 based system and an 8-bit 5" system that can read PC disks. I was therefore able to download all the 5" release disks to 8" single-density, and then read those copies on the LDP2. Lomas offers another version of their system, which comes with 5" drives. Potential buyers would probably do better to consider that model, unless conversion facilities are available.

Lomas supplied two large binders full of documentation for the system. One of these contained the hardware manuals of all their boards. The other binder contained a preliminary manual for MS-DOS version 2.0. A few weeks later, a third large binder arrived, containing a more complete and up-to-date MS-DOS manual. In addition to these large binders, we received the CP/M-86 manual set, in its standard IBM-style minibinders.

**Performance**

At first the system did not boot up, but a quick scan of the recommended jumper settings listed in the MS-DOS installation notes revealed one discrepancy on the Hazitall board. I'm not sure why, but fixing this jumper allowed the system to come up properly with both CP/M-86 and MS-DOS. One other note page which proved handy was the sheet at the front of the hardware manual, which described the correct way to wire terminal and printer cables. The two serial ports on the Hazitall are laid out as DTE devices, which means that they would connect directly to a modem (modems are DCE devices). Just to prevent the confusion, the serial connectors mounted on the unit were female, which usually signifies DCE, not DTE. It would have saved a good deal of time and confusion if Lomas had laid out their connectors in such a way that special cables were not required for the terminal and printer.

My next step in getting the system up was to attempt to create some working disks. The operating systems were supplied on single-sided, double-density disks, which of course worked fine once I solved the jumper problems mentioned above. Since the system was supplied with double-sided drives, I decided to make some double-sided work disks. Well, it turns out that the utilities provided with both operating systems would not generate a double-sided system disk directly. One must instead use the direct hardware disk read and write commands in the system's PROM-resident monitor to transfer the system tracks of a single-sided disk to a double-sided disk. Other than this one anomaly, both CP/M and MS-DOS seemed to take the intermixing of single-density single-sided, double-density single-sided, and double-density double-sided pretty much in stride. Of course, switching formats usually required typing control-C when swapping disks around.

I later discovered one other strange quirk in Lomas' disk handling. Occasionally, when logging in a new disk, the system would just hang up with the heads loaded on the new disk. Whenever this occurred, the system reset button had no effect. The only way to regain control of the system was to switch the power off and on. Each time I did this I kept my fingers crossed, because only most machines removing power from a floppy drive with the heads still loaded usually results in a crashed disk. This

---

**Table 1. Parameter values**

<table>
<thead>
<tr>
<th>Language</th>
<th>Lomas LDP2</th>
<th>PC clone</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL/1-86</td>
<td>7.1</td>
<td>13.2</td>
</tr>
<tr>
<td>CB-86</td>
<td>9.5</td>
<td>17.2</td>
</tr>
<tr>
<td>Personal BASIC</td>
<td>1:25.4</td>
<td>2:38.5</td>
</tr>
</tbody>
</table>
Continued from page 95

did not seem to be a problem on the Lomas, however, since in the dozen or so hangups that I experienced, the disk in question was never harmed.

Once I actually started programming on the system, I was immediately impressed by its speed on disk operations. The disk drives employ a large sector size along with a track-buffering scheme which appears to work quite well. Its disk I/O ranks among the fastest of the many 8" floppy systems I have used.

Computer-bound operations also seemed to be going faster. In order to see just how much faster, I entered and ran the "Sieve of Eratosthenes" benchmark in all three languages provided by Digital Research. For those unfamiliar with this benchmark, it uses a simple process of elimination to determine all the prime numbers in a given range. Since only addition and comparison operations are used, it's a good test of raw CPU speed. Unfortunately, I had not obtained any programming languages that would take advantage of the 8087 math processor. Although it was not available at the time I wrote this, Digital Research has advised me that 8087-compatible versions of several of their language compilers are about to be released. By the time you read this, you should be able to obtain 8087-supporting versions of DR C, Pascal/MT+, Fortran, and PL/1-86. At the present time, all of my testing reflects the use of the 8086 by itself. For the sake of comparison, I ran the same benchmark programs on a PC clone. Since the PC look-alikes also use a 5 MHz clock, the huge timing differences must be attributed to the difference in bus width: 16 bits for the 8086 in the Lomas system, 8 bits for the 8088 in the PC clone. The results I obtained are shown in Table 1.

All times have been given as "seconds.tenths" or "minutes:seconds.tenths". As you can see, the difference in execution times was almost two to one. One can only guess what difference the 8087 might have made on each machine. Perhaps I can investigate and report this at a later date.

Summary

What conclusions can we reach about this machine? Well, the lack of IBM PC compatible graphics and hardware architecture means that many programs for the IBM PC won't run, even though the processor and operating system are the same. On the other hand, more generic MS-DOS and CP/M-86 programs that use only the normal I/O facilities in the operating system will run almost twice as fast, with about four times as much disk space available to them. Of course, with the Lomas machine you also have the easy expandability of the S-100 bus. Of the 10 slots provided in the chassis, only four are used by the basic system. This leaves plenty of room for additional memory and peripherals such as an S-100 modem card.

Maybe someday someone will design an S-100 graphics card that emulates the graphics of the IBM PC. Until then, we can conclude that while this machine is not for everybody, it does succeed in providing a faster, more powerful alternative to the IBM PC and its look-alikes for the serious user.

More information on this system and the rest of the Lomas line may be obtained from: Lomas Data Products, Inc., 66 Hopkinson Road, Westborough, MA 01581, (617) 366-6434.

Bruce Ratoff, 26 Broad Street, Cranford, NJ 07016

EMPROM-1:

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* I/O mapped—consumes no system RAM space
* 16K bytes of on-board emulation RAM
* Zero insertion force programming socket
* Complete with software which runs under CP/M, MP/M, or CDOS • menu driven program supports both programming and emulation • limited debugger type functions are provided • supplied in source code on 8" single sided soft-sectored disk.
* Incorporates the Intel fast programming Algorithm
* NO personality modules necessary
* Hardware provisions have been incorporated to allow programming of future 32K Eproms

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* Hardware provisions have been incorporated to allow programming of future 32K Eproms

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Board without zif socket
External programming module + 3' cable

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Adaptive Educational Testing
How to eliminate problems with carriage returns and line feeds

by Maynard Brandsma

Microsoft's Fortran-80 has problems with formatted I/O to disk files, as pointed out by Robert S. Minnis in his article in the November 1983 issue of Microsystems. The first problem is that formatted writes to a disk file do not convert the carriage control characters of Fortran to the ASCII characters needed by some text editors and all printers to properly display the text. The second problem involves formatted input from a disk file. When an input file is prepared with a text editor that uses a carriage return-line feed combination to mark the end of a line, the presence of line feeds confuses the formatted input as described by Minnis.

This technical note presents the code changes to the disk driver routine DSKDRV.MAC necessary to solve these problems. DSKDRV.MAC is the source code for the disk driver routines that Microsoft supplies as part of the Fortran-80 package. I have been using the modified DSKDRV for Fortran-80 version 3.44 with no problems.

One benefit of sending formatted output to a disk file instead of directly to the printer is that programs execute much faster if they don't have to wait for a slow printer. A second benefit is that input and output can be arranged in the same way as on an IBM mainframe. You can follow the IBM convention of reading input data from unit 5 and writing output to unit 6. When a program is through, you can review the output using your text editor. You can decide if you want to print all, or part, or none of the output file.

Modification for the formatted disk read routine

The addition of two extra lines of code to the routine that gets a character from the disk file (DSKIN) will cause this routine to throw away any line feeds it finds in an input record. Listing 1 shows the necessary changes.

Modification of formatted disk write routine

This is the more complicated situation mentioned by Minnis. I have modified the formatted disk write routine to convert the carriage control characters produced by Fortran in column 1 of formatted output to the ASCII characters.
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FORTRAN-80

Continued from page 99 for line feed or form feed needed by text editors and printers.

With this modification, you can open an output file with a statement like:

CALL OPEN(6, "OUTPUT DAT", 0).

Direct your program’s output to that file with program statements like:

WRITE(6,15) A
15 FORMAT(///, 5H A = ,F5.1).

You can view the output file using your text editor. To print your output you can copy it to the CP/M list device using:

PIPLST:=OUTPUT.DAT.

Multiple output files can be printed using a command like:

PIPLST:=OUT1.DAT,OUT2.DAT.

The required changes to the formatted disk write routine DSKFWR are shown in Listing 2.

Maynard Brandsma, P.O. Box 374, Drango, CO 81301

Sending formatted output to a disk file causes programs to execute faster.

LISTING 1. Modification to DSKDRV.MAC to ignore line feeds in formatted disk reads. The routine shown, DSKIN, is part of the lengthy DSKDRV.MAC file. The CPI and JZ instructions inserted near the end cause DSKIN to ignore line feeds in the input file.

LISTING 2. Modification to DSKDRV.MAC to add line feeds and form feeds in formatted disk writes. The routine shown, DSKFWR, is part of the DSKDRV.MAC file. Replace the section indicated (routine DSKFW2) with the patch shown in Listing 3.
List 3. Begin patch for formatted writes to disk ----------------------
Patch adds carriage control for formatted output to disk files

```
MOV A,127
LDA $BL
MVI C,MD.OUT
MOV A,M
LDA $BL ;GET
STC
ORA
LDA
ORI
CALL
JNZ DSKFW2
POP PSW
CALL RNDCHK ;If Rnd Mode, Set offset to 0.
DCR A Decrement count
CALL $ERR ;Warn User of ••
JP DSKFWO
ORA A
RZ ; IGNORE NULL BUFFERS
ORA A
CALL OPNCHK ;OPEN FILE IF NEEDED
CALL DSKOUT ;SEND OUT BYTE
DB OBOVF Output Buffer Limit Exceeded
PUSH
JNZ
DCR
POP
CALL
MVI
A,15Q
M,A
MD.WRT
GTMODE
A
M
A,127
and truncate to 127 bytes.
MVI
A,127

*** REPLACE ***

PUSH PSW ; SAVE COUNT *** THIS
MOV A,M ; SECTION
CALL DSKOUT ;SEND OUT BYTE *** WITH
INX H ; Increment count *** PATCH
POP PSW ; Retrieve count *** GIVEN IN
DCR A ; Decrement count *** LISTING 3
JNZ DSKFW2 ; One more time ***
```

List 3. Patch to be inserted where shown in Listing 2.

```
begin patch for formatted writes to disk ----------------------------
patch adds carriage control for formatted output to disk files
DCR A ;decrement buffer length
PUSH PSW ;and save it
MVI A,15Q
CALL DSKOUT ;output carriage return
MOV A,M ;Get 1ST CHARACTER IN BUFFER
CLI
JE DSKFW2 ;NO PAGE ADVANCE IF 1ST CHAR = "1"
CLI
JNZ DSKFW1 ;NO PAGE ADVANCE IF 1ST CHAR. NOT "1"
MVI A,14Q
CALL DSKOUT ;INSERT FORM FEED IF 1ST CHAR = "1"
JMP DSKFW2

DSKFW1: MVI A,12Q ;CARRIAGE CONTROL
CALL DSKOUT ;ADVANCE PAPER 1 LINE
MOV A,M ;GET CHARACTER BACK
CLI
JNZ DSKFW2
MVI A,12Q ;LINE FEED
CALL DSKOUT ;IF 1ST CHAR = "0", ADVANCE PAPER ANOTHER LINE
DSKFW2: POP PSW ;GET LENGTH BACK
INX H ;INCREMENT POINTER
DSKLOP: R2 ;RETURN IF NO MORE CHAR.
PUSH PSW ;SAVE CHARACTER COUNT
MOV A,M ;FETCH NEXT CHARACTER
INX H ;INCREMENT BUFFER POINTER
CALL DSKOUT ;SEND OUT CHARACTER
POP PSW ;RETRIEVE COUNT
DCR A ;DECREMENT COUNT
JNZ DSKLOP ;DO IT AGAIN

;end of patch for carriage control----------------------------------
```
The authority, Peter Norton, takes a stand on the Microsoft Disk Operating system and has created a compendium of information on DOS unavailable elsewhere. Over sixty computers use MS-DOS or a related version, so this book will serve as a welcome reference for the PC at home or in the office.

With handholding examples and explanations of MS-DOS, Peter Norton includes chapters on Fundamentals of DOS Commands, Getting the Most of DOS Editing Keys, What You Need to Know about Diskettes and File Formats, Programming Languages, Batch Files, and Copy Protection. Norton gives expert advice on copy protection and software selection. For both the novice and the expert, he provides a glossary and a summary of commands for easy reference.

Peter Norton has earned his reputation as the authority on the IBM PC resulting from years in the field, articles in major magazines, lectures, interviews and consulting work. The expertise gleaned by Norton appears within the pages of his two books and benefits the reader and his PC.

The book that has become the final companion to the machine, "Inside the IBM PC: Access to Advanced Features and Programming" illuminates the inner workings of the machine while demonstrating how both beginning and advanced programmers can take advantage of the many features offered by the PC. Norton also explains how the ROM is allocated for BASIC and BIOS. He explores the RAM for functions like the monochrome and color monitor displays and shows how the assembler can be integrated into Pascal and BASIC to access more power from the IBM PC.

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The PC Specific Library

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This intelligent four-line serial I/O board, first designed for UNIX, performs well under CP/M-80

There's a new and improved way of connecting terminals and printers to your S-100 system. The Dual Systems "SIO4/DMA" intelligent four-line serial input/output board was designed from the ground up with UNIX in mind, but can be used quite well with CP/M-80, as this article shows.

In fact, if you have a Dual Systems System/83 UNIX computer (see review in the September 1983 issue) and are technically inclined, you could alternate between CP/M-80 and UNIX as I do. Pull the 68000 CPU card, install an 8085 or Z80 CPU board, and change disks. The listing describes the portion of BIOS for the console; a BIOS for the floppy disk controller can be ordered from CompuPro (the secret is out; Dual uses a CompuPro floppy disk controller). Here's how to use the SIO4/DMA with CP/M, but first—the hardware.

The SIO4/DMA board

Like most Dual boards, the SIO4 is very well designed and built. It uses 24-bit (or 16-bit) addressing, has vectored interrupt lines, is a temporary master (the TMA interface), can handle a CPU clock up to 8 MHz, and will insert from 1 to 16 wait states as needed. There is support on board for XON/XOFF protocol if you want it, for printers with a "buffer full" signal, and direct access to the USARTs. The serial line drivers are claimed to conform fully to the RS-232 signal standard. The SIO4 has a limited ability to do synchronous I/O (this could be used with high-speed intercomputer communications). Each line can be wired for a terminal or a modem (DTE or DCE). Vectored interrupts on the VIO lines can be sent for "character ready" in the FIFO and/or DMA output complete. The baud rate on each channel is settable under software control. In fact, for simple serial applications, that's all the programmer has to do, because the board itself is intelligent. It has an 8085 processor on board; the 8085 implements buffering of characters on input and DMA on output. This 8085, and its 2K of software in EPROM (2716), also takes care of initializing the USARTs. A USART is a chip that converts the parallel data from the CPU or system bus into a form suitable for transmission over serial cables to terminals, printers, and modems. The USARTs in the SIO4 are Motorola MC2661s—an extension of the Signetics 2651. And because the 8085 takes care of buffering input and doing DMA on output, the operating system...
can tell the board to output an entire line of characters, and have only a single interrupt when the entire line has been sent.

Considerable CPU overhead is freed up for productive use by application programs.

However, CP/M-80 does not know how to utilize such a powerful board, since there is no call to the BIOS to write a line to the console. The developer of the CP/M system assumed that serial I/O boards would never be smarter than they were in 1975 on the particular system he was using. So the BDOS part of CP/M forcibly breaks a call to “write a character to the console.” You could easily write a BIOS routine to send one character at a time to the DMA output processor. Fortunately, the board designer thought to allow you direct access to the USARTs, so the BIOS can just treat the output operation like any non-DMA I/O card. This is what my BIOS does.

The SIO4/DMA also has two modes for doing input. One buffers incoming characters in a FIFO queue (FIFO stands for “First-In, First-Out”). The other is a conventional polled I/O mode. The FIFO mode means that the operating system does not have to read characters as fast as you type them. Since the Godbout BIOS is not interrupt driven, you cannot “type ahead” when using the Godbout "Interfacer 1" serial card (which Dual used in their early systems as the "SIO2" card). If you have a Dual SIO4/DMA card, you can type ahead up to 256 characters while your application is executing. Although the characters are not echoed until they are actually read by the program or by CP/M, it’s still quite an improvement! The usual editing characters work as you’d expect.

The big difference between the SIO4/DMA and most other cards only shows up in the FIFO input mode of operation. When operating with the FIFO turned on, the SIO4/DMA provides a single input channel for all incoming characters! This shows clearly how well the DUAL designer anticipated the needs of a multitasking, multiuser operating system such as UNIX, in which a single “device driv-
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When operating with the FIFO on, the SIO4/DMA provides a single input channel for all incoming characters!

SIO4/DMA has a strong family resemblance to the preferred serial I/O board on DEC equipment, the DH-11.

The only problem I've had with the board is that it hangs my system when I erroneously refer to a non-connected terminal. Handshaking is implemented using DTR on pin 20 (changeable), and the board will wait until the terminal is ready. The manual describes a way around this for applications in which full handshaking is not used.

**Documentation**

The manual for the board comes in two parts. Part 1 is written by Dual; it provides an overview, details the switch settings and options, and provides programming information. Part 2 is an extract from the Motorola document on the MC2661 USART; this section gives bit-twiddling details. I found the "programming" section of the Dual manual a little short of examples (only three on 8080 examples). A few details were not explicit; i.e., the baud rate and other parameters to which the on-board processor initializes the USARTs. However, a programmer accustomed to writing BIOS code should be able to handle it. And that's who this manual is written for.

**The CP/M-80 BIOS**

In the FIFO input mode, the Dual SIO4/DMA gives you a single input channel of (possibly typed-ahead) characters. The board returns the line number along with the character, and the BIOS has to sort them out. This version of my BIOS uses the FIFO for console
Dual Systems

Continued from page 107

input (because I like type-ahead), but doesn’t have to sort out what character is from which line, because I’ve only enabled the FIFO from line zero.

To use multiple FIFO input lines, you could implement internal queuing within the BIOS, assigning a character to an input queue based upon its line number. A simpler approach, and one more in keeping with the CP/M BIOS way of doing things, would be to not enable the FIFO and access the USARTs directly. Then input is like any conventional multiline I/O card. And conventional coding techniques could be used within the CP/M BIOS.

Listing 1 contains the SIO4/DMA access routines for simple, console-only access using the FIFO for input, and sending one character at a time to the USART for output. The code for reading characters from the USART would not be much different; the input ports used by ConSt and ConIn become accessible the FIFO and access the USARTs directly. Then input is like any conventional multiline I/O card. And conventional coding techniques could be used within the CP/M BIOS.

To use the code in Listing 1, replace the “Interfacer” access modules in the BIOS with this code. Add a call to

At a glance

Name: SIO4/DMA intelligent four-port serial input/output board

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Price: $650 assembled and tested, with on-board software

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System: IEEE-696 S-100

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"coninit" in the cold boot code (label CBOOT). Then regenerate the BIOS and system disk using a working CP/M-80 system and the Godbout documentation. If, on a System/83, you want to keep the hard disk for UNIX use only, be sure to disable the code in the BIOS for hard disk access! Enable the floppy controller’s BOOT EPROM (Dual UNIX runs with it disabled). Take out the 68000 CPU and put it in a safe place. Install a 8080 or Z80 CPU card with 24-bit addressing and boot the system. (The CPU must have 24-bit addressing, since this is used on all the other cards). You should now be running CP/M from the floppy disk.

I’ve discussed the SIO4/DMA serial interface card, and shown one way—the hard(ware) way—to run CP/M with Dual Systems’ System/83 computer. There are other ways—but that’s a topic for another article.

Note: If you’re not experienced with S-100 hardware and CP/M BIOS software, then please don’t tear apart a Dual Systems’ UNIX system yourself. Get your dealer to do the integration and show you how to make the changes. The instructions in this article are intended for the experienced “techie” only.

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Magic-Bind Supersedes MailMerge

All the power of MailMerge with none of the complexity

by Roger C. Schlobin

Did you ever expect to hear the words: "MailMerge superseded"? Good old MailMerge, the indispensable add-on to WordStar that allows you to merge-print, make multiple copies, use command files, boilerplate, insert files, read variables, and all the other good features that have saved users so much tedium for a number of years. Yet, just as MicroPro's SpellStar has been challenged by superior spelling checkers such as The Word Plus, so too has MailMerge fallen under the shadow of MagicBind.

MagicBind offers all the features of MailMerge and much more—all at the same price! The first blessing MagicBind brings is a solution to that bitter insecurity that has always plagued WordStar lovers. We all know that dread moment: as you are raving to a wide-eyed audience about the joys of WordStar and all its support programs, a sardonic voice invariably carries from the back of the room: "What about proportional spacing?" Suddenly the WordStar lover, now in a cold sweat, is subject to all the smug vulgarities of Perfect Writer, SpellBinder, and Final Word users. Never mind the fact that these word processors accomplish proportional spacing by spreading out the spaces between the words and thus haven't a real typeset quality. They had it and we didn't!

Now, through both MagicBind and its more limited cousin, MagicPrint, the WordStar user can have true proportional spacing with either a justified or an unjustified right margin. The increments are spread throughout both the spaces and the words, and true centering is finally a reality (no more of one letter sticking out when two words of different lines have only a one-character difference). This comes at an important time: many users are now trying to decide whether or not to update their old MailMerges and WordStars to V3.3, and I expect that many are considering the MicroPro line or the addition of MailMerge. After reading this article, you may find that MagicBind is not only a more useful utility, but a real bargain as well.

Before getting into the many joys of MagicBind, let's take a quick look at the usual requirements. To run MagicBind, you need at least 48K of RAM, WordStar (or another standard ASCII text editor like T/Maker, WordMaster, P/Mate, Magic Wand, or Electric Pen-
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MagicBind
Continued from page 111

cil), CP/M-80 (a CP/M-86 version is in the works) or SB-80, and a Diablo 630/1650 compatible printer or a NEC Spinwriter. If your equipment satisfies these requirements, you can produce copy that has over 20% more text per page, and many people will not be able to distinguish it from typesetting, especially with a Diablo metal wheel (a small tip: Diablo plastic wheels work well, too).

MagicBind is, as you have probably surmised, a print formatter, among many other things. The new version for WordStar (1.11/W) will run from WordStar's "R" (Run another Program) command. This is a major improvement over the earlier version, which would only run out of CP/M. However, it will not allow you to edit one file and print another at the same time. Given MagicBind's many features, this isn't a serious limitation at all and can easily be overcome with a software or hardware spooler.

What, then, can MagicBind do, in addition to true proportional spacing and centering? For starters, it can do everything MailMerge can; it can respond to all of WordStar's embedded print commands except that MagicBind has a more sensitive method of "kerning" or changing pitch, respond to all the standard dot commands (line height, etc.), and do it all easier and much faster. MagicBind can read data files created in WordStar's Document mode, not just the Non document mode, and it skips empty fields in data files automatically. MagicBind's merge commands are also much easier; instead of the ".RV" line and ampersand delimiters, simply identify the data file (created the usual way) and pop in the number of the item of each field wherever it appears. Control-PA, a colon, and the number of the item. That's all there is to it, and there are none of MailMerge's annoying pauses while printing.

MagicBind can also do columns (speaking of another WordStar insecurity), multiple-line headers and "footers," automatic chapter and paragraph numbering, print-time record selection while merging, print-time insertion of formatting commands, and automatic handling of widow/orphan lines. Most of this is accomplished by using double dot (...) commands, allowing a file to have both MailMerge and MagicBind commands in it. As if all this weren't enough, MagicBind also has a system for automatically producing up to 15 footnotes per page with a maximum of 500 characters per note. Since Footnote (Digital Marketing) at $125 is currently the only program that does this for WordStar, and since it does have limitations that aren't in MagicBind, many users may find this feature, by itself, enough justification to buy the program.

Believe it or not, there's even more! Two very nifty programs are included...
MagicBind
Continued from page 113
with MagicBind: VERIFY and LABEL. VERIFY is used to check the accuracy of data files: no more of the hit-and-miss disasters discovered only at print time. LABEL is a real treasure. While installing it, the user specifies the type of labels most frequently used: four across, two across, whatever. This becomes the default (although there are other choices at print time). No more of the excessive dot commands that MailMerge demands for label formatting—just a simple control file for the merge with the data file, using the combination of Control-PA, a colon, and the item number.

It's rare to find a program as versatile and as easy to use as MagicBind. The manual is well written: the program's over 60 commands are clearly explained, and the menus are more than helpful. There are instructions for program modifications, and installation is a breeze. There is even room to get very creative with all the program's features.

MagicPrint is a smaller version of MagicBind, with all the print features, but none of the merge capabilities. Considering the $55 difference, you'd be better off buying MagicBind instead of MagicPrint, unless you don't need the merge program.

Ben O. Jones, the creator of these programs, has also produced an indexing program for MagicBind and MagicPrint, called MagicIndex (necessary since both change the pagination, rendering such programs as StarIndex and Documate/Plus inaccurate in their pagination modes). When bought with MagicBind, MagicIndex is a real steal for only an extra $45 (as opposed to StarIndex at $195). Computer EditType is also working on a communications program, MagicLink, and on an editor, MagicEditor. If these programs are as well conceived and as well coded as MagicBind, they, too, will be splendid!

WordStar, MailMerge, and SpellStar are trademarks of MicroPro International, 33 San Pablo Ave., San Rafael, CA 94903; (415) 499-1200.

Footnote is marketed by Digital Marketing, 2383 Boulevard Circle, Walnut Creek, CA 94593; (415) 938-2880.

MagicBind, MagicPrint, MagicIndex, MagicLink (forthcoming), and MagicEditor (forthcoming) are registered trademarks of Computer EditType Systems. MagicBind is $250; MagicPrint, $195; and MagicIndex, $150. The MagicBind-MagicIndex package is $295. All these programs are available through local dealers or Computer EditType Systems, 509 Cathedral Parkway #10A, New York, NY 10025. (212) 222-8748.

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Keep your code under control and your programming understandable with SAL/80

On the one hand, structured languages often produce code that isn't too efficient in terms of space and time. On the other hand, assembly languages can be a haven for unstructured, unreadable, but efficient code. If you wanted to provide methods for writing structured assembly code and spent enough time with the macro capabilities of your favorite assembler, you might produce something like SAL/80. Of course, with SAL/80, you can just start writing the code for your program.

The macro library

SAL/80 version 2.1 is a macro library containing a variety of useful macros, including macros for selection (if-else, case), repetition (while, repeat, loop, do, for-until), flow-of-control (call, conditional calls), and various helpful utilities. It is intended for use with the MAC or RMAC assemblers from Digital Research, and requires a 64K 8080/Z80 system running CP/M 2.2.

The SAL/80 macro libraries contain a good collection of assembly language macros. The manual does not provide the easiest introduction to their use, but with the original source listing provided in the manual and some experimentation, they are usable.

The utility macros in the SAL/80 libraries are, in part, adapted from those in the MAC library on Volume 24 of the CP/M Users' Group, and from other sources. They provide several varieties of console interaction, including console status, character or buffer input/output, binary converted to ASCII hex for output, and ASCII hex input converted to binary. Binary/hex and binary/decimal conversions are also included.

Utility macros for register/stack and register/memory manipulations, double-register subtractions and comparisons, and 16×8-bit multiply and divide routines act as extensions to the assembly language. Block moves, string search within a block, lower-to-upper case conversion, and string comparison macros complete the set of utilities.

Although the utility macros are a kind of bonus in SAL/80, since the package focuses on structured assembly language programming, I would have liked a more complete set of utility macros, including interfacing to all the CP/M functions and a fuller set of string manipulations. The set of utility macros that is provided does not seem to have been as carefully designed and thought out as the set of structured lan-

By Mike Barker

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SAL/80

Continued from page 116

guage macros. For example, the lack of file-I/O macros forces you to write new code every time, or to write your own macros, or to use macros from yet another source.

Documentation

The SAL/80 manual is (mostly) a hacker’s explanation of an approach to programming and an example of that approach. The example uses the SAL/80 macros and assembly language. However, the description focuses on the approach, not the macros. I enjoyed this description as a working example of a programming language, but not as a complete working language. It is often difficult to see the macros for the syntactic description. This section is modeled on a syntactic description of a language, but rarely with the syntax language programmers by providing code structures that encourage the use of structured programming techniques. Assembly languages can certainly be made friendlier by judicious use of macro libraries (some PDP-11 code seems to consist almost entirely of macros, using the well-developed libraries available for those systems).

If you have the MAC assembler (or RMAC), or if you have to write extremely fast or compact code, SAL/80 may be just the extra advantage you need. Or, if you want to learn about macros, the large collection in SAL/80 could be a useful introduction. Macros are a powerful, exciting feature in any language, and SAL/80 shows how helpful they can be.

Before you buy, decide what tools you need for the job you want to do. If you decide that MAC or RMAC is what you need, then try SAL/80. It can help keep your code under control, and your programming understandable. However, if you’re trying to pick a structured language for programming, I would recommend a C compiler.

A lengthy “single system license agreement & support contract” of relatively normal format for microcomputers is included. The license does not indicate whether or not a royalty is required if you sell code produced using SAL/80. If you intend to use SAL/80 for serious production of salable software, you will need to negotiate a contract aimed at that production work.

Protos, a division of Newberry Microsystems, is registered with the U.S. Patent Office. SAL/80 is a trademark of Newberry Microsystems and is available from: Protos, 24225 Summerhill Ave., Los Altos, CA 94022; (415) 948-8807.

Price: $59 for 8" SD disk, 235-page manual, and one free update.

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Mass Renaming by Filetype

One major problem with the CP/M "REN" command is that you can't RENAME files of one type to a different type using a single command. For example, if you wanted to RENAME all of your .ASM files to be .LIB files, you would have to go and RENAME them one at a time. You couldn't just type a command like:

```
REN .ASM=.LIB.
```

In essence this is what RENEXT (RENAME extension) does: it will rename all files having a given filetype to files having the same names but a different filetype. Since RENEXT is not a CP/M function built into the operating system, the program must exist in every user area by which it is to be used. Once the program has been assembled (using ASM.COM) and turned into a .COM file (using LOAD.COM or DDT.COM), it can then be executed.

To use ED.COM, ASM.COM, DDT.COM, and LOAD.COM, see your CP/M manual. The RENEXT format is:

```
RENEXT [D:] Sext Dext
```

where [D:] is the drive you want to rename on (A: to P:). If you don't put one in, then the default drive is assumed. Sext is the SOURCE extension or the extension to search for when renaming. Dext is the DESTINATION extension or the extension to rename to once the source extension is found.

The program will display the filename as it was, and then its new name. If it comes across a filename that already exists, it will not rename that file. What it will do is stop execution and beep to let you know that this file already exists under the new extension. A sample session would look like this:

```
RENAMING TEST.ASM TO TEST.LIB
RNAMING RENEXT.ASM TO RENEXT.LIB
```

Rename files of one type to a different type using a single command
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John-
Have you seen this?
Let's discuss ASAP!
Bill
Now, if the file ROUTINES.LIB were already on disk, it would look like:

```
RENEW ASM LIB (rename all
ASL files to
LIB files)
RENEW TEST.ASM TO
TEST.LIB
RENEW RENEXT.ASM TO
RENEXT.LIB
THE FILE ROUTINES.ASM ALREADY
EXISTS.
PROCESSING Halted. ALL FILES
MAY NOT BE RENAMED
```

And you are returned to CP/M.

If you are on drive A: and you want to rename the files on B:, the format is:

```
RENEW B:ASM LIB
```

Note that you only have to put the drive number on the source extension.

That's about it. If any problems do occur, please contact me.

George M. Gallen, P.O. Box 17622, Philadelphia, PA 19135
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**Program name:** DataCURE: Error-correction disk backup/restore utility  
**Hardware system:** 8080/Z80; CP/M 2.2; 8" drive  
**Minimum memory:** 48K  
**Language:** 8080 Assembler with some Fortran  
**Description:** DataCURE is a utility program to ensure the integrity of data or programs on archive or interchange disks. It uses very powerful proprietary error-correction algorithms. DataCURE rebuilds files affected by bad sectors, restoring the original data to replacement sectors. It can regenerate a complete track, including the directory track. Information for detecting bad sectors and correcting the data in them is kept in duplicate "protection" files occupying about 5% of disk space. DataCURE supports all CP/M compatible formats and sector sizes. It is self configuring, with both menu and command modes, and gives English-language error messages.  
**When released:** May 1983  
**Price:** $99, including 8" disk and bound user's manual. Demo disk priced at $19; includes .DOC file. Add $5 shipping.  
**Available from:** Colorado Online Systems, Inc.  
40 Balfour Lane  
Ramsey, NJ 07446  
(201) 327-5155  
CIRCLE 310 ON READER SERVICE CARD

**Program name:** TXL: Telex Link  
**Hardware system:** A modem; runs on any microcomputer with CP/M, CP/M-86, MP/M, MP/M-II, MP/M-86, MS-DOS  
**Minimum memory:** 48K (8-bit); 64K (16-bit)  
**Language:** C  
**Description:** TXL is a telecommunications package to interface most microcomputers to the Western Union Telex II (TWX) network. TXL allows your computer to function as an intelligent telex station, replacing the conventional paper tape telex machine. Edit your telex messages to perfection using your text editor. TXL automatically formats and sends them. Incoming telex messages are received, displayed, stamped with date and time and then written to disk storage.  
**When released:** 1979  
**Price:** $350  
**Available from:** Cawthon Scientific Group  
24224 Dearborn, MI 48124  
(313) 365-4000  
CIRCLE 312 ON READER SERVICE CARD

**Program name:** CTL: Computer Telex Link  
**Hardware system:** A modem; any microcomputer with CP/M, CP/M-86, MP/M, MP/M-II, MP/M-86, MS-DOS  
**Minimum memory:** 48K (8-bit); 64K (16-bit)  
**Language:** C  
**Description:** Computer Telex Link is a communications program designed specifically for use with Western Union's EasyLink service. With your personal computer, CTL, and an EasyLink account you can conveniently send and receive messages to and from any telex station anywhere in the world. In addition, you can originate mailgrams, telegrams, and international cables. CTL is delivered complete and ready to run. No user software patching is required.  
**When released:** 1982  
**Price:** $165  
**Available from:** Cawthon Scientific Group  
24224 Dearborn, MI 48124  
(313) 365-4000  
CIRCLE 313 ON READER SERVICE CARD

**Program name:** GINA +  
**Memory and hardware requirements:** 64K with CP/M-80 or 128K with CP/M-86 or PC-DOS, an 80-column CRT; two high-capacity double-sided double-density disk drives.  
**Language:** Pascal MT +  
**Description:** GINA + is a software program that functions as a point-of-purchase microcomputer retail sales assistant. It is designed to help the salesperson educate, acclimate, qualify, and instill confidence in apprehensive and/or curious prospects. GINA + helps the prospect decide which of the retailer's systems could meet his needs, but leaves the "fine tuning" and personalized selling to the salesperson. The GINA + software system consists of three major components: 1) software and hardware tutors, 2) the consultant, and 3) the proposal. The tutors provide the information required to understand the purpose and use of the system components that need to be purchased. The consultant conducts an interview to obtain information on what is to be done by the system, as well as how much and how often. Follow-up information is also obtained. Based upon the answers supplied, a proposal is generated. The proposal then serves as a model upon which the prospect and salesperson build.  
**Price:** $495  
**Included with price:** a program to configure GINA + for your terminal, a customizer that allows the dealer to input specific items from his inventory by
brand name, the GINA + system, and documentation.
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Millbrae, CA 94030
(800) 352-9999 or
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CIRCLE 313 ON READER SERVICE CARD

Program name: Informail
Hardware system: IBM VMCMS
Minimum memory: 256K
Description: Informail is a proprietary electronic mail system offered to time-sharing users of the Informatics data center. It provides each user with an electronic mailbox which acts as a storage device, backs up all files automatically, and only permits users to read mail sent to their own mailbox ID. The directory function allows mail to be addressed to a user's name if the Informail ID is unknown. Even if the user does not supply exact spelling, the directory recognizes names of recipients by abbreviations, partial names and phonetic spelling. When a perfect match is not found, the system presents the user with a list of options. The directory also contains information about organizational structure and allows the user to request the names of all employees reporting to a particular manager. The directory can also create distribution lists for future use. The system's create function

Informail's directory recognizes abbreviations, partial names, and phonetic spellings.

prompts the user for standard memo fields and text entry. A send feature allows the user to specify each receiver's mailbox ID. A read capability allows the user to receive mail from other system users. Mail may be directed to the terminal, the printer or disk. The modify function permits the user to cancel any mail received and add or delete names and IDs from a distribution list. A list of outgoing mail can be created including subject, date and time sent, intended receiver and information on

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- Support for numerous add-on libraries including: HALO Graphics, C Tools for fundamentals in many areas, PHACF for ISAM file management and numerous others. Ask for a list.

Pull Charlie's strings with our fast, complete, proven, reliable C Compiler—the leading compiler for serious programmers of MS-DOS and CPM-86 systems.
**SOFTWARE**

Continued from page 129

whether mail has been read or cancelled.

**Price:** $25 per hour

Available from:

Informatics General Corporation
6 Kingsbridge Road
Fairfield, NJ 07006
(800) 631-1156

CIRCLE 314 ON READER SERVICE CARD

Program name: SmartKey II

Hardware system: any microcomputer running CP/M; the IBM PC

Minimum memory: SmartKey II: 4.25;

SmartPrint: 4K (2.2K when run with SmartKey II)

Language: Some Assembler, some C

Description: SmartKey II is a background utility program that allows the user to customize a microcomputer keyboard to reflect software needs. All keys may be redefined at will to become other characters, software commands, or whole words, phrases or boilerplates. Definitions may be changed at any time and saved to disk. Features of SmartKey II include instantaneous installation of special function keys, an expanded buffer capable of handling 3,750 definitions at a time, a text compiler that can reduce entire text files to a single keystroke, and a built-in editor for complex reorganization of key definitions. SmartPrint, an upgrade to SmartKey II, enables users to implement all of a printer’s built-in functions and character sets.

**Price:** SmartKey II: $89.95

SmartPrint: $49.95

Both programs together: $129.95

Available from:

Heritage Software
3757 Wilshire Blvd., #211
Los Angeles, CA 90010
(213) 384-4120

CIRCLE 315 ON READER SERVICE CARD

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"**Q-PRO 4 blows dBASE II away**

We now complete complex applications in weeks instead of months."

says Q-PRO 4 user, Richard Pedrelli, President, Quantum Systems, Atlanta, GA

"As a dBASE II beta test site the past two years, we were reluctant to even try Q-PRO 4. Now we write all our commercial applications in Q-PRO 4. We find it to be an order of magnitude more powerful than dBASE II.

We used Q-PRO 4’s super efficient syntax to complete our Dental Management and Chiropractic Management Systems much faster. Superb error trap and help screen capabilities make our finished software products far more user friendly, too.

In my estimation, any application programmer still using outdated 3rd generation data base managers or worse, a 2nd generation language like BASIC, is ripping himself off."

Runs with PC-DOS, MS-DOS, CP/M, MP/M, CP/M86, MP/M86, TurboDOS, MmmDOS, MUSE, and NSTART.


Money-back guarantee • Author’s lock up package available • Finished applications are freely transportable between operating systems • Multi-user with true record and file lock.

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CIRCLE 196 ON READER SERVICE CARD

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**Departmentalization of accounts is allowed for 99 departments.**

99 departments. MICA General Ledger also has master/sub account relationships to provide flexibility in formatting the balance sheet and the P&L statements. Reporting flexibility is also provided through the grouping of accounts in up to 20 user-definable account categories including a special category for nonoperating format, and is balance-verified by the computer to eliminate an unbalanced ledger situation. Transaction entry is also performed in batch mode which enables the user to print a data entry proof and make corrections prior to updating permanent account
balances.
Available from:
Micro Associates, Inc.
2300 Highway 365, #510, LB 131
(409) 724-6583
CIRCLE 316 ON READER SERVICE CARD

Program name: MITE/MS
Hardware system: any microcomputer running IBM PC-DOS or MS-DOS
Minimum memory: 64K
Language: Assembler
Description: MITE/MS is a menu-driven data communications package that converts any computer into an intelligent terminal for use with online services such as Dow Jones, The Source, CompuServe, TWX and for transferring both text and binary files between 8 and/or 16-bit microcomputers. MITE/MS can also be used to access corporate data centers. It has user-protection features that prevent operator errors. All communications parameters (parity, baud rate, etc.) are under full user control on all versions. Various user-selectable options allow MITE/MS to capture text from or send text to virtually any asynchronous/ASCII online system. The user may also define up to 10 programmable macro strings which can be invoked via function keys from within the link. This mechanism also supports fully automatic login on most systems. A full set of system interface functions (DIR, TYPE, etc.) are available from within MITE/MS. It also supports three binary file protocols, (XMODEM, CLINK, CROSSTALK, and HAYES) for compatibility with the largest possible number of other programs. These protocols allow transfer of any file with error checking and automatic retransmission. MITE/MS is now available preinstalled on the IBM PC-XT, Columbia, Compaq, Corona, VICTOR and on other MS-DOS systems. MITE, the 80/86 version, is available on Xerox, Exxon, San Jo, TeleVideo, Heath/Zenith, KayPro, North Star, Radio Shack, and others. MITE/86, the CP/M-86 version, is available on many CP/M-86 machines. Price: $195
Included with price: 5' disk and reference manual
Available from:
Mycroft Labs, Inc.
P.O. Box 6045
Tallahassee, FL 32314
(904) 385-1141
CIRCLE 317 ON READER SERVICE CARD

TimeEPROMmer,
the S-100 CP/M* compatible programmer that's useful every second of every day. A real time calendar/clock with lithium battery and an EPROM programmer that programs all popular eproms. Unbeatable price/performance ratio. Features designed for easy operation.

EPROM Programmer: Port addressable.
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CIRCLE 188 ON READER SERVICE CARD

THE
488+3
IEEE 488 TO S-100 INTERFACE

CIRCLE 66 ON READER SERVICE CARD
New Products

What’s new: a quick roundup of recent innovations and improvements

**Hard disk systems for CP/M**

CFX Disk Systems, Inc., formerly a part of CF CompuTrax, has announced the release of its first two hard disk systems for CP/M machines: the CFX-10 and the CFX-16. Both these systems incorporate a 5¼” Miniscribe hard disk.

These systems are currently available for most Z80- or 8080-based machines running CP/M and having the Digital Research utility MOVCPM.COM. Additionally, special models are available for the NEC 8000, Apple II and III, and the IBM PC. Setup and use is fast and simple. Both systems included a manual that gives step-by-step instructions for adding the adapter to the computer and a complete explanation of the software sold with the disk. The software is used not only to format, verify, and run the system, but also to check out the disks, controller card and buffer in the event a problem should arise.

The CFX-10 disk system is actually a 12 MB disk which, when formatted, yields 10 MB of usable space. The CFX-16 disk system is based on a 20 MB disk before formatting.

**Prices**: Current mail order pricing is $1,995 for the CFX-10 and $2,395 for the CFX-16. Future products will include a tape backup system for the hard disk, 40 MB formatted to 32 MB—to be called the CFX-32—and chaining up to four disks for even greater storage.

**CFX Disk Systems, Inc., P.O. Box 920152, Norcross, GA 30092; (404) 253-3030.**

**Circle 320 on Reader Service Card**

**High-performance hard disk drives**

Percom Data Corporation has announced the release of a new generation of high-performance PHD® hard disk drives for a variety of personal computers. The new product line will provide speed enhancements and one of the most efficient implementations of memory caching available today.

Percom Data claims to have improved on Winchester technology by implementing a very efficient form of caching driver. Their design permits speed performance increases four times greater than that of key competitors. Percom’s benchmark tests show that the PHD hard disk product line is more than five times faster in data transfer than the IBM XT hard disk. The new hard disks are fast, responsive and flexible in performance.

Caching design permits the Percom Data hard disk drive to work with the host computer so that most used files are actually stored and processed in memory—to increase speed—then transparently returned to hard disk memory for data security.

This will benefit sophisticated users, programmers, office managers, network resource managers, and anyone anticipating future applications with multitasking, multiuser functions.

The new Percom Data PHD product line is immediately available for the IBM-PC, and supports PC DOS 2.0. High-performance PHDs for IBM-compatible microcomputers will soon be available.

**Prices**: Caching driver “personality kit,” $149.95. Percom PHD hard disk subsystems will continue to be priced from $1,895 (for a 5 MB version) and up. A caching driver software upgrade kit is also available direct from Percom Data for $50. This will enable present Percom IBM DOS 2.0 PHD owners to upgrade to the high-performance version. Cost of the upgrade package is $50 and is available only from Percom Data. Minimum memory requirement: 256K RAM.

**Percom Data Corp., 11220 Pagemill Rd., Dallas, TX 75243; (214) 340-5800.**

**Circle 321 on Reader Service Card**

**16-bit SBC built around Intel 80126**

Advanced Digital has announced the introduction of the SUPER 186®, the first 16-bit S-100 single board computer build around the Intel 80186. The 8 MHz SUPER 186 can be configured as a stand-alone bus master or bus slave to serve both single or multiple users with superior speed, versatility, and reliability.

SUPER 186 features 256 KB of memory, expandable to 1 MB, and a floppy disk drive controller that can simultaneously support both 8” and 5¼” disk drives. It also comes with four serial RS-232 and two parallel 1/0 ports, DMA controller, parity and monitor EPROM to aid in initial loading. The board is compatible with CP/M-86, MP/M86, TurboDos and MS-DOS operating systems. Performance of existing CP/M-86 systems can improved by as much as 2½ times with SUPER 186.

In a TurboDOS environment, SUPER 186 can also function as a powerful 8/16-bit bus slave. By using the SUPER 186 for large processing demands, the user frees the remaining, less-powerful boards for other tasks, while the SUPER 186 board rapidly completes the assigned job.

**Price**: $1,650; quantity discounts available for OEMs and independent sales organization.
SUPER 186 is the latest addition to Advanced Digital Corporation's S-100-based modular microcomputer line that includes SUPER SYSTEM II, one of the most powerful multiuser microcomputer systems available; SUPER STAR, the first S-100 system with both a fixed and removable Winchester drive and expandable to four users; SUPER SIX (16 MHz, Z80-based) and SUPER QUAD (4MHz, Z80-based) 8-bit, single board computers; SUPER SLAVE, a powerful single-board processor; and a compact, microprocessor-based hard disk controller.

Advanced Digital Corp., 5432 Production Drive, Huntington Beach, CA 92649; (714) 891-4004.
CIRCLE 322 ON READER SERVICE CARD

Disk subsystems

PH Associates, Inc. has announced three new additions to its continuing disk subsystem product line. The DSS-5B, DSS-10B, and DSS-15B are designed to provide economical disk storage for those users not requiring the high performance (capacity and speed) of the MARK series. These 85 ms average access drives use industry standard Seagate ST-400 series compatible drives. The DSS series comes as a complete subsystem assembled in its own stand-alone chassis or in OEM versions consisting of drive, cables and controller for use by system integrators.

The subsystems include a smart controller with intelligent formatting and automatic alternate sectoring. Features include • 85 ms average access speed (buffered seek) • 90-day parts and labor warranty on both the controller and the disk unit, including heads and platter • 5¼" floppy physical size compatibility • 5, 10, and 15 MB disk capacities (formatted) • Heat dissipation less than 40 watts • Interfaces to DEC Q-BUS, S-100, and any Z80 processor such as the Northstar Advantage, Apple IBM PC, TRS-80, Zenith Z-100, Motorola VME BUS, Multibus, and NEC as well as any 8-bit parallel port • Complete software currently available for CP/M and Apple, TRS-80, NEC-IBM-PC • 5 megabit per second disk transfer rate.

Prices: Formatted capacities of 5, 10 or 15 MB are available with list prices of $1,995, $2,295, and $2,695 respectively. Significant quantity and OEM discounts are available.

PH Associates, 8720 Old Courthouse Rd., Vienna, VA 22180; (703) 281-5762.
CIRCLE 323 ON READER SERVICE CARD

Stand-alone array processor for APL software

Analogic Corporation has announced the APL Machine, the first stand-alone general-purpose computer system using array architecture to deliver mainframe APL performance at a fraction of the cost. Featuring the interaction and response of a personal computer, the APL Machine is a convenient yet powerful development tool for high-level decision making. Designed to replace traditional costly and less flexible methods of processing APL, the APL machine can be used for strategic planning and forecasting, as well as financial, actuarial, graphics animation, and scientific applications.

A typical configuration consists of a 4 MB array processor, an IBM PC as the programmer's workstation, a 124 MB hard disk, a dual-mode tape drive, and an I/O processor supporting up to 8 terminals, and the Analogic software system. System architecture supports several levels of overlapped and parallel processing, permitting a very high level of performance and throughput.

While the APL interpreter runs in the 12.5 MHz 16/32-bit super micro control processor, handling all of the aspects of syntax and conformance checking, the array portion of the machine concurrently executes arithmetic and logical expressions. Moreover, it provides several high-speed processing elements executing additions, multiplications, and logical operations at the same time. The APL Machine's array processor can execute up to 10 million full floating-point operations per second. Because of hardware design efficiencies, pipeline throughput is competitive with machines rated at 15 million operations per second.

The Analogic 32-bit floating-point array processor used in the APL Machine is also programmed directly in APL. Since the primitive functions and operators of APL reside in pipeline microcode, high-speed execution in most applications is achieved directly from APL. For applications using different software such as compiled or assembled code, Analogic's APL implementation provides shells to incorporate the non-APL code. These "shells" are similar to UNIX shells and handle non-APL code in the same manner as if it were written in APL.

The Analogic multiuser, virtual memory APL environment is designed to bypass the need for setting up independent workspaces and files. A sophisticated memory manager allows the user to nest applications and to share code among concurrent processes.
NEW PRODUCTS
Continued from page 133

A sophisticated operating environment on the PC workstation, designed by Analogic and called InSight, allows the user to display up to 10 concurrently running tasks on overlapping and sliding windows. The PC environment itself is a multitasking, virtual memory system that communicates to the array processor through a packet protocol. Its capabilities extend to using the PC for concurrent interaction with multiple processes on multiple systems.

Analogic is engaged in the design and manufacture of high-precision data conversion products, medical imaging systems, control instrumentation, and signal processing computer equipment.

Prices for a basic APL Machine with 1/2 megabyte of memory start at $44,000. The typical system described above is about $85,000.

Analogic Corp., Audubon Rd., Wakefield, MA 01880; (617) 246-0300.
CIRCLE 324 ON READER SERVICE CARD

Sierra Data Sciences
8 MHz micros

Sierra Data Sciences is producing two new S100 bus, Z80H single-board computers (SBCs). The boards, a master (SBC 100/8M) and a slave (SBC 100/8S) are the first production-run SBCs to feature 8 MHz speeds. In addition, this new generation of high-speed, very powerful microcomputers takes full advantage of the design benefits offered by the IEEE-696/S-100 bus standard for exceptional throughput rates. Typically, there is a 100% increase: SBCs operating under the latest versions of Sierra Data-supported CP/M or TurboDOS are significantly faster than most 8-bit micros.

On board each standard SBC, master or slave, is a Z80H central processor with 64 to 512K RAM, bank selectable in 8K segments. Additional support chips include DART for two serial ports, 4K to 32K EPROM, and an optional math coprocessor.

Two parallel ports and clock timing are provided for on the master via Zilog CIO. Similar functions are handled through a P1O and a CTC on the slave. The slave also features a 4K static RAM buffer for high-speed 8- or 16-bit bus transfers and upward compatibility to 16-bit systems.

The master uses a DMA controller that provides for very fast data transfers without CPU intervention and no wait states. Disk reads, for example, are typically 200 to 500% faster. DMA transfers are possible when moving data from master memory to slave memory and from master to or from floppy disk or hard disk. Additionally, a floppy disk controller that can simultaneously run 5 1/4" and 8" media is another onboard feature. A high-speed Winchester DMA port is also standard.

Built for speed and functional reliability, the SBCs are multilayer boards with separate ground and power planes. Yet both boards meet the IEEE-696/S-100 standard and therefore fit any compatible system.

In stand-alone configuration, the master makes an exceptionally powerful system for personal computing or standard data processing tasks. Applications requiring high-speed real-time monitoring, dedicated process control and communications are especially well suited to the new SBCs.

Prices: Standard boards (128K RAM) are "quantity-one" priced at $995 for the SBC 100/8M and $895 for the SBC 100/8S.

Sierra Data Sciences Inc., 25700 First Street, Westlake, OH 44145; (216) 892-1800.
CIRCLE 325 ON READER SERVICE CARD

"Watchdog" timer added to multipurpose Q-Bus board

Codar Technology, Inc., has announced a new version of its Q-Timer* single-board system module that adds a watchdog timer to existing functions such as a calendar clock and nonvolatile CMOS memory.

Designed for integrators of realtime systems based on the DEC family of microprocessors, the dual-wide Q-Timer board is the only product of its kind with complete software support stored in an on-board EPROM. The board provides built-in compatibility with DEC's 16, 18 and 22-bit bus architectures and, in some instances, can replace up to four dual-wide modules.

The watchdog timer makes the Q-timer particularly suitable for unattended or remote operations that it will re-boot a system if program execution stops because of a noncatastrophic problem, such as a bad memory cell, static discharge, or a failure to transfer data from a peripheral device.

If, for some reason, a programmed instruction is not completed, the machine may sit there and wait forever unless a person or an escape technique intervenes. The watchdog device will automatically activate power-fail/restart logic if a user program does not read the watchdog register at least once during a user-defined interval. Thus, when program execution stops prematurely, the timer is not reset and the system is rebooted.

Also integral to the Q-timer is a CMOS calendar clock that provides tens of seconds, minutes, hours, days, the day of week, month and year, with automatic leap-day insertion. It uses a 3.768 KHz crystal oscillator for reference.

An on-board CMOS RAM memory provided 2K X 16 bits of storage for data and/or programmed parameters. This feature is particularly useful for scientific or process applications where there is no disk storage.

CMOS devices are backed up by an on-board NiCad battery pack (with recharging circuit) that will maintain operational readiness for a minimum of 60 days.

All of the software necessary to operate the Q-Timer functions is stored in EPROM, eliminating the requirements of a SYSGEN or patching of either RT-11 or RSX operating systems. An EPROM software monitor provides self-diagnostics of on-board devices and has bootstrap routines for RLO1/02, RK05, RK06/07, RM02, TU58, and TM11 storage devices. In addition to the self-diagnostic routine, the software will run complete CPU and memory diagnostics.

Expandable 8-bit parallel input and output provide a path by which the Q-Timer can perform a variety of I/O functions in addition to routine calendar clock tasks, often eliminating a DRV11-type interface board.

Codar's Computer Products Division was formed in 1982 to market DEC system enhancement products developed by the company for its own use in a ruggedized data acquisition/HF radar system used in remote sensing of ocean surface conditions.

Price: Codar Technology Inc., 437 Main St., Longmont, Co 80501; (303) 772-2782.
CIRCLE 326 ON READER SERVICE CARD
BANNED - No content to display
NEW PRODUCTS
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Stok Software, Inc., 17 West 17th St., New York, NY 10011; (212) 243-1444.
CIRCLE 328 ON READER SERVICE CARD

ESDI/ESTI drives

OMTI has announced the introduction of the Series 6000 family of intelligent data controllers designed to attach disk and tape drives having the ESDI/ESTI (Enhanced Small Disk/Tape Interface) to a variety of host systems. The host computer bus is the industry standard SASI (ANSI­SCSI) bidirectional bus interface, with its associated high-level command set. The ESDI/ESTI disk and tape interface was developed by a cooperative effort of disk and tape drive manufacturers interested in meeting the demand for increased performance and capacity while providing an industry standard interface. Described as an evolution of the ST506/412 interface, the ESDI/ESTI interface standard is data rate independent (NRZ), encoding method independent, and defines a serial command and response protocol. This makes it possible for controllers to dynamically determine the drive parameters. The ESDI/ESTI interface is unique in the sense that both disk and tape drives can be attached on the same bus without sacrificing the performance characteristics or cost of either.

The Series 6000 controllers are designed around OMTI's third-generation advanced VLSI data controller chip set. This 15-megabit chip set provides performance features such as concurrent sector transfers, 2.0 MB host data transfer rates, and intelligent buffer management. The Series 6000 family will initially consist of the Model 6100 ESDI controller and the Model 6300 ESDI/ESTI controller, with other products to follow.

The Model 6100 disk controller is packaged in the industry standard 5½" form factor and will support up to four ESDI disk drives. Features include disk data rates up to 10 megabits per second, 2.0 MB host data transfer rates, concurrent sector transfers, overlapped seek operation, automatic configuration of disk parameters (heads, cylinders, sectors/track, data encoding method, etc.) on power-up, format using the drive manufacturer's prerecorded defect list, 48-bit ECC error correction code with 20-bit error correction capability, defective sector/track handling and interdevice copies.

The Model 6300 disk/tape controller is also packaged in the industry standard 5½" form factor and will support up to four ESDI/ESTI and/or ST506 devices. The ESTI devices may be streaming, start/stop, or block addressable tape drives. In addition to the Model 6100 features, the Model 6300 disk/tape controller supports tape data transfer rates to 5 megabits per second, automatic configuration of tape parameters (tracks, tape speed, tape density, data encoding method, etc.) and interdevice copies.

The ANSI­proposed Small Computer System Interface (SCSI) (also know as SASI) is implemented in the OMTI Series 6000 intelligent controller family. SCSI defines a host level I/O bus structure that can be operated at data rates in excess of 1.5 MB per second. The primary objective of this interface is to provide host computer with device independence, so that disk drives, tape drives, and future devices can be added to the host computer without requiring modifications to the generic system software or hardware. The ESDI/ESTI device level interface supports this concept by supplying the important device parameters upon request.

Prices: (in quantities of 1000): Model 6100, $255; Model 6300, $350. OMTI, 137 Sinar Ave., Campbell, CA 95008; (408) 370-3555. CIRCLE 329 ON READER SERVICE CARD

PC bubble memory board

Helix Laboratories, Inc., has introduced the PC Bubble board, a half-megabyte bubble memory expansion board designed to emulate a "mini-Winchester" in the IBM Personal Computer. The board brings many of the convenient features of the fixed disk to the PC without requiring an increased or external power supply.

The PC Bubble board responds to fixed disk commands under most operating systems including MS-DOS 2.0, Softtech Pascal IV.13, and CP/M-86 for the PC/XT. Software features such as the RESTORE and BACKUP commands as well as partitioning to hold multiple operating systems are available to the user. If the AUTOSCANN ROM BIOS is installed, the PC Bubble can also cold boot any of the above operating systems.

The all solid-state PC Bubble contains four Intel 7110 one-megabit bubble memories, providing rugged, nonvolatile mass memory with no moving parts, as well as immunity to dusty, hostile environments. Operation is completely quiet. Mean access time (40 ms) and data transfer rate (400 kbit/s) of the board result in file transfers that are several times faster than floppy disk. Bubble memory technology makes the PC Bubble several orders of magnitude more reliable than either the fixed or floppy disk.

In addition to the PC, the PC Bubble works in the IBM XT and most IBM-compatible computers. The lower power demands and compactness of the PC Bubble make it a unique enhancement to compatible portables, such as the Compaq and Corona.

Price: $1,495, with a four-to-six week availability time.

Helix Laboratories, Inc., 16776 Bernardo Center Dr., Ste. 106A, San Diego, CA 92128; (619) 451-0270
CIRCLE 330 ON READER SERVICE CARD

Monolithic Power FET Arrays

Supertex Inc., active in CMOS and DMOS technology, has introduced monolithic power FET arrays designed to drive high-voltage, nonimpact printers or flat panel (plasma, LCD or electroluminescent) displays. The 8-channel, AN01 (N-channel) and AP01 (P-channel) devices are fabricated using lateral DMOS technology.

The devices, which are available in 18-pin DIPs, reduce the cost per channel by up to 40% compared to similar circuits designed with discrete TO-92 parts. In addition to cost benefits, the arrays reduce insertion costs and improve board space utilization.

The arrays have common-source construction with underdedicated gates and drains. This provides the circuit design flexibility by allowing each FET to be independently driven. Designers using these arrays can directly interface CMOS logic with high voltages.

The AN01 and AP01 can sustain continuous drain currents of 30 mA and 15 mA per channel respectively and are rated from 200 to 400 volt drain to source voltage. Both are available from stock in production quantities.

Prices: Pricing depends on voltage level and whether the devices are plastic or ceramic. AN01 20NA (200 volts): $249 in 1K quantities; AP01 20NA (200 volts): $309 in 1K quantities. Both also available at 300 and 400 volt levels; prices are higher for the ceramic models.

Supertex Inc., 1225 Bordeaux Dr., Sunnyvale, CA 94086; (408) 744-0100
CIRCLE 331 ON READER SERVICE CARD
SOFTWARE DESCRIPTIONS

TPM (TPM I) - S80 A 280 only operating system which is capable of running on a wide range of microcomputers. It provides many features not found in CP/M such as independent disk directories partitioning for up to 255 user partitions, space, time and version commands, date and time, creating FCB's, chain program, direct disk I/O, and more. Available for North Star (either single or double density), TRS-80 Model I/II/III (or 40 and 80), or Tandy Model I/II.

TPM II - $125 An expanded version of TPM which runs on a fully CP/M compatible system but still retains the extra features such as expanded density capabilities allowing over 60k per side on an 8" disk. Available pre-compiled for Vensiloft II (6 or 8), Epson 80X, Osborne II or TRS-80 Model I.

CONFIGURATOR I
This program provides all the necessary programs for customizing TPM for a floppy controller which we do not support. We suggest ordering this on a single density disk.

CONFIGURATOR II
This package includes all the necessary programs for configuring TPM for a floppy controller which we do not support. This is an expanded version of CONFIGURATOR I.

DEVELOPER I
This package includes all the necessary programs for developing and debugging programs. It includes a macro processor for simplifying the development process.

DEVELOPER II
This package includes all the necessary programs for developing and debugging programs. It includes a macro processor for simplifying the development process.

DEVELOPER III
This package includes all the necessary programs for developing and debugging programs. It includes a macro processor for simplifying the development process.

DEVELOPER COMBO
This package includes DEVELOPER I, DEVELOPER II, and DEVELOPER III.

LINKER
This package includes LINKER.

MODEL I PROGRAMMER
This package is only for the TRS-80 Model I. Note: These are the only CP/M programs available for the Model I. It includes: TPM, BUSINESS BASIC MACRO I, MACRO II (S100), BUSINESS BASIC (S200), MODEM SOURCE (S40) and DISASSEMBLER (S80).

MODEL II PROGRAMMER
This package is only for the TRS-80 Model II. It includes: TPM II, BUSINESS BASIC MACRO I, MACRO II (S100), BUSINESS BASIC (S200), MODEM SOURCE (S40) and DISASSEMBLER (S80).

MODEL III PROGRAMMER
This package is only for the TRS-80 Model III. It includes: TPM III, BUSINESS BASIC MACRO I, MACRO II (S100), BUSINESS BASIC (S200), MODEM SOURCE (S40) and DISASSEMBLER (S80).

DISK FORMATS
When ordering software specify which disk format you would like.

DISK PACKAGING
When ordering software specify which disk format you would like.

ORDERING INFORMATION:
Visa/MasterCard/C.O.D.
Call or Write for Ordering Information...

OEMS:
Many CPD products are available for licensing to OEM's. Write to Carl Galletti with your requirements.

Computer Design Labs
CIRCLE 84 ON READER SERVICE CARD 342 Columbus Avenue/Trenton, NJ 08629

ZTEL - A00. An extensive text editing language and editor modeled after DEC's TECO.
ZEDIT - A00. A 4-mstr edit controller character line oriented. Works well with hardcopy or terminals and is easy to use. Includes macro command capability.

TOP I - S100. A Text Output Processor for formatting manuals, documents, etc. Includes commands which are entered into the text by an editor. Commands include: page number, heading, subheading, centering, and more.

TOP II - S100. A super set of TOP I. Adds: embedded control characters in the file. It is used for creating a format with a printing engine. The engine is called and the file is sent to it.

ACCOUNTING PACKAGE
Includes DEVELOPER I, DEVELOPER II, DEVELOPER III, LINKER, BASIC I and II, BUSINESS BASIC I and II, MODEM SOURCE I and II, DISASSEMBLER I and II.

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bank is currently selected. This memory is known as common, or global, memory. Code which changes banks must execute in common memory so that the instruction executed after the one which switches banks is the following instruction, rather than whatever happens to be at the corresponding address in another bank. This arrangement can be achieved using memory boards smaller than 64K, by having one board for the common memory addresses which ignores the extended address.

In order to try to solve this problem with memory boards of 64K or larger, things begin to get tricky. I would like to discuss both a straightforward solution and a more sophisticated one. Since these involve more complicated circuits, rather than simple changes to Bender's circuits, I will discuss them only in general terms.

The straightforward solution checks the regular address lines to determine whether an address is in common memory or not. (With an 8K common memory, it would check lines A13-A15.) If the address is not in common memory, the action is as before, using the contents of the latch to assert the value of 0 is used. In either case, the addressing lines will be within a common memory section and a more sophisticated one. Since there are many smaller banks which is "hidden" by the common memory in bank 0 will never be used, and is thus wasted. If this is unacceptable, then a more sophisticated memory mapping circuit must be used, which "logical" addresses (as specified by the address lines of the CPU and an extended address latch port) onto arbitrary 24-bit physical addresses. With such a circuit the physical addressing could be arbitrarily divided up into a common memory section and some number of banks of whatever size is desirable, and no memory would be wasted. A memory mapping circuit could be built with a RAM (or a ROM, if your configuration doesn't change much) and some support circuitry, but there are two disadvantages to keep in mind: the necessary circuit is fairly complicated, and it requires interception of the CPU address lines before they reach the bus; therefore modification of, and a jumper cable to, the CPU board is necessary.

A few unrelated complaints: the Bender article mentioned a "Listing 1"; try as hard as I might, I couldn't find one. Also, in general, I have found the placement of listings and figures in your magazine to be distressingly distant from the text which references them.

Kurt Gollhardt
128 E. 7th St., Apt. 308
Plainfield, NJ 07060

Editor's note:
The listing to Dr. Bender's article, which was inadvertently omitted, was subsequently published on page 140 of the December 1983 issue.

Dear Mr. Libes,
I found both "The New 16-bit Super Microcomputers" and "An Introduction to Local Area Networks: Part II" unnecessarily hard to read because the figures were so many pages beyond the text. I would prefer smaller figures, all on one or two pages, or the text squeezed among the illustrations so they flanked the text or (perhaps best) a combination of the two, since I felt many of the figures were too large for their content and thus could have been smaller and closer to the text.

I suspect that the figure on page 40 could have been clearer, since it seems the table names (GDT, etc.) are in the "visible" part, while the actual registers are in the "invisible" part. Also, having the top section of a table white (e.g., "BASE ADDRESS") usually indicates that it is a title block, which does not seem to be the case here.

Mike Firth
104 N. St. Mary
Dallas, TX 75214

Dear Mr. Libes,
Andrew Bender's hardware review of the CompuPro 66/87 system (November 1983) touched on many of the problems involved in configuring CompuPro boards with older hardware. Here are some observations resulting from my own recent experiences.

1) Older I/O boards: the problem with many I/O boards is not as simple a problem of speed as it is a problem of bus compatibility. Just as the CompuPro CPU and disk controller will not work on a nonterminating motherboard, some of the older I/O boards (at least the TEI 3P+3S vintage 1977/1978) have not been allowed to terminate motherboards. In my case, the addition of address buffers fixed the problem.

2) Stepper motors employing the steel band widget technology such as found in the Shugart 850 will run much cooler than the screw mechanism types.

3) For some reason the CBiOS is written with the ACT86 assembler rather than the assembler supplied with CP/M-86. One is therefore compelled to buy an additional assembler if one wants to make significant changes to the CBiOS. Finally, those with System Support Boards (or other similar boards) can use the EPROM at the top of memory to initialize any nonstandard hardware they might have. That is, put a jump at the reset point (FFFF0) to an area in the EPROM, do whatever you have to do, then jump to the disk loading process.

David Langmann
2900 Connecticut Ave. NW
Washington, DC 20008

Dear Mr. Libes,
I have some comments on the S-BASIC Compiler that was reviewed in the October 1983 issue. First, the reviewer, when stating how fast S-BASIC was, did not make clear whether this was referring to execution speed or the amount of time taken to compile the source code. Having written quite a few programs in it over the last year, I must say that it compiles code fairly swiftly and compactly, but the execution times are extremely slow, in some cases slower even than DR's CBASIC2. Interpreted MBASIC-80 runs circles around it, even on long programs. Floating point calculations are especially tedious, running almost 10 times slower than MBASIC for equivalent precision.

Speaking of floating point, there is a bug in S-BASIC's square root algorithm such that the error of the function increases with increasing value of the operand. Users are advised to use the equivalent (x) ^ .5 instead, which gives accurate results. Also, when doing character or string I/O via PRINT statements, CHR$(0) is not allowed. And, although procedures and functions can have local variables, the names of these variables must be unique, i.e., all of your function parameters cannot use "X" as their dummy parameter. This is an annoyance, especially when creating libraries of functions and procedures, which the compiler handles so nicely.

Excepting these minor (?) quibbles, I must agree with Mr. Parker's assessment of the power and flexibility of the language. If it weren't for the lack of speed in execution, it would be my favorite BASIC for the 8080/Z80. Considering its low cost, it is still quite a deal.

If only it were fast.

W. John Bau
Director
SPICA
1601 Paseo de Peralta
Santa Fe, NM 87501

Dear Mr. Libes,
Re: Loading and calling machine code from Basic:

1) Your listing to Dr. Bender's article, which was inadvertently omitted, was subsequently published on page 140 of the December 1983 issue.

2) Stepper motors employing the steel band widget technology such as found in the Shugart 850 will run much cooler than the screw mechanism types.

3) For some reason the CBiOS is written with the ACT86 assembler rather than the assembler supplied with CP/M-86. One is therefore compelled to buy an additional assembler if one wants to make significant changes to the CBiOS. Finally, those with System Support Boards (or other similar boards) can use the EPROM at the top of memory to initialize any nonstandard hardware they might have. That is, put a jump at the reset point (FFFF0) to an area in the EPROM, do whatever you have to do, then jump to the disk loading process.

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If only it were fast.

W. John Bau
Director
SPICA
1601 Paseo de Peralta
Santa Fe, NM 87501
In the October 1983 issue of Microsystems, Costa and Leibson describe a method by which a Basic program can load a .HEX file produced by an assembler such as ASM. Here is a simpler way, which depends on the realization that you can read a .HEX file directly from Basic, sort out the subroutine (you know it's got to be in there somewhere), and poke it into memory.

Listing 1 shows the .PRN file of a demonstration subroutine. When this subroutine is called, it prints a message to the console and returns to Basic. The associated .HEX file is shown in Listing 2. Notice the correspondence between the second column of the .PRN listing and the data field of the .HEX listing (FS at 8000H, CS at 8001H etc.). The file is structured in what is called Paper Tape Record Format. The colon signals the start of the record. The record type is 00 for data records. The sum of all the bytes in the record, starting with the record length and ending with the checksum, should be evenly divisible by 256. A record length of zero indicates end-of-file.

Listing 3 is a program in Mbasic to load the subroutine and run it. To use this method you will need to splice the loader segment (lines 210 to 350) into your program and provide the appropriate memory limit, subroutine name and call location (lines 130, 140 and 150). A different Basic dialect may require, in addition, some attention to the syntax of the file handling instructions, variable naming restrictions, and hexadecimal number representation. In some of the earlier Mbasic version 5.xx releases, the Clear instruction (line 130) doesn't work. You can accomplish the same thing by using the highest memory initialization option when loading Basic (e.g., A> MBASIC /M:&H7FFF).

Dave Russell
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LETTERS
Continued from page 139

Gentlemen,

The machine code loader for MBASIC-80 presented by Larry Costa and Steve Leibson (Microsystems, October 1983) is relatively fast when compared with the use of DATA and POKE statements, as described by the authors. By the use of a technique from the Microsoft Softcard BASIC Interpreter Reference Manual, an even greater increase in speed and efficiency can be obtained.

Costa and Leibson make use of the ASC and MID$ function in a FOR-NEXT loop to pick out each individual byte of machine code in a 128-byte sector, and then POKE it into memory. The loop is repeated until every sector is loaded into memory. Instead of this byte-by-byte method, each sector of code can be placed into memory by the use of a single LSET statement. This is done by first setting up a dummy string, CS, of 128 bytes in length, and pointing it into the area reserved for machine code, via the VARPTR and POKE functions. To the MBASIC interpreter CS now consists of the 128 bytes of memory where the sector of machine code is to reside. This sector of code becomes evident when it is used to set up a large machine-language environment in high memory of Basic. I have used it to load an area of 4K in less than 6 seconds. It is a versatile method, able to be adapted to save and/or move a block of memory quickly. The use to which it is put in the Microsoft manual is the loading and saving of high-resolution graphics screens.

Peter Tyler
Department of Clinical Chemistry
The Queen Elizabeth Hospital
Woodville, South Australia 5011

Dear Mr. Libes,

The article on “Floppy Problems” in the December '83 issue struck home with me, as it probably did with many S-100 readers. In particular, the editorial comments at the end of the article were most interesting.

However, they presented only half the problem. The gist was that an S-100 board manufacturer does not (and should not have to) provide support for system configurations using its board other than the systems for which the manufacturers made the board.

Consider the poor customer. S-100 board manufacturers rarely put in their ads or catalogs all the ‘fine print’ which describes the gotchas. My favorite horse which, I think, richly deserves flogging is the Texas company that advertised its disk controller in stand-alone ads. Naive purchasers like me found to their dismay that they faced a considerable dilemma. Either there were many other purchases required from the same company because all the software was tied together (key portions of the BIOS coming with each of several boards), or there was considerable programming to be done to bring the controller up. The company involved was monumentally uncooperative. After a considerable period of time, I disposed of the board on principle, preferring the products and approach of a more honest company.

I think a prospective purchaser seeing an ad unfettered by restrictions is entitled to expect that the board can be used in a variety of systems of the customer’s choosing. Details to facilitate the user’s reasonably expected needs should be included. This certainly doesn’t mean that the manufacturer itself has to go through all the effort of interfacing with every board and every conceivable combination of products; there are many capable customers buying stand-alone S-100 boards who will be glad to accept that challenge, given sufficient information on the product in the manual.

I guess the solution is to ask manufacturers to be more honest and forthcoming in their ads, and to give us customers a fair shake when preparing a manual. Let’s be frank before purchase about the limitations and restrictions as well as the benefits. Most of us will be glad to share our unusual applications and solutions with the manufacturer (user-group style), providing the manufacturer doesn’t unfairly commercialize our work.

Joseph Reymann
953 Avenida Ladera
San Dimas, CA 91773

Dear Mr. Libes,

The six hours of file reconstruction which prompted it! And alas too for the hours it cost him to write it! The easy solution for his inadvertent erasures was to load DUU (CP/MUG Vol. 71), go to Track 3 and replace all those E5 bytes with 00. Simple.

R. W. Odlin
2125 Hoogdal Rd.
Sedro-Woolley, WA 98284
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EDITED BY SOL LIBES

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