DARKSEED™

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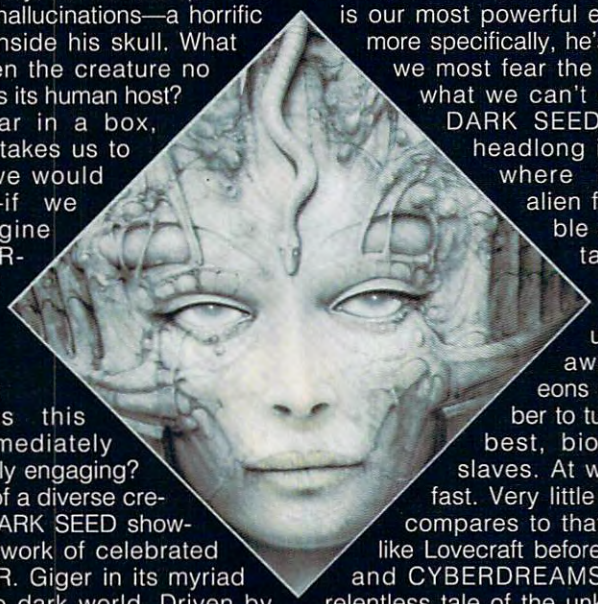
DARK SEED

Unarmed and confused, your alter ego Mike Dawson will cross between worlds to ferret out the source of his nightmares. Ironically, he carries the wellspring of his hallucinations—a horrific alien fetus—inside his skull. What happens when the creature no longer requires its human host?

Digital fear in a box, DARK SEED takes us to the places we would fear most—if we could imagine them. CYBERDREAMS knows where horror sleeps.



Shock in a Box

What makes this game so immediately and perpetually engaging? The progeny of a diverse creative team, DARK SEED showcases the artwork of celebrated surrealist H. R. Giger in its myriad scenes of the dark world. Driven by Giger's unique macabre energy, DARK SEED crawls into the psyche of its viewers from the first tentative steps. Giger's work simultaneously attracts and repels the viewer with its horrible beauty.

CYBERDREAMS has tapped something primal in this production. Horror writer H. P. Lovecraft has said that fear is our most powerful emotion. And more specifically, he's told us that we most fear the unfamiliar—what we can't understand. DARK SEED throws us headlong into a world where malevolent, alien forces capable of incapacitating, dismembering, and eating us need only awaken after eons of fitful slumber to turn us into, at best, biomechanical slaves. At worst, breakfast. Very little in our world compares to that threat, and like Lovecraft before them, Giger and CYBERDREAMS bring us a relentless tale of the unknown that is chilling for its potential believability.

Giger knows well the threat of the ancients. Inspired in part by the transdimensional spell book—the fabled,

BY DAVID SEARS

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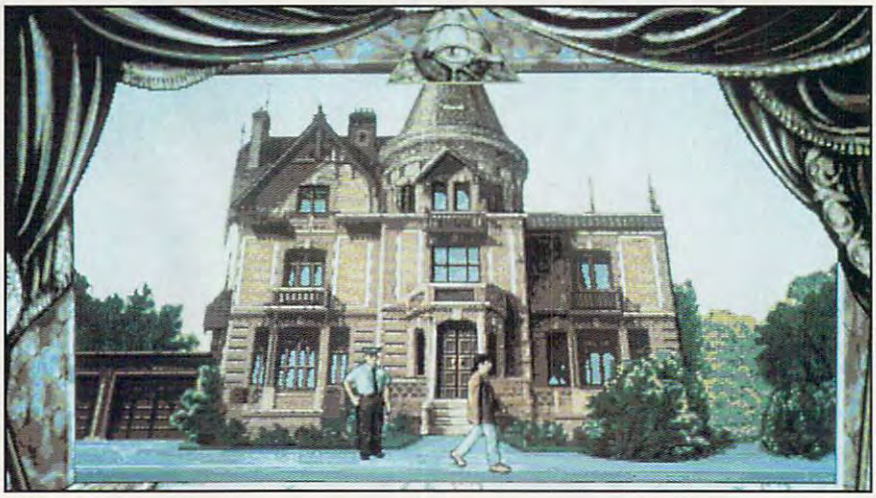
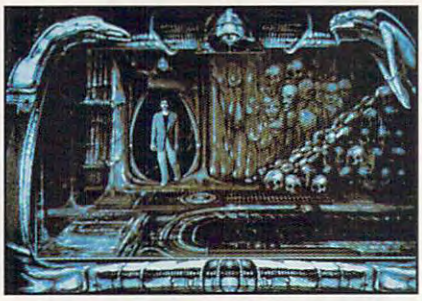
fragmentary Necronomicon, Giger's work never fails to elicit a visceral reaction. His tormented designs for the original Alien movie changed the face of science fiction forever. But Alien was set in the far reaches of the galaxy. In DARK SEED, aliens stalk the earth. DARK SEED merges not just science fiction and horror but also mystery. Who better to supply the images for such a game than Giger? Excited by the possibilities of a collaboration with computer game designers, Giger opened his doors to the artists from CYBERDREAMS, with only some minor hesitations.

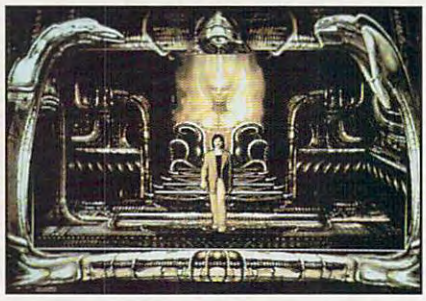
Crisis Resolution

Giger was unimpressed by the blocky pixels of low-resolution VGA graphics. A computing neophyte, Giger nonetheless recognized the deficiencies of the low-resolution graphics screens and insisted that CYBERDREAMS increase the resolution to one more compatible with his work. Giger wanted the most pixels possible.

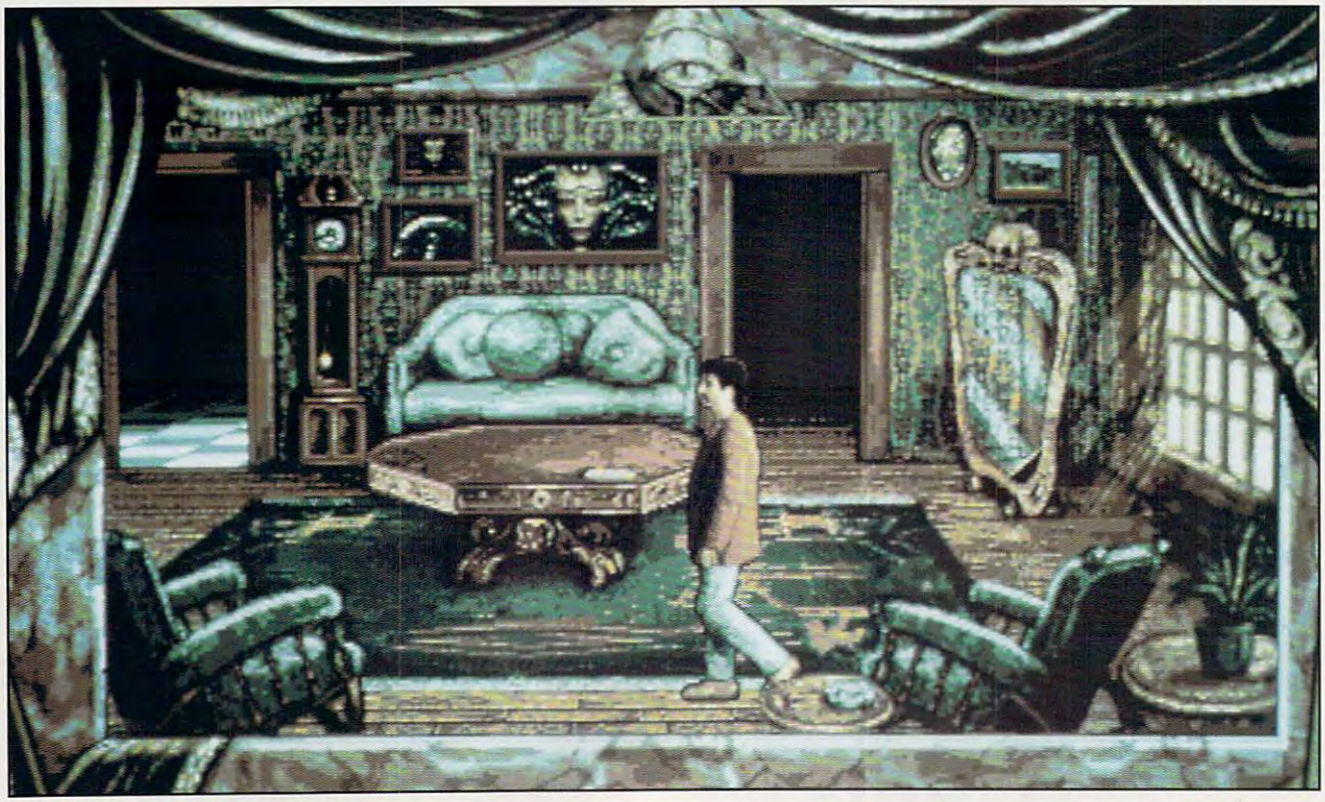
Back in California, DARK SEED team members increased the display resolution to 640 × 350, which reduced the number of available colors from 256 to 16 because of hardware limitations. The airbrushed, crepuscular nature of Giger's work withstood the translation well, however. And, disk in hand, CYBERDREAMS representatives returned to Switzerland, this time to meet with approval.







Top, Mike Dawson approaches the mansion he's just bought. Center left, he enters the hatchery. Center right, he arrives at another level of the hatchery. Bottom, he explores the house for clues.



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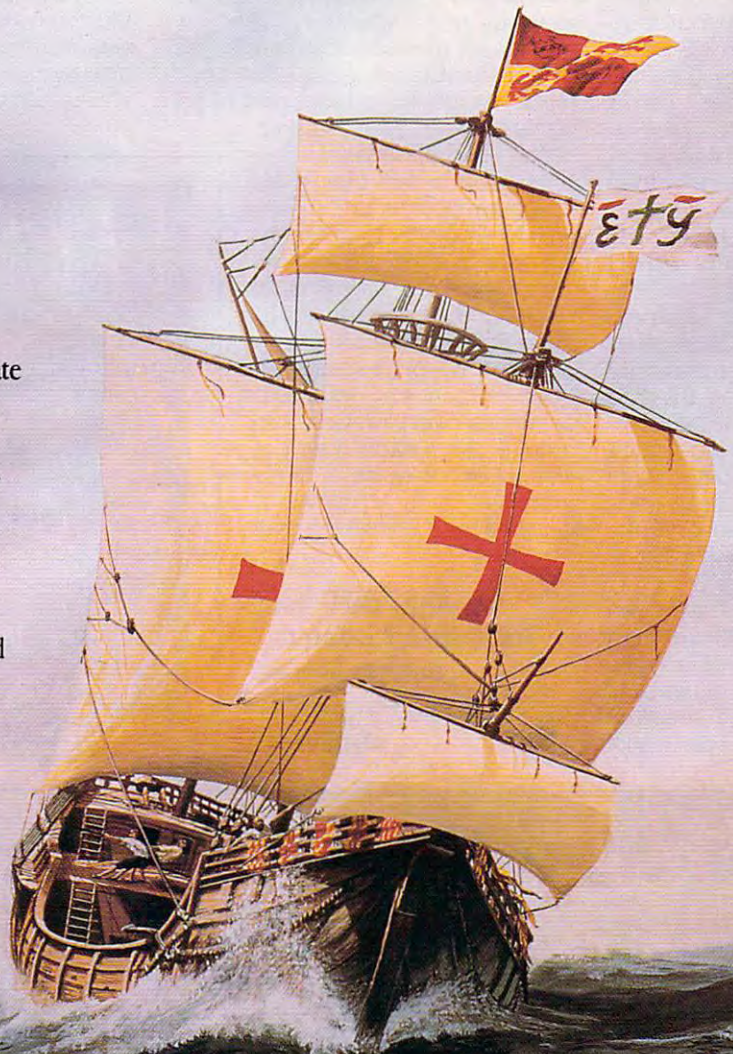

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Impressions

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Giger's response to the new digitizations was, "Beautiful!" Rumor has it he's so pleased that he's willing to collaborate with CYBERDREAMS on a second game, possibly to include new, original artwork.

Candid Chimera

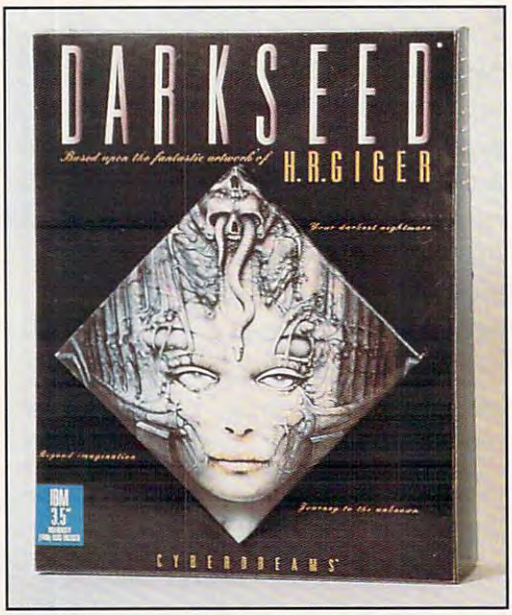
To incorporate Giger's fantastic realizations into the confines of a PC simulatation environment, CYBERDREAMS artists scanned portfolio selections with an Epson ES-300C flatbed color scanner. They then further altered the images using DeluxePaint IIe on the PC. Free to choose from virtually all of Giger's collection, the artists located more than enough faces, arms, legs, and assorted (if somewhat distorted) body parts to piece together a number of distinct menacing dark world characters. DARK SEED excels at landscapes, however, for the once-flat Giger paintings attain three-dimensionality through animation. It's one thing to admire the monochromatic smoothness of a Giger painting and quite another to walk past his bloated fungi in the foreground, twisted flesh trees to the left, and blasted planes of biomechanical tissue stretching to the horizon.

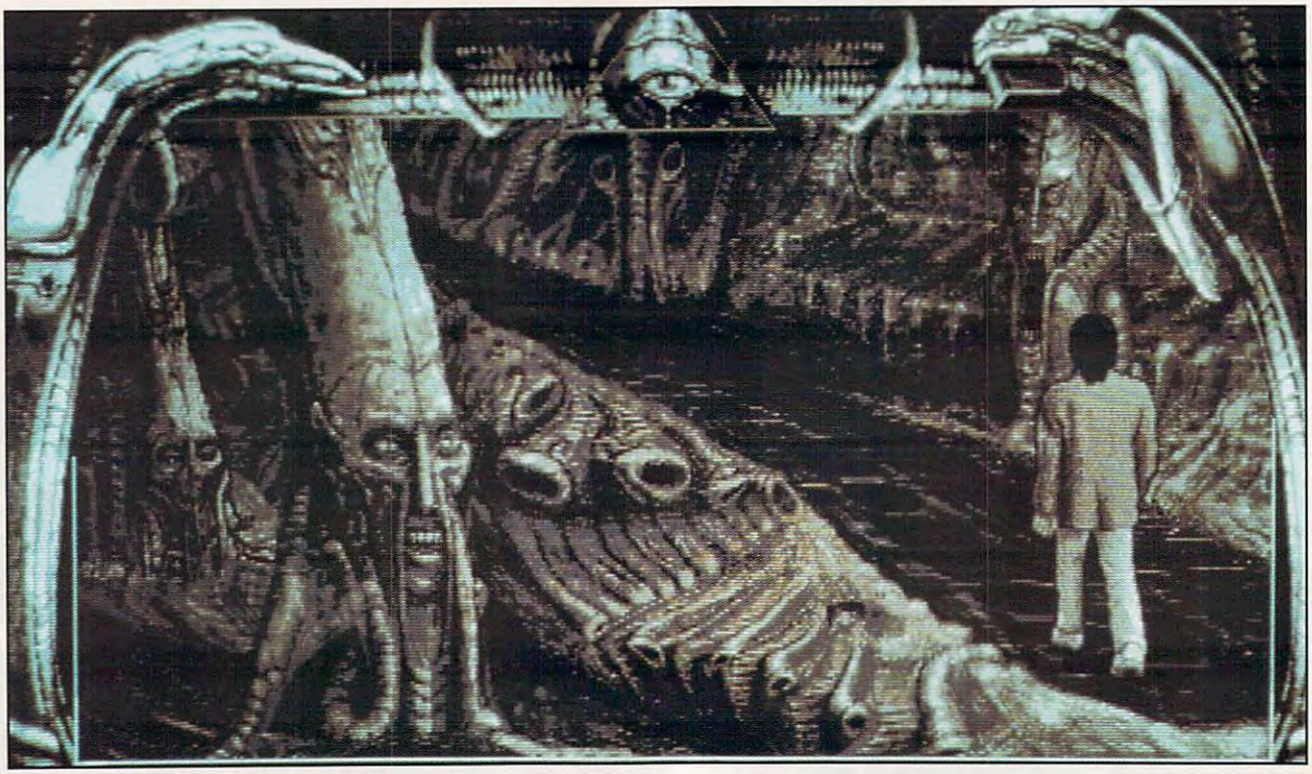
Furthermore, what may have been a gateway in the original painting becomes a floor in DARK SEED; tubes and conduits become so much slick wallpaper contoured to the shape of other Giger extractions. This visual cut-and-paste technique, similar to the literary cut-up approach popularized by William S. Burroughs in Naked Lunch, does here what words do in that science fiction novel. Fragments of larger images combine to provoke and disturb. In new associations with one another, these images seem capable of reprogramming the way you think about and perceive environments, and this definitely affects the way you move about in them. You won't want to touch anything for fear of the terrible violence that could result. At the same time, part of you wants to touch everything, no matter how repugnant.

Hidden in the dim landscape are objects and mechanisms essential to completing your mission and removing Dawson's brain parasite. Natives of the dark world have little trouble seeing in perpetual twilight; humans will need to take their time and scrutinize every crevice and alcove. And each moment spent on the dark side unnerves; you always feel watched, as if something may rise from the gloom to put an untimely end to your intrusion. DARK SEED designers appear to have consulted the architect responsible for the ancient city of Lovecraft's Cthulhu mythos—a city whose alien geometry would drive humans insane.

Haunted House Party

Meanwhile, back on earth normal, all is not well, either. Dawson's queer old Victorian house, purchased for the sole purpose of getting away from it all, seems menacingly derelict. Faded velvet curtains block the warm sun





Top, DARK SEED from CYBERDREAMS. Bottom, Dawson follows the pathway to the catacombs.

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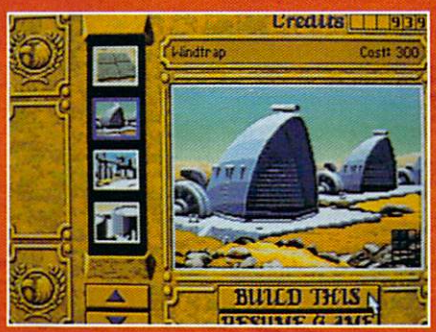

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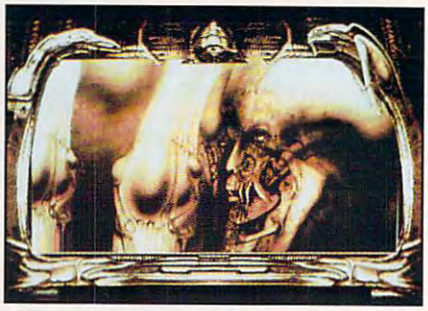
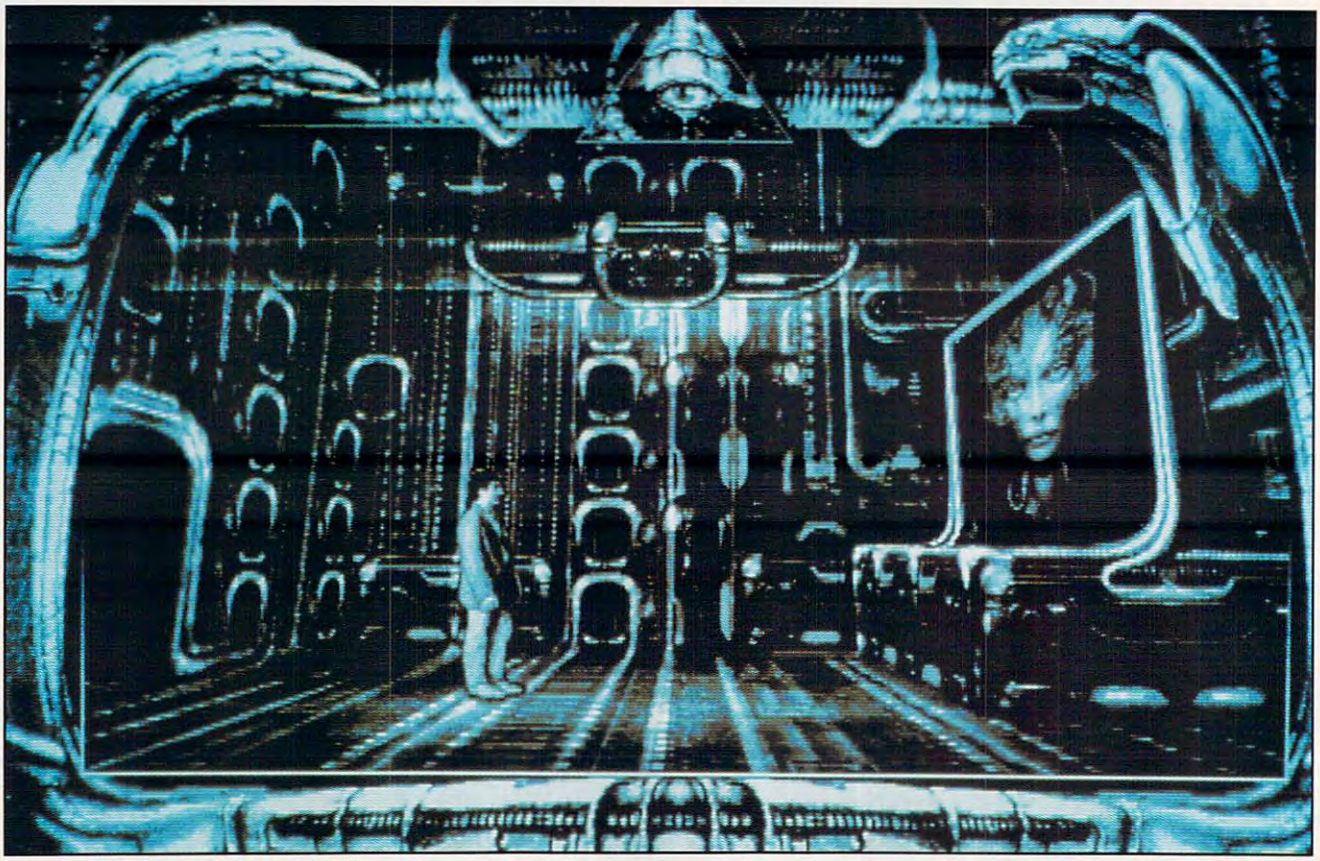
and offer only shadows in exchange. Intricately patterned wallpaper peels away; floorboards groan underfoot. Ethereal voices offer cryptic advice over an old AM radio. What lurks in the wine cellar? Why won't the librarian talk? Solving all the mysteries in the sleepy little town of Woodland Hills will have you robbing graves and running from the police—situations you wouldn't normally enjoy, but the threat of the dark world can make you a hero and justify your actions.

The high-resolution display allows the Giger paintings hanging in Dawson's home to glare at you in striking detail. You can almost count the leaves on trees and the bricks in buildings, though time for such pursuits seems short. A journey through the varied landscape takes you from mausoleums to attics to public libraries and back again, and no matter how many times you pass through a certain location, you'll never fail to appreciate the attention to detail.

To animate the players in this nightmare, artists used an Amiga, a Digiview, and a Mitsubishi SVHS video recorder to digitize actual human models in various poses. Saved in 16-color gray scale, these images were edited in the Amiga version of DeluxePaint, saved as IFF files, and transferred via CrossDOS to the PC for further editing. The sound samples



Top, an ancient rests in suspended animation. Pray his slumber is undisturbed. Center, Sargo is a prisoner of the dark side. Bottom, Dawson speaks to the keeper of the scrolls, who is portrayed by Li II, the guiding image of DARK SEED.



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were first taken on an Amiga, too, and the remarkable morphing title at the outset of the game originated there, as well. Imagine for the Amiga has the ability to map the reflections of objects in a virtual 3-D environment onto invisible bitplanes. Bowing to market demand, however, the Amiga version of DARK SEED won't debut until December, but it will make exceptional use of the Amiga's built-in sound capabilities. DARK SEED's art director comments that the game wouldn't have been possible without the interactivity of the two platforms. This synergism is welcome in computer game development, and in the case of CYBERDREAMS, reflects the company's approach to design itself.

To conserve memory and reduce hard drive access time, DARK SEED displays your current location in a 500 × 200 pixel window. At first, this seems a bit of a cheat, since CYBERDREAMS touts this game as the first high-resolution adventure game, but this screen fragment still packs in more pixels than standard VGA 256-color low-resolution mode. The windowing effect places some distance between you and Dawson—welcome distance, since DARK SEED has a way of getting under your skin. A second and unanticipated side effect of this windowing is a sense of claustrophobia. The draped curtains, the third eye of the Illuminati that watches you from the top of the display—you'll feel as though you're watching a stage play from a darkened box seat. The theater, of course, has only a single occupant. DARK SEED never lets you forget that the fate of the world is on your shoulders.

A Pinch of Gestalt

Nearly at the end of the original DARK SEED development schedule, the design team members examined their work and found it lacking. The black-and-white side images just didn't have enough visual appeal. The answer? Colorization by hand. With just 16 colors to choose from, altering the pictures took time—six more months, but the results are as beautiful as they are sinister. This illustrates the concern for and attention to detail found throughout DARK SEED. As in nightmares, every hair is in place.

With the stated purpose of bringing artistic and literary talent from outside the industry into computer gaming, CYBERDREAMS may have a string of hits on its hands. After this brooding horror tale, the company's looking forward to somewhat lighter fare, though the treatment of the subject matter will remain adult in orientation. Future projects include Cyber Race, a racing game envisioned by Syd Mead (a designer for Blade Runner, 2010, and Aliens).

Ongoing negotiations with prolific author Harlan Ellison could yield No Mouth, an adaptation of his widely anthologized story "I Have No Mouth, and I Must Scream." As with Giger's input—his suggestions were never limited by preconceptions of what a computer could and could not do—perhaps the new visionaries will demand that CYBERDREAMS push the PC past its acknowledged limits when showcasing their work. But survivors of DARK SEED will be eagerly awaiting whatever entertainment CYBERDREAMS produces next.

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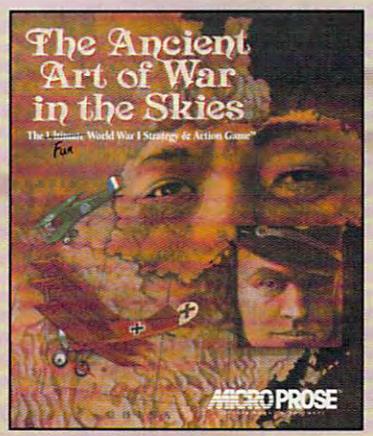

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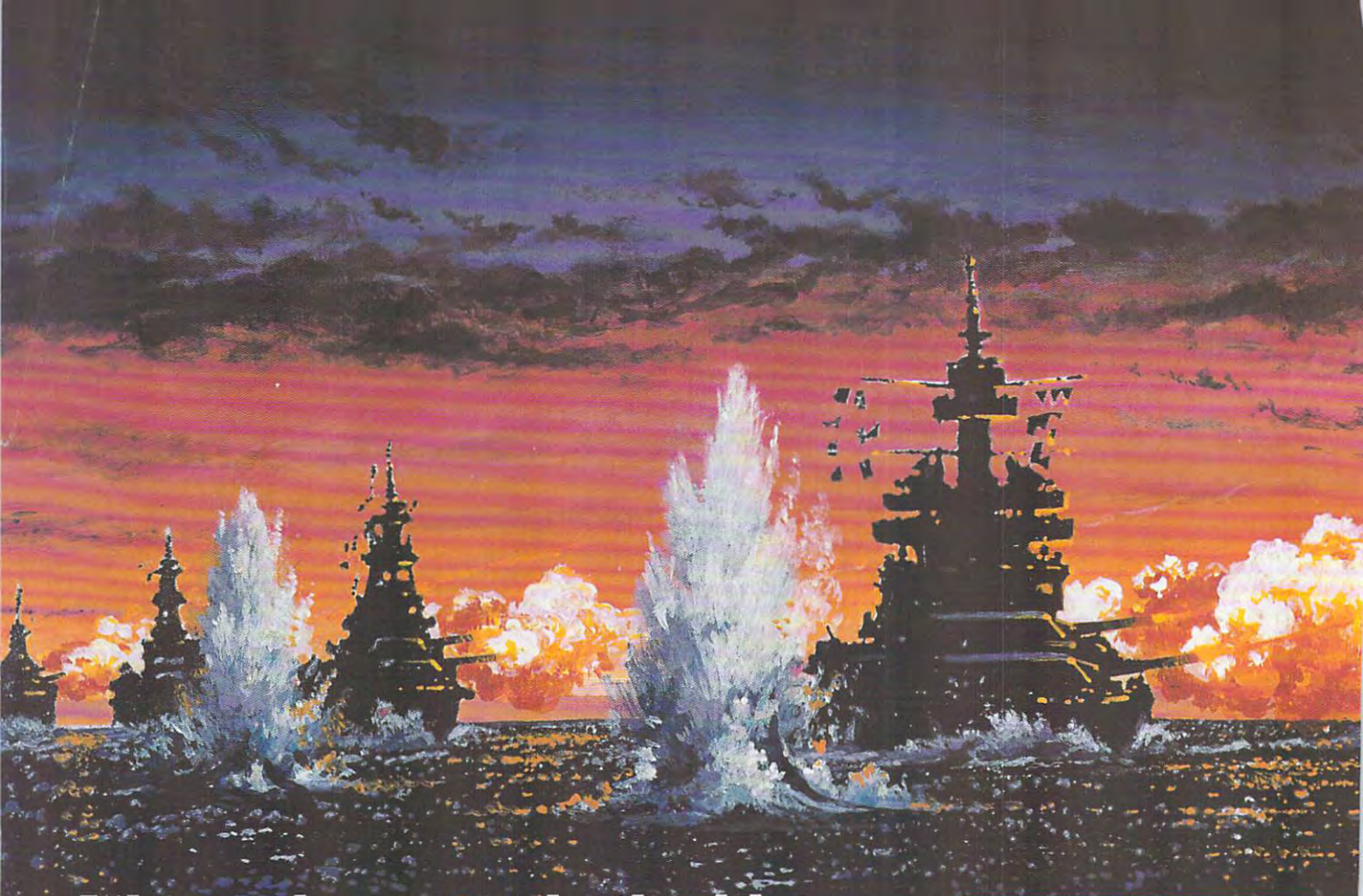

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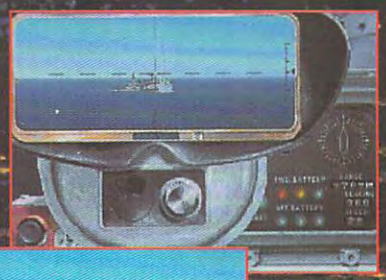

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64/128 VIEW

If you've submitted a program recently and are still waiting to hear from us, please be patient.

Tom Netsel

There is good news and bad news to report this month. The good news is that we've been swamped with excellent type-in submissions. The bad news is that we've been swamped with excellent type-in submissions.

I made a pitch for programs in this column and in fillers elsewhere in the magazine encouraging submissions. Boy, did they work!

In fact, they've worked almost too well. For the past few months we've been deluged with good and great programs. We now have a large stack of them waiting to be reviewed. This has led to a new problem: Since it takes time to evaluate a program properly, we've been slow in mailing out contracts and rejection notices.

If you've submitted a program and haven't heard from us, please be patient. The quality as well as the quantity of submissions has been excellent this year, and we want to buy as many programs as we can. It just takes time to go through them all. When we've selected the programs that we plan to use in an issue and then come across another good program, we hate to reject it. We'll often hold it and use it the following month. But when we start holding too many programs, the system backs up. We'll get things moving shortly.

Actually, I love having too many submissions—so please keep them coming! With your help, we've been able to publish some great programs, and we want to continue the practice. A couple that come to mind from last month are two SpeedScript spelling checkers for the 64 and 128.

I normally don't have two such similar programs in the same issue, but I thought that each spelling program would offer advantages to 64 and 128 users.

In this issue, we have a couple of programs that'll help programmers who work with sprites. These programs are geared more for the intermediate-to-advanced programmer who is already familiar with sprites and some of the problems associated with them.

MOB Master, by Hong Pham, adds ten new graphic commands to the 64 that make programming sprites much easier. Programming sprites on a 64 usually requires a lot of code filled with POKEs, but MOB Master gives the 64 many of the same features and sprite commands found in BASIC 7.0 on the 128. With these commands, you'll find it much easier to define, position, and animate sprites.

Most people know that the 64 is capable of producing 16 different colors, but how would you like to boost that number to 136? You can with 136 Colors, a program by David Kwong.

Machine language programmers who use a 128 will want Bassem 128. Long a popular assembler for the 64, the 128 version is too large to type in, but it's available as this month's Gazette Disk bonus program.

I hope you'll find these and the other Gazette programs to be entertaining and informative. Be sure to let us know which programs you like or dislike. ❐

GAZETTE

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Great submissions flood Gazette office.
By Tom Netsel.

SID SIMPLIFIED G-3
Cut through the confusion of programming the Sound Interface Device.
By Larry Cotton.

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SID SIMPLIFIED

BY LARRY COTTON

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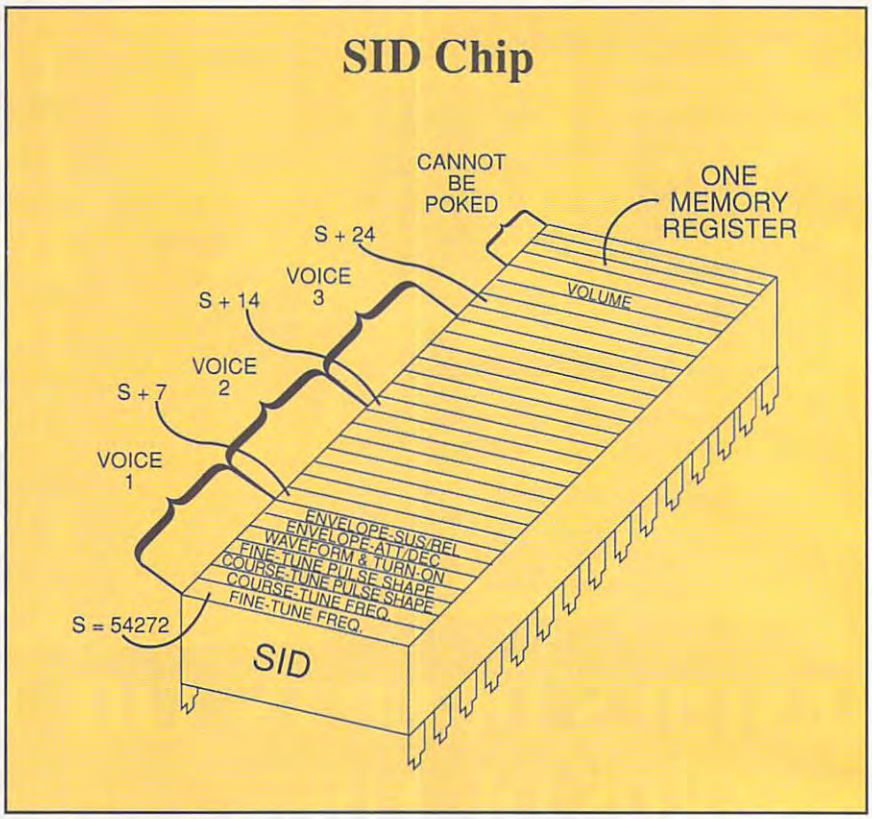
With all SID's capabilities, programming it in BASIC 2.0 remains an exercise in tedium, because of the many POKEs required to access the chip. (BASIC's POKE puts a number from 0 to 255 into a specific location in the computer.)

Fortunately for 128 owners, Commodore included with that machine a much-advanced BASIC 7.0, which does support SID and makes programming sounds much easier.

This article will attempt to cut through the confusion of programming SID and show you, step by step, how to access this marvelous chip. I'll confine my remarks to BASIC 2.0's commands, common to both the 64 and 128, and I'll show you how to cut down drastically on the number of POKEs. We'll start with the very simplest exercises and progress to the more advanced. If you'll stay with me from the beginning, you'll be pleased with the results.

If you're confused about programming SID, it will first be necessary to power down your own mind to rid it of all past frustrating programming sessions. Start from scratch. Remember that we're talking about only 29 of the 64's 64,000 or so memory registers. How complicated can they be?



Voices

A human being has only 1 voice; a saxophone has only 1 voice. A six-string guitar has 6; a piano, 88. SID has 3. Think of SID as a three-string guitar. That is, up to three notes can be played simultaneously, each under separate control (except for volume).

We'll limit our initial discussions to voice 1, which occupies SID's first seven memory registers. Remember that number, 7; it'll crop up again.

Order of POKEs

Here's a subject rarely addressed and, I think, fairly critical to the success of SID programming: the order that the memory registers are poked. Here is the normal order for playing a simple sound.

1. Clear the chip.
2. Turn up the volume.
3. Wait.
4. Set a frequency.
5. Set an envelope.
6. Turn on a waveform.

Clear the Chip

SID occupies memory registers 54272 through 54300. All those registers (except the last four, which cannot be poked) should always be cleared of their contents near the beginning of every BASIC program which uses sound. Here's how.

```
10 S=54272: FORJ=S TO S+24: POKEJ,0:
   NEXT: REM CLEAR SID
```

SID's first memory register should be defined as a constant; we'll use S. Then every other register may be defined as an offset of S. A FOR-NEXT loop pokes a 0 into each of the SID memory registers, effectively silencing the chip and preparing it for action.

Turn Up the Volume

SID's last pokable register is the volume control. Its range varies from 0 to 15, with 0 being the quietest setting. Let's turn the volume wide open with the following statement.

```
20 POKES+24,15: REM FULL VOLUME
```

Any memory register will accept values from 0 to 255, but 54296 uses only values from 0 (silent) to 15 (loud) to control volume. Normally, S+24 can keep a value of 15 throughout a BASIC program.

Wait

Turning up SID's volume makes a popping noise in the TV or monitor's speaker, and this can interfere with your carefully crafted sound. Always introduce a period of silence after first turning up SID's volume. We'll show a do-nothing time delay, but ordinarily at this point in a program you'd be preparing the screen, reading data, setting variables, and so forth.

```
30 FORT=1 TO 1000: NEXT
```

Set a Frequency

SID needs several other values poked to it before it will speak up. For instance, it needs a frequency. A frequency controls a note's pitch.

```
40 POKES+1,16: REM FREQUENCY
```

SID's voice 1 memory location 54273 (S+1) can use all values from 0 to 255. A value of, say, 5 produces sounds of low pitch (like a tuba). A value of 200 produces a high- pitched sound (like a piccolo).

Set an Envelope

What's an envelope? Nothing more complicated than how the volume of a single particular note (or sound effect) changes as it plays.

Think about the way a single guitar string sounds as it's being plucked. The guitar makes no sound at first, but its sound level rises from silence to maximum volume immediately after the string is plucked. That's called attack. The sound then gradually fades away to silence. This is called decay.

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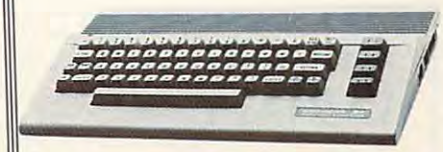

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G6B

SID can create sounds quickly, like a guitar, or slowly, more like a bowed violin. It can also do two more things to a sound which a guitar can't. It can prolong a sound's volume at a particular level. This is called sustain. SID can also cause the sound to stop at a controllable rate with a process called release.

So, there you have it. The sound's envelope is made of attack, decay, sustain, and release. Each of these properties is controllable. For now though, the properties we'll use are attack and decay. A value of 12, in fact, poked to the envelope simulates the plucking of a guitar string. Later, we'll see how to determine values to poke. Where do we poke that envelope value? We poked the frequency into S+1, so the envelope must be poked into S+2, right? I'm afraid not; S+2 and S+3 are reserved for fine-tuning the pulse wave. S+4? Nope. That turns on voice 1. S+5 (54277) is voice 1's main envelope-controlling register.

```
50 POKES+5,12: REM ATTACK/DECAY
```

If you want to experiment with sustain and release, add this line.

```
52 POKES+6,4: REM SUSTAIN/RELEASE
```

Turn On a Waveform

Last, but certainly not least, the sound needs a waveform. The 64 and 128 both feature four waveforms, each with a characteristic timbre. The triangle's sound is soft and mellow, the sawtooth mimics a saxophone, the pulse is hollow, and the noise is, well, noisy.

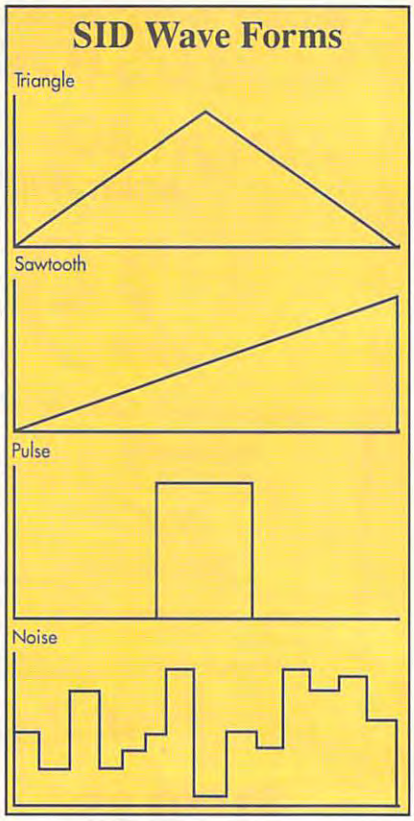
To actually begin the sound, we use voice 1's control register, S+4. We usually poke one of four particular values to produce the desired waveform.

Triangle	17
Sawtooth	33
Pulse	65
Noise	129

Here's the way we'll select a waveform in our program. For this example, let's select a triangle waveform and poke its value into S+4.

```
60 POKES+4,33: REM TURN ON SAWTOOTH
   WAVEFORM
```

I like waveform 33, the triangle; it has a nice bite to it. If you've been entering the lines as presented, you can now run the program. You should be rewarded with a nice strong note that begins suddenly and gradually dies out. (Be sure to turn up the volume on your TV or monitor. The 15 that we poked to 54296 ensures that a good strong signal leaves the computer, but it won't be heard if your monitor volume is too low.)



Six lines to create a sound; that's not too bad, is it? Just remember the order.

1. Clear the chip (S through S+24).
2. Turn up the volume (S+24).
3. Wait.
4. Set voice 1's frequency (S+1).
5. Set voice 1's envelope (S+5).
6. Turn on voice 1's waveform (S+4).

Other Registers

We produced sound with only three of voice 1's memory registers; we didn't use registers S, S+2, S+3, and S+6. Let's look at them now.

S is the register that fine-tunes voice 1's frequency, which was coarsely set with S+1. If you wanted just a noise or a beep of no particular frequency, S+1 would be enough frequency control. To accurately produce musical notes, however, we must also poke a value to S.

What value? For frequencies of musical notes, the values are listed in your User's Guide in a table appropriately called Music Note Values. For nonmusical sounds, such as drums, it's mostly a matter of trial and error. Let's fine-tune the frequency we poked into S+1 in line 40. Add this line to the program to give us an exact

SID AND VARIABLES

Using a variable such as F, instead of a number like 16, yields a whole new world of sounds. Here's an example which emulates a warning siren.

```
10 S=54272: FORJ=STOS+24: POKEJ,0:
   NEXT: REM CLEAR SID
20 F=16: REM DEFINE VARIABLE
30 POKES+24,15: REM FULL VOLUME
40 FORT=1TO200: NEXT: REM SHORT
   PAUSE
50 POKES+1,F: POKES+8,F*1.3: REM
   COARSE FREQUENCIES
60 POKES,195: POKES+7,31: REM FINE-
   TUNE FREQUENCIES
70 POKES+5,12: POKES+12,12: REM
   ATTACK/DECAY
80 POKES+6,255: POKES+13,255: REM
   SUSTAIN/RELEASE TO MAXIMUM
90 POKES+3,8: POKES+10,8: REM SHAPE
   OF PULSE
100 POKES+4,65: POKES+11,65: REM
    TURN ON PULSE WAVEFORM
110 F=F+1: REM INCREMENT FREQUENCY
    VARIABLE
120 IFF=36THENF=16: REM CHECK FOR
    UPPER FREQUENCY LIMIT
130 POKES+1,F: POKES+8,F*1.3: REM
    CHANGE FREQUENCIES BOTH VOICES
140 GOTO110
```

We're using the variable F (defined in line 20) instead of the number 16 for the coarse frequency. The coarse frequency pops up first at line 50. In line 130, voice 2's frequency is calculated as a multiple (1.3 times) of voice 1's. Why? We do it to keep the interval between the two voices' frequencies roughly constant for a more authentic siren sound.

In line 110, we increase variable F by 1. Try different increments or try decreasing, instead of increasing, F. Line 120 limits the upper value of F. Try other limits or values less than 16 if you're decreasing F.

Once a limit is reached, F is reset to its original value. Line 130 once again pokes new values to both voices' frequency registers. Voice 1 gets newly increased F; voice 2 gets a multiple of F. Line 140 sends control back to line 110, which increases F again. The program stays in a loop from line 110 through line 140 until you stop it by pressing the Run/Stop key.

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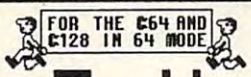

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pitch of middle C on the piano.

```
45 POKES,195: REM FINE-TUNE FREQUENCY
```

Shaping the Pulse

While S+2 and S+3 control the shape of voice 1's pulse waveform, S+2 is rarely used. Poking a value of 8 to S+3 will give the pulse waveform a nice, even shape. It's not necessary, however, to shape a pulse waveform unless you plan to use it. To hear what the pulse sounds like, add line 55 and change line 60 as follows.

```
55 POKES+3,8: REM SHAPE OF PULSE
60 POKES+4,65: REM TURN ON PULSE WAVE
   FORM
```

Run the program again, and listen to the difference in the sound. Now experiment. Try waveforms 17 (triangle) and 129 (noise). Try various frequencies and envelopes. A reminder: Don't confuse voices with waveforms. SID has three voices (remember our three-string guitar?) and four waveforms (triangle, sawtooth, pulse, and noise).

Voices 2 and 3

So much for voice 1. If you want to play more than one voice at a time, each must be set up independently. For instance, let's add another note to harmonize with the last one. Modify lines 40–60.

```
40 POKES+1,16: POKES+8,21
45 POKES,195: POKES+7,31
50 POKES+5,12: POKES+12,12
55 POKES+3,8: POKES+10,8
60 POKES+4,65: POKES+11,65
```

Voice 2's values follow the colon in each line. To program voice 2, just add 7 to voice 1's memory registers. In line 40, S+1 for voice 1 becomes S+8 for voice 2; in line 45, voice 1's S becomes voice 2's S+7; and so on.

Notice that in this example I've poked all voice 2 registers with the same values—except frequency in lines 40 and 45. Frequency values 21 and 31 (from the Music Note Values table) are needed to produce E above middle C on the piano. You may, if you like, set different envelopes for each voice (line 50) or different waveforms (line 60). If you run the program now, you'll hear a two-note chord in perfect harmony.

As you've probably noticed by now, SID's three voices are arranged within the chip in groups of seven registers each. Thus the control registers for voices 1, 2, and 3 are 54276, 54283, and 54290, respectively. The attack/decay portion of the three envelopes is set in registers 54277, 54284, and 54291, respectively. Therefore, to program voice 3, just offset the memory registers by 7 again.

As promised, here's how to reduce the proliferation of POKEs for this particular program. This technique won't always be applicable, but it may give you some ideas. Begin by copying lines 10 and 30 from the above program. Then delete the remaining lines. Now add these lines.

```
40 FORG=1 TO 10: READL,D:POKES+L,D
50 NEXT:END
100 DATA 1,16,8,21,0,195,7,31,
    5,12,12,12,3,8,10,8,4,65,11,65
```

That's it! All SID's offsets from S (54272) and the pokable values have been compressed into one data line. One FOR-NEXT loop does the rest of the work.

While this simple program touches on only a few of the SID chip's wonderful possibilities, you can have fun experimenting with changing waveforms, frequency values, and voices. I hope programmers will be encouraged to further explore the sound capabilities of their 64s and 128s. ❑

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ARACHNOPHOBIA

A deadly spider from South America has migrated north, laying her loathsome eggs in hundreds of homes, schools, buildings, barns, and cemeteries. In a frighteningly short time, her offspring have hatched and have begun to reproduce.

Thus begins the arachnids' reign of terror in communities across America. This Disney arcade game for the 64 closely follows the basic premise of the studio's hit movie *Arachnophobia.*

Homes are overrun, citizens terrorized, and whole communities abandoned. Residents have tried everything to rid themselves of the unwanted guests, but nothing seems to stop these creepy crawlers. The eight-legged enemy is upon us. It's enough to make your skin crawl.

As a last resort, the U.S. Department of Agriculture sends a frantic plea to Delbert McClintock, owner of the McClintock Infestation Management Company. McClintock is the inventor of a patented insecticide, Toxi-Max, which is said to be strong enough to kill the arachnids. Fearless Delbert loads his bugmobile with the lethal Toxi-Max and a supply of bug bombs, and sets out to free his country from the invading horde.

You won't need a lot of practice to get into the swing of playing this game, nor will you need to refer to the instruction manual throughout play. Disney does recommend that you make a backup of the game's double-sided disk before playing and use the backup for play. The game is compatible with most Fast Load cartridges, too. Since there's enough variety in Arachnophobia's sharp, colorful graphics to keep you playing for hours, you'll find using a Fast Load cartridge will save you a lot of time, since you must flip sides during the game.

When you load Arachnophobia, you'll see the bugmobile as it drives past homes, farms, schools, and cemeteries. Pick the building you want to enter; then use your joystick to guide the bugmobile there.

Delbert McClintock is the nation's last line of defense against hordes of invading spiders from South America.

When you stop at a location, the screen changes to an interior scene showing Delbert. Your mission is to help him clear the infested rooms by hunting down and destroying all the spiders and the egg sack that's hidden in every structure. Sound easy? Don't be so sure.

Spiders are everywhere. They'll do all they can to guard their egg sack. Sneaky ones drop from the ceiling to land on you; others slither down web strands and bite you from behind. You'll be attacked at ground level, too. Often, the soldier spiders work in groups, testing both your sense of timing and your joystick skills.

Spider webs are a real nuisance. Blundering into one will slow you down to half speed and make you more vulnerable until you break free.

A single spray of deadly Toxi-Max is enough to kill a soldier spider within spraying distance. It only takes a few spider bites to slay you, however, so keep your eyes open for first-aid kits. These will restore your strength. There's at least one kit in every building.

Don't forget you're wearing heavy work boots, too. You can stomp on some of the creepy crawlers, conserving your limited supply of insecticide.

The quickest way to clear a room is to use a bug bomb. You start the game with only three of these, so use them wisely. Other items you find as the game progresses are almost as useful as bug bombs. Matches and aerosol cans can be fashioned into nifty flamethrowers, which have a better range than your insecticide sprayer. More important, the homemade flamethrowers can clear an entire floor or ceiling of a room with just one pass.

When you've cleared a structure, you can safely return to the bugmobile. But there's no time for you to rest. The battle has only begun! There are more buildings and towns needing your bug-slaying skills. Just guide your bugmobile to another building and start exterminating spiders.

Every building in every town is filled with hordes of vicious spiders, defending an egg sack. Only one structure in each town hides a queen spider. The queen is the same size as the original South American spider. You'll know this mean mama by the distinctive yellow markings on her legs. Watch out! She's tougher than her soldiers and can even bite after she's been stunned. Slaying her will transport you to another city with yet another queen spider to roust.

All in all, this is a challenging game that's designed to give you a real workout. If you succeed in besting the queen spider in every town, you'll have saved the country and proved yourself a hero. As a reward, the United Nations will give you a secret assignment in the Amazon rain forest. The monstrous arachnids there will make you wish you'd been a little less successful.

To aid you during play, the bottom of the screen displays status information. There's an amusing picture of Delbert that monitors the state of your health. It changes from smiling to frowning to screaming in pain, depending on how many times you've been bit. First-aid kits will restore Delbert's smile.

Next to Delbert's picture

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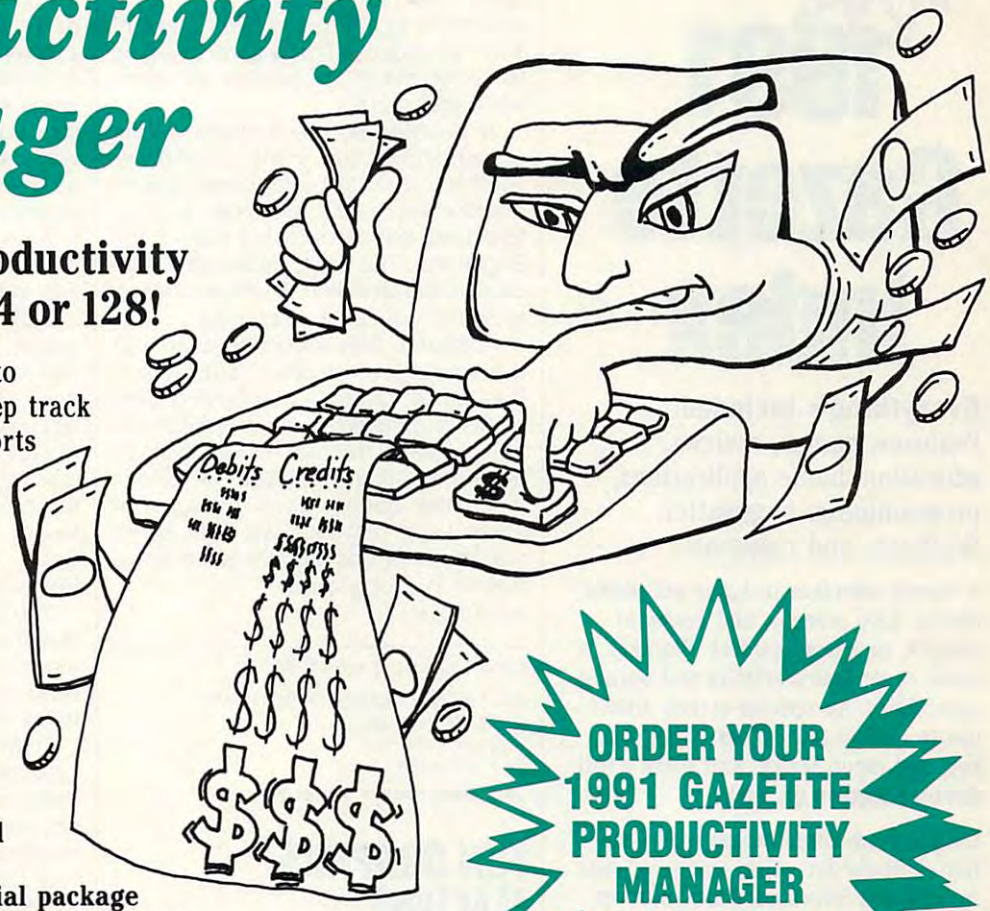

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REVIEWS

is an indicator showing how much Toxi-Max insecticide remains in your spray tank. It refills automatically whenever you return to the bugmobile. (Beware! You can leave a building at any time for refills, but all the spiders will return while you're out.)

A counter at the bottom of the screen shows how many bug bombs you have. You start with three but earn another every time you clear a structure. Last, but definitely not least, is the Bugometer. This compasslike device indicates the direction in which to travel to find the queen in each city.

I prefer to play Arachnophobia with the sound turned down, but my son likes to hear Delbert's bug-fighting comments and the sizzle of his flamethrower. I like to go through houses systematically rousting arachnids; he zeroes in on the queen. Even though our styles vary, however, we both agree that this is the best arcade game we've played in a long while.

MARTI PAULIN

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FUN GRAPHICS MACHINE

Fun Graphics Machine is a great way to create and manipulate graphics and hi-res screens on a 64. My introduction to the program was a free demo that's available on QuantumLink. I was amazed at the ways that I could work with the designs on the screen: flip, flop, reverse, stretch, shrink, crop, rotate, fasten, copy, and print the results. The demo won't allow you to save and print features, but the asking price for the registered version makes it a real must-have bargain. The reference manual is the first good feature.

The spiral-bound manual lies flat, so you can really use it. Some of the instructions are duplicated, but that stops the page flipping when you need to refer back to some detail that has slipped your memory.

The manual itself was produced with FGM. It even shows step-by-step instructions of how various pages were composed. This is not a drawing program. It doesn't have lines, circles, or squares, and there are no colors—just a white screen (or rather, three white screens) to work with.

The program uses color in a useful way. The cursor and borders change color to let you know what mode you're in. Blue cursor is text, gray is grab, purple is adjust, and so on.

You work on a 40-column screen, and the screens can be linked both across and down. By combining two screens across, you have your 80-column format for printing a full page. You can use a third screen as a workplace. Link the screens down for as many as you need. Print a banner of any length.

Save your work with a simple method of coding, and then use one instruction to print all of your work.

FGM is really a collection of programs, not just one. With the program disk in one drive, it'll recognize the presence of any other two drives. Create lets you do your own thing. Demo runs demos that are available on the program disk or replays those that you create and save. Clip-Art uses artwork found in other programs like The Print Shop, The Newsroom, and Doodle. Printer sends your work to your printer.

You can print your work to disk in files that others can view without having to run FGM. You can design and send greeting cards or draw screens to be used as titles on your VCR.

FGM has its own department on Q-Link. Download a file with 50 different fonts, and you can type in just about any style that you like. FGM contains a customizer, which will design or modify a font. Updates are always being added. If you have a question, someone online will have the answer, and samples of what users have done are always interesting to study.

If you're using a 128 and have the reset switch, you'll discover something remarkable. Suppose you're running a program in 64 mode and see a graphic on the screen that you'd like to save. Hit the reset switch. The program will be gone, but then load and run FGM. On most occasions the graphic will be available on one of FGM's screens. Now you can save it, grab part of it, and paste it on another screen. Have fun; that's what the program is all about—having fun with graphics.

Since you can edit at the pixel level, you can do some finely detailed work, and a smoothing technique takes away some of the rough spots on captured pictures. With the overlay method of grabbing and pasting, you can design and save different templates and then use them for various projects. A simple template with a musical symbol font and score lines is useful for writing musical scores. A grid pattern can be overlaid with needlework designs.

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Playing with FGM can become addictive. Searching for different graphics to manipulate, adding new eyes to a face from a Print Shop cartoon, using part of a picture as the cover for a greeting card, and designing your own letterhead are just some of the fun you can have working with graphics.

In text mode you can link two screens across, use word-wrap, select a font, set the margins, and type your document. The size of the cursor can be changed with a single keypress. And with that size change, the size of your font changes, all the way to a full screen.

Great graphic work on the screen can be work wasted if you can't send it to a printer. FGM supports most printers, and it gives you the option of telling your printer to perform various effects. You can select dots-per-inch density; single or double height; single, double, or triple width; various margins; and so on.

Try printing the same screen with different options, and you'll be surprised by the results. Not only does FGM let you design and work with your own graphics, but you have the ability to load files from other programs. The possibilities are endless. You have complete control over every pixel on the screen. Artwork can be stretched, shrunk, slanted, rotated, overlaid with shadows, and more. By using two screens and flipping between them, you can create simple automation for your demos.

Learning to use the program can take time, but you don't have to learn it all at once. If you go too far, a couple of keystrokes will always take you back to where you started. There's no need to remember filenames.

Selections are made from a screen menu, and a disk directory is always available. You can use up to three drives with FGM, and the program will ask you which one you want to access. You can customize your program disk so that it will default to your particular printer.

If you'd like the cursor and borders to be different colors, you can change them. Copy the program disk and then customize the copy with your most used fonts, character sets, and graphics for a program default to suit your own needs.

FGM is always being updated on Q-Link. The author, whose Q-Link handle is RonH8, is often online in the Starving Artists' Cafe. He is always offering new hints and suggestions.

Q-Link members can download an FGM demo and try it before buying. But once you try FGM, you'll be hooked on graphics—and spoiled. No more having a graphic that won't fit in the space you need on your document. With FGM you can copy it, shrink it, expand it, paste it, and then smile at the results.

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DWEEZILABEL

If Dweezil is anything like the program that bears his name, he must be one clever dog. Once again, Dave Ferguson, GEOS programmer *extraordinaire* and human who lives with Dweezil, has released an intriguing and useful GEOS program with a picture of a dog in a party hat on the label.

DweeziLabel is everything a GEOS user could want in a label program. Well, to be fair, it's everything Ferguson would want in a label program. He'll be the first to admit that the program evolved more as an answer to his specific needs than as a general-purpose label maker. Even so, it includes enough features to function as a minidatabase, a minipublisher, and who knows what else.

In the course of running Quincy Softworks, Ferguson needs to keep track of customers from all over the world and to keep notes on what they've ordered, how much they've paid, and so on. DweeziLabel emerged as his ideal multipurpose low-end business application. You can find it on Dweezil Disk #3, which includes MYgeoDIARY and geoWORDS.

Since Ferguson runs his business exclusively with GEOS products, data from DweeziLabel is compatible with applications such as geoMerge and geoCalc. Text scraps and numeric data can be neatly clipped in formatted chunks to fit those GEOS applications.

An even better example of DweeziLabel's versatility is the way it handles data. The program works with files of up to 50 records, similar to a card file database. These files can be created from within DweeziLabel, geoWrite, or geoFile. Ferguson wanted room in those records for more than just names and addresses. He wanted to keep notes about what products people had ordered and the amount of

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money they'd paid, so he added several extra data lines for that express purpose, data that the labeler part of the program doesn't print unless you want it to. So far, that's pretty tame stuff, but this is no wimpy Rolodex.

Tucked away in the Text menu is a series of search commands that let you sail through your data with ease. The six possible lines of data could be names and addresses. You could store shoe sizes and a recipe for Pan Galactic Gargle Blasters in there if you wanted, but DweeziLabel restricts you to the number of spaces you can use. In fact, aside from the size limit and the lack of the trivial feature of saving a graphic to a record, DweeziLabel can hold its own with geoFile for usefulness. As I said before, it even creates merge files for geoMerge.

But, hey, what about labels? Yes, DweeziLabel does labels, any kind of labels. It produces any kind of printed output that is 2 inches tall, for that matter, on pages up to a full 11 inches tall. Using a technique called layering in the work window, you can put together combinations of graphics and text to create just about any kind of label you can imagine.

By paging through the database, you can select label text that can be modified however you like. You can use any GEOS font you might have available (on either disk, up to the file selector's limit—no six or seven font maximum here) and any style, including reverse. The work window is conveniently sized to fit Ferguson's premier graphics desk accessories, NewTools and geoStamp (available on other Dweezil Disks). This means you can stamp yourself a border around a label or curve and angle graphics and text to your heart's delight.

All this power doesn't come as easily as it could, however. The documentation provided on disk is extensive but a bit thin in spots. The entire process of layering a graphics label is not particularly intuitive, which is not necessarily bad, but a step-by-step tutorial for this process would save the user some trial and error.

The words *scrap* and *label* appear often, sometimes meaning one thing and sometimes another. While these variations are defined in the short glossary, they do get confusing. Maybe since this program has become second nature to Ferguson, he's lost the perspective of a neophyte. The documentation should've been written from the perspective of the user who hasn't a clue about how this program operates—but it wasn't. As a result, this program runs the risk of being tossed aside after a half hour of frustration by casual users who don't care to figure out things on their own.

That would be a shame. DweeziLabel is too powerful an application to be missed by anyone who has some honest-to-goodness work to do with GEOS. The results are worth the extra effort it takes to master the intricacies of the interface. Heck, when used in conjunction with NewTools and geoStamp, DweeziLabel might be, as the ads claim, the "hottest GEOS label program to come along in years!"

STEVE VANDER ARK

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TYPING AIDS

MLX, our machine language entry program for the 64 and 128, and *The Automatic Proofreader* are utilities that help you type in Gazette programs without making mistakes. To make room for more programs, we no longer include these labor-saving utilities in every issue, but they can be found on each *Gazette Disk* and are printed in all issues of *Gazette* through June 1990.

If you don't have access to a back issue or to one of our disks, write to us, and we'll send you free printed copies of both of these handy programs for you to type in. We'll also include instructions on how to type in Gazette programs. Please enclose a self-addressed, stamped envelope. Send a self-addressed disk mailer with appropriate postage to receive these programs on disk.

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ONLY ON DISK

In addition to the type-in programs found in each issue of the magazine, Gazette Disk offers bonus programs. Here's a special program that you'll find only on this month's disk.

BASSEM 128
By Fernando Buela Sanchez
Querétaro, QRO
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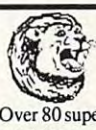

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FEEDBACK

Questions and answers about computer memory, onscreen messages, and more

More Memory

What exactly is the purpose of expanding the 64's memory, using cartridges such as the 1750? On an IBM, certain amounts of memory are required to use certain software. Is there any software for the 64 that requires more memory than the 64 has?

JOHN VEILLEUX
ORRINGTON, ME

There's no software that we know of which requires more memory of the 64 than what is native to the machine. On the other hand, several software packages, such as GEOS, can make use of RAM expansion if it's available. Many programs—games in particular—use the disk drive for virtual storage when either the program or its data is too large to be loaded and maintained in memory at one time. If more of the game can be stored in memory, then the game runs faster and the user doesn't have to wait for the computer to access the data stored on disk.

Large spreadsheets and databases are two reasons why business applications benefit from larger memories. Programmers can use more memory, which allows for code that is more highly developed and interpreters or compilers that are more sophisticated. More memory is also a boon to graphics, especially animation, where several scenes must reside in memory at once for smooth screen updates. A computer can do great things with digitized sound, but a lot of storage space is needed to contain reasonable sound samples.

Where speed isn't a critical factor, disk drives are a practical means of extending the 64's 64K limit. But where speed and quick responses are needed, more memory is very handy indeed.

Flashing Message

I've been working on some games for the 64 and have run up against a problem. There are certain messages, such as *DANGER*, that I'd like to have flash on the screen. How do I do this?

CAL BODWIN
GREENSBORO, NC

You could flash a message in BASIC by alternately printing in normal and reverse mode again and again. The program would have to stop while the message blinked, however. When the program continued, the flashing would stop.

Here's a machine language solution. The following program will flash in black any message that is printed on the screen. Other colors will print normally.

```
10 FOR A=828 TO 914: READB:
   POKEA,B: C=C+B: NEXT: IFC
   <>8545THENPRINT"DATA
   ERROR": STOP
15 POKE 6,0:SYS828
   :POKE53281,1: POKE53280,1:
   PRINT"{CLR}{3 DOWN}{15
   RIGHT}{BLK}DANGER!"
20 DATA 120,169,81,141,20,3,
   169,3,141,21
30 DATA 3,169,0,141,147,3,
   141,148,3,88
40 DATA 96,206,148,3,16,58,
   169,10,141,148
50 DATA 3,169,0,133,2,133,4,
   169,4,133
60 DATA 3,169,216,133,5,162,4,
   160,0,177
70 DATA 4,41,15,197,6,208,9,
   77,2,41
80 DATA 127,13,147,3,145,2,200,
   208,236,230
90 DATA 3,230,5,202,208,227,
   173,147,3,73
100 DATA 128,141,147,3,76,
    49,234
```

If you want a different color to flash, poke its color code (0–15) into location 6. The speed of the flashing can be adjusted by poking location 855 with a number from 0 to 255; the smaller the number, the slower the flash rate. SYS 828 enables the flashing messages. To stop the flashing, press the Run/Stop key and tap the Restore key.

Sequential Files

Could you please explain what a sequential disk file is and how to create one?

JACK DEMEANOR
CHARLESTOWNE, MA

A sequential file provides a way of keeping information separate from the program that uses it. This allows you to create general-purpose programs that can act on different sets of information. Instead of writing one program to keep track of a stamp collection, for example, and a second program to list a collection of rare books, you could write (or buy) a general inventory program that stores data in sequential files. One file would contain notes about stamps, and another would have the data about the books.

A single program could handle two or more different files. Sequential files are like DATA statements because you start reading at the beginning and continue until the end.

To create a sequential disk file, open it for writing, write one or more pieces of information to it, and then close the file. It's important to close a file when you've finished using it; otherwise, some of the information will be lost.

Reading the file requires an operation similar to that for writing. Open the file for reading, read the information, and then close the file.

Here's a short program that creates a sequential file.

```
10 PRINT "ENTER THREE
   NAMES"
20 PRINT"(PRESS RETURN AFTER
```


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```
   EACH ONE"
30 PRINT"OR SEPARATE THE
   FIRST TWO WITH COMMAS)"
40 INPUT A$,B$,C$
50 OPEN 1,8,2,"NAMES,S,W"
60 PRINT#1,A$: PRINT#1,B$:
   PRINT#1,C$
70 CLOSE1
```

The three numbers after the OPEN command in line 50 are the logical file number, the device number, and the channel. The file number can be any number that's not already being used by a peripheral. If you had previously opened a file to printer with OPEN 1,4 (file 1, device 4), you couldn't use logical file number 1 for opening the disk file. The logical file number is important because it's the number used to read from and write to a file.

The second number after OPEN is the device number (a single disk drive is device 8). The third number is the channel to be used. There are 16 disk channels, numbered 0–15. Channels 0 and 1 are used for loading and saving, and 15 is the command channel, so that leaves channels 2–14 for sequential files. It doesn't matter which channel you use, as long as it's not being used by another disk file. You can open more than one disk file, but each must have a different logical file and channel number.

The "S,W" after the filename means that the file will be sequential (S) and that you'll be writing (W) to it. Note the five commas in line 50; they're all necessary to separate the various parts of the OPEN command.

When the file is open, the red light on the front of the 1541 (or green light on the front of the 1571) drive will turn on and stay on until the file is closed. In line 60, PRINT# writes information to the file. It must be followed by the logical file number, a comma, and the information. If line 5060 had been OPEN 5,8,3, line 60 would have used PRINT#5 instead of PRINT#1. Line 70 closes the file. CLOSE is followed by the logical file number.

Now that we've written a file called NAMES, here's a program to read the data.

```
10 OPEN 5,8,4,"NAMES,S,R"
20 INPUT#5,A$,B$,C$
30 PRINT A$:PRINT B$:PRINT C$
40 CLOSE 5
```

Since we're reading the file, there's an R, *rather than a* W, *at the end of the OPEN command in line 10. In this instance, we're using logical file 5 and channel 4, although we could have used 1 and 2 as in the first program. INPUT# reads information from the file. Like PRINT#, it's followed by the logical file number and a comma. GET# acts like INPUT#, but it reads a single character at a time.*

The programs have similar structures: They both INPUT from one source and PRINT to another. The first used INPUT/PRINT# to read the keyboard and write to a file, while the second used INPUT#/PRINT to read from the file and write to the screen.

Double-Width Printing

I use SpeedScript with my Star NX-1000C printer, but the PRINT command for double-width characters does not work. Is there a way to modify the program to use these commands, or should I use a Ctrl-£ command?

DON SYWASSINK
SIERRA VISTA, AZ

A Ctrl-£, or stage 2, command should do the trick. With SpeedScript, you can define printkeys that will print whatever codes your printer uses for features such as double-width or emphasized mode.

To define a printkey, at the top of your document press Ctrl-£ (or Ctrl-3), followed by the key that you want to assign as the printkey. Then enter the equal sign (=) and the ASCII value to be substituted for the printkey during printing. Many systems use an escape (ESC) code to break out of the word processor, and then certain ASCII values to activate various print modes.

For convenience, SpeedScript has already set four printkeys. Printkey 1 is defined as the escape key (ASCII 27). (With some printers and interfaces, you must send two escape codes to bypass the emulation.) Printkey 2 has a default value of 14, which is the ASCII code that puts most printers into double-width mode. Therefore, to switch to double-width mode, press Ctrl-£ and then press 1, press Ctrl-£ again, and then press 2. Next, enter the text you want printed in double-width mode.

How to create and use sequential files and use double-width printing with SpeedScript

Printkey 3 has a default value of 15, which turns off double-width on some printers and selects condensed mode on others. Printkey 4 is defined as 18, which selects reverse field on Commodore printers and some interfaces in emulation mode. On other printers, it switches to condensed mode. (See your printer manual for exact codes.)

To print the word WIDE *in double width in the following example and then revert back to normal printing, your screen should look like this.*

This is 12WIDE3 printing.

Remember, some printers require two escape codes. In that case, you would have 112 *in front of the word* WIDE. *Codes can vary from printer to printer, so check your manual for specific values.* ❐

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MACHINE LANGUAGE

Jim Butterfield

CODING CHOICES

When programming, there's usually the fastest way or the most compact way. Here's an attractive compromise.

Recently, I saw the following message posted on a computer network: "I have a value in a single byte, and I want to calculate the remainder after dividing by 5. What code do you suggest?"

The remainder after division is often called the modulo; I don't know why the user wanted to calculate this, but there are several methods available that we can try. In this column, we'll discuss a couple of methods for solving the problem, and we'll also demonstrate the tradeoff between a program's speed and size. While we're at it, this might be a good time to gain some insight into hexadecimal numbers.

The standard method for solving this problem would be to use a conventional division routine that would yield both quotient and remainder. There are methods, however, that are designed either to achieve maximum speed or to utilize minimum memory. One rarely finds a piece of code that offers both. Almost all coding is a tradeoff between these two extremes.

A sample program called MOD5, printed at the end of this column, provides us with three approaches. The first routine offers speed, the second efficiency, and the third is a compromise of the two. You may want to examine the code of each one.

The fastest method is to look up the remainder in a table. Since a one-byte number can contain only 256 possible values, we can do this with a table of 256 bytes. This method couldn't be faster. We put the original byte into the Y register, and do the translation with a single instruction: LDA TABLE,Y. You'll find this at hex address 2015 in the program at the end of this column.

The method wastes memory, since we must devote 256 bytes to hold the table. The table could be loaded in, but it's quicker to calculate it when the program starts. You'll see this one-shot table build at addresses $2000–$2011. If only a few values were to be calculated, we couldn't justify this extra work. On the other hand, if there were thousands of values, this program would be speed efficient.

If the byte in question contains a value of 5 or more, we could subtract 5 and then repeat. Eventually, we end up with a value of 0 to 4; that's the remainder. The calculation loop, at addresses $202C–$2033, requires only four instructions: compare to 5, branch out if less (BCC), subtract 5, and branch back to the loop (BCS). Serious students of code will be able to explain why we don't need to set the C (carry) flag before subtraction and why the BCS (Branch Carry Set) command always branches.

The code is compact, fitting within eight bytes, but it could be slow. Since the original value could be as high as 255, the loop might be repeated as many as 51 times!

Most programs trade off speed against size. Programs that need to be fast will unfold their loops; this saves time but calls for more instructions. In this case, it really doesn't matter much. We have plenty of memory, and even the slowest method runs plenty fast for our purposes.

I wanted to add one more method, however. This third piece of code is moderately compact and fast. More important, it helps to show an interesting aspect of hex numbers.

It takes only a glance at a decimal number to tell whether it divides evenly by 5 or what the remainder would be. The last digit of the number tells the story (5 is a factor of 10, the base of decimal numbers). That's not true of hexadecimal numbers. The last digit will signal whether the number is divisible by 2, 4, 8 or 16, but it won't help you on the mod-5 question. Hex numbers such as 20 and 65 seem as if they should divide by 5, but they don't. Their decimal values are 32 and 101.

There is, however, a quick way to inspect hex numbers to see whether or not they will divide by 5. It's similar to the method we use with decimal numbers in testing whether or not a number divides by 9 or by 3. Add the decimal digits together; the total will have the same mod-9 value as the original number. Thus, decimal value 1234 will have a remainder of 1 when divided by 9. Calculate 1+2+3+4, giving 10, and the answer is a snap. The same holds true for division by 3, which is a factor of 9.

In hex, the sum of digits tells us about division by 15 or either of its factors (3 or 5). So, hex 23 will divide exactly by 5, and hex BC would have a remainder of 3. We know this because 2+3 gives 5, B+C or 11+12 gives 23, which would leave a remainder of 3 when divided by 5.

How would we do this in a computer program? A hex digit corresponds to four bits. We can extract the value of the high hex digit by shifting the number right four places. We extract the low digit value with a simple AND #$0F. Add them together, and we have the sum of the two hex digits within a byte.

This sum cannot be greater than 30 (decimal), so we know that the simple subtraction of method 2 will now loop not more than six times. Quite an improvement from a possible 51 times around the loop.

Four LSR (Logical Shift Right) commands extract our high hex digit. We store the re-

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sult and then call back the original value; masking with AND #$0F isolates the low digit. Add them together (don't forget to clear the carry flag first with CLC), and we can repeat the subtract loop of method 2. The whole thing goes from hex address 2040 to 205B. That's a bit longer than the previous method, but there's quite a speed advantage.

The program works on almost any Commodore 8-bit computer. It first pokes the machine language code into place. Then it does the mod-5 calculation four times.

The first calculation is in BASIC, followed by each of the three above methods. The values used for the calculation are from ROM, hex addresses E000 through E006. You'll get the same results each time, of course.

You might want to use a machine language monitor to inspect the MOD5 code more closely. That'll give you an even better understanding of what's happening in the different routines.

```
100 DATA 162,0,160,0,152,157,
    0,33,200,192,5,144,2,160,0
110 DATA 232,208,242,188,0,224,
    185,0,33,9,48,32,210,255
120 DATA 232,224,7,144,240,169,
    13,76,210,255
130 DATA 162,0,189,0,224,201,5,
    144,4,233,5,176,248,9,48
140 DATA 32,210,255,232,224,7,
    144,235,176,226
150 DATA162,0,189,0,224,72,74,
    74,74,74,141,255,32,104
160 DATA 41,15,24,109,255,32,
    201,5,144,4,233,5,176,248
170 DATA 9,48,32,210,255,232,
    224,7,144,220,176,186
200 FOR J=8192 TO 8295
210 READ X:T=T+X
220 POKE J,X
230 NEXT J
240 IF T<>12902 THEN STOP
400 PRINT "BASIC:"
410 FOR J=57344 TO 57350
420 X=PEEK(J):PRINT X-5*INT(X/5);
430 NEXT J
440 PRINT
450 PRINT"TABLE LOOKUP:"
460 SYS 8256
470 PRINT "SUBTRACT LOOP:"
480 SYS 8231
490 PRINT "HEX CHECKSUM:"
500 SYS 8256
510 PRINT "END."
```

❐

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BEGINNER BASIC

Larry Cotton

ADDING ZIP TO BASIC

When your BASIC programs need a burst of speed, give them a shot of machine language.

I get lots of requests for programming tips on ways to use BASIC with many applications, ranging from games to databases. A typical question might be, "How do I write a fast subroutine for doing searches for a given name and address in BASIC?" Another might be, "How do I make the aliens move faster while monitoring the joystick port, keeping score, and moving background scenery?"

The answer to these questions is simple: If you want to do it fast, forget BASIC. Any program can be written in BASIC (assuming it will fit the computer's memory), but you might drop off to sleep waiting for something to happen.

Many articles have been written on maximizing BASIC's speed, and you can get some improvement using these techniques. However, none but the shortest, most elementary database programs should be written in BASIC. Any program that is more sophisticated is best written in some other programming language—preferably machine language (ML). To learn more about those programming techniques, consult Jim Butterfield's "Machine Language" column elsewhere in Gazette.

As for games, some can easily be written in pure BASIC, especially those that don't require blinding speed. Some examples would be word-search, spelling, math-drill, and even simulated board games. These types of games don't require much speed, and the user wouldn't notice if the computer slowed a little during execution.

Actually, BASIC and ML can be used together. One way is to use a BASIC program as an ML loader. Then a SYS command puts you into machine language to stay.

The other way is to incorporate a speedy routine within a relatively slow BASIC program. Here's an example of the latter.

Suppose you're writing a pick-a-card-any-card game. You need to shuffle a deck of 52 cards quickly. By generating a nonrepeating list of 52 numbers, you could assign the numbers to an array of all the cards. The following program is one way to generate those numbers in BASIC.

BASIC RND

```
10 PRINT"{CLR}{DOWN}PRESS
   ANY KEY TO RANDOMIZE 52
   NUMBERS
20 PRINT"{DOWN} WITH OUT
   REPEATS.
30 GETA$:IFA$="" "THEN 30
40 PRINTCHR$(147)
50 Q=RND(-TI/101)
60 C=52:DIMRN(C)
70 FORX=1TOC
80 RN(X)=INT (C*RND(1))+1
90 FORT=XTO1STEP-1:
   IFRN(X)=RN(T-1) THEN80
100 NEXT
110 PRINTRN(X),
120 NEXT
130 PRINT"{DOWN} I'M SURE
    YOU DON'T WANT A REPEAT!
```

Now, let's try doing the same thing using machine langage. (Don't worry, Jim Butterfield. Your column is safe!)

ML RND

```
10 Q=RND(-TI/101):
   PRINTCHR$(147)
20 FORT=49152TO49221:
   READD:POKET,D: NEXT
30 POKE54286,255:
   POKE54287,255: POKE54290,
   128: REM SET UP VOICE 3
40 CB=49480
50 A=52:REM RANDOMIZES
   FROM 1 TO A WITHOUT
   REPEATS; MAX. VALUE OF A
   IS 255.
60 POKE49222,A
70 PRINT"{DOWN} PRESS ANY
   KEY TO RANDOM-
   IZE"A"NUMBERS
80 PRINT"{DOWN} WITH OUT
REPEATS.
90 GETA$:IFA$="" "THEN90
100 PRINTCHR$(147): SYS49152
110 FORT=CB+1TOCB+A:
   PRINT(PEEK(T)),: NEXT
120 PRINT:PRINT:PRINT"AGAIN?
   (Y=YES, N=NO)
130 GETA$: IFA$<>"Y" THENIFA
   $<> "N"THEN130
140 IFA$="N"THENEND
150 GOTO100
1000 DATA 172,70,192, 69,0,153,
     72,193,136,208,250, 173,
     70,192,170,160, 0,153,72
1010 DATA 192,200,240,11,202,
     138,208,246,173,70, 192,
     170,76,17,192,173,70,192,
     141
1020 DATA 71,192,173,27,212,
     170,189,72,192,172,70,
     192,217,72,193,240,241,
     136,208
1030 DATA 248,172,71,192,153,
     72,193,206,71,192,208,
     227,96
```

Run both programs and observe the difference in how long it takes to generate 52 nonrepeating numbers. Allow plenty of time in the BASIC version, especially for the last several numbers.

To use embedded ML subroutines in a BASIC program, just SYS to the routine (see line 100 in ML RND). After the numbers are generated, they appear in memory registers 49481 through 49532 (for 52 numbers).

Here's an invitation to you programmers. I'd like to see your own versions of both BASIC and ML no-repeat randomizing programs. Please send them to me in care of COMPUTE's Gazette, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408. If you keep them small enough to print on one page of the magazine, I'll publish the best examples in a future column. ❐

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D'IVERSIONS

Fred D'Ignazio

CAPTAIN FUTURE AND HIS POCKET COMMANDER

In this exciting episode, read how a mild-mannered magazine columnist is transformed into Captain Future.

Hello. This is Captain Future. People used to call me Fred, but that's when I was stationary, physical, and sitting in a real chair in a real office with real wires tying me to one spot.

Now I'm Captain Future. I'm mobile. I'm cordless. I'm wireless. I'm on the go. Where I call you from one minute is not where I'll be the next. You may be *there* (where you really are), but I'm only *here* in a metaphorical sense. I'm totally virtual. I beam you up from my little pocket phone somewhere on the planet. You beam me up, and I might be on a rock cliff or in my minivan or under a giant sequoia.

The revolution in my personal communications style occurred two months ago when I began renting my little Fujitsu Pocket Commander phone. The phone weighs just a few ounces; it's about five inches long and two inches deep. I wear it in a little case on my belt.

When I'm wearing my Pocket Commander, I feel like a new man. With that little phone strapped to my side, I pretend I'm James Bond with his shoulder holster. But instead of a warlike secret agent, I'm a peaceful agent, armed for the future, ready to communicate with the world.

As soon as the Fujitsu lady checked me out on my new phone, I placed my very first call to my wife. I found her in an unlikely spot: the kitchen. She picked up the kitchen phone and said, "Hello?"

"Hello, dear," I said. "It's Captain Future, your husband."

"Where are you?" asked my wife, not at all impressed with my new secret identity.

"Right outside the kitchen door, dear," I answered proudly. "About five feet away from you, in the driveway."

Next I called my mom. "Hello, Mom," I said. "It's your son, Captain Future."

"Who is this really?" my mother asked suspiciously.

"Aw, Mom," I said. "I'm calling you with no wires. No cables. Just thin air. And we're talking just like on a real phone. Isn't it grand?"

"I don't know any Captain Future," my mother said. "And whoever this is, you sound like you're calling me from inside a fish tank or a tin can. Please go away." Clink!

After calling my mom, I called everyone else I could think of. I called people from restaurants, bowling alleys, baseball diamonds, petting zoos, and public marinas.

Suddenly, I realized that I had become an addictive communicator. I first realized this after I installed the Fujitsu Pocket Commander in a cellular dock inside my minivan. Now I had a boosted power source, a cellular antenna corkscrewing up the side of my car, and an in-car speaker phone with a tiny mike clipped to the sun visor over the driver's seat. After I ran out of other people to call on my car phone, I began calling my wife again.

"Hello, dear!"

"Is that you, Fred?" my wife asked, from inside the house. "Where are you now?"

"Outside in the driveway, in our car."

"If you're already home, why don't you come inside and talk, like a real person?"

"Because it's more fun to call you from the car. It's kind of like an intercom. Besides, I've got my laptop computer out here, and I'm trying to plug it into the car phone so I can call online bulletin boards and maybe even send faxes."

"Why would you want to send faxes from your car?" my wife asked. "Especially when you're parked in our driveway?"

Since then, my wife has slowly warmed to pocket phones. For example, last week she and I were trekking around a rock quarry on the seacoast north of Boston. There wasn't another person for miles around. Nature was in bloom all around us. Suddenly, my wife reached for my belt.

"Dear!" I screamed, jumping backward. "What's got into you?"

"Your phone," she said. "I want your phone. I just remembered I have to call my office."

While my wife sat on the quarry's edge talking with her boss and her secretary, I began climbing down the vertical wall of the quarry. After about 15 minutes, I made it down to the level of the water that filled the quarry's inner basin. I took off my shoes and dangled my bare toes in the water, scaring away a couple of polliwogs that were sunning themselves on a big boulder just beneath the surface. I listened to my wife as she talked on the cellular phone, her voice crystal clear high above.

"This is weird," I thought. Somehow, my wife's phone call to her office didn't seem out of place even here, deep in the heart of undisturbed nature. In addition, the call didn't stress me out or make me lose my sense of awe and appreciation for my surroundings. Somehow, everything seemed to fit in.

It'll be amazing to see how this revolution changes the future face of work and leisure. Maybe in the future it'll be normal to conduct business on a rock cliff while on a daylong trek into a remote granite quarry. As I gazed out at the deep blue quarry lake all around me, I thought that might be kind of nice. ❐

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GEOS

Steve Vander Ark

ULTIMATE GEOS

Now that the holiday season is fast approaching, here's the GEOS system I'd really like to find under the tree.

In an IBM magazine recently, a senior editor describes his quest for the ultimate PC. The cost of this system would buy a pretty nice sports car.

That started me thinking about the ultimate GEOS setup. I wondered just how powerful GEOS could be with all the right gizmos hooked up to it. And, since Christmas is just about once again to take over prime time and the malls, I figure this is a great time to make yet another GEOS wish list. While the total wouldn't buy a snazzy sports car, it might be enough to buy, oh, a used Ford Escort.

My dream GEOS setup has to start with a computer, of course. I'll go with the 128, since an 80-column screen is essential. Now, the 128D does have a detachable keyboard, which is nice, and an extra 64K of video RAM, but I don't like the idea of having that darn 1571 permanently set up as drive 8. I have much better ideas for disk drives, so I'll stick with the flat 128.

One advantage to the Commodore computer is that you don't have to spend heaps of money on extra cards to do things like create color screen displays. Our 128 has 40-column and 80-column modes built right in; all we need to do is to choose a monitor which can display either mode on command. Since nothing but the best will do for our ultimate setup, I'll add a Commodore 1084S monitor.

Mode switching can become a constant chore when you work with GEOS on the 128; many programs, from little utilities like Blue Pencil to big utilities like geoPublish, run fine on the 128 but demand 40 columns. To make life a little easier, I'll add a 13-inch 40-column monitor on the side. You'd be surprised how handy this configuration can be. When you switch to 40-column mode, the image jumps from one monitor to the other, and the screen of the unused monitor goes peacefully blank. If you can't afford a second monitor, a color TV works about as well. I'm going for broke here, though, so I'll pick up an 1802 monitor.

One or two more details are needed before we tackle the big question of drives and RAM expansion. We must, for example, have an input device. Speaking from experience, having used a joystick, mouse, KoalaPad, and light pen with an assortment of drivers, I strongly recommend a mouse. Speaking from the experience of friends, the mouse of choice is the Commodore 1351.

OK, let's talk disk drives. It would be nice to include drives to handle both 5¼-inch and 3½-inch disks. For the 5¼-inch disks, the best bet is the good old 1571, which can read single- or double-sided floppies. That's pretty much standard stuff.

Let's take a leap into the big leagues for the 3½-inch drive. We have a couple of very impressive choices, now that Creative Micro Designs (CMD) has released a pair of high-density drives: the FD-2000, with 1.6 megs per disk, and the FD-4000, with a whopping 3.2 megs of data on a floppy! We're talking dream material here, folks! The ultimate GEOS system has to have an FD-4000.

That accounts for two of the drives. GEOS can effectively handle only three drives, so this next choice might be a little sticky. Some form of RAM expansion is a must with GEOS, but if it's configured as a RAM drive, there goes the third drive. It's hard to imagine an ultimate system, however, without a hard drive. For now, anyway, I'll just choose both.

The hard drive of choice will be one of the CMD HD-series drives, which are compatible with GEOS and practically everything else. Since money's no object, I'll take the HD-200 with 200MB capacity.

I do need RAM expansion as well, so let's take a look at the options. The Commodore 1751 RAM expansion unit can be upgraded to larger capacities than the stock 512K, but it's still a pretty bland unit. A much more exciting choice would be either the RAMLink or RAMDrive from CMD. Each has two invaluable features no RAM expansion device should be without: a separate power supply, which keeps the data intact when you shut down your system, and a battery backup, which means that in the event of a power failure, your data won't evaporate like spit on a hot skillet. Both are fine units. RAMLink can be upgraded to 16 megs, while RAMDrive is limited to 8 megs. RAMLink also can be fitted out with a realtime clock circuit to set your clock in GEOS, and it also features a pass-through port that I just might need before this system is completed. I'll add RAMLink, maxed out to 16 megs.

I'll have to decide how to configure all those drives when I pick a desktop program, but I'll do that next month when I talk about software. For now, let's recap my shopping list.

128 CPU (used)	$ 200.00
1084S monitor	$ 289.00
1802 monitor (reconditioned)	$ 99.95
1351 mouse	$ 32.95
1571 disk drive (used)	$ 100.00
FD-4000 disk drive	$ 300.00
HD-200 hard drive	$ 1,099.95
RAMLink with battery and 16MB RAM	$ 584.90
TOTAL	$ 2,706.75 ❐

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PROGRAMMER'S PAGE

Randy Thompson

READER'S GRAB BAG

Readers take over this month's column with a collection of handy tips for the 64 and 128.

From the mailbox to the printer, this grab bag of programming gems comes from you, our readers. Keep 'em coming. We pay up to $50 for each tip we publish.

64 or 128?

There's an easy way for your BASIC program to detect which 8-bit Commodore computer it's running on. Simply check the variable DS$ in the first line of your program. If DS$ is equal to a null string (DS$=""), your program is running on a 64 or on a 128 operating in 64 mode. That's because in 128 mode, the DS$ string returns the current status of the disk drive, whereas on a 64, DS$ doesn't hold anything until you define it.

Incidentally, checking DS$ on a 128 that has no drive attached can crash your program, but how many driveless 128 owners do you know?)

ARTHUR MOORE
ORLANDO, FL

Redefining Restore

This two-line program turns your Restore key into a computer reset button. After you type in and run the program, tapping (sharply, of course) the Restore key will yield the same results as the BASIC command SYS 64738.

```
10 FOR I=32768 TO 32776:
   READD: POKEI,D: NEXT
20 DATA 248,252,226,252,195,
   194,205,56,48
```

To disable your new reset key, turn the computer off and then on again.

Here's how the program works. Whenever you press the Restore key, the computer checks memory locations 32772–32776 for the numbers 195, 194, 205, 56, and 48. These numbers are the PETSCII codes for the reversed capital letters *CBM* followed by the number 80. If that string is found, the computer jumps to the machine language subroutine pointed to by memory locations 32770 and 32771. The program listed above redirects this vector to point to the 64's reset routine found at 64738. Things get a bit tricky here, because the reset routine at 64738 also looks at memory locations 32772–32776 for the string *CBM80*. If it finds those characters, it jumps to the subroutine pointed to by the vector at 32768. To avoid such jumpy behavior, our Restore-reset routine sets this vector so that it points right back into the 64's reset routine, forcing the computer to continue the reset operation from where it left off.

One of the neat features of this program is that you can set the vector found at 32770 so that it points to your own machine language program—one that will execute every time you press Restore. In the program above, this vector is set equal to the third and fourth numbers found in the DATA statement on line 20.

Note that this program disrupts the normal operation of the Run/Stop–Restore key combination. Now, pressing Run/Stop–Restore resets the computer, also, but it clears any program that may have been in memory.

LANCE SLOAN
SWARTZ CREEK, MI

Convenient Comma Key

This hack is for 128 owners who enter a lot of data via their numeric keypads. It transforms the keypad's Enter key into a comma key. Such a setup is ideal for people who type in a lot of MLX listings.

```
10 FOR I=0 TO 28: READ D:
   POKE 4864+I,D:C=C+D: NEXT
20 IF C<>3231 THEN PRINT
   "ERROR IN DATA STATE
   MENTS": END
30 BANK 15: SYS 4864: PRINT
   "NUMERIC COMMA KEY
   ACTIVE"
40 PRINT "TO DISABLE: POKE
   830,128:POKE 831,250"
50 PRINT "TO REACTIVATE:
   BANK 15:SYS 4864"
60 DATA 160,0,185,128,250,
   153,29,19
70 DATA 200,192,89,208,245,
   169,19,141
80 DATA 63,3,169,29,141,
   62,3,169
90 DATA 44,141,105,19,96
```

EMIL HEYROVSKY
PRAGUE, CZECHOSLOVAKIA

ReDIMing Arrays

If you ever want to erase and/or redimension (DIM) your variable arrays, execute the following two commands from within your program.

```
POKE 49,PEEK(47): POKE
50,PEEK(48)
```

This will erase all arrays. Unlike the CLR command, however, these POKEs will not affect nonarray variables.

HELEN ROTH
LOS ANGELES, CA

Monitoring 64 Code on the 128

The most popular area for programmers to store machine language programs on the 64 is in the 4K area starting at 49152 ($C000). Of course, this area is relatively useless on the 128 because 49152 is where editor ROM is mapped, but that doesn't mean you'd never want to load your 64 code here. Because RAM underlies 128 editor ROM, 64 machine code can be stored here and worked on using the 128's built-in machine language monitor.

YANNICK TROTTIER
BRIDGETOWN, NS
CANADA ❐

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MOB MASTER

By Hong Pham

Sprites (or movable object blocks) are large user-defined graphics that can be placed anywhere on your monitor's screen. The 128 has a powerful sprite controller that is built into its BASIC operating system to make sprite programming fairly easy. The 64, which has the same sprite capabilities as the 128, lacks the 128's sprite controller system. Programming sprites on a 64 usually requires many lines of code filled with awkward POKEs—but now there's MOB Master.

MOB Master gives the 64 many of the same features and sprite commands that are found on a 128. It also has extras, such as sprite animation and boundary-handling commands.

While this article explains how to use MOB Master's commands, it doesn't provide a complete tutorial for creating and using sprites. Programmers who already use sprites should have no trouble using MOB Master. Beginners can find more detailed descriptions of sprites and video banking in such reference books as *Commodore 64 Programmer's Reference Guide* or *Mapping the Commodore 64*.

Getting Started

MOB Master is written entirely in machine language. Use MLX, our machine language entry program, to type it in. If you don't have a copy of MLX, see "Typing Aids" elsewhere in this section. When MLX prompts, respond with the following values.

Starting address: 7D00
Ending address: 86EF

When you've finished typing in MOB Master, be sure to save it before exiting MLX.

To activate MOB Master, load it with the ,8,1 extension and then type *SYS 32000*. At this point you'll see a title screen that lets you know MOB Master has been activated. You may now begin writing your own sprite program. Instead of using cumbersome POKEs to control your sprites, however, you'll have a whole new library of commands at your disposal.

Ten Sprite Commands

MOB Master adds ten new BASIC commands for easier sprite definition, positioning, movement, animation, and other miscellaneous functions. The first three commands are similar to the 128's sprite commands of the same name.

Here's an important programming note to remember: When using a MOB Master command within a BASIC program, you must precede that command with a slash (/). In immediate mode, however, you don't need to use the slash.

SPRITE *#, on/off, fgnd, priority, x-exp, y-exp, mode*

The SPRITE command defines most of the characteristics of a sprite. Select the sprite number *(#)* with a value ranging from 0 to 7.

Use a 1 in the *on/off* parameter to turn on your sprite; use a 0 to turn it off.

The sprite foreground *(fgnd)* color is defined with a value between 0 and 16.

To make the sprite appear in front of objects on the screen, set its *priority* parameter to 0. To make it appear behind the objects on the screen, set the parameter to 1.

The sprite can expand to twice its original size horizontally *(x-exp)* or vertically *(y-exp)* by setting the next two parameters to 1. Set these parameters to 0 to turn off sprite expansion.

Turn on multicolor *mode* with a 1 or turn it off with a 0.

MOVSPR *#, x, y*

MOVSPR either positions or moves the sprite. The first example plots the sprite anywhere on the screen, with *x* being any pixel number between 0 and 319 and *y* any number between 0 and 199. Unlike normal sprite programming, MOB Master lets you place sprites beyond the 255th pixel without additional programming.

MOVSPR *#, direction # speed*

This variation moves the sprite in a specific direction and speed. The *direction* value can range from 0 to 255. This value can be converted to degrees by multiplying it by 45/32. To move the sprite up, use a value of 0. To move it to the right, use a value of 64. To move down, use 128. To move left, use 192. Intermediate values will move the sprite at different angles across the screen.

The value for *speed* can range from 0 to 255, with 0 being fastest and 254 being slowest. A value of 255 means that the sprite is stationary.

The format for this command is similar to that used for positioning a sprite, but instead of using a comma to separate the values, use the # sign. For example, MOVSPR 0, 64 # 100 would move sprite 0 to the right at a fairly slow speed.

SPRCOLOR *color 1, color 2*

In multicolor mode, the two multicolor colors are shared among all eight sprites. The first parameter defines multicolor 0, and the second parameter defines multicolor 1.

ANIMATE *#, speed, mode, start frame, end frame*

ANIMATE defines a sprite image or animates the sprite by successively changing its image pointers. The animation *speed* can range from 0 to 255, with 0 being fastest and 254 being slowest. A value of 255 means that the sprite has no animation. The *mode* parameter tells MOB Master how the sprite will be animated. A value of 0 means that the sprite will always be animated, and a 1 means that the sprite will be animated just once. Any other value will stop the sprite from being animated.

Sprite data resides in blocks of 64 bytes each. These blocks are numbered from 0–255. To calculate the location of a block of sprite data in memory, multiply the block number by 64. The result gives you the location where the first byte of a sprite definition should be poked. If you define several sprites whose shapes differ slightly and then switch rapidly among these blocks with the ANIMATE command, the sprite will appear to move in an animated fashion.

The *start frame* parameter indicates the first sprite image or block for animation. The *end frame* parameter indicates the ending block number for the animated sequence. Any sprite

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frames that are in between these will be automatically called.

BOUNDARY *#, mode, top, bottom, left, right*

Each sprite has its own individual screen boundaries. Once the sprite reaches a boundary that you set with a pixel number, the *mode* parameter indicates the action that the sprite will take. A 0 means that the sprite will wrap around and be placed on the opposite boundary. A 1 indicates that the sprite will bounce off the boundary. A 2 indicates that the sprite will stop at the boundary. Any other value indicates that the sprite will be turned off when it reaches a boundary, discontinuing motion.

For convenience, MOB Master allows only the horizontal boundary to be accurate to within two pixels. The actual boundary occurs on every even pixel. MOB Master will automatically divide the value that you have supplied with the boundary parameter by 2.

BOUNCE *#, mode*

BOUNCE bounces a sprite in a certain way, even if it's not at its boundary. *Mode* indicates how the sprite will bounce. A 0 argument means that the sprite will bounce vertically; a 1 indicates that the sprite will bounce laterally. Any other value will reverse the sprite's direction.

SPLIT *mode*

MOB Master supports two different raster-interrupt routines for flicker-free sprites. It accomplishes this task by updating its shadow registers when the raster scan is at a certain position on the screen. To select one of the two raster-interrupt routines, set *mode* to either 0 or 1. The only difference is that the latter routine allows you to display sprites on the top and bottom borders. If no argument follows SPLIT, it will turn off the raster-interrupt routine.

Before attempting an input or output operation, especially with a disk drive, it's best that you turn off the raster-interrupt routine. If you don't turn off the routine, the computer may freeze until you hit the Run/Stop and Restore keys simultaneously.

IRQ *enable/disable*

When you move multiple sprites as if they were one sprite, one sprite may move ahead of the others, creating a gap. This is because MOB Master updates the sprites 60 times a second, and BASIC may be too slow to move all the sprites before MOB Master updates them. One sprite may be updated before BASIC updates the others.

To temporarily stop MOB Master from updating the sprites, use IRQ 0. Any other value will allow MOB Master to continue updating the sprites. Be careful not to hold the system for too long, or the computer may hang up.

ZAP

ZAP clears all the sprite registers.

KILL

KILL disables MOB Master and restores the previous interrupt and BASIC vectors.

Additional Notes

For all MOB Master statements, with the exception of IRQ, you can substitute an unknown parameter with an asterisk (*). You can also use the asterisk if you don't want to make any changes to the current parameter. You don't have to supply all of the parameters of the command, but you must denote the sprite number. You cannot substitute an asterisk for the sprite number.

Collision Detection

Sprite-to-sprite or sprite-to-background collisions can be monitored by using the USR command. To return the status of the last sprite-to-sprite collision, type in *PRINT USR(0)*. Likewise, to return the status of the last sprite-to-background status, type *PRINT USR(1)*.

Shadow Registers

MOB Master updates its shadow registers to the VIC-II during a raster interrupt, or once every 1/60 of a second, to avoid sprite flickers. An advantage of this setup is that the sprites continue to move while your program does something else. You shouldn't make a direct POKE to the VIC-II registers to define a sprite, because once a raster interrupt occurs, MOB Master overwrites the VIC-II register with the contents of the shadow register. Therefore, poke to the shadow register instead. Below is the memory map of the shadow register and its VIC-II equivalent.

VIC-II Location	Equivalent Shadow Register	Description
	(Base + offset)	
$D000 (53248)	Base + 1312	Sprite 0 *x* position
$D001 (53249)	Base + 1320	Sprite 0 *y* position
$D010 (53264)	Base + 1328	Most significant bits of sprites 0–7 horizontal positions
$D015 (53269)	Base + 1329	Sprite enable register
$D017 (53271)	Base + 1330	Sprite Y-Expand register
$D01D (53277)	Base + 1331	Sprite X-Expand register
$D01B (53275)	Base + 1332	Sprite-to-foreground priority register
$D01C (53276)	Base + 1333	Sprite multicolor mode register
$D025 (53285)	Base + 1334	Sprite multicolor register 0
$D026 (53286)	Base + 1335	Sprite multicolor register 1
$D027 (53287)	Base + 1336	Sprite 0 color register
$07F8 (2040)	Base + 1344	Sprite shape data pointers. The actual location of this register depends on the location of the video matrix.

The default base is $7D00 (32000).

MOB Master and Machine Language

MOB Master's sprite-handling ability is not restricted to BASIC programs. Machine language programmers will find

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MOB Master useful, as well. In fact, MOB Master and machine language are a great combination because you can do much more with machine language than you can with BASIC.

To make access to MOB Master's subroutines easier, MOB Master has a jump table. For all of MOB Master's subroutines, enter it with a JSR instruction, and use the X register to denote the sprite number. The following is the memory layout of the jump table.

Location	Description
(Base + offset)	
Base	Enable MOB Master's BASIC interface.
Base + 3	Enable raster-interrupt routine 1.
Base + 6	Enable raster-interrupt routine 2.
Base + 9	Disable raster-interrupt routine.
Base + 12	Zap all sprite registers.
Base + 15	Turn sprite on or off; C flag set = sprite is on.
Base + 18	Position sprite at *x, y*. AC = LSB of *x* position; C flag = MSB of *x* position; YR = *y* position.
Base + 21	Set sprite color; put sprite color in AC.
Base + 24	Set sprite multicolor mode characteristics. C flag set = multicolor mode on. AC = multicolor 0; YR = multicolor 1.
Base + 27	Set sprite to background priority; C flag set = background has priority.
Base + 30	Set Y-expand; C flag set = expand sprite vertically.
Base + 33	Set X-expand; C flag set = expand sprite horizontally.
Base + 36	Set sprite speed; AC = sprite speed.
Base + 39	Set boundary action mode (similar to BASIC BOUNDARY statement).
Base + 42	Set sprite direction; AC = sprite direction.
Base + 45	Set animation speed and mode. AC = animation speed; YR = mode.
Base + 48	Set animation start and end image pointers. AC = start image location; YR = end image location.
Base + 51	Set top and bottom borders. AC = top border; YR = bottom border.
Base + 54	Set left and right borders. AC = left border; YR = right border. Note: Divide border value by 2.
Base + 57	Bounce sprite vertically.
Base + 60	Bounce sprite laterally.
Base + 63	Reverse sprite direction.

Note: C flag = Carry flag, AC = Accumulator, XR = X register, YR = Y register

If you're using MOB Master exclusively in machine language, you may delete the BASIC interface module starting at location $82CC (33484) or (base) + 1484 to $86EA 34538 or (base) + 2538.

MOB MASTER

```
7D00:4C CC 82 4C 7A 7D 4C 81 4D
7D08:7D 4C 88 7D 4C A1 7D 4C ED
7D10:AB 81 4C 94 81 4C BC 81 4C
7D18:4C C2 81 4C D9 81 4C EA 37
7D20:81 4C FB 81 4C 60 81 4C B9
7D28:80 81 4C 69 81 4C 6D 81 7D
7D30:4C 75 81 4C 84 81 4C 8C F2
7D38:81 4C 12 81 4C 1F 81 4C 8F
7D40:29 81 78 CD 14 03 D0 05 6F
7D48:EC 15 03 F0 0E 48 AD 14 6F
7D50:03 8D DA 7D AD 15 03 8D B8
7D58:DB 7D 68 8D 14 03 8E 15 65
7D60:03 A9 7F 8D 0D DC A9 81 C0
7D68:8D 1A D0 AD 11 D0 29 7F 43
7D70:8D 11 D0 AD 1E D0 AD 1F 1A
7D78:D0 60 A9 B9 A2 7D 4C 42 AA
7D80:7D A9 DC A2 7D 4C 42 7D 89
7D88:78 A9 81 8D 0D DC A9 00 62
7D90:8D 1A D0 AD DA 7D 8D 14 C9
7D98:03 AD DB 7D 8D 15 03 58 F2
7DA0:60 A2 80 A9 00 9D 20 82 58
7DA8:CA 10 FA A2 07 A9 FF 9D 13
7DB0:48 82 9D 78 82 CA 10 F7 03
7DB8:60 AD 19 D0 8D 19 D0 29 1B
7DC0:01 F0 16 20 1E 7E AD 11 94
7DC8:D0 29 7F 8D 11 D0 A9 FA 59
7DD0:8D 12 D0 20 BC 7F 20 70 C7
7DD8:7E 4C 31 EA AD 19 D0 8D FB
7DE0:19 D0 29 01 F0 19 A9 00 11
7DE8:D0 21 20 1E 7E AD 11 D0 18
7DF0:29 7F 09 08 8D 11 D0 A9 FD
7DF8:F9 8D 12 D0 EE E7 7D 20 D5
7E00:BC 7F 20 70 7E 68 A8 68 95
7E08:AA 68 40 AD 11 D0 29 77 EC
7E10:8D 11 D0 A9 00 8D E7 7D 50
7E18:8D 12 D0 4C D9 7D A2 07 50
7E20:A0 0E BD 20 82 99 00 D0 F5
7E28:BD 28 82 99 01 D0 BD 38 F6
7E30:82 9D 27 D0 BD 40 82 9D 59
7E38:F8 FF 88 88 CA 10 E3 AD 57
7E40:30 82 8D 10 D0 AD 31 82 CA
7E48:8D 15 D0 AD 32 82 8D 17 14
7E50:D0 AD 33 82 8D 1D D0 AD DF
7E58:34 82 8D 1B D0 AD 35 82 9D
7E60:8D 1C D0 AD 36 82 8D 25 1C
7E68:D0 AD 37 82 8D 26 D0 60 4F
7E70:A2 07 BD 48 82 C9 FF F0 E8
7E78:11 C9 40 90 14 BD 50 82 3C
7E80:F0 0F DE 50 82 D0 03 20 18
7E88:9D 7E 20 83 7F CA 10 E2 5A
7E90:60 38 BD 48 82 E9 3F 9D DF
7E98:50 82 4C 87 7E BD 58 82 7E
7EA0:DD 60 82 F0 09 9D 60 82 06
7EA8:20 2E 7F 9D 68 82 BD 58 2C
7EB0:82 C9 20 90 21 C9 40 90 AF
7EB8:26 C9 60 90 2B C9 80 90 62
7EC0:30 C9 A0 90 35 C9 C0 90 48
7EC8:3A C9 E0 90 3F 20 45 7F FE
7ED0:20 15 7F 4C 4E 7F 20 45 CD
7ED8:7F 20 15 7F 4C 48 7F 20 DA
7EE0:48 7F 20 15 7F 4C 45 7F 6E
7EE8:20 48 7F 20 15 7F 4C 4B 84
7EF0:7F 20 4B 7F 20 15 7F 4C B7
7EF8:48 7F 20 4B 7F 20 15 7F D8
7F00:4C 4E 7F 20 4E 7F 20 15 70
7F08:7F 4C 4B 7F 20 4E 7F 20 94
7F10:15 7F 4C 45 7F 20 2E 7F AF
7F18:18 7D 68 82 C9 20 90 08 AF
7F20:38 E9 20 9D 68 82 38 60 B1
7F28:9D 68 82 68 68 60 BD 58 7F
7F30:82 29 20 08 BD 58 82 29 BC
7F38:1F 28 F0 08 8D 43 7F 38 20
7F40:A9 20 E9 FF 60 A0 00 2C 0B
7F48:A0 01 2C A0 02 2C A0 03 6C
7F50:BD 48 82 C9 40 B0 1E 38 66
7F58:A9 41 FD 48 82 20 D0 80 77
7F60:98 F0 09 88 F0 09 88 F0 3F
7F68:09 4C 98 80 4C D1 7F 4C 0F
7F70:49 80 4C 16 80 BD 48 82 2D
7F78:38 E9 3F 9D 50 82 A9 01 B0
7F80:4C 5D 7F BD 98 82 30 0F 07
7F88:BD 78 82 C9 FF F0 08 BD 03
7F90:80 82 F0 04 DE 80 82 60 2D
7F98:BD 78 82 9D 80 82 BD 40 88
7FA0:82 DD 90 82 F0 04 FE 40 68
7FA8:82 60 BD 98 82 F0 06 A9 CF
7FB0:FF 9D 98 82 60 BD 88 82 DF
7FB8:9D 40 82 60 AD 00 DD 29 3F
7FC0:03 AA AD 18 D0 29 F0 4A 7A
7FC8:4A 18 7D 1C 82 8D 39 7E 9F
7FD0:60 BD 28 82 DD A0 82 B0 C3
7FD8:33 20 5B 81 F0 27 88 F0 23
7FE0:1E 88 F0 0F AD 31 82 3D 94
7FE8:14 82 8D 31 82 A9 FF 9D AF
7FF0:48 82 60 BD A0 82 9D 28 0F
7FF8:82 A9 FF 9D 48 82 60 20 AA
```


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```
8000:12 81 4C 3F 80 BD A8 82 B6
8008:9D 28 82 60 38 BD 28 82 C3
8010:E9 01 9D 28 82 60 BD A8 36
8018:82 DD 28 82 B0 21 20 5B A4
8020:81 F0 15 88 F0 0C 88 F0 03
8028:03 4C E4 7F BD A8 82 4C 34
8030:F6 7F 20 12 81 4C 0C 80 87
8038:BD A0 82 9D 28 82 60 18 8E
8040:BD 28 82 69 01 9D 28 82 62
8048:60 20 DD 80 BD B8 82 20 3B
8050:55 81 F0 02 B0 31 20 5B 80
8058:81 F0 23 88 F0 1A 88 F0 35
8060:03 4C E4 7F A9 FF 9D 48 5B
8068:82 AD CA 82 8D C8 82 AD D9
8070:CB 82 8D C9 82 4C F4 80 F5
8078:20 1F 81 4C BF 80 BD B0 72
8080:82 20 32 81 4C 69 80 18 4A
8088:AD C8 82 69 01 8D C8 82 CB
8090:90 03 EE C9 82 4C F4 80 C4
8098:20 DD 80 BD B0 82 20 55 32
80A0:81 F0 02 90 1A 20 5B 81 71
80A8:F0 0F 88 F0 06 88 F0 B4 EE
80B0:4C E4 7F 20 1F 81 4C 87 22
80B8:80 BD B8 82 4C 81 80 38 4A
80C0:AD C8 82 E9 01 8D C8 82 0C
80C8:B0 03 CE C9 82 4C F4 80 09
80D0:8D 11 80 8D 44 80 8D 8C 91
80D8:80 8D C4 80 60 AD 30 82 BA
80E0:3D 0C 82 D0 03 A9 00 2C CB
80E8:A9 01 8D C9 82 BD 20 82 1B
80F0:8D C8 82 60 AD C8 82 9D 74
80F8:20 82 AD 30 82 3D 14 82 17
8100:8D 30 82 AD C9 82 F0 09 44
8108:AD 30 82 1D 0C 82 8D 30 C5
8110:82 60 38 A9 40 FD 58 82 3B
8118:18 69 40 9D 58 82 60 A9 9A
8120:00 38 FD 58 82 9D 58 82 34
8128:60 BD 58 82 49 80 9D 58 DD
8130:82 60 18 0A 8D CA 82 90 5D
8138:03 A9 01 2C A9 00 8D CB 3E
8140:82 60 38 AD CA 82 ED C8 83
8148:82 8D 53 81 AD CB 82 ED 02
8150:C9 82 09 FF 60 20 32 81 63
8158:4C 42 81 BD C0 82 A8 60 DF
8160:9D 48 82 A9 00 9D 50 82 C8
8168:60 9D 58 82 60 9D 78 82 23
8170:98 9D 98 82 60 9D 88 82 6F
8178:9D 40 82 98 9D 90 82 60 C8
8180:9D 70 82 60 9D A0 82 98 D1
8188:9D A8 82 60 9D B0 82 98 28
8190:9D B8 82 60 8D C8 82 B0 2C
8198:03 A9 00 2C A9 01 8D C9 80
81A0:82 78 20 F4 80 58 98 9D 8A
81A8:28 82 60 AD 31 82 90 05 01
81B0:1D 0C 82 B0 03 3D 14 82 58
81B8:8D 31 82 60 29 0F 9D 38 1E
81C0:82 60 48 AD 35 82 3D 14 43
81C8:82 90 03 1D 0C 82 8D 35 1E
81D0:82 68 8D 36 82 8C 37 82 7B
81D8:60 AD 34 82 90 05 1D 0C 05
81E0:82 B0 03 3D 14 82 8D 34 7F
81E8:82 60 AD 32 82 90 05 1D 9B
81F0:0C 82 B0 03 3D 14 82 8D AD
81F8:32 82 60 AD 33 82 90 05 66
8200:1D 0C 82 B0 03 3D 14 82 A9
8208:8D 33 82 60 01 02 04 08 17
8210:10 20 40 80 FE FD FB F7 15
8218:EF DF BF 7F C3 83 43 03 B2
8220:00 00 00 00 00 00 00 00 25
8228:00 00 00 00 00 00 00 00 2D
8230:00 00 00 00 00 00 00 00 35
8238:00 00 00 00 00 00 00 00 3D
8240:00 00 00 00 00 00 00 00 45
8248:FF FF FF FF FF FF FF FF 4D
8250:00 00 00 00 00 00 00 00 55
8258:00 00 00 00 00 00 00 00 5D
8260:00 00 00 00 00 00 00 00 65
8268:00 00 00 00 00 00 00 00 6D
8270:00 00 00 00 00 00 00 00 75
8278:FF FF FF FF FF FF FF FF 7D
8280:00 00 00 00 00 00 00 00 85
8288:00 00 00 00 00 00 00 00 8D
8290:00 00 00 00 00 00 00 00 95
8298:00 00 00 00 00 00 00 00 9D
82A0:32 32 32 32 32 32 32 32 A5
82A8:E5 E5 E5 E5 E5 E5 E5 E5 AD
82B0:0C 0C 0C 0C 0C 0C 0C 0C B5
82B8:A0 A0 A0 A0 A0 A0 A0 A0 BD
82C0:00 00 00 00 00 00 00 00 C5
82C8:00 00 00 00 20 94 85 20 4C
82D0:A1 85 A9 79 A2 85 8D 11 2C
82D8:03 8E 12 03 38 A5 37 ED 2A
82E0:EE 82 85 0F A5 38 ED F0 7A
82E8:82 05 0F 90 08 A9 00 A2 E4
82F0:7D 85 37 86 38 20 44 E5 16
82F8:A9 0D 20 D2 FF A2 08 20 02
8300:3A 86 A9 9B A0 86 20 1E 32
8308:AB A2 06 20 3A 86 A9 CC 5C
8310:A0 86 20 1E AB A2 09 20 09
8318:3A 86 20 30 E4 4C 74 A4 CA
8320:A6 3A E8 F0 10 20 73 00 1D
8328:C9 AD D0 06 20 AC 85 4C 05
8330:3B 83 4C 93 83 20 AC 85 F3
8338:20 73 00 A9 45 A2 86 85 0E
8340:26 86 27 A0 00 84 28 20 6D
8348:B7 85 A0 00 B1 26 F0 29 D1
8350:20 73 00 D1 26 D0 03 C8 A4
8358:D0 F2 20 B7 85 E6 28 E6 03
8360:28 A5 28 CD 44 86 90 02 26
8368:B0 2C A0 00 20 CA 85 B1 CF
8370:26 D0 F9 20 CA 85 4C 47 4C
8378:83 20 73 00 A6 28 BD 87 90
8380:86 8D 8C 83 BD 88 86 8D A2
8388:8D 83 78 20 FF FF A9 00 9B
8390:F0 01 58 20 D1 85 4C FF 9A
8398:FF 20 1F 86 20 0E E2 C9 BC
83A0:AC D0 1F 20 73 00 C9 23 6A
83A8:F0 12 BD 20 82 8D EE 83 12
83B0:AD 30 82 3D 0C 82 8D E9 2E
83B8:83 4C D2 83 20 73 00 4C 42
83C0:FE 83 20 E7 85 8C EE 83 6A
83C8:8D E9 83 20 79 00 C9 23 06
83D0:F0 20 20 73 00 20 ED 85 75
83D8:90 09 AE 43 86 BD 28 82 72
83E0:A8 B0 05 20 F4 B7 8A A8 4F
83E8:A2 FF 20 0F 86 A9 FF 4C 5D
83F0:12 7D 20 73 00 AD EE 83 B3
83F8:AE 43 86 20 2A 7D 20 DA 5D
8400:85 20 ED 85 B0 0A 20 F4 CC
8408:B7 8A AE 43 86 4C 24 7D C4
8410:60 20 1F 86 20 06 86 B0 74
8418:06 20 0C 86 20 0F 7D 20 6E
8420:DA 85 20 06 86 B0 06 20 7F
8428:18 86 20 15 7D 20 DA 85 DB
8430:20 06 86 B0 06 20 0C 86 F5
8438:20 1B 7D 20 DA 85 20 06 FC
8440:86 B0 06 20 0C 86 20 1E 54
8448:7D 20 DA 85 20 06 86 B0 A2
8450:06 20 0C 86 20 21 7D 20 EE
8458:DA 85 20 06 86 B0 13 20 D1
8460:0C 86 AD 35 82 90 05 1D 97
8468:0C 82 B0 03 3D 14 82 8D 2B
8470:35 82 60 AD 97 83 8D 08 89
8478:03 AD 98 83 8D 09 03 20 70
8480:AC 84 A9 B5 A0 86 4C 1E 67
8488:AB 20 79 00 F0 1E C9 3A 6C
8490:F0 1A C9 AC F0 1E 20 F4 D1
8498:B7 8A F0 02 A9 01 CD C1 0D
84A0:85 F0 06 8D C1 85 20 09 AF
84A8:7D 4C C0 85 A9 00 8D 15 71
84B0:D0 4C 09 7D 20 73 00 4C 49
84B8:C0 85 20 ED 85 B0 06 20 81
84C0:F4 B7 8E 36 82 20 DA 85 37
84C8:20 06 86 B0 06 20 F4 B7 91
84D0:8E 37 82 60 20 1F 86 20 EF
84D8:06 86 B0 06 20 18 86 9D 09
84E0:78 82 20 DA 85 20 06 86 B7
84E8:B0 06 20 18 86 9D 98 82 AF
84F0:20 DA 85 20 06 86 B0 09 28
84F8:20 18 86 9D 88 82 9D 40 8C
8500:82 20 DA 85 20 06 86 B0 DE
8508:06 20 18 86 9D 90 82 60 1E
8510:20 1F 86 20 06 86 B0 06 77
8518:20 18 86 9D C0 82 20 DA 0F
8520:85 20 06 86 B0 06 20 18 15
8528:86 9D A0 82 20 DA 85 20 B1
8530:06 86 B0 06 20 18 86 9D 62
8538:A8 82 20 DA 85 20 06 86 29
8540:B0 06 20 29 86 9D B0 82 4A
8548:20 DA 85 20 06 86 B0 06 7E
8550:20 29 86 9D B8 82 60 20 11
8558:1F 86 20 F1 B7 8A AE 43 40
8560:86 C9 00 F0 07 C9 01 F0 82
8568:06 4C 3F 7D 4C 39 7D 4C D7
8570:3C 7D 20 F4 B7 8E 8F 83 E6
8578:60 20 AA B1 85 0F 98 05 CA
8580:0F F0 0B AC 1F D0 A9 00 0B
8588:20 91 B3 4C 73 7D AC 1E 4C
8590:D0 4C 86 85 AD 08 03 8D 61
8598:97 83 AD 09 03 8D 98 83 99
85A0:60 A9 20 A2 83 8D 08 03 D9
85A8:8E 09 03 60 A5 7A 8D B8 8E
85B0:85 A5 7B 8D BC 85 60 A9 96
85B8:FF 85 7A A9 FF 85 7B 60 7C
85C0:A9 00 D0 03 4C 03 7D 4C A0
85C8:06 7D E6 26 D0 02 E6 27 F8
85D0:60 A5 7A D0 02 C6 7B C6 BA
85D8:7A 60 20 79 00 F0 05 C9 6C
85E0:3A F0 01 60 68 68 60 20 31
85E8:8A AD 4C F7 B7 A0 00 B1 9F
85F0:7A C9 AC F0 02 18 60 20 A1
85F8:73 00 F0 08 C9 3A F0 04 79
8600:C9 2C D0 F3 38 60 20 0E E7
8608:E2 4C ED 85 20 F4 B7 18 0C
8610:8A F0 01 38 AE 43 86 60 32
8618:20 F4 B7 8A 4C 14 86 20 F1
8620:F4 B7 8A 29 07 8D 43 86 F4
8628:60 20 E7 85 84 26 85 27 B1
8630:46 27 66 26 A5 26 AE 43 BF
8638:86 60 A9 20 20 D2 FF CA EE
8640:D0 FA 60 00 14 4D 4F 56 4B
8648:53 50 52 00 53 50 52 49 27
8650:54 45 00 53 50 52 43 4F AF
8658:4C B0 00 41 4E 49 4D 41 3F
8660:54 45 00 42 4F 55 4E 44 BD
8668:41 52 59 00 42 4F 55 4E 1E
8670:43 45 00 53 50 4C 49 54 40
8678:00 5A 41 50 00 49 52 51 64
8680:00 4B 49 4C 4C 00 00 99 4A
8688:83 11 84 BA 84 D4 84 10 68
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8690:85 57 85 89 84 0C 7D 72 41
8698:85 73 84 4D 4F 42 20 4D BB
86A0:41 53 54 45 52 20 20 56 AB
86A8:32 2E 31 30 2F 39 32 30 76
86B0:33 30 39 0D 00 0D 4D 4F 79
86B8:42 20 4D 41 53 54 45 52 75
86C0:20 44 49 53 41 42 4C 45 3E
86C8:44 2E 0D 00 43 4F 50 59 76
86D0:52 49 47 48 54 20 31 39 85
86D8:39 32 20 20 42 59 20 48 15
86E0:4F 4E 47 20 50 48 41 4D 87
86E8:0D 00 00 00 00 00 00 00 7C
```

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136 COLORS

By David Kwong

As most people know, the 64 is capable of producing 16 different colors. How would you like to increase that number to 136 colors?

You can with 136 Colors. This interesting program does it by placing differently colored pixels side by side to produce a third color. Since the 64 has 16 built-in colors, it would appear that you could create 256 colors by combining the 16 × 16 color matrix. In reality, you get a total of 136 different hues, since 120 of them would be duplicated.

There are three programs built into the main 136 Colors program. The first program is an editor that will produce sprites capable of 136 colors. Additionally, each sprite character can have up to four colors simultaneously in high resolution mode. The second program is an interrupt program designed to make programming in BASIC with 136 Colors a lot easier. The third program is also an interrupt program designed to be used with other programs to make 136 Colors available for use.

Typing It In

Since 136 Colors is written entirely in machine language, enter it with MLX, our machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts, respond with the following values.

Starting address: C79C
Ending address: CFAB

Be sure to save a copy of the program before exiting MLX.

Program 1

Load the program with the ,8,1 extension, and then type *NEW*. To activate the first program, type *SYS 51200*.

The first thing to do is to select a block number, indicated at the upper right corner. A block number is an address where sprites can be stored. Recommended block numbers are 128–255 (block numbers range from 0 to 255). To find the actual address where the sprite is stored, multiply the block number by 64.

After you've selected a block number, a cursor appears in a grid that is used to create a sprite. The sprite that the grid represents is located at the upper right of the screen. The keys used to move the cursor are displayed at the lower right of the screen. Press f1 to begin drawing. A menu at the bottom provides other options. One option, NO DR/ER, means that the cursor will neither draw nor erase. This option lets you move the cursor without affecting what's on the screen.

To change colors while in draw mode, press either 1, 2, or 3. To change a sprite into its 136-color shape, either exit or change the block number. The program will then ask you whether or not to change the sprite into 136-color mode. If you elect to do so, the program then will ask you where to store the 136-color sprite.

Each 136-color sprite is composed of two normal sprites, one on top of the other. Sprite 1 is represented by color 1; sprite 2 is represented by color 2. Color 3 is divided between the two sprites. When the two sprites are overlapped, color 3 is capable of producing a color from the 136-color palette. The two sprites must have the same coordinates for them to overlap perfectly.

Program 2

The second program, which is an interrupt program, is activated or deactivated by SYS 52600. When activated, you'll see a message onscreen that says *136 BAS ON*.

This program provides 16 new sprite registers that will ease the usage of the four high-resolution sprites and 136 colors. There are only four high-resolution sprites, instead of the normal eight, because of the fact that each hi-res sprite requires two normal sprites. This program defines hi-res sprite 1 as the overlap of sprites 0 and 1. Hi-res sprite 2 is the overlap of sprites 2 and 3, hi-res sprite 3 is the overlap of sprites 4 and 5, and so on.

The first eight registers from 52882 to 52889 provide the *x*- and *y*-coordinates of the four high-resolution sprites. The first high-resolution sprite can be moved by using the horizontal register 52882 and the vertical register 52883, much like the system used by the 64 to move the eight normal sprites. Therefore, every two registers provide the horizontal and vertical registers of one hi-res sprite.

The next four registers, 52890 to 52893, provide the colors of each of the four hi-res sprites. The color numbers range from 1 to 136.

The last four registers, 52894 to 52897, provide the block numbers for the four hi-res sprites.

This interrupt program supposes the block numbers for each hi-res sprite to be next to each other. Keep in mind that one hi-res sprite is composed of two normal sprites. Therefore, when you choose block number 200, the two overlapping sprites will be composed of blocks 200 and 201.

All registers are write-only registers. When you attempt to read them, they will return a 0. When the registers are 0, the interrupt program will not alter any sprites. Therefore, should you poke 52882,0, nothing will happen, meaning that if you originally poked 140, poking a 0 will not move it from location 140 to location 0.

In order to see the sprites you have produced, you must first set register 53269 to turn on the sprites you desire. Hi-res sprite 1 can be turned on with a POKE 53269, 3. POKE 53269, 12 turns on hi-res sprite 2. POKE 53269, 40 turns on sprite 3, and POKE 53269, 192 turns on sprite 4. To turn on more than one sprite, simply add up the previous values.

Program 3

The third program is activated or deactivated by SYS 52900. When activated, you'll see *136C ON* printed on the screen. This simple program is designed to work with other programs that can make use of the 136 colors.

The only register provided is at

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52844. This register is a 136-color register. By poking colors 1 to 136 into this register, 2 colors will be returned at locations 52898 and 52899. When the 2 colors are placed together, they'll combine to create 1 of the 136 available colors.

Since machine language programs may be too fast for the interrupt to be effective, you must keep track of location 52844. After execution of the interrupt, 0 will be stored in location 52844. If using machine language, you may choose to poke the required color in 52844 and then JSR $CE5A (make sure the interrupt is deactivated) to obtain the two colors in locations 52898 and 52899.

Technical Notes

This program takes up minimal space from $C79C (51100) to $CFAA (53162). Considering that 136 Colors is composed of three programs, applications that require only one of these three programs may isolate that particular program for usage.

The first program is located from $C79C (51100) to $CD77 (52599), the second program is located from $CD78 (52600) to $CFAA (53162), and the third program is located from $CE5A (52826) to $CFAA (53162).

Since different color combinations may produce the same color, there may in fact be less than 136 colors. Following is a color chart of the 136 colors. The colors are organized from brightest to darkest. (These colors were very difficult to organize. Please excuse some slight mistakes!)

White–Black	(1–13)
Gray 2	(14–16)
Extra Gray	(17–23)
Brown 1	(24–32)
Brown 2	(33–35)
Brown 3	(36–38)
Brown 4	(39–42)
Red	(43–51)
Orange	(52–57)
Yellow	(58–64)
Tan	(65–71)
Green 1	(72–77)
Green 2	(78–81)
Green 3	(82–86)
Green 4	(87–93)
Green 5	(94–95)
Cyan	(96–102)
Blue	(103–111)
Purple 1	(112–118)
Purple 2	(119–123)
Purple 3	(124–127)
Purple 4	(128–134)
Purple 5	(135–136)

Seeing Is Believing

The 136 Demo program is designed to show the various colors in action and to provide programmers with additional details on how to use 136 Colors.

The demonstration consists of a BASIC program and machine language sprite data. To avoid typing errors, use The Automatic Proofreader to enter the BASIC portion. Use MLX to enter the sprite data. When MLX prompts, respond with the following values.

Starting address: 3200
Ending address: 347F

Before leaving MLX, save the sprites with the filename Sprites. When the demonstration runs, it loads 136 Colors and Sprites and looks for those filenames.

136 COLORS

```
C79C:A2 00 A0 00 BD F3 CC 85 6E
C7A4:FD BD 08 CD 85 FE A9 0E 0A
C7AC:91 FD C8 C0 18 D0 F9 E8 8A
C7B4:E0 15 F0 03 4C 9E C7 A9 5E
C7BC:00 8D 52 CD 4C 62 C8 29 7D
C7C4:07 49 07 A8 4C DF C9 20 2B
C7CC:E4 CB A9 01 8D 15 D0 4C B5
C7D4:08 CB BD 21 04 29 0F 18 20
C7DC:65 FB 85 FB A9 00 65 FC A3
C7E4:85 FC F0 03 4C 0A CB A5 8C
C7EC:FB 8D F8 07 A0 06 06 FB 92
C7F4:26 FC 88 D0 F9 A9 00 8D F8
C7FC:52 CD 60 00 A9 06 8D 21 D6
C804:D0 A9 0E 8D 20 D0 8D 86 E8
C80C:02 A9 80 8D 8A 02 A9 0A AB
C814:8D 00 D0 A9 3C 8D 01 D0 0C
C81C:A9 93 20 D2 FF A9 01 8D CE
C824:10 D0 8D 27 D0 8D 15 D0 CD
C82C:8D D6 CB A9 04 8D D7 CB 20
C834:A9 FE 8D B8 CB A9 CB 8D C1
C83C:B9 CB 20 B5 CB A9 01 8D 91
C844:E4 D8 A9 0F 8D 5C D9 A9 DF
C84C:07 8D D4 D9 A2 00 BD E4 72
C854:CC E8 A8 A9 03 99 98 DB C1
C85C:4C 55 CD 20 0A CB A9 00 F7
C864:8D 4D CD 8D 4E CD A9 29 C8
C86C:8D 90 C8 A9 04 8D 91 C8 DE
C874:A9 15 8D CE C8 A0 00 A2 2A
C87C:00 A9 80 8D 85 C8 B1 FB 10
C884:29 00 F0 05 A9 51 4C 8F D3
C88C:C8 A9 2D 8D 00 00 E8 E0 1E
C894:08 F0 0E E0 10 F0 0A E0 6F
C89C:18 F0 06 4E 85 C8 4C 5F 63
C8A4:CD C8 E0 18 F0 0B EE 90 0F
C8AC:C8 D0 03 EE 91 C8 4C 7D EB
C8B4:C8 18 AD 90 C8 69 11 8D 0B
C8BC:90 C8 AD 91 C8 69 00 8D 11
C8C4:91 C8 CE CE C8 F0 04 4C 76
C8CC:7B C8 EA AC 4D CD AE 4E C3
C8D4:CD BD F3 CC 85 FD BD 08 AF
C8DC:CD 85 FE AD 52 CD F0 0F 2C
C8E4:C9 01 F0 07 A9 0E 91 FD D0
C8EC:4C F3 C8 A9 01 91 FD 38 D7
C8F4:A5 FE E9 D4 85 FE A9 80 9F
C8FC:11 FD 91 FD 20 E4 FF F0 2E
C904:FB AC 4D CD AE 4E CD C9 5B
C90C:55 F0 43 C9 49 F0 40 C9 E3
C914:4F F0 40 C9 4A F0 42 C9 94
C91C:4B F0 39 C9 4E F0 39 C9 C7
C924:4D F0 3B C9 2C F0 36 C9 F9
C92C:31 F0 37 C9 32 F0 38 C9 A7
C934:33 F0 39 C9 85 F0 3D C9 95
C93C:86 F0 3E C9 87 F0 3F C9 FB
C944:88 F0 43 C9 93 F0 45 C9 12
C94C:42 F0 4F 4C 00 C9 88 CA EE
C954:4C A7 C9 CA C8 4C A7 C9 6E
C95C:E8 88 4C A7 C9 C8 E8 4C 1A
C964:A7 C9 A9 01 4C 72 C9 A9 EC
C96C:0F 4C 72 C9 A9 07 8D F0 FA
C974:C8 4C 6A C8 A9 01 4C 84 C7
C97C:C9 A9 02 4C 84 C9 A9 00 03
C984:8D 52 CD 4C C5 C9 20 14 9B
C98C:CA 4C 03 CA A0 00 A9 00 FD
C994:91 FB C8 C0 3F D0 F9 4C 92
C99C:9C C7 20 14 CA 4C 1C C8 3E
C9A4:EA EA EA C0 FF D0 02 A0 B9
C9AC:17 C0 18 D0 02 A0 00 E0 7F
C9B4:FF D0 02 A2 14 E0 15 D0 06
C9BC:02 A2 00 8C 4D CD 8E 4E CF
C9C4:CD AD 52 CD F0 36 8A 0A 51
C9CC:6D 4E CD AA 98 29 18 F0 99
C9D4:06 C9 08 F0 01 E8 E8 98 04
C9DC:4C C3 C7 A9 01 88 30 04 A9
C9E4:0A 4C E1 C9 48 8A A8 68 8F
C9EC:AE 52 CD E0 02 F0 07 11 27
C9F4:FB 91 FB 4C 00 CA 49 FF EC
C9FC:31 FB 91 FB 4C 6A C8 A9 61
CA04:00 8D 8A 02 8D 15 D0 8D 5E
CA0C:10 D0 A9 93 20 D2 FF 60 F8
CA14:A9 00 8D 15 D0 A9 25 8D 86
CA1C:B8 CB A9 CD 8D B9 CB A9 A7
CA24:6A 8D D6 CB A9 04 8D D7 3A
CA2C:CB 20 B5 CB 20 E4 FF F0 A8
CA34:FB C9 59 F0 07 C9 4E D0 41
CA3C:F3 4C 05 CB 20 E4 CB A9 12
CA44:3E 8D B8 CB A9 CD 8D B9 89
CA4C:CB A9 6A 8D D6 CB 20 B5 34
CA54:CB 20 0A CB A5 FB 85 FD FB
CA5C:A5 FC 85 FE A9 32 8D 72 48
CA64:04 20 0A CB A0 3F A9 00 57
CA6C:88 91 FB 91 FD D0 F9 8D F7
CA74:A3 CA A9 40 8D C4 CA A9 86
CA7C:29 8D 86 CA A9 D8 8D 87 DA
CA84:CA AD 00 00 29 0F AA A9 6F
CA8C:80 E0 0F D0 04 11 FB 91 77
CA94:FB E0 01 D0 04 11 FD 91 7F
CA9C:FD E0 07 D0 1F AA A9 00 4E
CAA4:29 01 D0 07 8A 2C A1 CA AC
CAAC:4C B3 CA 8A 2C 09 CB D0 45
CAB4:07 11 FB 91 FB 4C C0 CA 08
CABC:11 FD 91 FD AD 86 CA C9 53
CAC4:00 D0 1C 18 69 11 8D 86 C4
CACC:CA AD 87 CA 69 00 8D 87 BE
CAD4:CA AD C4 CA 69 28 8D C4 4C
```


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```
CADC:CA EE A3 CA 4C EB CA EE 4B
CAE4:86 CA D0 03 EE 87 CA AD 93
CAEC:8C CA C9 01 F0 06 4E 8C 8D
CAF4:CA 4C 85 CA A9 80 8D 8C 57
CAFC:CA C8 C0 3F F0 03 4C 85 E7
CB04:CA 4C CB C7 60 55 A9 00 B5
CB0C:85 FB 85 FC A9 20 A2 03 FB
CB14:9D 21 04 CA D0 FA A9 A0 56
CB1C:9D 22 04 8E 4F CD 20 E4 4B
CB24:FF F0 FB AE 4F CD F0 0C 02
CB2C:C9 14 F0 17 C9 0D F0 1C BD
CB34:E0 03 F0 EA C9 30 90 E6 E0
CB3C:C9 3A B0 E2 9D 22 04 E8 F1
CB44:4C 1A CB A9 20 9D 22 04 5C
CB4C:CA 4C 1A CB A9 20 9D 22 87
CB54:04 E0 01 F0 23 E0 02 F0 E6
CB5C:12 AD 22 04 A0 06 20 88 D2
CB64:CB A0 05 20 88 CB A0 02 63
CB6C:20 88 CB BD 20 04 A0 03 E0
CB74:20 88 CB A0 01 20 88 CB 27
CB7C:4C D6 C7 EA EA EA EA EA 5B
CB84:EA EA EA EA C9 00 F0 03 8B
CB8C:8D 90 CB A9 00 29 0F 8D 73
CB94:50 CD A9 00 8D 51 CD 18 62
CB9C:0E 50 CD 2E 51 CD 88 D0 8F
CBA4:F6 18 AD 50 CD 65 FB 85 F9
CBAC:FB AD 51 CD 65 FC 85 FC DB
CBB4:60 A2 00 BD 00 00 E8 C9 9C
CBBC:80 90 16 F0 22 29 7F 18 57
CBC4:6D D6 CB 8D D6 CB A9 00 54
CBCC:6D D7 CB 8D D7 CB 4C B7 A1
CBD4:CB 8D 00 00 EE D6 CB D0 F0
CBDC:03 EE D7 CB 4C B7 CB 60 A2
CBE4:A9 20 A2 00 E0 1C F0 11 18
CBEC:E0 0E B0 06 9D 6A 04 4C D9
CBF4:F9 CB 9D 84 04 E8 4C E8 BD
CBFC:CB 60 37 36 35 34 33 32 EF
CC04:31 30 37 36 35 34 33 32 9F
CC0C:31 30 37 36 35 34 33 32 A7
CC14:31 30 83 02 0C 0F 03 0B 90
CC1C:23 86 30 A7 31 A7 32 A7 9D
CC24:33 A7 34 9B 31 20 03 0F A0
CC2C:0C 0F 12 20 31 83 35 9B 71
CC34:28 13 10 12 09 14 05 31 9D
CC3C:29 83 36 A7 37 9B 32 20 39
CC44:03 0F 0C 0F 12 20 32 83 8E
CC4C:38 9B 28 13 10 12 09 14 0E
CC54:05 32 29 83 39 A7 30 9B BE
CC5C:33 20 03 0F 0C 0F 12 20 C9
CC64:33 83 31 9B 28 31 33 36 FA
CC6C:20 03 0F 0C 0F 12 13 29 89
CC74:32 A7 33 A7 34 9B 0B 05 1D
CC7C:19 02 0F 01 12 04 3A 83 AD
CC84:35 A7 36 9D 15 20 09 20 9E
CC8C:0F 85 37 9E 0A 5B 0B 86 3A
CC94:38 9D 0E 20 0D 20 2C 85 3C
CC9C:39 A7 30 D2 02 20 03 08 8E
CCA4:01 0E 07 05 20 02 0C 0B 9F
CCAC:23 84 03 0C 12 20 03 0C 3D
CCB4:05 01 12 20 13 03 12 05 23
CCBC:05 0E 84 06 31 20 04 12 71
CCC4:01 17 82 06 33 20 05 12 8B
CCCC:01 13 05 82 06 35 20 0E C7
CCD4:0F 20 04 12 2F 05 12 82 D3
CCDC:06 37 20 05 18 09 14 80 29
CCE4:03 14 15 16 28 29 31 32 83
CCEC:3B 3C 48 49 FF FF 00 29 F9
CCF4:51 79 A1 C9 F1 19 41 69 46
CCFC:91 B9 E1 09 31 59 81 A9 36
CD04:D1 F9 21 49 D8 D8 D8 D8 74
CD0C:D8 D8 D9 D9 D9 D9 D9 D9 E6
CD14:DA DA DA DA DA DA DA DB B0
CD1C:DB 00 00 00 00 00 00 00 A5
CD24:00 03 0F 0E 16 05 12 14 40
CD2C:20 13 10 12 09 14 05 9E 01
CD34:28 19 2F 0E 29 3F 80 BF F7
CD3C:00 00 13 10 12 09 14 05 1D
CD44:20 23 31 80 00 10 FF BF E6
CD4C:00 00 FF FF 00 00 FF FF E7
CD54:00 E0 0C F0 03 4C 52 C8 6F
CD5C:4C 5F C8 EE 90 C8 D0 03 4A
CD64:EE 91 C8 4C 82 C8 FF FF F0
CD6C:00 00 FF FF 00 00 FF FF 08
CD74:00 00 FF FF AD 14 03 C9 9D
CD7C:E3 D0 31 AD 15 03 C9 CD 55
CD84:D0 2A 78 AD F0 CD 8D 14 EA
CD8C:03 AD F1 CD 8D 15 03 58 4F
CD94:A2 00 BD A2 CD 20 D2 FF F7
CD9C:E8 E0 0E D0 F5 60 0D 31 30
CDA4:33 36 43 20 42 41 53 20 AF
CDAC:4F 46 46 0D AD 14 03 8D 6C
CDB4:F0 CD AD 15 03 8D F1 CD 43
CDBC:78 A9 E3 8D 14 03 A9 CD 22
CDC4:8D 15 03 58 A2 00 BD D6 B9
CDCC:CD 20 D2 FF E8 E0 0D D0 67
CDD4:F5 60 0D 31 33 36 43 20 51
CDDC:42 41 53 20 4F 4E 0D A2 C6
CDE4:00 BD 92 CE D0 08 E8 E0 88
CDEC:10 D0 F6 4C 00 00 BD 92 76
CDF4:CE A8 A9 00 9D 92 CE E0 0D
CDFC:08 90 1B E0 0C 90 35 8A C9
CE04:38 E9 0C 0A AA AD 11 D0 59
CE0C:10 FB 98 9D F8 07 C8 98 AB
CE14:9D F9 07 4C EF CD 8A 29 99
CE1C:01 F0 07 8A 0A AA CA 4C DC
CE24:29 CE 8A 0A AA AD 11 D0 FA
CE2C:10 FB 98 9D 00 D0 9D 02 3E
CE34:D0 4C EF CD 8A 38 E9 08 39
CE3C:0A 48 8C 6C CE 20 5A CE C3
CE44:68 AA AD 11 D0 10 FB AD F3
CE4C:A2 CE 9D 27 D0 AD A3 CE 68
CE54:9D 28 D0 4C EF CD A9 20 D3
CE5C:8D 69 CE A9 CF 8D 6A CE E7
CE64:A2 00 A0 00 AD 00 00 C9 9E
CE6C:00 F0 17 E8 E0 10 D0 07 A7
CE74:C8 98 AA C0 10 F0 11 EE 53
CE7C:69 CE D0 03 EE 6A CE 4C D7
CE84:68 CE 8E A2 CE 8C A3 CE C4
CE8C:A9 00 8D 6C CE 60 00 00 6F
CE94:FF FF 00 00 FF FF 00 00 32
CE9C:FF FF 00 00 FF FF 00 00 3A
CEA4:AD 14 03 C9 07 D0 2D AD 9E
CEAC:15 03 C9 CF D0 26 78 AD 89
CEB4:10 CF 8D 14 03 AD 11 CF 02
CEBC:8D 15 03 58 A2 00 BD CE AB
CEC4:CE 20 D2 FF E8 E0 0A D0 DB
CECC:F5 60 0D 31 33 36 43 20 4B
CED4:4F 46 46 0D AD 14 03 8D 96
CEDC:10 CF AD 15 03 8D 11 CF BD
CEE4:78 A9 07 8D 14 03 A9 CF B2
CEEC:8D 15 03 58 A2 00 BD FE 0C
CEF4:CE 20 D2 FF E8 E0 09 D0 0A
CEFC:F5 60 0D 31 33 36 43 20 7B
CF04:4F 4E 0D AD 6C CE F0 03 DE
CF0C:20 5A CE 4C 00 00 00 00 F0
CF14:00 00 00 FF 00 00 FF FF B3
CF1C:00 00 FF FF 0D 17 33 66 4D
CF24:76 4D 6F 40 39 20 32 0C FE
CF2C:0B 4C 6E 0A 01 2C 60 70 BC
CF34:57 68 3A 34 24 2B 12 03 19
CF3C:48 67 02 31 16 74 55 7B D5
CF44:3E 30 1E 2F 1D 1C 53 79 3F
CF4C:1A 61 81 5F 6B 42 27 56 80
CF54:13 10 0F 5E 69 0E 72 07 B8
CF5C:88 2D 73 75 71 7E 7D 14 E5
CF64:87 7C 4B 65 4F 54 51 45 5A
CF6C:5D 5C 4A 63 5A 6D 28 7F A9
CF74:2A 7A 86 85 64 6C 83 3B 08
CF7C:3D 3F 3C 46 44 4E 11 41 35
CF84:36 38 35 23 22 52 78 21 92
CF8C:1F 37 26 25 50 29 47 2E 84
CF94:1B 19 43 77 18 09 08 5B 38
CF9C:84 15 06 59 82 05 49 62 37
CFA4:58 6A 80 04 00 00 00 00 5B
```

136 DEMO

```
EQ 10 REM COPYRIGHT 1992 - COM
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      TD - ALL RIGHTS RESERVED
AC 20 REM BY DAVID KWONG
JD 30 REM
DK 40 POKE53281,0:POKE53280,0:
      POKE53269,0
RE 45 IFPEEK(52720)=49THEN90
RK 50 PRINTCHR$(147)"PLEASE WA
      IT..."
MD 60 IFF=0THENF=1:LOAD"136 CO
      LORS",8,1
AA 70 IFF=1THENF=2:LOAD"SPRITE
      S",8,1
QQ 80 SYS52600
CS 90 PRINTCHR$(147):POKE198,0
MG 100 POKE52882,150:POKE52884
      ,174:POKE52886,198:POKE
      52888,1
KE 110 POKE52883,100:POKE52885
      ,100:POKE52887,100:POKE
      52889,1
BB 120 POKE52894,200:POKE52895
      ,202:POKE52896,204
XP 130 POKE52890,13:POKE52891,
      13:POKE52892,13
DM 135 IFPEEK(52896)<>0THEN135
ES 136 POKE53269,255
GK 140 FORL=13TO1STEP-1
FB 150 POKE52890,L:POKE52891,L
      :POKE52892,L
QD 160 FORW=1TO10:NEXTW
RC 170 NEXTL
ED 180 PRINT"{HOME}{10 DOWN}
      {WHT}";
KM 190 DIMCL(13,1)
KM 200 FORL=1TO13
KP 210 READCL(L,0),CL(L,1)
EE 220 NEXTL
QG 230 DATA 1,13,24,32,43,51,5
      2,57,58,64,65,71,72,77,
      82,86,88,93,96,102,103,
      111
GX 240 DATA 112,118,128,134
QR 250 C=INT(RND(1)*13)+1:D=1
PR 260 LO=CL(C,0)
KB 270 POKE52890,LO:POKE52891,
      LO:POKE52892,LO
FC 280 LO=LO+D
MX 285 IFPEEK(198)>0ANDEN=1THE
      NPOKE198,0:GOTO400
```


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```
HF 290 GOSUB2000
GE 300 IFLO=CL(C,1)THEND=-1:GO
       TO270
AB 310 IFLO<CL(C,0)THEN250
AJ 320 GOTO270
KG 330 DATA "COLORS*"
FK 340 DATA "£12"
QF 350 DATA "BY DAVID KWONG*"
SJ 360 DATA "£12345678"
FX 370 DATA "{BLU}*"
DC 380 DATA "PRESS ANY KEY TO
       {SPACE}CONTINUE<"
RH 400 POKE53269,0
MH 410 PRINTCHR$(147)
HX 420 POKE52882,0:POKE52883,7
       5:POKE52894,206:POKE528
       90,129
PM 430 POKE53269,3
EE 440 FORX=0TO174STEP2:POKE52
       882,X:NEXTX
MQ 450 EN=0:SN$="":PRINT"
       {HOME}{7 DOWN}{GRN}"
JG 460 C=INT(RND(1)*136)+1
CP 470 POKE52890,C
XD 480 FORW=1TO30
MB 490 GOSUB2000
CQ 500 IFPEEK(198)>0ANDEN=1THE
       NPOKE198,0:GOTO700
GQ 510 NEXTW
AF 520 GOTO460
CS 530 DATA "IN ADDITION TO BE
       ING ABLE TO PRODUCE*"
SR 540 DATA "136 COLORS, THIS
       {SPACE}PROGRAM CAN ALSO
       *"
RK 550 DATA "CREATE 4 HIGH RES
       OLUTION (1 PIXEL RES-*"
FS 560 DATA "OLUTION) SPRITES,
        EACH WITH 4 COLORS.*"
GS 570 DATA "OF THOSE 4 COLORS
       , 1 COLOR IS CAPABLE*"
CA 580 DATA "OF 136 COLORS. TH
       E OTHER 3 COLORS ARE*"
PA 590 DATA "RESTRICTED TO THE
        16 COLORS OF THE*"
EX 600 DATA "COMMODORE 64. EAC
       H HIGH RESOLUTION*"
GG 610 DATA "SPRITE IS CREATED
        FROM TWO SPRITES.*"
FP 620 DATA "INCLUDED WITH THE
        PROGRAM IS AN EDITOR*"
CA 630 DATA "TO PRODUCE THESE
       {SPACE}4 HIGH RESOLUTIO
       N*"
XR 640 DATA "SPRITES. THERE AR
       E ALSO TWO INTERRUPT*"
EK 650 DATA "ROUTINES INCLUDED
        TO EASE THE USAGE*"
EP 660 DATA "OF 136 COLORS AND
        HI-RES SPRITES.*"
JC 670 DATA "{BLU}*"
DB 680 DATA "PRESS ANY KEY TO
       {SPACE}CONTINUE<"
ED 700 POKE53269,0:PRINTCHR$(1
       47)
AH 710 POKE52882,138:POKE52884
       ,162:POKE52886,186:POKE
       52888,210
RE 720 POKE52883,75:POKE52885,
       75:POKE52887,75:POKE528
       89,75
MQ 730 POKE52894,208:POKE52895
       ,208:POKE52896,208:POKE
       52897,208
RP 740 POKE52890,1:POKE52891,2
       :POKE52892,3:POKE52893,
       4
FE 745 IFPEEK(52897)<>0THEN745
HH 750 POKE53269,255
MB 754 PRINT"{HOME}{10 DOWN}
       {WHT}";:EN=0:SN$=""
ED 755 GOSUB2000
QM 756 IFEN=0THENGOTO755
EQ 760 PRINT"{HOME}{6 DOWN}
       {WHT}";TAB(15);"↑"
PX 770 PRINT"{DOWN}";TAB(12);"
       COLOR"
BM 780 DIMC(3):C(0)=1:C(1)=2:C
       (2)=3:C(3)=4:D=0
PR 790 FORS=0TO3
FC 800 POKE52890+S,C(S)
ER 810 NEXTS
RJ 815 PRINT"{HOME}{8 DOWN}";T
       AB(17);"{4 SPACES}"
HM 816 PRINT"{UP}";TAB(17);C(0
       )
XP 820 GETA$:IFA$=""THEN820
BQ 830 IFA$="J"THEND=-1
FJ 840 IFA$="K"THEND=1
JP 850 FORLR=0TO3
JQ 860 C(LR)=C(LR)+D
BG 870 IFC(LR)>136THENC(LR)=1
XF 880 IFC(LR)<1THENC(LR)=136
EE 890 NEXTLR:D=0
KB 900 IFA$="E"THEN1020
PA 910 GOTO790
AR 920 DATA "NOW, YOU MAY OBSE
       RVE THE 136 COLORS*"
QP 930 DATA "YOURSELF BY SCROL
       LING TO THE LEFT BY*"
CM 940 DATA "PRESSING 'J' AND
       {SPACE}SCROLLING TO THE
        RIGHT*"
GX 950 DATA "BY PRESSING 'K'.
       {SPACE}TO END, PRESS 'E
       '.*"
XR 960 DATA "YOU WILL NOTICE T
       HAT THE COLORS ARE*"
BK 970 DATA "ORGANIZED INTO SE
       VERAL GROUPS. I HAVE*"
EP 980 DATA "ARRANGED EACH GRO
       UP FROM BRIGHTEST TO*"
AX 990 DATA "DARKEST. EACH SPR
       ITE HAS ITS OWN COLOR*"
RK 1000 DATA "ADDRESS IN WHICH
        TO POKE ITS COLOR*"
GD 1010 DATA "NUMBER.<"
FF 1020 PRINTCHR$(147):POKE532
        69,0
BR 1030 POKE53281,6:POKE53280,
        14:POKE646,14
RA 1040 END
EA 2000 IFEN=1THEN2075
ER 2010 IFSN$<>""THEN2045
GH 2020 READSN$
GK 2030 IFLEFT$(SN$,1)="£"THE
        N2080
HA 2040 L=LEN(SN$):CH=0:PRINTT
        AB((41-L)/2);
FA 2045 CH=CH+1
HP 2050 IFMID$(SN$,CH,1)="*"TH
        ENSN$="":PRINT:GOTO207
        5
RM 2060 IFMID$(SN$,CH,1)="<"TH
        ENEN=1:GOTO2075
RG 2070 PRINTMID$(SN$,CH,1);
JF 2075 RETURN
QJ 2080 R=LEN(SN$)-1
GR 2090 FORRT=1TOR:PRINT:NEXTR
        T
EB 2100 SN$="":GOTO2075
```

SPRITES

```
3200:00 2A 00 00 54 00 00 AA 3C
3208:00 01 54 00 02 AA 00 05 F6
3210:14 00 00 2A 00 00 14 00 49
3218:00 2A 00 00 14 00 00 2A D1
3220:00 00 14 00 00 2A 00 00 AF
3228:14 00 00 2A 00 00 14 00 61
3230:00 2A 00 00 14 00 02 AA 6E
3238:A0 05 55 50 0A AA A8 00 2A
3240:00 54 00 00 AA 00 01 54 65
3248:00 02 AA 00 05 14 00 0A 05
3250:2A 00 00 14 00 00 2A 00 5F
3258:00 14 00 00 2A 00 00 14 27
3260:00 00 2A 00 00 14 00 00 5A
3268:2A 00 00 14 00 00 2A 00 77
3270:00 14 00 00 2A 00 05 55 8A
3278:50 0A AA A8 05 55 50 00 85
3280:00 0A 00 00 55 40 02 AA C1
3288:A0 05 51 50 0A 00 28 04 52
3290:00 14 00 00 08 00 00 14 4E
3298:00 00 28 00 15 50 00 2A 16
32A0:A0 00 15 50 00 00 28 00 4D
32A8:00 14 00 00 08 04 00 14 76
32B0:0A 00 28 05 51 50 02 AA E9
32B8:A0 00 55 40 00 0A 00 00 44
32C0:00 15 00 00 AA 80 01 55 19
32C8:50 02 A0 A8 05 00 10 0A C6
32D0:00 08 00 00 14 00 00 08 DF
32D8:00 00 14 00 2A A8 00 55 09
32E0:50 00 2A A8 00 00 14 00 65
32E8:00 08 00 00 14 0A 00 08 20
32F0:05 00 10 02 A0 A8 01 55 F8
32F8:50 00 AA 80 00 15 00 00 37
3300:00 2A 80 01 55 40 02 AA 6B
3308:A0 05 00 50 02 00 20 04 59
3310:00 00 0A 00 00 04 00 00 C7
3318:0A 2A 00 14 55 40 0A AA B9
3320:A0 15 40 50 0A 00 08 14 9D
3328:00 14 0A 00 08 04 00 14 39
3330:0A 00 28 05 00 50 02 AA E0
3338:A0 01 55 40 00 2A 00 FF 86
3340:00 55 00 00 AA A0 01 55 2B
3348:50 02 80 20 05 00 10 0A BB
3350:00 00 04 00 00 0A 00 00 5F
3358:04 15 00 08 AA A0 15 55 DD
3360:50 0A 80 A8 15 00 14 0A E6
3368:00 08 04 00 14 0A 00 08 22
3370:04 00 10 02 80 A8 01 55 F8
3378:50 00 AA A0 00 55 00 FF BB
3380:00 01 F8 00 07 F0 00 7F C1
3388:FE 01 FF FC 03 FF E0 07 5F
3390:FF 00 1F FC 00 3F F0 00 89
3398:7F 80 08 FF 00 54 7C 00 2A
```


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```
33A0:AA 38 01 55 20 0A AA 00 5E
33A8:15 54 00 AA A0 01 55 50 5D
33B0:02 AA A0 15 54 40 2A AA CA
33B8:00 05 40 00 0A 00 00 FF B8
33C0:00 00 00 00 00 00 00 00 27
33C8:00 00 00 03 00 00 1F 00 9D
33D0:00 FE 00 03 FD 00 0F FF 35
33D8:00 7F F6 00 FF AA 03 FF AE
33E0:55 07 FE AA 1F F5 54 3F F6
33E8:EA A8 7F 55 50 7E AA A0 A6
33F0:ED 55 40 8A AA 00 15 55 29
33F8:00 0A A0 00 11 00 00 FF 7E
3400:AA AA AA 55 55 55 AA AA 13
3408:AA 55 55 55 AA AA AA 55 C5
3410:55 55 AA AA AA 55 55 55 23
3418:AA AA AA 55 55 55 AA AA 2B
3420:AA 55 55 55 AA AA AA 55 DD
3428:55 55 AA AA AA 55 55 55 3B
3430:AA AA AA 55 55 55 AA AA 43
3438:AA 55 55 55 AA AA AA 00 A0
3440:55 55 55 AA AA AA 55 55 FD
3448:55 AA AA AA 55 55 55 AA 5B
3450:AA AA 55 55 55 AA AA AA 0E
3458:55 55 55 AA AA AA 55 55 16
3460:55 AA AA AA 55 55 55 AA 73
3468:AA AA 55 55 55 AA AA AA 26
3470:55 55 55 AA AA AA 55 55 2E
3478:55 AA AA AA 55 55 55 00 E0
```

David Kwong, 17, says he hopes this expanded palette program will generate many new ideas and give the 64 a new look. He lives in Edmonton, Alberta, Canada.

TUNNEL TRAP

By Danny English

In the days of knights and castles, disputes could be settled by a sword fight, a joust, or a good game of Tunnel Trap. The first two activities have pretty much faded into obscurity, but you can still enjoy this game for the 64.

Challenge a friend to a heated battle inside a 32-screen maze of tunnels. Destroy your opponents by slingshot or by strategically set traps. Tunnel Trap features a realtime split screen and responsive controls.

Getting Started

Tunnel Trap is written entirely in machine language. To enter it, use MLX, our machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts, respond with the following values.

Starting address: 0801
Ending address: 1990

Be sure to save a copy of the program before exiting MLX.

The Challenge

When you're ready to play, connect two joysticks to the computer. Although Tunnel Trap is written in machine language, it loads and runs like a BASIC program. When the title appears, you have the option of turning trap sensors on or off. Pressing f1 will enable trap sensors, and pressing f3 will disable them. They will be explained later in the article. Pressing the space bar begins the game.

The Split Screen

Playing Tunnel Trap can be a bit confusing at first. The top screen belongs to player 1, and the bottom to player 2. Each player is controlled by joystick, and each player has a status line.

The two views represent windows on different sections of a large maze. The two players begin their search for each other at opposite ends of the maze. Players control their knights with joysticks. Pressing the fire button launches slingshots. The shot fires in the last direction that the player moved. When the players enter the same screen, an image of each player appears in each window. The best way to avoid confusion is to look only at your own window.

The Deadly Traps

Besides being able to shoot at each other, each player begins the game with 25 traps. Player 1 can dig a trap anywhere in the tunnel by pressing f1; player 2 presses f7. Your enemy cannot see the traps you set, and you cannot see his. You cannot fall into your own traps. On the title screen, you have the option to enable trap sensors. These are state-of-the-art warning devices. When they're activated, a green light at the far right of the screen flashes a warning when you're near an enemy trap. The sensor won't pinpoint the trap's exact location, but it does warn you to take caution.

How to Win

On the left side of each player's status bar is a green stamina indicator. Each time a player is hit with a slingshot or falls into a trap, he loses one stamina point. When all points are gone, the other player wins that round. The game continues until someone wins three rounds. The victorious knight will be crowned champion of the day. To return to the title screen at any time, press the Commodore key in the lower left corner of the keyboard.

TUNNEL TRAP

```
0801:0B 08 70 17 9E 32 34 30 6E
0809:37 00 00 00 20 20 20 20 96
0811:20 20 20 20 20 20 A0 C4 B9 06
0819:3C 08 99 F8 00 B9 FD 08 F6
0821:99 33 03 88 D0 F1 A0 09 4C
0829:B9 0C 08 99 FF 03 88 D0 A1
0831:F7 A9 3C 85 2D A9 20 85 5D
0839:2E 4C 00 01 12 F0 00 3C 14
0841:20 07 18 B9 6E 09 99 E8 75
0849:07 C8 D0 F7 EE 02 01 EE 19
0851:05 01 C6 F9 D0 ED A2 03 23
0859:20 34 03 F0 33 C9 07 D0 95
0861:16 A2 01 20 34 03 D0 0A A0
0869:A2 04 20 34 03 18 69 07 65
0871:10 05 A2 0A 20 34 03 85 1D
0879:A8 A5 A7 85 A9 A5 FE 85 FB
0881:F7 A5 FF 85 F8 20 6C 03 73
0889:A5 F8 85 FF A5 F7 85 FE 72
0891:E8 20 34 03 D0 1E A2 08 21
0899:20 34 03 A0 02 84 A8 85 2A
08A1:A6 18 A5 FC 65 A6 85 F7 58
08A9:A5 FD 65 A7 85 F8 20 6C EF
08B1:03 4C 13 01 E8 20 34 03 FB
08B9:D0 1C A0 03 84 A8 E8 20 36
08C1:34 03 F0 08 A2 08 20 34 F4
08C9:03 4C 5C 01 A2 0C 20 34 C3
08D1:03 E6 A7 4C 5C 01 E8 20 AF
08D9:34 03 D0 0A E8 20 34 03 B2
08E1:18 69 04 A8 D0 D6 E8 20 37
08E9:34 03 D0 0A A2 02 20 34 21
08F1:03 18 69 06 D0 ED A2 08 A2
08F9:20 34 03 D0 E6 A9 00 85 F7
0901:A7 A4 FB F0 0C 06 FA 2A 37
0909:26 A7 C6 FB CA D0 F2 A8 D8
0911:60 48 B1 FE 85 FA A9 08 FE
0919:85 FB 68 A4 FE D0 02 C6 4A
0921:FF C6 FE C0 E7 D0 DE A4 B5
0929:FF C0 07 D0 D8 A9 37 85 BA
0931:01 58 4C 10 08 A4 A8 F0 79
0939:22 A5 F7 38 E5 A8 B0 03 7E
0941:C6 F8 38 85 F7 A5 FC E5 8A
0949:A8 B0 02 C6 FD 85 FC B1 3A
0951:F7 88 91 FC 98 D0 F8 C4 42
0959:A9 F0 0A B1 F7 C6 FD C6 76
0961:F8 C6 A9 10 EC 60 78 E6 98
0969:01 4C 16 08 60 00 0B 08 73
0971:0A 00 9E 32 30 36 34 E3 26
0979:02 45 00 78 A9 34 07 3E CF
0981:A2 05 BD 42 08 9D 2D 03 16
0989:8F 10 F7 9A B7 75 C6 32 63
0991:CE 2C 08 B1 31 E0 0E 00 5B
0999:E2 F8 A5 32 C9 08 A0 67 4A
09A1:B9 48 08 B6 01 2E EB C5 6D
09A9:66 01 08 FD E8 3C 20 ED 76
09B1:00 01 2A 2A 29 07 AA BD 64
09B9:1A 01 8D 18 C6 97 29 1F 52
09C1:AA 3A 8B 4C FF 01 A4 43 7E
09C9:AB 79 58 3B 3F 29 92 93 26
09D1:C4 60 13 13 E2 F0 C5 A9 02
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09D9:87 EF A9 46 74 EB 82 73 11
09E1:E2 F0 A8 05 B2 20 83 01 25
09E9:1D C5 C8 F5 3C 23 F1 30 F6
09F1:8F 86 39 2D AA 4C 22 01 33
09F9:20 71 01 02 70 99 E6 2F 9F
0A01:AC 82 30 E6 2D D0 02 E6 18
0A09:2E 82 EB ED C6 39 10 E9 56
0A11:E8 50 2C DA 01 A9 37 85 83
0A19:01 58 20 00 40 4C AE A7 FF
0A21:CF 0D 84 EE A9 04 2C A9 3F
0A29:08 85 FF B1 2F 91 2D C8 A0
0A31:C4 FF E8 2A 10 2D 21 11 EF
0A39:2D A5 2E 5D 44 2E A0 85 8A
0A41:08 E5 4C 2F 65 FF 85 2F B4
0A49:A5 30 0B 70 F9 30 4C 00 CD
0A51:01 B9 00 EF 99 00 FF C8 E8
0A59:D0 F7 CE DC 01 CE A3 BA C0
0A61:AD DF 01 C9 DF 80 66 2C FA
0A69:9F FE 00 90 13 7B 5C C7 1D
0A71:48 1C 02 05 71 BD 33 00 2A
0A79:18 1E 4A 1B 26 1F 1E 1A 20
0A81:2C 0D 42 E1 B0 B1 38 D0 E2
0A89:28 D5 30 33 D2 E1 3A 43 36
0A91:B1 78 23 CE 20 08 44 62 F9
0A99:AF D2 98 9C 78 68 34 34 19
0AA1:08 85 C3 C6 42 1C 13 19 C1
0AA9:87 0C 80 14 18 EC 38 C5 80
0AB1:21 5C 20 45 1E 3B 02 73 1B
0AB9:C2 22 21 6D B8 21 07 A2 AD
0AC1:2A 6D 41 0F 23 0A 20 67 48
0AC9:07 80 30 96 B1 21 1A D2 0A
0AD1:08 C0 44 61 51 EC C4 BC 3D
0AD9:80 2D 17 52 C7 44 86 CA A8
0AE1:86 33 8D 34 6C 70 99 34 87
0AE9:0A 7E 80 24 00 08 21 3D 94
0AF1:52 09 00 C8 8C B2 4F A5 71
0AF9:24 3C 80 00 19 07 0B 3E 78
0B01:88 40 21 7C 20 02 BC 22 FB
0B09:3C 20 02 66 A2 21 E7 AE 04
0B11:21 18 85 40 00 26 C8 EF 8C
0B19:96 64 49 A3 6D 36 04 08 4B
0B21:8D E6 03 A2 00 CA D0 FD 0D
0B29:CE F0 CF E1 70 A0 B9 E8 5D
0B31:67 27 AB C4 99 90 D9 88 D1
0B39:39 C8 D0 F0 58 2C 08 99 64
0B41:91 D9 99 31 DA 13 3C D0 49
0B49:30 80 99 3F A9 57 0F 8D 15
0B51:1D BC 80 C6 17 39 00 4A 89
0B59:A9 1F 8D 27 7C 29 90 87 61
0B61:8C 96 D2 40 6E 28 E6 2A CD
0B69:41 1E E0 60 30 46 8A 18 91
0B71:07 2B E6 2D 40 D0 19 2C 29
0B79:D0 8D 2E D0 A9 E5 8D FC 2B
0B81:8B 0B FD 88 FE 07 8D FF 97
0B89:00 6E 00 B9 43 03 AD BA 13
0B91:60 10 02 AD BB 56 00 20 4E
0B99:05 BC F2 01 20 0F BD 42 CA
0BA1:05 AD BE 40 85 04 AD BF D8
0BA9:20 BC 02 D0 AD C0 40 40 7D
0BB1:A3 86 60 04 5B 6C 3A 07 8F
0BB9:7B 6C DA C9 20 E4 E4 52 51
0BC1:F0 4C 39 53 F0 03 DB 06 11
0BC9:94 27 B1 14 72 90 64 38 42
0BD1:6C 90 80 C3 46 08 61 90 34
0BD9:C4 05 43 B2 01 3A 1A 24 70
0BE1:19 0E 1B CF 84 41 12 0B C0
0BE9:0F 49 0A 3C 24 1B 7E A1 0B
0BF1:41 92 E1 B0 41 02 0E 1B DD
0BF9:24 0C 0D 49 50 3C 15 19 12
0C01:D3 03 0F 4F 0D 10 0E 18 77
0C09:69 5B 0E 1B 38 0D CF AD 63
0C11:C1 15 C0 A0 BE BC D0 0B 07
0C19:02 2C 64 E4 85 C6 C6 02 EE
0C21:A6 02 02 E6 05 03 3C 0A 72
0C29:19 EB 90 17 76 24 43 5E 75
0C31:C8 21 51 E4 05 1C 12 E4 10
0C39:39 12 1B D7 49 E4 05 1C 57
0C41:05 45 5E 10 3D C5 41 46 C3
0C49:5E 68 D4 00 91 17 D3 40 16
0C51:5A 6E 80 91 17 48 F8 3E 65
0C59:79 41 2C 14 05 C5 42 2D 36
0C61:53 11 20 05 20 21 59 A1 95
0C69:3F 42 C6 03 98 17 02 E6 C6
0C71:03 5C 5E 58 78 38 40 5E F6
0C79:D0 81 01 11 1B 0A 90 17 C4
0C81:76 60 C1 F4 61 F4 14 79 F4
0C89:61 E1 61 73 D1 58 64 B4 9B
0C91:64 58 14 41 4C C3 64 01 C3
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0CB1:18 13 A8 41 55 5E 10 B1 B9
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0CC9:42 20 F9 42 4C 17 43 20 D3
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0CD9:42 43 A4 93 1E 91 0B 0F 0E
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0CE9:D0 18 29 AC 42 7F 42 CB C0
0CF1:2A E4 E8 88 23 2F 34 3A 76
0CF9:8A BC D0 E8 D8 68 E9 A8 14
0D01:A3 06 F2 02 0E 9E EE 04 B9
0D09:B9 B6 02 51 42 6B 2B C0 D9
0D11:46 B0 62 32 12 00 76 F2 5A
0D19:C2 8E 4F 23 9C 8A 06 21 90
0D21:AC 01 9A 9F 8C BC C0 0A 02
0D29:F9 B9 AD 27 06 F2 82 C4 9C
0D31:43 21 8E 27 C8 0B 42 00 70
0D39:0E 84 C9 78 CA 0B 38 A6 D5
0D41:83 40 33 0E CF 8A 23 0E 71
0D49:D0 82 EE 43 38 E2 C8 0B 68
0D51:8C 8A 22 2F 34 38 8A BC DF
0D59:D0 E0 CE 10 01 30 C8 30 79
0D61:10 AD 08 31 33 C8 0B 0C E1
0D69:9D BC 90 1D 41 E6 6F 21 0B
0D71:00 67 A1 30 05 04 04 A6 83
0D79:04 E0 FF 75 2A 28 41 21 BA
0D81:E1 47 61 8E 52 48 C8 6E 27
0D89:42 52 43 22 E3 47 A2 E3 49
0D91:91 D8 E4 91 D8 58 3D E1 E4
0D99:86 30 E1 98 82 A9 E2 AC F5
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0DA9:02 79 FC 17 4C C0 F8 40 CB
0DB1:AD 73 03 0F C9 0E F0 56 8F
0DB9:C9 0D F0 64 C9 0B F0 32 EE
0DC1:C9 07 F0 3E C9 0A F0 12 EE
0DC9:C9 06 5E F0 86 09 F0 16 75
0DD1:C0 11 25 18 A9 E0 77 76 EC
0DD9:C4 0C 2C 14 05 C5 42 A7 8B
0DE1:53 8B 20 05 20 9B 44 4C 21
0DE9:B9 44 C6 05 A0 FF 79 BC CF
0DF1:E6 05 81 16 E2 31 60 A0 8F
0DF9:01 74 28 22 3C 76 22 04 DC
0E01:44 A0 2C 22 F9 43 20 2F 5B
0E09:62 41 60 0B AB B8 2C 8C 88
0E11:9E 20 C1 40 AE BA 43 60 08
0E19:AA 2F C2 A2 ED B1 C8 68 09
0E21:C9 B0 28 82 4C 3D C8 04 68
0E29:42 2C E1 72 54 A0 00 54 4E
0E31:32 04 20 C5 4C 35 82 26 2A
0E39:01 64 22 04 44 4B 0F 34 15
0E41:26 22 44 B6 32 8D 88 05 CA
0E49:2A 43 B9 18 69 08 8D 28 B2
0E51:23 4C 0F 44 20 2D 54 50 E6
0E59:45 20 73 45 4C 91 45 40 56
0E61:B8 48 A4 4E 51 86 38 ED 68
0E69:01 89 5C 0D 45 78 89 54 38
0E71:78 F0 C9 E8 11 50 86 18 BC
0E79:6D 09 40 8D 81 8E 08 8C 52
0E81:54 05 20 F9 44 AC F0 CF 33
0E89:DC F4 21 1D 16 F3 50 67 CF
0E91:74 14 33 CE 39 1D E2 3B 7F
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0EA9:44 88 D0 FA 4C 06 47 FC D9
0EB1:3C 26 23 61 01 DC 29 10 CD
0EB9:33 41 AD 11 CF F4 9C 32 44
0EC1:32 0B AB C2 15 7E 20 F3 32
0EC9:4E BA 10 F8 B9 AD 27 06 26
0ED1:68 0D 1A 6A 14 64 36 84 72
0ED9:4E 31 0E 2D 60 CE 4E 21 F9
0EE1:A0 90 0C 60 EE 5E 01 C8 B5
0EE9:C9 F0 AC 34 0C 8E AF 22 1C
0EF1:7E 0F 18 56 E0 D8 18 45 59
0EF9:82 EE 43 38 E2 58 01 8E 08
0F01:4E B0 2D 8E 01 F0 D1 F8 69
0F09:38 CE 72 04 C0 20 FF F0 FC
0F11:10 8F A4 C9 05 90 01 60 19
0F19:AD 0D CF E1 72 B4 60 4C DC
0F21:42 41 AD 00 41 F0 02 04 3C
0F29:29 02 90 02 06 29 08 90 04
0F31:02 0C 29 0A D0 8D 0E 40 32
0F39:04 01 E9 00 90 05 06 03 7E
0F41:41 40 07 76 2E F8 64 A0 17
0F49:AD 70 96 4A 63 A0 18 C1 61
0F51:D0 69 26 04 0D 41 0B D0 8B
0F59:38 E9 78 50 B2 AD 61 54 85
0F61:09 06 A9 33 BE 82 A9 FF 41
0F69:8D 3C 57 C3 C0 46 4C 06 42
0F71:47 DD 07 A2 E8 C8 CF 46 06
0F79:AB E8 C2 C3 00 40 8A 04 56
0F81:A2 C8 F2 8A 78 72 8A 15 E1
0F89:48 C8 20 AD 05 A8 02 B0 5C
0F91:AD 06 40 B0 86 82 B0 15 CF
0F99:CA 52 40 12 A5 40 1D 29 6C
0FA1:40 51 82 15 40 4C 15 47 7A
0FA9:44 01 30 08 01 FA 84 FB A9
0FB1:A0 06 A2 58 03 6E A0 07 95
0FB9:A2 20 20 4C 47 20 DA 49 B3
0FC1:4C 39 48 8C D0 F3 07 8E 19
0FC9:79 80 97 20 04 AC 64 03 58
0FD1:7E AC 25 AE 42 0A 20 8B EF
0FD9:47 AD B0 00 C4 8D 08 AA 34
0FE1:03 09 CF A2 EE 10 01 AD 4F
0FE9:07 CF C9 04 D0 DA E0 89 36
0FF1:19 5F 90 58 86 FE 84 FF 45
0FF9:AC 03 F7 AB 40 86 FC 84 83
1001:FD AA E0 00 F0 11 70 5C EF
1009:25 32 47 A5 CA 4C 9A 47 8F
1011:4E 00 C1 B1 FC 91 FE C8 A0
1019:C0 0A D0 F7 A5 FE E4 0C B4
1021:28 85 FE A5 FF CA FF D0 EC
1029:E0 1A 0A 0E AE D1 E8 E0 D1
1031:05 D0 D6 EB D8 20 0E 04 09
1039:8D 43 E1 01 0E A9 DA 59 63
1041:17 A9 06 74 67 58 4C 02 96
1049:50 00 53 10 0C 19 10 41 23
1051:FA 4F 9B 59 78 D4 C2 D1 3A
1059:1C 23 1B 1E 43 30 92 31 C6
1061:04 23 22 3B 46 52 B0 14 35
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1069:A9 0B 91 F8 77 70 A1 ED 91
1071:7A 84 E7 76 02 83 4C 46 51
1079:12 DC 11 91 0F D9 1F 91 C4
1081:90 1D 91 68 48 20 EB 47 CB
1089:7B D7 0B 43 32 10 20 FA FF
1091:47 A5 F9 C9 DB D0 F1 A5 46
1099:F8 C9 E8 D0 EB 60 A8 AE B3
10A1:91 FA 4C 8B 5B 26 C0 11 91
10A9:40 B5 48 6D D5 64 40 CD C5
10B1:04 03 95 A1 5C E1 01 75 43
10B9:A8 0F 41 02 0E 53 03 4E 4C
10C1:54 1C 02 AD C2 00 51 DA C1
10C9:F1 38 42 DB 05 60 AD 14 10
10D1:22 41 F0 03 4C 06 49 82 31
10D9:DA B0 D0 64 19 C0 9A 03 F7
10E1:30 0E C5 F6 85 00 4F 62 F2
10E9:13 4F 96 2C EC 01 41 04 EE
10F1:0E 23 A5 05 50 1E A1 CE F3
10F9:23 AD 20 0C C9 AF 84 CE C0
1101:2A 56 79 B9 8D 2B 06 62 20
1109:43 E1 52 18 0D 05 71 D1 42
1111:A5 4B 40 F2 4B A5 4C 79 13
1119:54 4C 8D 42 46 8E C2 A0 E0
1121:28 20 54 49 88 C0 00 3C 02
1129:1C 77 30 FC 04 23 AC DE F1
1131:D9 0A 2B 9E 40 17 E4 88 C2
1139:DB 08 BB F0 88 DA 08 AB 3D
1141:83 61 C3 83 01 A8 36 18 5D
1149:32 06 33 C2 36 06 33 C2 8B
1151:14 76 C2 32 38 84 2E 06 CC
1159:A9 08 8D 2E DA E0 7E 83 C1
1161:CF 63 09 04 F2 3C D0 08 D7
1169:64 41 A2 52 20 74 3C A0 73
1171:01 B4 03 E4 A1 20 3C 4A 40
1179:C7 B0 E1 C1 90 FF C3 50 60
1181:47 08 30 5A 49 48 46 5E 4B
1189:F9 A2 53 47 12 CF 4C 47 DF
1191:4A 98 04 19 1D 4D 4D 03 CC
1199:5C F8 38 E9 01 85 F8 A5 83
11A1:F9 E9 11 BF F9 92 E0 22 57
11A9:24 C7 98 87 26 A8 85 12 4C
11B1:2A 3C 12 EE C8 B1 F8 C9 F1
11B9:20 D0 03 E0 21 A0 29 68 D4
11C1:4C A9 B0 04 1D 60 A5 4D CD
11C9:18 69 07 85 4D A5 4E 18 41
11D1:AF 1E 4E A6 23 A2 00 2B 56
11D9:8A 42 08 C8 24 32 C0 07 D1
11E1:D0 F7 33 A2 E8 31 E0 64 2D
11E9:D0 EA C2 29 96 4A E0 00 B9
11F1:F0 07 20 9F 4A CA 4C CE 31
11F9:4A E6 56 A2 00 CF F5 10 2B
1201:22 03 04 8D 10 C2 31 11 4F
1209:08 1C 8D 01 41 02 2F 10 7A
1211:D7 8D 72 5E AC 04 8D 09 52
1219:96 0B 80 08 0D D0 8D 0F B1
1221:A0 78 99 BF 50 A3 40 C3 38
1229:68 08 D1 02 D3 F4 C4 5D 37
1231:D3 93 E1 B0 D1 B3 31 50 7B
1239:F4 C0 01 F4 C4 97 D3 13 B6
1241:04 4F CF 04 4E 4F 1D 6C CB
1249:A0 31 04 C9 53 DC 23 20 9B
1251:80 48 A0 E6 B0 0E 20 33 7B
1259:4F A0 E7 AD 71 0F C8 C8 47
1261:41 20 92 4B A0 E9 9E 4B 6A
1269:98 6B BA AE CD 20 CB 4A C7
1271:A0 34 62 0B 91 4D 85 0A C6
1279:44 4E A9 93 02 A3 8C 82 FB
1281:8C 2E F1 60 8C F9 07 8C A2
1289:FB 07 C0 99 1E D0 C9 A5 8C
1291:F0 0A C9 5A F0 11 8C EB 60
1299:6D 0C 08 A1 90 0B 46 4C 1C
12A1:CC 49 03 26 69 20 91 43 73
12A9:4C DF 4B AC 05 3F 80 87 CD
12B1:D0 CE 11 AD 12 20 89 3B 4E
12B9:60 AC BC 03 E0 07 30 06 8A
12C1:CE 4E AD 13 80 F4 00 F0 90
12C9:1B 8D 01 1E 8D 24 01 46 26
12D1:8D 9A 04 60 AD EE 2B 80 E9
12D9:84 EF CF 8D 0E 02 C0 41 4A
12E1:AD CA 05 C0 18 33 4C 23 85
12E9:4C EE 5A 01 AD 1A 06 C9 F6
12F1:B3 F0 74 20 F2 4B E3 2D 76
12F9:01 47 2F 60 74 04 C6 4B E8
1301:85 47 A7 10 0A A1 4C FF 21
1309:4B D7 94 B1 D3 94 E1 01 2E
1311:D3 94 66 03 03 98 D0 B4 14
1319:E3 81 00 4D F8 F3 34 FA 61
1321:49 72 93 34 89 4C 20 FA F6
1329:65 DA B2 8D E9 05 AD 04 AA
1331:CF CD 05 CF F0 08 A9 02 4D
1339:39 3F 4C B4 A8 60 0A 64 DF
1341:16 88 0A D1 90 10 39 C6 F0
1349:01 D0 03 4C 6F 3F 63 18 A0
1351:65 AD 60 10 C9 E9 08 A9 52
1359:E9 8D F9 07 8D FB 07 4C 3E
1361:C0 4C A9 EA 4C D7 4C AD E6
1369:17 C7 BA 46 06 EE 8E 08 D9
1371:40 4B 28 B0 09 DE 39 64 35
1379:14 1E 60 AD 14 9D 41 0A BB
1381:AD 15 9E 01 F0 0B 4C 1E 12
1389:85 1E DE 05 4C 07 4D A9 E8
1391:54 8D 2E 06 AD 64 F2 04 54
1399:C9 50 B0 01 54 00 8D 16 B2
13A1:8A 20 DA 9C 04 AD 4A 20 C5
13A9:19 40 20 BA 46 20 3B 40 85
13B1:4C 8C 40 13 EC 11 39 90 09
13B9:12 B4 9F C1 CC 30 20 49 D6
13C1:7C 11 43 48 D4 50 23 2C B1
13C9:21 0D 2D 85 A8 5D 2E 13 EB
13D1:EE 11 22 92 05 E3 F8 70 3B
13D9:15 21 41 F2 57 92 2E 50 DB
13E1:4C 41 59 45 52 F6 1C 54 F8
13E9:49 EA 06 56 A0 A4 54 59 2F
13F1:59 20 47 41 4D 45 E2 02 11
13F9:48 1F E4 20 E9 94 5B 05 08
1401:25 46 31 2F 46 33 5D 20 40
1409:20 9F 54 52 41 50 6E AE AF
1411:45 4E 53 4F 52 53 3A 20 43
1419:4F 41 BC 9D E3 11 21 9E EE
1421:E8 20 62 5D 50 52 45 53 91
1429:53 20 53 50 41 43 45 20 34
1431:54 4F 20 42 45 47 49 4E A7
1439:C8 C1 43 A9 A0 99 90 A0 66
1441:66 C7 63 04 5D 1B 82 3E D5
1449:4D 65 37 3C 95 40 31 0E 3A
1451:0F 45 A9 20 25 91 01 23 1E
1459:B1 91 F1 2D 07 20 F2 06 74
1461:8D F3 06 A0 28 17 CF 15 6A
1469:07 83 28 C1 42 85 07 66 B3
1471:70 DB 75 28 24 98 A9 1D ED
1479:95 2C 10 D8 8D 16 D8 46 C3
1481:20 4E 0B 84 7C 8D 86 02 20
1489:A9 93 B4 32 A9 05 8D 22 C3
1491:25 0D 8D 23 D0 01 22 15 57
1499:D0 54 6C 5A 82 8D 21 D0 CF
14A1:D4 49 02 34 05 28 04 B9 94
14A9:F2 62 99 18 05 C2 19 F0 EE
14B1:D0 EF 4C B9 73 4D 20 D2 47
14B9:FF 9D 87 87 D0 F5 4C A5 4F
14C1:38 88 4E 07 03 C6 40 41 57
14C9:4E A5 C5 C9 3C F0 0B C9 5D
14D1:04 F0 0C C9 05 F0 10 A7 0A
14D9:33 85 C6 60 A9 01 20 19 86
14E1:6C F0 83 20 2E 4E 4C B1 E3
14E9:78 1D 60 BC 68 00 65 18 93
14F1:19 2F 3E 32 81 7C 3E 0A E1
14F9:72 3E 4A 50 7C 3E 32 07 81
1501:7C 3E 36 60 20 E7 4E A9 AC
1509:14 BC 43 E6 21 8D 04 23 AD
1511:0C 8D 05 30 82 06 1C 02 AE
1519:0F A1 84 06 32 8D 82 D8 C9
1521:8D 00 D4 8D 01 D4 A9 03 37
1529:E1 86 CE 8D AD FF 00 59 5F
1531:01 D0 E8 9A 19 10 29 FE 31
1539:90 54 41 29 FB 44 44 D0 C5
1541:FA D6 84 A9 D0 90 A9 30 16
1549:05 7D A0 00 B1 FA 91 E8 EE
1551:FA 84 30 FA A5 FB E4 31 E7
1559:FB A5 FC 18 69 01 85 FC 63
1561:34 BC 69 40 86 FD A5 FD 7B
1569:C9 38 D0 DA B9 5C 5F 99 E5
1571:08 32 98 63 A0 D0 F5 A5 4F
1579:01 09 04 85 01 AD 18 27 55
1581:09 01 8D 0E DC 50 10 A8 F3
1589:99 12 C8 C0 3F D0 F8 60 B9
1591:AD 8D 02 C9 02 F0 01 60 09
1599:4C E2 90 AE C1 8D 18 03 17
15A1:A9 FF C3 35 45 85 C6 20 5A
15A9:70 4F 20 86 06 70 01 5A 9A
15B1:4E 20 2C 4D EE 16 AD 10 A0
15B9:04 C9 10 90 17 A9 00 8D 50
15C1:F3 CF 20 16 E4 02 54 82 99
15C9:CE 41 20 48 44 20 A5 4B 6D
15D1:20 D7 4F A9 02 20 0B 40 6D
15D9:20 35 60 5D 67 43 20 A7 73
15E1:42 20 A3 00 F8 AF 82 08 3D
15E9:E1 88 21 45 20 F4 48 20 25
15F1:5B 46 20 E5 4C 4C FC 4F 9A
15F9:8F 1A 00 22 80 F5 0E E3 70
1601:AF 26 DB 00 EA FE FE C4 20
1609:28 00 54 94 A4 A4 E8 E8 8F
1611:F8 E3 6A 2D A0 EE 56 55 95
1619:55 FF BF BF AF AB AB AA 12
1621:56 E6 FC 60 42 BC A8 47 75
1629:65 EA A5 9D 7A 64 D5 54 B6
1631:26 6B 3D 02 F8 74 65 45 BC
1639:74 17 62 9D 51 65 57 55 AF
1641:4E E9 91 16 95 5D 45 15 64
1649:90 67 9C 50 E4 D4 79 5D FA
1651:16 16 07 09 55 06 19 55 C9
1659:66 6B 75 E5 51 10 10 04 8F
1661:44 48 5D E5 65 75 65 A8 40
1669:C2 E4 D5 C5 21 99 CC A8 F8
1671:2D FF D7 5A 5A 6A 6A DB 02
1679:8B 21 1E 08 FE 10 B0 98 2A
1681:A4 64 BC 58 01 09 A2 25 CC
1689:1A 81 84 C2 30 4E 46 00 27
1691:9A A2 42 08 54 46 32 12 AE
1699:28 9A A1 22 04 41 8A 3D 4E
16A1:9B 35 88 89 23 0D 41 46 A8
16A9:03 03 28 3B C3 03 B2 C1 22
16B1:03 9E 0B E3 01 A2 60 27 21
16B9:EA 10 38 29 04 40 0C 05 37
16C1:81 EE 0A 0A B8 03 2D 88 01
16C9:CD 08 09 08 0A B0 25 11 EE
16D1:49 00 41 0A 0C 5A 2D 92 22
16D9:84 62 03 0C 8A 4E E2 E3 39
16E1:0C 27 00 3C 09 69 12 A3 57
16E9:60 30 11 30 09 45 EA 8A 35
16F1:81 E2 04 E6 20 61 E3 04 D8
```


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```
16F9:12 0E 12 E8 64 02 12 12 E4
1701:0D 33 A7 58 03 3C 05 79 89
1709:08 93 A1 22 0F 2C 12 37 FA
1711:99 28 12 0E 0F 28 A1 0C A1
1719:49 0F 0F 0D 00 C0 03 08 73
1721:81 92 02 0C 0C 0D 72 A7 D6
1729:0B 61 00 0D 24 02 0B EB 31
1731:33 11 09 E8 0A 60 04 60 27
1739:08 11 2A 09 C8 07 90 04 0D
1741:02 A2 27 0D 5C 05 0A A0 7A
1749:04 A2 2D 02 00 10 01 04 2E
1751:01 E1 09 02 0D 02 01 E3 10
1759:04 26 05 47 00 0B 04 04 60
1761:E4 0C 2A 13 13 20 3E 06 17
1769:00 01 01 80 14 E3 13 A1 F7
1771:0F 88 91 C1 A2 C1 0F 79 4B
1779:90 22 00 FB 0A 99 FF 23 12
1781:50 11 80 05 10 0F C2 A1 60
1789:60 E1 C0 23 4C 42 36 B7 3A
1791:73 AC D5 28 B3 36 07 4C B2
1799:87 47 41 1C 24 71 C0 54 04
17A1:22 F8 0C 04 88 44 25 CE 4F
17A9:54 06 C7 32 3C 63 77 74 72
17B1:C5 01 51 B0 ED E5 18 26 95
17B9:ED A0 6D 94 04 06 50 C1 98
17C1:B7 C1 75 80 31 20 2C 27 7C
17C9:4A 68 1C 81 D2 02 8E 41 CF
17D1:29 4E CF C6 0D 14 EA 48 65
17D9:48 1C 03 10 92 34 33 76 D6
17E1:E1 C1 B3 21 92 51 00 84 58
17E9:48 E4 8E C8 2E 4E 41 41 42
17F1:B0 71 0D C4 20 10 11 F0 17
17F9:B1 C1 08 18 19 46 82 01 DB
1801:1E 73 70 6C 64 E7 E4 AC 2B
1809:44 C9 24 E5 30 17 1B 5E 23
1811:21 32 08 2B 0C C1 86 38 BE
1819:43 20 50 C1 40 EC 01 80 51
1821:2B 20 21 63 07 76 FF 00 5B
1829:32 FE 00 46 C2 06 40 14 59
1831:13 4B 39 1D 4B E3 47 3E 6D
1839:99 29 A0 00 04 30 91 61 F9
1841:00 01 10 48 20 7E 47 32 F3
1849:02 03 45 47 80 E0 43 52 B8
1851:C6 10 DC C6 81 05 0D 17 42
1859:1E 06 49 42 00 87 1B 65 21
1861:1B 32 20 71 E1 81 B1 31 70
1869:42 D1 5C 80 40 20 20 20 A5
1871:F8 20 EA 4E EA 4D C5 6F EF
1879:C1 A7 78 5B F1 38 2C 7C 7E
1881:8A 9B 47 49 B8 DA E2 70 C2
1889:81 BB 0C B9 8C 9A 22 7B 15
1891:2A 80 A3 60 82 A0 38 5A D2
1899:0A AA 82 A7 F8 00 8D 4C 73
18A1:4B 2A A1 4D 09 02 82 48 A8
18A9:1C 82 8D 96 8C 90 4E 4E 35
18B1:AD 0F 20 2B 1C 0A 82 0D 4E
18B9:82 48 46 22 47 87 24 4C 15
18C1:47 C3 0C A0 A5 4D 4D 47 56
18C9:73 00 02 4C 4A 22 4B 4C 76
18D1:A8 12 4A 4B E8 4E 4B 85 75
18D9:21 43 FE F9 06 02 1B 82 DB
18E1:41 23 AA A1 C3 C3 60 0E E6
18E9:83 24 1D B5 62 AC 58 E3 3E
18F1:6A 16 2E F1 7C 0A 60 A1 30
18F9:E7 20 23 7B E4 68 FC 5A 5F
1901:EA 20 35 FC A4 36 3C C8 66
1909:E6 90 88 83 60 83 00 10 3D
1911:E8 1A 2C 41 E9 92 00 90 02
1919:28 1C 90 0C 91 E2 20 22 B3
1921:9E 03 02 31 C8 28 20 8A 68
1929:28 12 43 E6 20 2F 41 DA E5
1931:8D 8C 88 39 06 02 1A 88 E6
1939:E9 20 34 BC 81 20 46 A0 74
1941:41 42 43 1B 20 68 04 44 AD
1949:45 46 80 32 20 21 0A 3E BA
1951:FE A0 28 D5 A5 CC B1 93 E4
1959:72 E3 E4 A0 80 28 51 29 D4
1961:A0 90 8C 81 99 85 92 CD 87
1969:33 20 27 97 89 8E 93 41 8A
1971:1F B0 E3 A0 2E 94 92 81 50
1979:90 93 A0 8C 85 86 94 BA DF
1981:A0 B2 B5 E5 A0 EA 50 FD 15
1989:A0 00 00 68 F0 00 00 00 1A
```

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BASIC MOVE AND SAVE

By Daniel Lightner

Have you ever been in the middle of a great BASIC programming session when all of a sudden an *OUT OF MEMORY ERROR* message appears on the screen? Perhaps you've had a large program to halt in the middle of execution with a similar error message?

As a programmer, you may know that there's a 4K block of free RAM hidden under BASIC's ROM and RAM from 49152 to 53247. Wouldn't it be great if you could store some of your BASIC code there?

Well, you can with BAMOV and BASAV. These two utility programs for the 64 let you use this block of RAM that's usually reserved for machine language programs. They are particularly useful when you're using programs that require a lot of sprite or character data.

Getting Started

BASAV and BAMOV are written in machine language. To enter them, use MLX, our machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts for starting and ending addresses for BASAV, respond with the following.

Starting address: C000
Ending address: C0C7

When entering BAMOV, respond with these addresses.

Starting address: CF62
Ending address: D001

Be sure to save each program before leaving MLX.

A Few Rules

Before these programs can be used, certain techniques must be employed and certain rules followed. Your large BASIC program must be divided into two parts. The second part of the program will be called by the first part during execution.

It's important to note that program 2 must be at least 42 bytes shorter than program 1. In most cases you won't have any problems determining this size differential, but here's a way to check. Load program 1 and type this line of code in direct mode.

```
PRINT INT(PEEK(46)*256)+PEEK(45)-2049
```

The value returned is the length of the program in bytes. Load the second program and enter the line again. To determine the difference, subtract the value given for program 2 from the value given for program 1. The number returned must be 42 or greater.

Special Coding

Program 1 must contain these or similar lines of code at the end of the program. Just be sure the line numbers are high enough to place the code at the end of the listing.

```
50000 GOSUB 50005
50001 SYS 53090: RETURN
50005 SYS 53090: GOTO10
```

When you want program 1 to call program 2, read its data, or whatever, have it GOSUB to line 50000. When program 2 has finished executing, the program will return normally to the next statement following the GOSUB 50000. However, it's not mandatory that control return to program 1.

Program 2 must also begin with whatever line the GOTO in line 50005 of program 1 dictates. In the above example, it's line 10. Remember to keep this number below 50000.

To pass control back to program 1, program 2 must end with a RETURN that is not part of any GOSUB routine in program 2.

A Demonstration

Two short demo programs labeled Prg1 and Prg2 are included to demonstrate how BASAV and BAMOV work.

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These programs are written entirely in BASIC. To help avoid typing errors, enter them with The Automatic Proofreader. See "Typing Aids" again.

Running the Demos

Note that when Prg1 executes, it loads BAMOV and a file called Program2 into memory. Having the program load these two is not mandatory. You could load these two programs in direct mode before loading and running Prg1. If you decide to load them in immediate mode, delete lines 25 and 30 of Prg1. This will be better understood as we continue.

Load BASAV with the ,8,1 extension. Then type *NEW* and press Return. Now load Prg2 as you would any BASIC program. Before you go further, be sure there's a formatted disk in drive 8 in order to receive a relocated version of Prg2. Then type *SYS 49152* and press Return. The program will run, and the file will be saved as BAS-TMP. After the file has been saved, enter the following line of code in direct mode.

```
OPEN1,8,15, "R0:PROGRAM2=BAS-TMP": CLOSE1
```

It should be clear now that PROGRAM2 as listed in Prg1 is Prg2 relocated. Place a copy of BAMOV on the same disk as Program2. Reset the computer by either typing *NEW* or turning it off and on again. Load Prg1 and place the disk containing Program2 and BAMOV in drive 8. When you run the program, notice that control alternates between the two programs.

As its name implies, BAMOV is the BASIC mover. It pulls program 2 from beneath BASIC's ROM and places part of program 1 there. When activated again, it does the reverse.

When control is passed to line 50000 in program 1, it does a GOSUB to line 50005 so that when a RETURN is encountered, it will return to the next set of commands. At line 50005, BAMOV is activated, pulling program 2 into BASIC's memory while removing program 1. After it returns from the SYS call, the program encounters the GOTO10 command, and BASIC passes control to line 10 of program 2.

Program flow continues from there until it encounters a RETURN. At that point, control returns to line 50001 following the GOSUB in line 50000 of program 1.

Note that this line must remain at the same location in memory. This is the reason for making sure that program 2 is at least 42 bytes shorter than program 1. Next, BAMOV is called again, and program 1 is put back in place. The RETURN in line 50001 returns control to the line that originally called the GOSUB50000, in this case line 65. All the switching back and forth may sound confusing, but it should become clear when you run the programs.

BASIC programs that require sprite and character data can read the data into memory and then pass control to the second program. But remember that this can only work as long as the second program is shorter than the first program.

BASAV

```
C000:AD 0E DC 29 FE 8D 0E DC 31
C008:A5 01 29 FE 85 01 AD 0E 4B
C010:DC 09 01 8D 0E DC A9 C1 34
C018:8D 18 03 A9 34 8D 14 03 64
C020:A5 2D 8D 00 A0 A5 2E 8D F6
C028:01 A0 A9 01 85 FB A9 08 0F
C030:85 FC A9 03 85 FD A9 A0 31
C038:85 FE A5 2D 8D B2 02 A5 A4
C040:2E 8D B3 02 A0 00 B1 FB 37
C048:91 FD 20 9F C0 A5 FB CD 72
C050:B2 02 D0 F2 A5 FC CD B3 65
C058:02 D0 EB A9 07 A2 BA A0 FF
C060:C0 20 BD FF A9 02 A2 08 A4
C068:A0 02 20 BA FF A6 FD A4 A5
C070:FE A9 00 85 FD A9 A0 85 91
C078:FE A9 FD 20 D8 FF AD 0E D5
C080:DC 29 FE 8D 0E DC A5 01 A3
C088:09 01 85 01 AD 0E DC 09 F7
C090:01 8D 0E DC A9 47 8D 18 23
C098:03 A9 31 8D 14 03 60 18 8A
C0A0:A5 FB 69 01 85 FB A5 FC 95
C0A8:69 00 85 FC 18 A5 FD 69 1C
C0B0:01 85 FD A5 FE 69 00 85 51
C0B8:FE 60 42 41 53 2D 54 4D 73
C0C0:50 00 00 00 00 00 00 00 6A
```

BAMOV

```
CF62:AD 0E DC 29 FE 8D 0E DC B1
CF6A:A5 01 29 FE 85 01 AD 0E CB
CF72:DC 09 01 8D 0E DC A9 C1 B4
CF7A:8D 18 03 A9 34 8D 14 03 E4
CF82:A9 01 85 FB A9 08 85 FC 1D
CF8A:A9 03 85 FD A9 A0 85 FE 2A
CF92:AD 00 A0 8D B2 02 AD 01 EF
CF9A:A0 8D B3 02 A0 00 B1 FB E8
CFA2:8D B4 02 B1 FD 91 FB AD 6D
CFAA:B4 02 91 FD 20 E0 CF A5 01
CFB2:FB CD B2 02 D0 E8 A5 FC AC
CFBA:CD B3 02 D0 E1 AD 0E DC 3A
CFC2:29 FE 8D 0E DC A5 01 09 D1
CFCA:01 85 01 AD 0E DC 09 01 3E
CFD2:8D 0E DC A9 47 8D 18 03 96
CFDA:A9 31 8D 14 03 60 18 A5 FD
CFE2:FB 69 01 85 FB A5 FC 69 2D
CFEA:00 85 FC 18 A5 FD 69 01 06
CFF2:85 FD A5 FE 69 00 85 FE CE
CFFA:60 00 00 00 00 00 00 00 CA
```

PRG1

```
EA 10 REM COPYRIGHT 1992
GJ 15 REM COMPUTE PUBLICATIONS
      INTL LTD
GM 20 REM ALL RIGHTS RESERVED
HA 25 X=X+1:IFX=1THENLOAD"PROG
      RAM2",8,1
AP 30 IFX=2THENLOAD"BAMOV",8,1
AJ 35 PRINT"{CLR}":POKE53280,0
      :POKE53281,0
HA 40 PRINT"{2 DOWN}{2 RIGHT}
      {7}THIS IS PROGRAM ONE O
      F THE BAMOV DEMO."
MQ 45 PRINT"{DOWN}{2 RIGHT}PRO
      GRAM TWO IS UNDER BASIC'
      S ROM."
DQ 50 PRINT"{2 DOWN}{2 RIGHT}I
      T WILL CLEAR THE SCREEN
      {SPACE}AND"
CM 55 PRINT"{2 DOWN}{2 RIGHT}C
      HANGE THE SCREEN AND BOR
      DER COLORS"
ES 60 PRINT"{2 DOWN}{2 RIGHT}W
      HILE DISPLAYING A MESSAG
      E."
FB 65 FORT=1TO5000:NEXTT
AX 70 GOSUB50000
PX 75 POKE53280,0:POKE53281,0:
      PRINT"{CLR}{2 DOWN}
      {2 RIGHT}{7}BACK AT PROG
      RAM ONE NOW!"
HE 80 END
RA 50000 GOSUB50005
RQ 50001 SYS53090:RETURN
MX 50005 SYS53090:GOTO10
```

PRG2

```
EA 10 REM COPYRIGHT 1992
GJ 15 REM COMPUTE PUBLICATIONS
      INTL LTD
GM 20 REM ALL RIGHTS RESERVED
EQ 25 PRINT"{CLR}":POKE53280,6
      :POKE53281,6
PX 30 PRINT"{2 DOWN}{2 RIGHT}
      {WHT}THIS IS PROGRAM TWO
      OF THE BAMOV DEMO."
MX 35 PRINT"{2 DOWN}{2 RIGHT}W
      HEN THIS PROGRAM FINISHE
      S, IT WILL"
HR 40 PRINT"{2 DOWN}{2 RIGHT}R
      ETURN CONTROL TO LINE 50
      001"
XC 45 PRINT"{2 DOWN}{2 RIGHT}O
      F PROGRAM ONE."
PC 50 FORT=1TO5000:NEXTT
PD 55 RETURN
```

Daniel Lightner, a frequent contributor, lives in Sidney, Montana.

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NOAH'S READER

By Daniel Lightner

Last year (July 1991) we published Noah's Arc, a program that creates self-dissolving archive (SDA) files. People who use that program will find this short utility program for the 64 valuable.

Archiving is a convenient method for combining a number of related files into one master file. This process is convenient for uploading and downloading programs and instructions to and from a BBS. Many files and programs can be stored within one large file. When the SDA file is loaded and run, it dissolves into the original individual programs and saves them to disk.

The problem with archive files is that unless you have the filenames written down, there isn't any way of knowing the contents of the archived file. This is especially true if you have just downloaded a new file from a BBS or have come across a forgotten SDA file in your library. Dissolving the file will do the trick, but it's time-consuming and a bit awkward.

Noah's Reader solves this problem. Noah's Reader reads the beginning of the SDA files from disk and lists the names of the files that are stored within the archive file.

Entering the Program

Noah's Reader is written in machine language and will have to be entered using MLX, COMPUTE's machine language entry program. See "Typing Aids" elsewhere in this section. When MLX prompts for starting and ending addresses, respond with these values.

Starting address: 0801
Ending address: 09F7

Make sure that you save a copy of Noah's Reader before you exit MLX.

Running the Program

Noah's Reader loads and runs like a BASIC program. The first thing it does is to ask for an SDA filename. It then searches drive 8 for that filename and reads information until it locates the various filenames.

Noah's Reader then lists those files to the screen. The listing can be stopped by pressing any key. When the key is released, the listing continues until it prints the names of all of the archived files.

Run Noah's Reader again to read another SDA file.

NOAH'S READER

```
0801:0B 08 0A 00 9E 32 30 36 2E
0809:31 00 00 00 A0 00 8C 20 EF
0811:D0 8C 21 D0 B9 8F 09 C9 C5
0819:FF F0 07 20 D2 FF C8 4C BC
0821:15 08 A0 00 20 FA 08 B9 88
0829:85 09 20 D2 FF C8 C0 0A 1E
0831:D0 F5 20 FA 08 A9 3E 20 5E
0839:D2 FF 20 15 09 AC 34 03 6E
0841:A2 00 BD 81 09 99 35 03 8E
0849:EE 34 03 C8 E8 E0 05 D0 70
0851:F1 CE 34 03 AD 34 03 A2 AB
0859:35 A0 03 20 BD FF A9 02 D1
0861:A2 08 A0 02 86 FC 20 BA 1C
0869:FF 20 C0 FF 20 CC FF A5 73
0871:BA 20 B4 FF A9 6F 85 B9 4D
0879:20 96 FF 20 A5 FF C9 30 32
0881:D0 0D 20 A5 FF C9 30 D0 F3
0889:06 20 AB FF 4C 96 08 20 07
0891:AB FF 4C E7 08 A2 02 20 6E
0899:C6 FF 20 FA 08 A9 01 85 2F
08A1:FB 20 F1 08 20 E4 FF 85 90
08A9:FE 20 07 09 A5 FB C9 B0 14
08B1:D0 F2 A5 FC C9 09 D0 EC 6C
08B9:20 E4 FF 85 FD A2 00 20 06
08C1:E4 FF C9 2C F0 08 20 D2 FA
08C9:FF E8 E4 FD D0 F1 A9 0D 3F
08D1:20 D2 FF 20 F1 08 20 F1 8A
08D9:08 20 E4 FF A5 CB C9 40 C2
08E1:D0 FA C6 FE D0 D2 A2 00 F8
08E9:20 C6 FF A9 02 4C C3 FF 1F
08F1:20 E4 FF 20 E4 FF 4C E4 F1
08F9:FF A9 0D 20 D2 FF 20 D2 C1
0901:FF A9 9A 4C D2 FF 18 A5 02
0909:FB 69 01 85 FB A5 FC 69 C5
0911:00 85 FC 60 A0 00 A9 00 82
0919:8D 34 03 20 E4 FF C9 00 1C
0921:F0 F9 C9 14 F0 41 C9 7B 40
0929:B0 F1 C9 11 F0 ED C9 13 40
0931:F0 E9 C9 1D F0 E5 C9 22 16
0939:F0 E1 C9 2C F0 DD C9 0D D7
0941:F0 10 AC 34 03 C0 14 F0 DC
0949:D2 20 D2 FF 20 5E 09 4C FF
0951:1C 09 AC 34 03 C0 00 F0 98
0959:C2 20 D2 FF 60 AC 34 03 50
0961:99 35 03 EE 34 03 60 AC F7
0969:34 03 C0 01 B0 03 4C 1C C4
0971:09 20 D2 FF 38 AD 34 03 4E
0979:E9 01 8D 34 03 4C 1C 09 40
0981:2C 50 2C 52 46 49 4C 45 9D
0989:4E 41 4D 45 20 3F 93 9A D0
0991:0D 20 20 20 20 20 20 4E 48
0999:4F 41 48 27 53 20 53 44 25
09A1:41 20 52 45 41 44 45 52 F2
09A9:0D 20 20 20 20 20 20 20 32
09B1:43 4F 50 59 52 49 47 48 67
09B9:54 20 31 39 39 32 0D 43 A7
09C1:4F 4D 50 55 54 45 20 50 76
09C9:55 42 4C 49 43 41 54 49 46
09D1:4F 4E 53 20 49 4E 54 4C 04
09D9:20 4C 54 44 0D 20 20 20 27
09E1:20 20 41 4C 4C 20 52 49 C9
09E9:47 48 54 53 20 52 45 53 99
09F1:45 52 56 45 44 0D FF 00 B0
```

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LOCATE

By Farid Ahmad

Programmers who use BASIC are familiar with the various tricks for positioning text on a screen. Most use various PRINT statements and a lot of trial and error, but now there's a better way.

Locate is a short machine language routine for the 64 that provides BASIC programmers with two commands for cursor positioning and text color adjustment. Although the program is written in BASIC, it stores its machine language subroutine in a BASIC REM statement. This technique provides the speed of machine language with the convenience of BASIC.

Preparing Locate

Notice that Locate's first line contains a REM followed by 73 periods. It looks strange, but it's important not to change this line in any way. Since this line fills two screen lines, enter it without a space between the line number and the word REM. If you include the space, your cursor will drop down a line after you type the final period. Should that occur, cursor back up to the line and press Return.

Locate is written entirely in BASIC. To help avoid typing errors, use The Automatic Proofreader to enter the program. See "Typing Aids" elsewhere in this section. Be sure to save a copy of the program when you've finished.

Load and run the program. Now list it again. You'll see that Locate's first line number is missing and the line itself contains a number of meaningless characters. Next, delete lines 30–90. Delete a line by cursoring to an empty spot on the screen, typing *30,* and then pressing Return. Do this for lines 30–90. Finally, the program will consist of only two lines: the unnumbered line 10, which contains the meaningless symbols, and line 20. Save this two-line program with the usual SAVE command.

Using the Program

Before starting to write a BASIC program, load this two-line program. Now start writing your program with a line

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number greater then 20. When you want to position text, the following two commands are available.

SYS AT, *row, column, color*

The row may be from 0–24 and the column from 0–39. The color may be from 0–15, the usual Commodore colors. This parameter will effect the color of following text. Values outside these limits will produce an *ILLEGAL QUANTITY ERROR* message.

For example, SYS AT, 5, 0, 1 will position the cursor at the beginning of the sixth screen line and change text color to white. The color parameter is optional. If you don't want to set the text color, omit this parameter and the preceding comma. SYS AT, 5, 0 will position the cursor at the same place but will not change the text color. Spaces after the commas are also optional. Any PRINT statement that follows this or the following command will begin printing at the cursor position that you have indicated.

SYS CL, *row, column, color*

The syntax of this command is exactly the same as that of SYS AT, but it clears the screen before positioning the cursor. For example, SYS CL, 0, 0, 1 will clear the screen, position the cursor at the upper left corner, and set text color to white. As with SYS AT, the color parameter is optional.

Other Considerations

The machine language routine in Locate is relocatable. It will work correctly even if the start of BASIC pointer has been changed. The only condition is that the two lines of Locate be the first two lines of the program. The line numbers, however, may be changed with a renumbering utility.

The variables *AT* and *CL* are defined by Locate as the starting addresses of the Locate routines. These variables must not be used elsewhere in the program, or the program might crash.

If you want to use Locate with an existing program, you'll need a merge utility, such as the MERGE command in METABASIC. Renumber your program so that the first line number is greater than 20. Then merge it with Locate.

A Demonstration

Demo is a demonstration program that illustrates some of the ways Locate commands can be used and modified. It's also written in BASIC and should be entered with Proofreader.

With a merge program, you can combine the two programs later. If you don't have a merge program, load and run Proofreader, load the two-line Locate program, and then enter Demo, starting with line 30.

The Technique

The technique used with Locate is a convenient way of adding short machine language routines to BASIC programs. A few things must be kept in mind, however. First, the ML routine must not contain the number 0. This is because 0 is reserved by the BASIC interpreter to mark the end of a BASIC line. Since 0 is the ML instruction for BRK, it's seldom required. It may be needed, however, as the argument of an ML command. It's usually possible to get around this problem. For example, to load the X register with 0, use LDX#1, :DEX.

Note the quotation mark at the beginning of the first line. If this is not included, the ML numbers will be interpreted as BASIC tokens. This will still work, but the resulting list may look a bit strange. The quote itself may also produce some problems. Once the quote is encountered, some of the graphic characters might be interpreted as control characters. When the program is listed, the list may change colors, or the screen may be cleared. This is irritating, but it doesn't do any harm to the program. The best way to avoid this problem is to list the program from the second (or higher) line. Whether or not the quote is used, once the ML is in the REM statement, do not reenter the line by pressing Return over it. This will enter the line incorrectly and garble the ML. If the quote has been used, the line may look the same after reentering, but the damage may still have been done. This is because many graphic symbols have more than one POKE code, and the BASIC editor always stores the lower value in memory. So if your ML contains the instruction JSR $AEFD, reentering the line will change this to JSR$ AEBD, as $FD and $BD are the POKE codes for the same graphic symbol.

Locate prevents this from happening by including enough delete characters in the line to delete the line number. Thus, the line cannot be reentered by mistake.

LOCATE

```
EQ 10 REM".....
      .....
      .....
      .....
EC 20 CL=PEEK(43)+256*PEEK(44)
      +14:AT=CL+5
KD 30 DATA20,20,20,20,20,20,20
      ,20
KG 40 DATA{2 SPACES}169,147,03
      2,210,255,032,253,174,03
      2,158,183,134,002,032,25
      3,174,032
AE 50 DATA{2 SPACES}158,183,13
      8,168,166,002,224,025,17
      6,033,192,040,176,029,02
      4,032,240
CJ 60 DATA{2 SPACES}255,160,00
      1,136,177,122,170,224,04
      4,208,014,234,032,253,17
      4,032,158
BD 70 DATA{2 SPACES}183,224,01
      6,176,004,142,134,002,09
      6,162,014,076,139,227
RH 80 FORI=0TO72:READA:CK=CK+A
      :POKE CL-8+I,A:NEXT
DS 90 IFCK<>8427 THENPRINT"ERR
      OR IN DATA STATEMENTS":E
      ND
```

DEMO

```
MQ 30 A$="L O C A T E":B$="LOC
      ATE"
AP 40 PP=15
MA 50 POKE53280,0:POKE53281,0
KS 60 SYSCL,10,09,1:PRINTA$
AB 70 FORA= 1 TO 09
DR 80 SYSAT,A,A,A:PRINTB$
BD 90 SYSAT,A,35-A,A:PRINTB$
MH 100 NEXT
HA 110 FOR A=13 TO 1 STEP -1
GP 120 SYSAT,A+10,A+10,15-A:PR
      INTB$
SK 130 NEXT
QM 140 FOR A=1 TO100
QC 150 SYSAT,10,09,A-INT(A/15)
      *15:PRINTA$
CP 160 NEXT
SQ 170 SYSCL,5,3,1
BJ 180 PRINT"LOCATE ALLOWS YOU
       TO POSITION TEXT"
FE 190 SYSAT,7,5,2
DR 200 PRINT"ANYWHERE"
AX 210 SYSAT,9,13
MK 220 PRINT"ON"
QG 230 SYSAT,11,15
QC 240 PRINT"THE
BH 250 SYSAT,13,20
CJ 260 PRINT"SCREEN"
```


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```
XX 270 SYSAT,PP,5,3
SJ 280 PRINT"IN"
FR 290 SYSAT,PP,10,6
FJ 300 PRINT"ANY"
FB 310 SYSAT,PP,15,11
PR 320 PRINT"COLOR"
MM 330 FORA=0 TO 15:SYSAT,PP,2
      2+A,A
QQ 340 PRINT"!"
BH 350 NEXT
```

Farid Ahmad is a frequent Gazette contributor. He lives in Islamabad, Pakistan.

BUG-SWATTER

A portion of the machine language listing for Blanker in the August 1992 issue was omitted. We regret the inconvenience it may have caused some readers. Here is the entire listing.

If you have already entered and saved the earlier portion, load and run MLX, responding with the following starting and ending addresses.

Starting address: 0247
Ending address: 0763

Now select Load File from the MLX menu and load the saved file. Then begin entering data from address 03D7.

After you have saved the entire program, remember that it must be converted to GEOS format with the converter program in the August issue.

BLANKER

```
0247:0F 03 15 BF FF FF FF 80 B2
024F:00 01 BF FF FD B0 00 0D 4B
0257:A0 00 05 A0 00 05 A0 00 AB
025F:05 A0 00 05 A0 00 05 A0 0E
0267:00 05 A0 00 05 A0 00 05 70
026F:A0 00 05 A0 00 05 B0 00 E3
0277:0D BF FF FD 80 00 01 FF D7
027F:FF FF 4F FE 72 20 00 04 75
0287:3F FF FC 83 05 00 00 04 2F
028F:BA 2C 00 04 53 63 72 6E B7
0297:20 42 6C 61 6E 6B 65 72 3E
029F:56 31 2E 30 00 00 00 00 E3
02A7:43 68 61 72 6C 65 73 20 BA
02AF:57 2E 20 42 6F 7A 61 72 AD
02B7:74 68 20 0F 2C 00 00 44 AA
02BF:65 73 6B 20 61 63 63 65 87
02C7:73 73 6F 72 79 20 66 6F FF
02CF:72 20 62 6C 61 6E 6B 69 2D
02D7:6E 67 20 74 68 65 20 47 98
02DF:45 4F 53 20 73 63 72 65 3A
02E7:65 6E 2E 0F 34 00 00 20 B2
02EF:4E C1 20 B7 C1 00 60 99 73
02F7:08 40 1F 20 53 C2 00 C8 64
02FF:00 00 40 01 A9 80 85 2F A5
0307:20 B7 C1 1F 85 1E 29 9C C8
030F:03 20 B6 06 20 31 07 20 C9
0317:E6 06 A5 02 C9 02 F0 38 57
031F:A9 00 85 39 A9 04 8D A2 59
0327:84 A9 69 8D A1 84 A9 04 56
032F:8D A4 84 A9 69 8D A3 84 9D
0337:A9 01 85 3B A9 3F 85 3A 46
033F:A9 C7 85 3C A5 16 0A A8 C2
0347:88 88 B9 29 07 8D 9B 84 A7
034F:C8 B9 29 07 8D 9C 84 60 06
0357:AD 11 D0 09 10 8D 11 D0 CC
035F:A9 30 85 01 20 B7 C1 1E 88
0367:29 1F 85 9C 03 20 A5 C1 E9
036F:00 C8 00 00 40 01 20 B7 A5
0377:C1 99 08 00 60 40 1F 4C 54
037F:3E C2 A9 00 8D 9C 84 A9 1C
0387:00 8D 9B 84 A9 35 85 01 DA
038F:AD 11 D0 29 EF 8D 11 D0 06
0397:60 A9 04 8D 9C 84 A9 C7 A3
039F:8D 9B 84 A9 A0 85 03 A9 49
03A7:00 85 02 A9 00 85 05 85 8F
03AF:06 A9 5A 85 07 60 A6 05 D2
03B7:A4 06 B9 28 05 A8 B1 02 7B
03BF:3D 20 05 91 02 20 0A 05 CF
03C7:18 A9 0A 65 02 85 02 90 96
03CF:02 E6 03 A5 03 C9 BF D0 DA
03D7:04 A5 02 C9 40 D0 D7 A9 C4
03DF:A0 85 03 A9 00 85 02 20 CC
03E7:0A 05 C6 07 D0 0A A9 04 83
03EF:8D 9C 84 A9 93 8D 9B 84 9D
03F7:60 E6 06 A5 06 C9 0B D0 41
03FF:04 A9 00 85 06 E8 E0 08 68
0407:D0 02 A2 00 86 05 60 7F D4
040F:FB DF FE EF BF FD F7 03 D4
0417:07 01 09 04 06 00 08 05 89
041F:02 00 A9 05 8D 9C 84 A9 3F
0427:48 8D 9B 84 A0 09 A9 FF EE
042F:99 8E 08 88 D0 FA 60 20 84
0437:76 05 90 28 18 20 33 C1 B9
043F:E6 18 A5 18 C9 C8 F0 14 5E
0447:A9 00 38 20 33 C1 20 87 95
044F:C1 AD 0A 85 C9 28 B0 04 91
0457:A9 C8 85 18 20 96 05 A9 A7
045F:10 8D 4E 06 60 AC 50 06 59
0467:B9 8E 08 C9 FF F0 12 85 FA
046F:18 98 0A A8 B9 7A 08 85 C2
0477:08 C8 B9 7A 08 85 09 38 35
047F:60 20 C6 05 60 AC 50 06 45
0487:A5 18 C9 C8 F0 21 99 8E FB
048F:08 98 0A A8 A5 08 99 7A 88
0497:08 C8 A5 09 99 7A 08 EE D0
049F:50 06 AD 50 06 C9 0A D0 48
04A7:05 A9 00 8D 50 06 60 A9 7A
04AF:FF 99 8E 08 60 CE 4E 06 51
04B7:D0 19 AD 4F 06 18 69 08 84
04BF:8D 4F 06 C9 60 90 0A A9 C2
04C7:04 8D 9C 84 A9 AA 8D 9B BF
04CF:84 18 60 AD 4F 06 8D 98 4D
04D7:08 20 87 C1 AD 0B 85 C9 67
04DF:FA B0 D2 85 19 AD 0A 85 5D
04E7:85 18 A9 01 85 05 A9 40 D1
04EF:85 04 A2 18 A0 04 20 69 50
04F7:C1 A5 13 85 09 A5 12 85 8D
04FF:08 20 3F C1 90 01 60 CE 30
0507:98 08 F0 A9 20 87 C1 30 EA
050F:1D E6 08 D0 02 E6 09 A5 D2
0517:09 C9 01 D0 04 A5 08 C9 D5
051F:40 D0 DE A9 00 85 09 A9 C5
0527:00 85 08 4C 12 06 E6 18 E6
052F:A5 18 C9 C8 D0 CB A9 00 E0
0537:85 18 4C 12 06 10 07 00 33
053F:A9 06 8D 9C 84 A9 60 8D 34
0547:9B 84 A9 01 85 02 60 A9 24
054F:C8 85 06 A2 00 86 03 A9 D3
0557:00 85 05 20 3C C1 A2 28 BB
055F:18 A0 00 B1 0C F0 02 E6 C7
0567:05 6A 91 0C 08 18 A9 08 7D
056F:65 0C 85 0C 90 02 E6 0D 08
0577:28 CA D0 E7 A5 05 D0 11 D4
057F:C6 06 A5 06 D0 0B A9 04 8D
0587:8D 9C 84 A9 93 8D 9B 84 39
058F:60 A6 03 E8 E4 02 D0 BD F0
0597:E6 02 A5 02 C9 C8 90 04 01
059F:A9 C8 85 02 60 A9 27 85 FE
05A7:05 A9 D9 85 04 A9 8C 85 97
05AF:07 A9 A7 85 06 A2 0D A0 6A
05B7:19 B1 06 20 11 07 AD 27 A4
05BF:8C 91 06 88 D0 F3 18 A9 ED
05C7:28 65 06 85 06 90 02 E6 B5
05CF:07 CA D0 E3 60 A9 27 85 E5
05D7:05 A9 D9 85 04 A9 8C 85 C7
05DF:07 A9 A7 85 06 A2 0D A0 9A
05E7:19 20 1A 07 91 06 88 D0 C0
05EF:F8 18 A9 28 65 06 85 06 88
05F7:90 02 E6 07 CA D0 E8 60 E3
05FF:84 08 A0 00 91 04 4C 20 B7
0607:07 84 08 A0 00 B1 04 E6 78
060F:04 D0 02 E6 05 A4 08 60 2B
0617:93 04 AA 04 33 05 51 06 D9
061F:A9 00 85 3B A9 E0 85 3A 7A
0627:A9 5D 85 3C A9 07 85 03 4B
062F:A9 C9 85 02 20 56 C2 60 93
0637:A9 00 8D B5 84 A9 07 8D 8B
063F:9C 84 A9 59 8D 9B 84 60 C9
0647:A9 00 8D 9C 84 A9 00 8D FB
064F:9B 84 A9 01 85 16 20 9E F2
0657:07 60 A9 01 85 17 A5 16 2E
065F:C9 01 D0 22 60 A9 02 85 FF
0667:17 A5 16 C9 02 D0 17 60 A9
066F:A9 03 85 17 A5 16 C9 03 4F
0677:D0 0C 60 A9 04 85 17 A5 9F
067F:16 C9 04 D0 01 60 20 9E FE
0687:07 A5 17 85 16 A9 00 85 98
068F:09 A9 59 85 08 A9 00 85 7A
0697:0B A9 61 85 0A A9 2A 85 E8
069F:06 A6 16 A5 06 18 69 11 E9
06A7:85 06 CA D0 F6 A5 06 18 D0
06AF:69 06 85 07 20 2A C1 60 A0
06B7:81 13 49 07 01 11 37 02 9F
06BF:11 48 0B 10 10 38 08 0B 45
06C7:30 21 59 08 0B 30 32 61 BE
06CF:08 0B 30 43 6C 08 0B 30 A6
06D7:54 73 08 12 03 1A 01 08 97
06DF:12 03 2B 09 08 12 03 3C 76
06E7:11 08 12 03 4D 19 08 00 CF
06EF:21 08 00 00 02 09 6B 07 A0
06F7:21 08 00 00 02 09 76 07 BE
06FF:21 08 00 00 02 09 81 07 DC
0707:21 08 00 00 02 09 8C 07 FB
070F:92 FF E0 80 20 80 20 80 4E
0717:20 80 20 80 20 80 20 80 25
071F:20 FF E0 0E 00 04 BF 18 E1
0727:50 6C 65 61 73 65 20 53 FF
072F:65 6C 65 63 74 20 42 6C 03
0737:61 6E 6B 69 6E 67 20 4F 36
073F:70 74 69 6F 6E 3A 1B 00 59
0747:18 42 6C 61 6E 6B 1B 00 EC
074F:18 44 69 73 73 6F 6C 76 87
0757:65 1B 00 18 44 72 69 70 8F
075F:1B 00 18 54 69 6C 74 1B 44
0767:00 00 00 00 00 00 00 00 75
```


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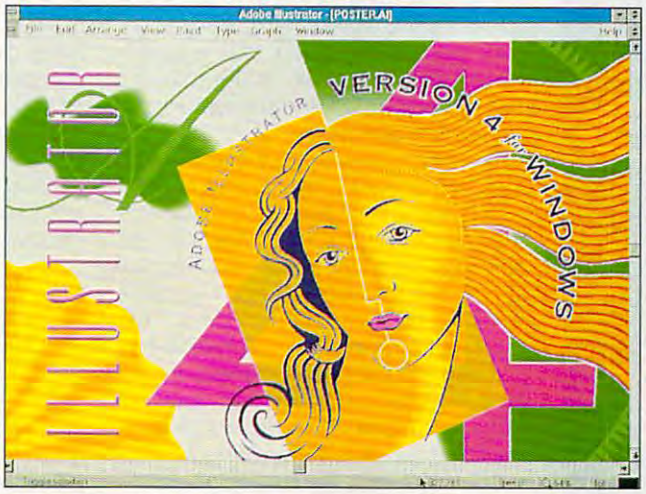
ADOBE ILLUSTRATOR VERSION 4.0 FOR WINDOWS

Adobe Illustrator has long been the big kahuna among Macintosh illustration programs. So it was eagerly awaited by early Windows users hoping to put the power of PostScript-based drawing into their PCs. However, the first release of Illustrator for Windows was, to put it bluntly, a dog—not as elegant or powerful as the Mac version, and buggy, too.

But don't let the bad rep of that earlier release put you off from the new Adobe Illustrator Version 4.0 for Windows. If you need what it can do, this Illustrator is now the best thing going for high-end PC illustration.

Illustrator is, as I said, a PostScript drawing program; that is, it creates drawings in the PostScript page description language invented by Adobe and native to most high-end laser printers and imagesetters. The advantage of drawing with PostScript is that your drawings can be accurately printed on any PostScript printer or imagesetter at the highest resolution of which the device is capable.

In Illustrator, you draw by manipulating control points along paths, a skill that takes some time to master but that gives you greater control of the look of every curve and line. You can start sketching with the free-form drawing tool and then edit the sketch, or you can import scanned images and have Illustrator turn them into editable line drawings. (The package comes with Adobe Streamline, which converts scans to PostScript art more effectively than Illustrator's own scan-tracing tools.) You can edit in a fast wireframe mode or show all colors (up to 16.7 million), lines, and templates. Illustrator also allows you to open and work on many drawings at once. The included Adobe Separator utility then turns your finished color art into a file ready for 4-color separation by any service bureau that accepts files from other versions of Illustrator.



With Version 4.0 for Windows, Adobe Illustrator has gone from being a dog to being the top dog of Windows drawing programs.

Font handling is one of Illustrator's strong points, as you might expect from an Adobe application. Within Illustrator itself you can enter and edit text directly on your drawing, without having to work within a special text box as in some other programs. Text can be wrapped outside or fit inside any shape and run along a curved path; you can import any Adobe font as an editable outline and create your own typefaces, as well. There are complete tracking and kerning controls, too. Included with Illustrator is the latest version of Adobe Type Manager, an indispensable Windows font-display utility; Adobe TypeAlign, a font manipulation program; and 40 Type 1 Adobe fonts.

A feature new to this version of Illustrator is the ability to create instant charts and graphs. Set up the general parameters for your graph in a dialog box, enter the graph data in Illustrator's simple built-in spreadsheet, and click the graph tool. Voilà! Instant graph. No other high-end drawing program can do this. If you mainly create and embellish data graphics for corporate reports, this one feature alone may justify Illustrator's price.

As good as it is, the program does have a few shortcomings. There's no on-screen color palette, so you can't just click on a color block to change colors. The color picking, specification, and naming features are complete and easy to use, but there's no substitute for seeing all the colors of your drawing in one palette. Also, I wished for a layer feature like the one in Illustrator's archrival, Aldus FreeHand. The complexity of an Illustrator drawing can get confusing, especially if you're working in wireframe (Artwork Only) mode. Complex drawings are easier to organize if you can put related elements on separate layers and edit each layer while hiding or dimming the others. These are relatively minor drawbacks, however.

Should you chuck your copy of CorelDRAW!, Designer, or Arts & Letters for Illustrator? If you do light-duty illustration and never print on PostScript imagesetters, then probably not; scaling the learning curve for Illustrator may not be worth the time. If you already work in a PostScript environment (with Aldus PageMaker, for example), have to share files with users of the Mac or Next versions of Illustrator, or are sending out work to desktop publishing service bureaus, then you'd do well to look into Illustrator. Adobe offers a competitive upgrade for owners of other popular PC drawing programs.

Illustrator is now the premier Windows drawing program. Its rich feature set and smooth interface, coupled with the fact that service bureaus everywhere can handle Illustrator files with minimal fuss, make it the first choice for professional illustrators and desktop publishers. Adobe has done it right this time.

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REVIEWS

FORCE TECHNOLOGY F33

For the same reasons you might choose a convertible over a VW Beetle, you'll choose the Force Technology F33 over most of the vanilla clones in the channel. Bristling computing horsepower, this black beauty could appeal more to self-styled hackers and postmodern lawyers only if the minitower came sheathed in hand-tooled black leather.

Even if you have no aspirations to the technoelite, you'll befriend the F33 right out of the box: Windows 3.1, DOS 5.0, and Procomm 2.4.2 already reside on the 130MB Maxtor hard drive. Abundant hard disk space and a good-sized chunk of RAM—4MB—ensure that you can install and run almost any application you desire.

The 14-inch Super VGA monitor supplied with the F33 displays up to 1024 × 768 pixels in noninterlace mode at a fine .28 dot pitch. The Speedstar Super VGA display card will display 32,000 colors onscreen in a resolution of 800 × 600, or 256 at 1024 × 768. The palette ranges to 16.7 million colors, and the card itself packs a megabyte of RAM on board, so you can make full use of VESA drivers for software that requires them—Virtual Laboratories Vistapro, for example. Unless you're using Windows for extensive DTP, you probably won't need an accelerator. The F33 runs graphical environments at a more than acceptable speed, and it will even multitask telecommunications software in the background without appreciable slowdown.

With a 33-MHz 486 at its heart, the motherboard also harbors a 64K cache, five 16-bit expansion slots, and three 8-bit slots; it will accept up to 64MB of RAM in mix-and-match SIMM configurations. The video card and the 2400-bps modem claim two of the expansion slots, but most users probably don't need room for more than six additional cards. You might want to add a CD-ROM drive, though, and to do it, you'll have to remove the Teac 5¼-inch drive to mount the CD-ROM internally or buy an external CD-ROM drive instead. If that's the case, consider a mid-tower or even a full-tower chassis, both available from Force Technology. The standard Teac 3½-inch floppy drive should serve you well for the life of the computer. All told, the system performs admirably, clocking in with a respectable Norton index of 50 and a better-than-rated hard drive seek time of 13.96 ms.

The F33 tactile keyboard and the matching black serial mouse give you your choice of input devices, neither of which lacks elegance or precision. The dark olive power button sits well above the smaller black reset and turbo buttons; there's no confusing these.

Besides the one-year parts-and-labor warranty, Force Technology provides outstanding support for its customers. For example, when Lemmings wouldn't run on the test unit, the staff at Force called Psygnosis and Speedstar, the manufacturer of the video display card. Not only did a Speedstar representative call to help, but the Force representatives had more than a few suggestions themselves. That ornery version of Lemmings runs fine now, and no other software gave the F33 the least bit of trouble—even Windows never crashed.

A combination of near-universal compatibility and courteous assistance from Force means a long and congenial partnership between this well-made PC and users looking for a bit of distinction on their desktops.

DAVID SEARS

Force Technology F33 with 4MB RAM, 130MB hard drive, 5¼-inch and 3½-inch floppy drives, modem, and Super VGA monitor—$2,222

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KLONIMUS NOTEBOOK AT

The Klonimus notebook computer from QSI is an excellent example of how the portable AT is finally coming of age. To my mind, the principle attributes of a computer (for most applications) are storage capacity and speed—roughly, though not necessarily, in that order.

My review model came equipped with a 60MB hard drive, but QSI offers a wide range of hard drive capacities, from 20MB to 120MB. A minimum of 2MB of RAM can be expanded to 4MB, 6MB, or 8MB. The built-in single 3½-inch floppy drive adds another 1.4MB with each disk you use. The microprocessor is a quick 16- or 20-MHz 80386SX or a 25-MHz 386SL, depending upon your requirements. (The 386SL microprocessor is faster and uses less power. Consequently, it costs a bit more.)

Following closely behind storage and speed is graphics capability—a realm of personal computing that's tak-

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en on a life of its own since the early monochrome text days. Klonimus provides an outstanding VGA display. It isn't color—that's not yet a common feature of the notebooks—but the triple-supertwist illuminated LCD display has true black-on-white contrast. VGA color emulation is done by utilizing 64 shades of gray—a very sharp and adequate emulation in most cases. The maximum screen resolution is 640 × 480 pixels.

For ease of use, the cover upon which the screen is mounted can be tilted by as much as 135 degrees from its closed position, and friction-retarded hinges allow it to be set at any convenient angle within that range. Of course, the backlighting can be timed to go off at a convenient interval and there are brightness and contrast controls. But here's the bonus: If an LCD display isn't to your liking, and there's a VGA monitor available, a handy video port on the side will accept a VGA plug so that you can enjoy complete color capability.

The keyboard is a largely well-designed one with an 83-key format. My standard of good design is how well a small keyboard approximates the omnipresent 101-key variety. One thing that almost always annoys me when using a notebook keyboard is that the placement of keys is so often confused. Distance isn't usually a problem, or even that the numeric keypad is missing—I don't use a keypad much because different software makes different use of it. But I begin throwing fits if the cursor keys aren't to the lower right in an inverted-T formation, or if the Page Up and Page Down keys aren't on top of one another, or if the Esc key isn't in the upper left, and so on. These keys are too frequently used to be placed arbitrarily.

Fortunately, the Klonimus does pretty well in this regard. The inverted-T cursor layout is there, and the Page keys and Esc key are fine. Problems occur when you try to find the Ctrl key on the lower left and you press the Alt key instead (this can be catastrophic with certain software). Then, when you go for the Alt key on the left of the space bar, you find that a special function key for the keypad simulation occupies that spot. But even this doesn't worry me. The reason I'm placid is bonus feature number 2: A standard 101 keyboard can be plugged into the port provided on the right side of the unit. (It's the smaller mini-DIN variety of plug, but an adaptor is included for larger connectors.) When both a keyboard and color VGA monitor are hooked up, you have a nice AT with a very small footprint!

So how small and light is the Klonimus? It's conveniently small: 4 inches high × 12 inches wide × 9¼ inches deep. It's also conveniently light at 7 pounds. A not insignificant part of that weight is contributed by the two nickel-cadmium batteries which slide into place below the screen, with an easily accessible slider release for each just in front of them and back from the keyboard. The two batteries combined are estimated to last six hours between recharges, but I've found that something a little over four hours is a more realistic expectation when the computer is regularly used with moderate floppy-drive access.

The power switch, slightly indented on the left side, can be a bit of a problem, since that's where my finger tends to go when I move the unit. Convenience, however, often has its price.

The ports include a 30-pin connector for an expansion pack (providing an external floppy drive and a COM2 port), a 68-pin bus connector for various function packs (modem, fax/modem, fax/scanner, Ethernet pack, and IBM 3270 emulation pack), a parallel printer port (25-pin standard female), and a serial port (9-pin male).

To round off its features, QSI's Klonimus also comes with an attractive and functional travel bag full of compartments for floppies, pens, and papers. Hardly a crucial feature, I know, but a nice touch to accompany a solid machine.

BRUCE M. BOWDEN

Klonimus Notebook AT—$1,575 with 20MB hard drive; $1,949 with 60MB hard drive; $3,495 with 386SL-25 microprocessor, 8MB RAM, 120MB hard drive, external floppy drive, all modules, Ethernet card, IBM-3270 emulation for mainframe connection, math coprocessor, vertical stand, serial mouse, and car adapter

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NEW WAVE 4.0

I welcomed the opportunity to review Hewlett-Packard's New Wave 4.0 because, frankly, I've never really understood what it does. The reviews talk about objects, tools, agents, and task languages. While all those words have meaning to me, until now they haven't added up to an understanding of the program.

Hewlett-Packard bills New Wave as "the premier desktop for Microsoft Windows." As a desktop manager, it replac-

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es the Windows Program Manager and, partially, File Manager. It makes Windows even more Mac-like (even down to the trash can icon for deleting things) and insulates you completely from DOS directories and filenames.

New Wave is built completely around objects and tools. Tools are programs with no data of their own; they merely work on your system or data generated by other programs. The printer tool and the trash can are tools. Objects are usually documents (or files, if you think that way) linked to the program that created them. To create an object, attach a data file to its program, give it a name of up to 32 characters, and put the resulting descriptively named icon somewhere on your desktop. Double-clicking on the new icon launches the program and loads the data file; you're immediately ready to work on the document. You don't need to know the name of the program, the name of the data file, or their locations in your disks and directories. Just click on the icon, and the program's running.

New Wave icons (representing objects and tools) can be on the primary desktop or in folders. Folders can contain other folders—giving you the nested program groups that Windows does not—and can be filed in the file cabinet (another tool icon). With folders and the file cabinet, you can create an organized maze of directories and subdirectories without ever knowing how you did it. This is the first truly effective way I've seen to control the ever-growing army of icons on my Windows desktop.

While Windows 3.1 delivers useful new drag-and-drop features (primarily in File Manager), New Wave expands the concept. To print a document, for instance, merely drag the object icon to the printer icon and drop it there. Delete by dragging items to the trash can. You can even open a file by dragging it from the Windows File Manager and dropping it on the New Wave object icon for its related program.

It's an extremely effective desktop manager, but there's more to New Wave than that. One of the tools is the agent. To use DOS terms, the agent is a combined batch file and macro facility. You can define a complex set of procedures for automatic execution through the Agent Task Language, which is powerful enough to run DOS programs and handle concurrently running programs. You can create dialog boxes with push-button options, schedule agent tasks to run at a later time, or even key them to run when specific events take place.

The agent is definitely in power user country. Using the agent, a savvy PC manager can write procedures that will truly insulate his novice users from any DOS or Windows pain.

A third leg of New Wave is the work group library. You can drag objects to the Object Storage area, where they will be available to other network users. You don't have to know the network drive letters or directories to store or retrieve the objects.

New Wave definitely improves your ability to organize and manage your daily Windows work. If I were an office network manager with a batch of nervous users, I'd love what New Wave could do for me. As an individual computer user, however, I'm not sure the admittedly first-rate desktop management functions are worth the program's price and the more than 7MB of hard disk space that it occupies. And if I were a nervous novice, I doubt that I'd have the insight necessary to configure the program well enough to help me significantly.

But, oh, what this could do for an office PC manager!

RICHARD O. MANN

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EPSON ACTION LASER II

Epson's Action Laser II provides HP LaserJet Series II compatibility, a print speed of six pages per minute (PPM), and dual-interface flexibility, along with other outstanding standard features, to produce a mid-size laser printer that's big in performance.

The Action Laser II measures 14 × 18.9 × 27.6 inches and weighs about 29 pounds with the paper cassette, photoconductor unit, output tray, and toner cartridge installed, ready for use. These dimensions make fairly heavy demands on the desktop area, so giving the Action Laser II its own roll-about printer stand or stationary table wouldn't be a bad idea.

The Action Laser II is equipped with 512K of RAM as its standard complement, and this can be expanded up to a maximum configuration of 5.5MB. As with other lasers, the 512K RAM configuration is good for text-only work; graph-

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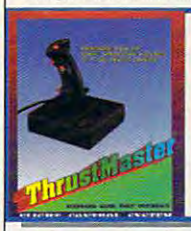

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Circle Reader Service Number 246

ics, desktop publishing, and presentation applications will require at least 1MB or more, so upgrading the basic RAM is something you should consider to make the Action Laser II fully functional for these applications. The unit I reviewed came equipped with 1MB of RAM already installed.

Sixteen bitmapped fonts are resident in the Action Laser II: The Courier typeface in medium, italic, bold, and bold italic variations is available in both landscape and portrait orientations in 10- and 12-point sizes; Line Printer Medium is available in 16.66 pitch in portrait and landscape modes; and Prestige Medium is also included in both 12 and 20 pitch in portrait mode only. If additional fonts are required or desired, an expansion slot is also provided which will accept HP Series II font cards, in addition to downloadable soft fonts. An additional expansion slot is also provided to accept "identity" cards that can change the printer's "personality."

The Action Laser II can also emulate Epson FX and LQ print modes when desired, providing greater flexibility. Dual Epson emulation capabilities permit the Action Laser II to emulate a 24-pin dot-matrix printer such as the Epson LQ-2500 or a 9-pin dot-matrix printer such as the Epson FX-850/1050 models.

The printer cranks out a respectable 6 PPM on the average, which places it in the middle ground between the competitive 4-PPM low-end models and pricier 10- to 12-PPM high-end printers. Paper weights from 16 to 24 pounds can be fed into the Action Laser II directly by the paper cassette, and paper and cardstocks in the 16- to 42-pound range can be manually fed into the printer. Plain and colored paper, labels, paper with punched holes, envelopes, and transparency stock can be imprinted with the Action Laser II.

The standard paper cassette will hold up to 100 sheets of standard 20-pound bond paper; the optional multimedia feeder can hold an additional 150 sheets or 15 envelopes. Default paper ejection is facedown only.

All controls for selecting functions and operations are easy to use and top mounted for easy access. A 20-character liquid crystal display keeps users informed of the printer's operational status, as well as presenting menu choices for configuring the unit.

Epson's documentation is excellent, especially in the technical and specification information it provides. According to the manual, the toner cartridge has a life expectancy of 8000 pages at 5-percent density, which makes it one of the longest-life toner cartridges available. In reality, however, 5-percent density isn't a practical measurement, since the average page of double-spaced text produces 20- to 35-percent density depending on how wide the margins are set.

The mid-size Epson Action Laser II printer: big only in performance.

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MIGHT & MAGIC III: ISLES OF TERRA

M&M!

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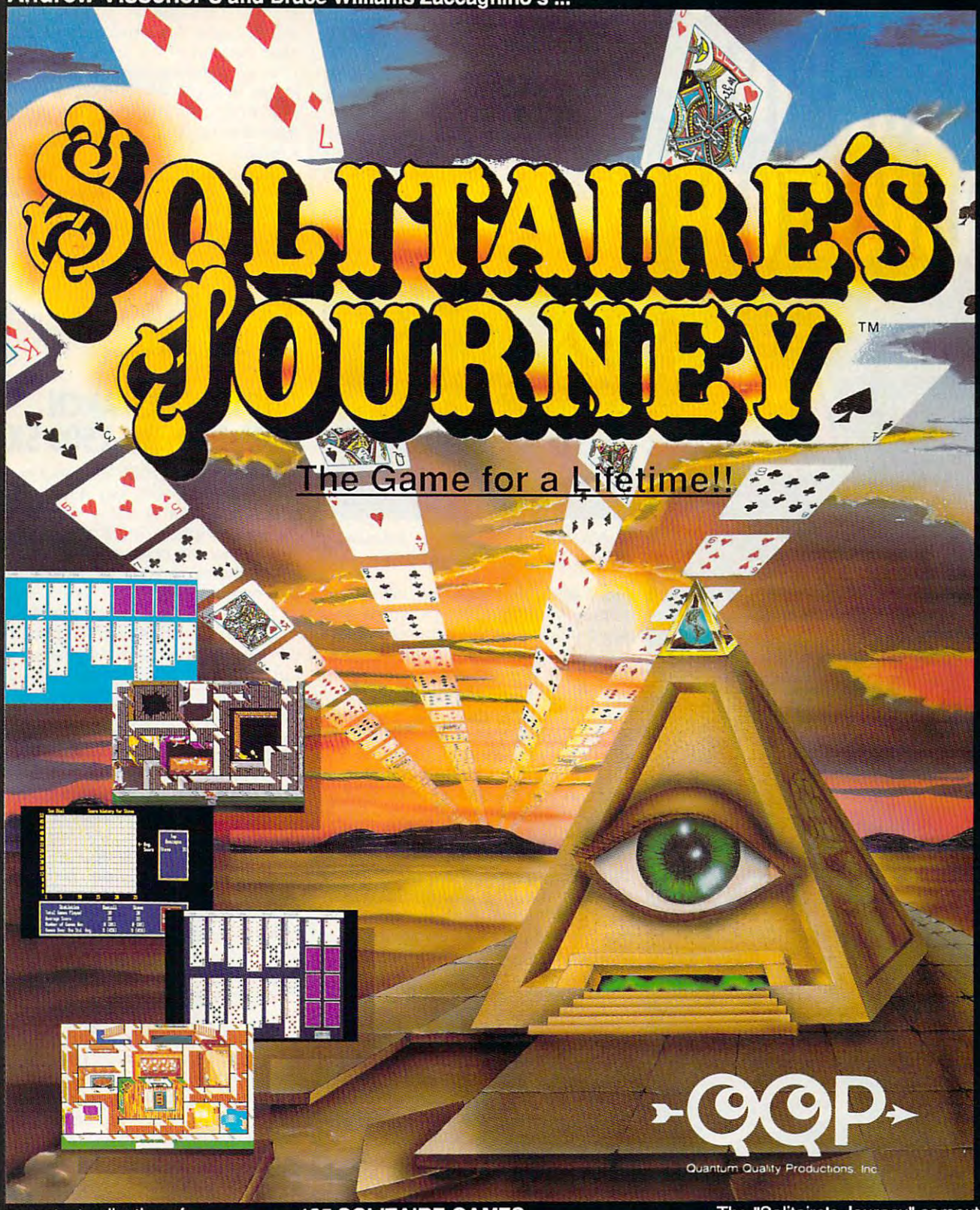

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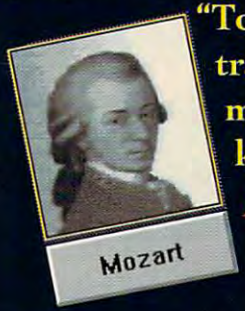

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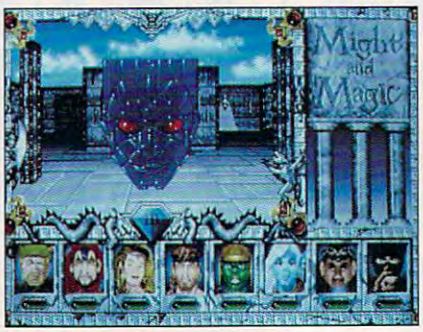
REVIEWS

tuning the character's statistical values, choosing a character class and alignment (Good, Neutral, or Evil), and giving your new adventurer a name. In addition, two nonplayer characters, or "hirelings," can join the party during the adventure.

Although M&M III is similar in many respects to most other FRP games, the thoughtful design of its game screen



Might & Magic III continues the entertaining tradition of its predecessors.

sets it apart. For instance, the ornate display window through which you view the outside world is framed by several indicators which, depending on the skills of your adventurers, can provide various types of information. If any character in the party has Direction Sense, for example, a gem at the bottom of the screen indicates the compass direction the party is facing. If a character has the Detect Secret Passages skill, a gremlin on the right side of the frame will wave its arm anytime the party is facing a secret passage. Similarly, a gargoyle on the left flaps its wings whenever a Levitate spell is in effect. Other indicators tell when the party is in danger of being attacked or when there is a protective spell in effect.

Besides the game screen, there is much else to like about M&M III. Other pluses include an icon-driven Options menu (with keyboard equivalents for all options), a vast fantasy world to explore that spans more than a dozen islands, a well-designed combat system, and a host of carefully drawn and animated monsters to battle. The game is as visually impressive as any FRP game available; it also features exceptional music and sound effects, as well as a superb end-game sequence that makes it clear that there will eventually be an M&M IV.

About the only real fault I could find with M&M III is that there is no option to rename your games as you save them. If you wish to avoid writing over your previously saved games, however, you can always back up your saved game files before you begin each session.

Despite this inconvenience, Might & Magic III is one of the most entertaining and challenging role-playing games to come along this year.

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ADDTECH RESEARCH SLIM-PRO MB-2500 SX

The Slim-Pro MB-2500 SX computer is a little marvel with big ambitions—which it seems to achieve with elegance and grace. There are three key factors that the buyer of this computer will likely be considering: size, cost, and expandability.

The size, while perhaps not of principal interest, is the first thing you notice about it. The case dimensions are approximately 11½ inches wide, 10½ inches deep, and 2¼ inches high—small enough to fit in a largish briefcase. The size makes it convenient for travel, and at about eight pounds it's relatively lightweight. Add to the transportability factor the power supply, which is external. The 45-watt, 110/250-volt power supply is about 3 × 6 × 1½ inches and weighs about a pound. It gets quite warm during operation of the computer, but this doesn't seem to be a problem. Even when not traveling, the small footprint of this machine is a blessing to those of us hard-pressed for desk space.

Essentially, this is a do-it-yourself, as-much-as-you-like computer with levels of pricing depending on how well you want it equipped. Its most uncultivated configuration is ideal for the hobbyist or meticulous individual who wants to selectively purchase as many system parts as possible. With a suggested retail price of $395, it consists of an 80386 microprocessor running at 16/20/25 MHz (turbo mode) and 8/10/12½ MHz (nonturbo mode), standard memory (with support for up to 16MB of expansion in a SIMM module), the case, and the power supply. There's no video card or keyboard, but a keyboard is optional. The keyboard connector is IBM standard, like every other significant part of the Slim-Pro. Beyond this basic configuration, more features can

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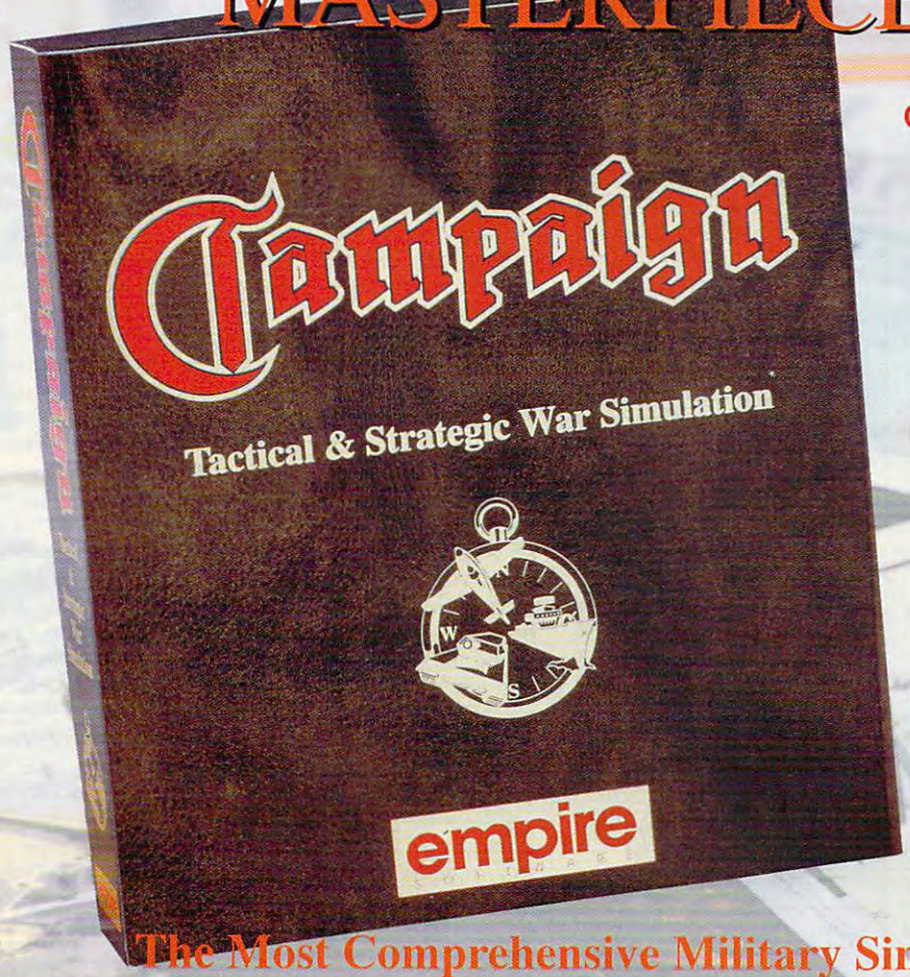

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be ordered, still at very reasonable prices. The next price plateau ($565) buys a unit with 1MB RAM, a high-density 3½-inch floppy drive, and a VGA card. For a little more ($705), the unit comes with 4MB of RAM, a high-density 3½-inch floppy drive, and a Super VGA card. Of course, with a unit designed for the IBM standard like this one, you have the advantage of purchasing and installing your own boards, equipment, and chips.

The Slim-Pro's standard I/O includes two serial 9-pin RS-232 ports and one parallel port. Additionally, there are two add-on slots for display adapters, LAN cards, or other add-on cards. Turbo mode can be activated by software or by a turbo-speed depressible button on the front of the unit. There are front-set LED indicator lights for power, turbo speed, hard drive access, and LAN operation.

My review unit came with the optional 81-key keyboard; its layout is reminiscent of that of a laptop. I like to rest a keyboard on my lap, and I found the smaller size (about 11½ × 6 × 1½ inches) inconvenient for that purpose. Also, the lack of specific noncursor navigation keys (Page Up, Page Down, Home, and End) which can be reached without depressing a special function key first is annoying. But such sacrifices are acceptable when the focus is transportability. Less acceptable aspects of this keyboard remain, however. I'm used to finding my Ctrl key on the lower left of the keyboard, but, on this machine, that's the location of the special function key for accessing operations that normally appear as separate keys on a 101-key keyboard (the navigation keys and keypad). The cursor keys are there, but not in the familiar inverted-T arrangement—another nuisance. Still, those are relatively minor details.

The thin user's manual is packed with information—providing all you need to know about the computer, its peripherals, and the extensive system software customization possible. It's small, however, as I said, leaving little room for the sort of carefully developed explanations that would make it easier for nontechnical people to understand.

In other words, the Slim-Pro MB-2500 SX computer doesn't come without flaws, but it's still a worthwhile machine. It's a highly portable computer that can be adapted to suit your needs.

BRUCE M. BOWDEN

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CORRECT GRAMMAR, GRAMMATIK 5, POWEREDIT

Grammar ain't easy for some people. A person might find it hard to say what they mean without making mistake. They can't write a sentence without going on and on, they write more in one Sentence than some people write in a paragraph. Or fragments. It beyond just misspelling wirds. Can't these people get no help from grammar checkers?

Whoever wrote the preceding paragraph clearly needs help. OK, we'll admit it—we deliberately wrote a paragraph chock-full of mistakes to test three grammar checkers. With each of the grammar checkers (Correct Grammar, Grammatik 5, and PowerEdit) on its default setting, we used the paragraph as a test case. Here's a quick rundown of how each performed:

- Correct Grammar noted the nonstandard *ain't,* pointed out that the third sentence is a run-on, noted that *wirds* is misspelled, and caught the double negative in the last sentence. However, it missed the problem with pronoun-antecedent agreement in the second sentence *(A person/they);* the *making mistake* problem, which could be corrected by either adding an article or making *mistake* plural; the incorrectly capitalized word *Sentence;* the fragment after the third sentence; and the absence of a verb between *It* and *beyond.*
- Grammatik 5 also noted *ain't, wirds,* and the double negative, though it missed the run-on sentence. While it did recognize that a verb is missing between *It* and *beyond,* it missed all the other things that Correct Grammar missed.
- PowerEdit caught *ain't* and the lack of the verb. It missed the lack of pronoun-antecedent agreement, *making mistake,* the run-on sentence, *Sentence,* the fragment, *wirds,* and the double negative.

All three proved mediocre, in other words. Those performances jibed with our experience using the grammar checkers on longer, more conventional files. While they can undeniably provide some good advice to casual writers, none of these three grammar checkers performed particularly well. Their features and ease of use varied—with some displaying more annoying traits than others—but none distinguished itself.

All three work from relatively self-explanatory introductory menu screens. (We worked with the DOS versions; all three of the grammar checkers are also available for Windows.) Each offers a helpful tutorial program. All three allow you to check files from a variety of word-processing programs using a variety of writing styles, such as Business, Informal, and Reviewer. You can also create your own customized style in each of the programs. Unfortunately, changing the style in PowerEdit is a complicated, unclear process, requiring multiple choices at multiple levels. Changing the style for Correct Grammar is also complicated, if not as convoluted as it is for PowerEdit. Changing the style for Grammatik 5 proved refreshingly simple.

It was apparent from the installation process that PowerEdit is the least appealing of the three. To begin with, it's a memory monster, requiring 470K of conventional memory and around 1000K of extended or expanded memory. Not that the benefits from such a memory-hungry program are greater: It missed most of the major mistakes in our test paragraph. On a more stringent style setting, PowerEdit caught more mistakes, but it also hung on every other word, making for lots of tedium and only a little good advice. In the test paragraph,

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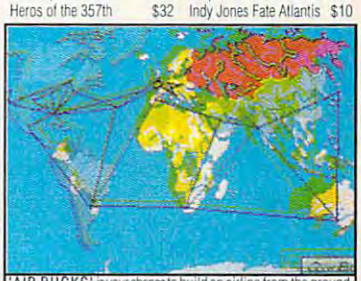

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for example, it questioned the use of the words *some, might,* and *it. "It" tends to be overused,* PowerEdit said. *Could you use a word that is more specific or descriptive?*

PowerEdit works well using a mouse, though it's difficult to navigate with a keyboard. On the other hand, Grammatik 5 works well with either. There are other ways Grammatik 5 proved user-friendly. It tells you what percentage of the file has been checked as you go along. Although Grammatik 5's suggestions for corrections aren't worded quite as politely as those of the other two, it does show the problematic sentence both in context and in a separate box. Correct Grammar shows the sentence in context but doesn't allow you to scroll back up, while PowerEdit only shows one sentence at a time unless you choose its Display option.

Unlike PowerEdit, both Grammatik 5 and Correct Grammar automatically recheck a sentence after a correction has been made to assure the correction works in context. Correct Grammar's suggestions for corrections are tactful and carefully worded; you're asked to *consider* making a particular change. Too bad Correct Grammar's Informal style setting doesn't make more of those polite suggestions—it fails to recognize such fundamental distinctions as those between *their* and *there, you're* and *your,* and *it's* and *its.*

While all the grammar checkers we tried have significant flaws, Correct Grammar and Grammatik 5 are probably the best two out of three. Any of the three will catch quite a few mistakes you might miss yourself, but all of them are also likely to miss quite a few more. Writers with serious grammar problems may benefit, but most people will probably do well enough own their on. Whoops—make that *on their own.*

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WAY YOU WORK: PERSONAL OFFICE

When I first picked up Way You Work and its inch-thick manual, I thought the program looked like just another DOS shell. I thought, What do I want with another gimmick program?

Way You Work bills itself as an object-oriented DOS shell, a personal desktop organizer, a Windows 3.0 bridge, a personal information manager, an electronic mail system, and a software robot automator. Hidden away in this Madison Avenue jargon is a bit of truth about the program, which is not just a DOS shell but, true to its name, has the capability to change the way you work.

You can use Way You Work simultaneously in both the DOS and Windows environments. Way You Work works with virtually any DOS or Windows application or data file. Those working within both the DOS and Windows environments will find the program works equally well with or without a mouse. Way You Work is a TSR (Terminate and Stay Resident) program that stays in the background while you're running other programs. The TSR uses up to 40K of conventional memory and 20K when using expanded or extended memory. Way You Work can also run under the 386 enhanced mode of Windows.

It utilizes a desktop organizer to create subject-oriented user folders and file drawers that can be worked with and booted up using software robots from any point on the desktop. You can file information by client or customer, regardless of the format. While working within a client or customer file, you can load a Lotus 1-2-3 spreadsheet or a Word for Windows file from the desktop with just a few keystrokes. When you select the data file from the file list within the folder, the computer can be instructed to load the application program and then the data file all in the same operation. In this way, you can keep all related files in the same location.

The program is a DOS shell and a database combined. More than 1000K of information can be stored on a file, identifying the customer or client, the date last updated, date originated, last backup, action date, encryption, four keywords, the author, priority, the general type of file, and a 40-character file name. The extra stored information on the files can be used to sort and search for specific information. The additional file information allows you to locate lost files and retrieve them from large disk drives.

The built-in clock and calendar are used to schedule activities and files. The program can actually be set to load an application program and a specific file at a particular time each day. A list of things to do can be set to appear automatically when you boot up your computer in the morning or just at a particular time and date. Reminders and messages can be set to pop up in the middle of applications to keep you on time for appointments. Activity logs can keep track of the work you perform on a day-to-day basis. You can even set up the computer and modem to dial the phone at a particular time or on a particular date that you need to call someone. Way You Work can be used to transfer files, messages, and letters to other users in the same network. Also, Way You Work is compatible with Novell and DOS-compatible LANs, and it has a work group expansion module for small LANs.

You can use Way You Work to set and automate appointments. The calendar can be used to schedule appointments. The program can be set to load the pertinent application program at the specified time of the appointment. Repeated appointments can be set for the same day of the week, a specific day of the month, and a particular time. Way You Work has its own password

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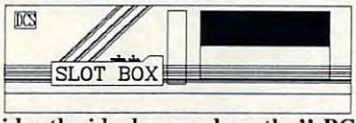

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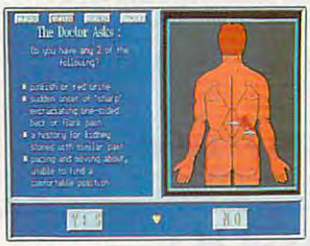

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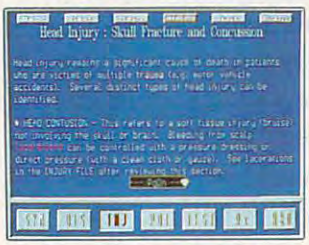

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REVIEWS

security system that prevents unauthorized access to your files from within the network. The program can be used to set up batch files to execute certain set files from within the desktop environment.

Way You Work makes great inroads into integrating the component parts of an office environment and making an integrated program less threatening and easier to use for both power users and novices. The program has the best conceptual integration system that I've ever seen. I look forward to seeing more of the Way You Work modules, such as the work group module and the toolkit module. On the negative side, several calls to Proteo, the producers of Way You Work, have gone unanswered.

Many will find Way You Work no more useful than DOS or Windows, while others will find this a most useful and important program. I came to the latter conclusion, finding Way You Work to be a good and useful program with interesting accessories available.

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PIXIE

A problem with high-end business presentation programs like Aldus Persuasion, Microsoft PowerPoint, and Micrografx Charisma is that they're expensive and somewhat difficult to use. If you, like most of us, aren't a professional presenter, you may have neither the time nor the inclination to spend hours and $500 or $600 on software that prepares transparencies and slides. But if you need to do an occasional slide show or presentation, perhaps Zenographics' Pixie is right for you—if you're running or planning to run Windows, that is.

Unlike the more sophisticated packages, Pixie doesn't require you to create your charts and graphs in obscure, complicated forms. Instead, you start with a basic chart template onscreen and modify it. This ease of use is unsurpassed by few (if any) graphics packages. Almost every function is performed with the click or drag of a mouse. If, for example, you want to increase the value of a bar in a bar chart, just select the bar and enlarge it. As you stretch the bar, a small dialog box displays your progress—the new values in numbers. When you finish, simply release the mouse button.

You can also create charts from spreadsheets such as Microsoft Excel. Dynamic Data Links (DDE) can be established between Pixie and Windows spreadsheets so that charts and graphs can be updated automatically as data in linked spreadsheets changes.

Pixie supports a number of chart types, including word, bullet, table, bar, line, stacked bar, error bar, scatter, area, and a few others. You can use the fonts that come with the package or a Windows type manager, such as ATM or TrueType. There is a spelling checker, and you can import several different graphics formats. Popular bitmaps such as TIFF and PCX files are not supported, however. And file exports are limited to three or four formats. Encapsulated PostScript (EPS) files cannot be exported, which is somewhat limiting for printing and compatibility with other programs, such as desktop publishing, draw, and word processing. The Windows Metafile and other formats Pixie exports are often not as versatile as EPS. The Windows Clipboard is supported. But so far, anyway, this is a less-than-perfect means of importing graphics from one application to another—especially EPS images.

For those of us who aren't colorwise, the program comes with a number of color palettes containing complementing combinations. Or you can create your own from Windows' palette of more than 16 million colors. Three-dimensional options are available for

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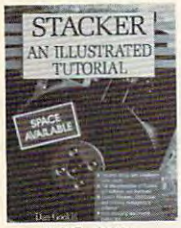

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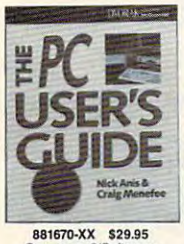

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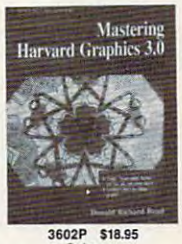

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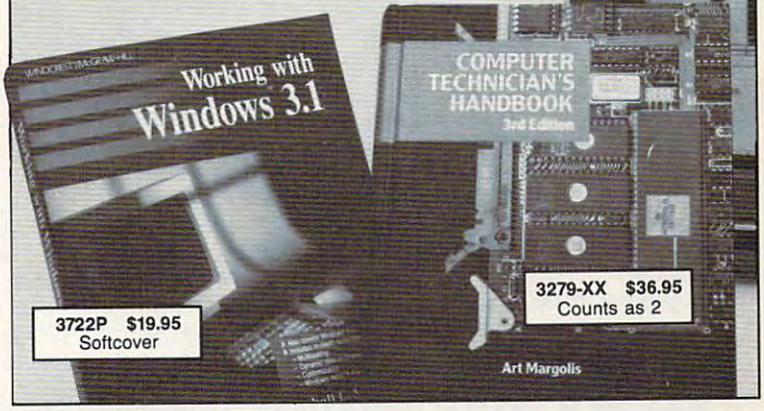

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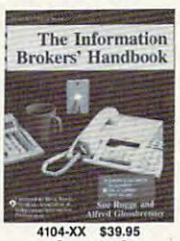

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text and charts. The sizes and angles are very limited, however, as are background fill options, which toggle between "plain" and "fancy." Fancy is nothing more than a linear fill. But Pixie is bundled with several clip art images and a library with 325 full-color graphics and backgrounds to enhance your slides.

In general, Pixie is an intuitive, easy-to-use presentation package. Considering its limitations, it might be slightly overpriced at $295. The price is suggested, though; if you shop around, you can find it for considerably less.

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THINX 2.0

Thinx 2.0 is a curious beast, neither fish nor fowl, but rather a peculiar combination of several dissimilar creatures. It's a fusion of spreadsheet, database, and graphics programs into a hard-to-describe, Windows 3.1–based business tool. It absolutely thrills those who have a use for it and mystifies those who do not. The latter group probably outnumbers the former by a large margin.

The developers say that the most common reaction at first exposure to this product is along the lines of, "Yes, but what's it for?"

The only way to explain it is to describe an application, so let's go through a basic example. Visualize a schematic of a deck you want to build in your backyard. It has planks to make the flooring and railings, outdoor furniture, and perhaps a barbecue grill. To design this and decide what you'll buy and how you'll arrange it, you might use a drawing or CAD program to diagram the layout. You can do that with Thinx. You define objects that will be used—planks, chaise longues, perhaps several choices of tables and chairs, a couple of possible grills, and so forth.

You can draw icons for these objects or use predrawn icons that come with the program. (Thinx provides plenty of object drawings appropriate for the more typical uses of the program.) You store the icons in a palette, where you can drag them out and drop them wherever they'll be useful.

Now for the database and spreadsheet elements. Each object can have a data table attached. For each of the objects we might put on our deck, the table could include a description, the price, labor costs associated with the object (if any), and perhaps colors. Each different type of chair or grill would have its own price and other data. This background data is not visible on the screen unless you call it up.

The spreadsheet element enters with formulas. In our example, we would build a small object (such as a box) on the screen and put a formula in it. We could have one for cost, in which the basic cost field from every object on the screen would be totaled. A similar box for labor cost would be helpful.

With all these raw materials laid out, you proceed to design your deck. Lay out the planking first by dragging and dropping the plank object repeatedly to form the size deck you want. As you do so, the cost and labor cost box totals increase. Then add your selections of furniture. As you add the various tables and grills and chairs to the screen, you can monitor the total cost of your choices.

When you're done, you have a schematic of the deck, information on the choices you've made, and the total cost of the exact deck you want to build. And you have a tool ready to help your neighbors plan their decks.

Another obvious use is for organization charts. Using icons in the shape of a person, each object would represent an individual employee, with his or her pay rate and other pertinent data attached in the table. As you assemble your staff on the screen, you can watch the total salary figure grow. A "based-on-condition" feature lets you test each object for certain characteristics and change the visual image as a result. You could, for example, turn the icon red for each staff member whose salary exceeds a certain level.

That's what Thinx does. Of course, its creators packed it with as many features that aid the basic mission as they could. The drawing program won't threaten the market leaders, but it does a nice job of setting up the visual part of the application. Images can, of course, be imported from other Windows-based drawing programs. Data elements can be entered directly or imported from dBASE, Lotus 1-2-3, or Excel files. Through the Windows DDE function, you can hot-link the Thinx data to information in other Windows program files. You can create a Link Object to take you from one Thinx document to another. And finally, you get toll-free technical support.

It all adds up to an impressive tool for creating visual spreadsheet and database files. If you have a use for such an application, you will love Thinx. If, however, nothing comes to mind that lends itself to such visual presentation of data, Thinx is not for you—especially since it lists for a hefty $495. For those who need its unique capabilities, though, it's a godsend—there's nothing else quite like it.

RICHARD O. MANN

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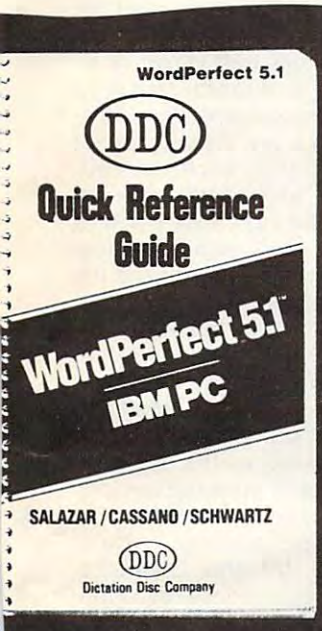

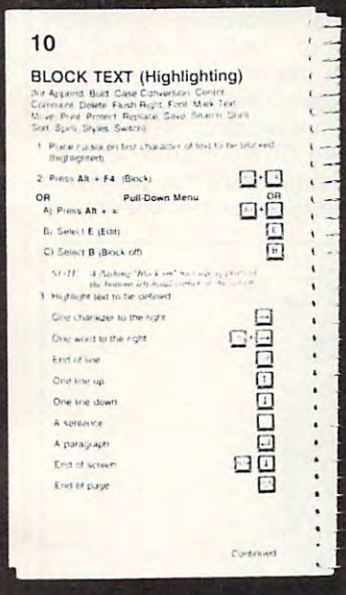

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The Audioport also features Sound Blaster and Ad Lib emulation, though with some important restrictions. The emulation only works with 386SX, 386DX, 486SX, and 486DX machines, and only with software that can run under Windows 3.1's 386-enhanced mode. That doesn't mean just Windows software; you can use the emulation with any DOS program that's able to run within the Windows 3.1 environment. For instance, I was able to run Space Quest IV, Gods, Red Baron, Stellar 7, Falcon 3.0, Lemmings, SimAnt, and a host of other DOS-based games. These days, almost every DOS-based game and educational program can run under Windows.

How good does it sound? With the small built-in speaker, it sounds a little tinny, which is to be expected. On the other hand, it's easy to plug headphones or a larger external speaker into the audio-out jack or to run a cable to your stereo for high-quality 8-bit sound. Overall, it's a reasonable compromise between portability and sound quality.

If I could add anything, it would be a parallel port pass-through. With the current model, you can plug your Audioport or your printer into your computer's parallel port, but not both at the same time. Otherwise, the Audioport is a great little device, especially for laptops.

But do us all a favor. If you insist on using your laptop to play a flight simulator while flying on a commercial airliner, please bring along a pair of headphones. For some reason, most people just don't seem to enjoy hearing the sound of airplanes crashing when they're cruising at 30,000 feet.

DAVID ENGLISH

Media Vision Audioport—$199

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Need a sound card that plugs into a parallel port and is small enough to fit in a shirt pocket? Try the Media Vision Audioport.

WINTER CHALLENGE

It's one thing to sit back and watch the Olympics on TV and quite another to don that ski parka and participate. Of course, few of us have the constitution required to survive the grueling rigors of the Olympics, and fewer still have the skill to win. Thank goodness for computer software, which—much like great books—lets us embark on adventures not otherwise possible.

A case in point is Accolade's new sports title, Winter Challenge. In this omnibus collection of snow-and-ice contests, you get to ride your skis, bobsled, or skates to victory, competing against the world's best athletes in a struggle to bring in the Olympic gold. And although you'll stay warm and snug in front of your monitor, you can participate in a slew of winter events, including downhill skiing, the giant slalom, ski jumping, bobsledding, the luge, the biathlon, cross-country skiing, and speed skating.

As with the real Olympics, the goal of Winter Challenge is to snag as many gold, silver, and bronze medals as possible. But also as with the real Olympics, you must be well trained before you join the competition. To ensure that you've honed your computer Olympic skills to their keenest edge, Winter Challenge provides a training mode in which you can practice each event until you've mastered it.

Luckily, with Winter Challenge's superb graphics and smooth animation, training is a joy. As you rocket down the slope, speed-skate around the rink, or soar through the air after a jump, you'll swear you feel the wind in your hair and the bitter cold nipping at your ears. Unfortunately, although the graphics are convincing, the sound effects are sparse. Still, digitized crowd sounds add much to the game, as the audience bemoans your failures and cheers your victories.

After training, you're ready for the Olympics. First, you choose ten opponents from around the world (any of whom may be human players, with the others controlled by the computer). During this process, you can create your own athletes, if you like, by selecting their countries and faces and then typing in their names. When your opponents have been selected, the tournament starts with an animated opening ceremony, in which white doves and hundreds of balloons stream up from the stadium among the ubiquitous flashes bursting from the audience's cameras.

During a tournament, you can play the events in any order. But unlike in the training mode, you get only one shot at the highest score. No event can be repeated in a single tournament. And although there are three skill levels for the computer-run opponents, you'll need to spend much time in the training mode before you'll be ready to take on these world-champion athletes.

Although you get only one try at an event, the instant replay feature lets you

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review that event as often as needed. Working much like a video recorder, the replay option even lets you save an event as a film for later viewing. While viewing a replay, you can fast-forward, fast-reverse, and freeze-frame, as well as view the film at the regular speed, either forward or backward.

If you're fascinated with the Winter Olympics but get numb fingers and frostbitten toes in the snow, Winter Challenge offers a chance to experience the thrill of Olympic competition vicariously. Winter Challenge may not be the real thing, but at least you don't have to train for a lifetime before you can begin to play.

CLAYTON WALNUM

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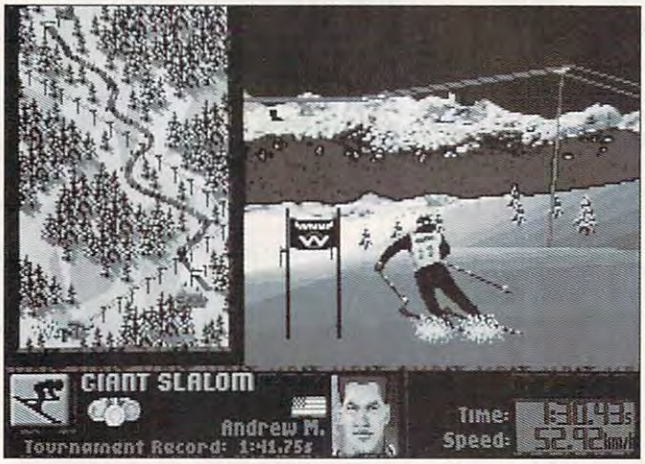

Other than the sparse sound effects, Accolade's Winter Challenge provides a convincing simulation of Olympic events.

The problematic Magnavox 7CM329 Super VGA/LE has been replaced by a Philips model, essentially the same monitor.

MAGNAVOX 7CM329 SUPER VGA/LE

Magnavox, a well-known producer of televisions, stereos, and other consumer electronics products, is also a well-known name when it comes to computer monitors. The company has been producing high-quality, affordable PC video displays for several years, and its latest offering is the 7CM329 Super VGA/LE color monitor.

The Super VGA/LE's 14-inch cathode-ray tube (CRT), which yields a 13-inch viewable image from corner to corner, utilizes a .28-mm dot pitch for tightly detailed, well-defined images in all of the standard and extended VGA modes. I tried the monitor using a Truevision Video VGA with Overlay adapter card equipped with 1MB of video RAM and a Tseng 4000-series chip set.

The styling of the Super VGA/LE is very attractive, with sleek, sculpted lines that accent the overall shape of the device. The styling theme is carried through right down to the nonremovable tilt-swivel base, which is an integral part of the monitor chassis.

All controls are conveniently located at the front of the unit under the CRT. A push-button power switch, located at the lower right corner, has an LED indicator positioned above it. Next to the power switch are the thumbwheel knob controls for adjusting vertical shift, horizontal shift, brightness, and contrast. A permanently attached video cable fitted with a 15-pin D connector and a female AC power receptacle are the only user-accessible items located at the rear of the unit.

Despite the Magnavox reputation, I was very disappointed with the performance of this monitor. A very annoying shadow bar was constantly present at the left edge of the screen in any non-Windows application, and I found it impossible to eliminate this ghost image regardless of how I adjusted the controls. Another less-than-ideal situation was the limited range of movement the horizontal shift control provided. I found myself constantly readjusting the centering of the screen image as I switched from one application to another, and the repositioning was mandatory to avoid clipping some of the video display from either the left or right side of the screen.

Compatibility with all of the standard VGA and Super VGA modes didn't pose a problem, and the Magnavox was able to produce viewable video at all resolutions up to and including 1024 × 768 in 256-color mode using a 1MB Truevision Video VGA with Overlay adapter.

The Magnavox exhibited a marked penchant for creating moiré patterns anytime there was a close dot or line pattern on the screen. Corner resolution was less than optimal on this monitor, with the corners tending to go into soft focus rather than the crisp, well-defined edges produced at the central areas of the screen.

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REVIEWS

Ghosting, streaking, and image persistence (lag) were other chronic conditions I encountered. These video anomalies, coupled with the moiré patterns and flicker, made using the Super VGA/LE for extended periods less than a pleasure. These problems were much less pronounced at the lower resolutions (for example, 640 × 480), but they became major optical obstacles at 800 × 600 and higher video settings.

If you intend to spend lots of time using applications in the Super VGA modes, you might want to spend some time looking at the Magnavox video display at the store before deciding to purchase it. There were too many problems with the monitor for me to recommend it.

Editor's note: At press time, Philips announced that the Magnavox 7CM329 Super VGA/LE monitor was being replaced by the Philips Super VGA 1436/LE, which retails for $499. According to the company, the only difference between the two monitors is two new front controls for horizontal and vertical sizing.

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DESIGN YOUR OWN RAILROAD

Whether you're a mild-mannered model railroad enthusiast looking for a new outlet or a Gomez Addams wannabe interested in destroying some rolling stock, Abracadata has a program that fits the bill. Design Your Own Railroad allows you to do just what the name says, from laying track to handpicking a train, car by car. And if you're so inclined, you can even smash your trains together without all the mess and expense you'd incur destroying your basement model railroad layout.

After holding your hand through a helpful demonstration, Design Your Own Railroad allows you to begin working on the railroad immediately. Unlike complex railroad simulations such as MicroProse's Railroad Tycoon, Design Your Own Railroad has you rolling down the track with minimal fuss. There are no competitors to slow you down and no geographical or historical factors to contend with. You simply pick a sample layout or create one of your own, couple up some cars, and hit the throttle.

Once you get into the program, you have the option of trying to deliver your freight and collect revenue against the clock, but it's no problem if you just want to run some trains around a track. There are a number of options available from easy-to-use pull-down menus, including maximum speed and type of crash. You can have your trains pass right through each other, ghostlike, or you can have them smash together with a loud report, scattering wreckage all around. Unfortunately, a crash sounds more like a set of glass wind chimes breaking than the genuine clash of metal.

Though a mouse isn't required to use Design Your Own Railroad, it sure does help. The track and train design features are as simple to use as any basic computer drawing program, but a mouse makes using them much easier, just as it simplifies access to the pull-down menus. When I tried the program using only my keyboard, I never could figure out a way to set the switch tracks. (And Gateway computer users beware: Abracadata says there's an interrupt conflict using Design Your Own Railroad on Gateways, a conflict

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Abracadata technicians say Gateway won't help resolve. I never could get the program to work on the Gateway 2000 386SX/16 I use at home.)

An index in the user's manual might have helped with the switch track trouble. The same goes for a troubleshooting section. Other than those deficiencies, however, the manual is clearly written and straightforward, including adequate illustrations. Though Design Your Own Railroad is simple enough to use employing good old trial and error, it helps to consult the manual for such diverse activities as adding switch tracks and overpasses to your layout and selecting buildings and scenery.

Design Your Own Railroad might help hardcore railfans experiment with different designs before modifying their own model railroad layouts, but don't buy the program expecting it to be a substitute for the real thing. While it gives plenty of the flavor of model railroading, from setting switches to running multiple trains, you get only a simplified overhead view as you run your trains, with cars largely indistinguishable from one another. You have access to full-screen, full-color views of your train cars and buildings, but the program's primary operating screens fail to deliver such impressive detail.

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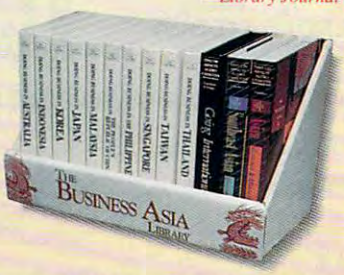

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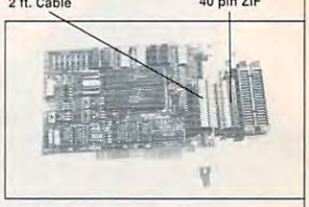

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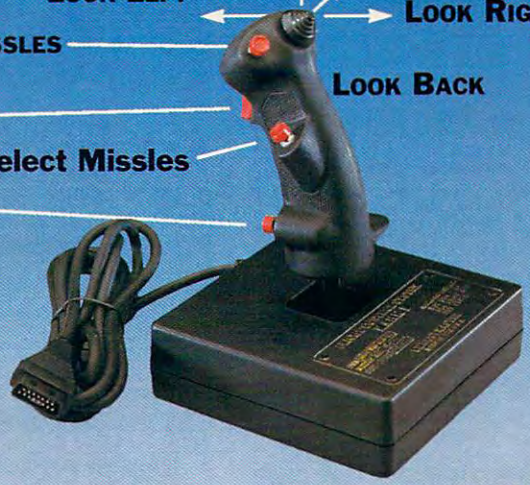

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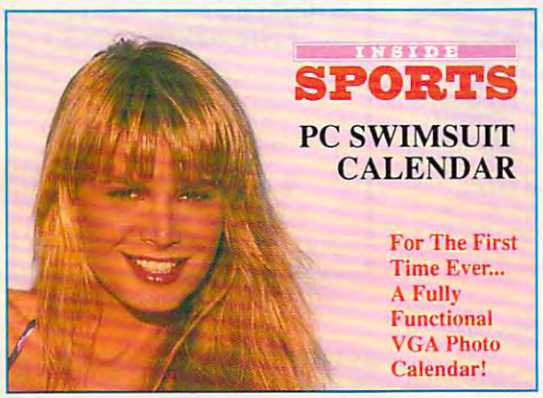

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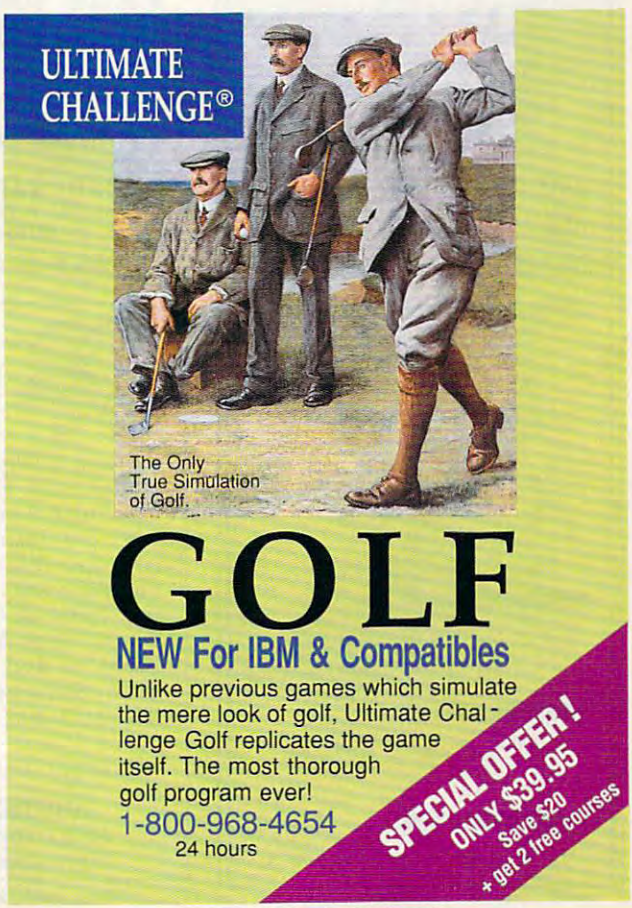

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NEWS BITS

Jill Champion

Recovering stolen computers, catching on and avoiding the rays, working at home, and—still going—repetitive-motion disorders

Stress and Repetitive Motion

An independent study of telecommunications workers who use video display terminals shows that work practices as well as psychological factors contribute to ergonomic VDT injuries. The study identifies 22 percent of the 593 U.S. West participants as victims of upper-body repetitive-motion disorders despite the fact that National Institute for Occupational Safety and Health (NIOSH) found U.S. West in compliance with 80 percent of the established physical standards for VDT workplaces—the best record of any telecommunications company whose workers are represented by Communication Workers of America.

"The study clearly shows that how workers are treated by management is at least as important in preventing repetitive-motion injuries as the equipment they are expected to use," says CWA president Morton Bahr.

The NIOSH study found that psychological considerations such as job insecurity, high-productivity demands, surges in workload, lack of control over work methods, and lack of support by coworkers all contribute to VDT illnesses. Work-practice variables (such as wearing corrective lenses, level of typing skill, and frequency of arising from one's chair) and work-organization factors (such as working overtime, task variation, being monitored electronically, and break frequency) also play significant roles in developing ergonomic disorders.

Future Trend

The number of telecommuters—employees working at least part-time at home during normal business hours—reached 6.6 million in 1992, according to new data from LINK Resources, a New York–based technology research and consulting firm. Such employees typically spend one or two days per week working from home and rely increasingly on computers and telephone services to stay in touch with their regular offices.

The trend grew 20 percent from the 5.5 million found a year ago in LINK's annual National Work-at-Home Survey of 2500 randomly selected U.S. households. Interviews are conducted by telephone during the second quarter of each year.

"Telecommuting is the fastest-growing segment of the work-at-home trend for the second year in a row," says Thomas E. Miller, vice president of home office research at LINK. "The most striking feature of the new telecommuters is the extent to which they have invested in PCs, modems, [fax machines], and new phone services to improve job performance while they work at home. It looks like many employees decided to buy a computer rather than a new car during the recession in order to save money—and wear and tear on themselves."

What Price Advice?

Krolman Enterprises (2 Bloor Street West, Suite 100, Toronto, Canada M4W 3E2; 800-388-3639 in the U.S., 416-778-4234 in Canada), a Canadian importer and distributor of computer accessories, recently discovered a new marketing angle for its antiradiation filters: a cassette seminar on the never-ending topic of computer radiation, titled "Computer Radiation: Fact or Fiction?" The 15-minute dialogue, which is designed to give you a "light" education on the five categories of radiation (electrostatic, UV visible, x-ray, ultrasound, and nonionizing electromagnetic), explains each in layman's terms, details its biological effects, and then suggests options for reducing exposure. Of course, the seminar plugs Krolman antiradiation filters as an option for those fearing the effects of sitting in front of a computer all day.

Computer Theft Prevention

In an effort to combat computer theft, the American Computer Exchange (AmCoEx, Northside Tower, 6065 Roswell Road, Suite 535, Atlanta, Georgia 30328; 404-250-0050) recently formed a National Database of Stolen Computers. Any victim of computer theft can call the toll-free number (800-786-0717) and list his or her stolen equipment on the NDSC at no charge. All transactions at AmCoEx are cross-referenced against the NDSC, so anyone wishing to verify a purchase of used equipment can call to ensure that it hasn't been listed as stolen. Law enforcement agencies who recover stolen equipment can also contact AmCoEx to locate the victims.

According to AmCoEx, the most important piece of information a theft victim can possess is the serial number of the stolen computer equipment. Unfortunately, the vast majority of victims don't have the number recorded anywhere. Some think their systems can be identified by the software on the hard drive, but most savvy crooks will reformat the hard drive. And while marking or engraving a computer in an inconspicuous location can help, the number can be altered or removed by the thief. The bottom line is that if you don't have a record of the serial number on your computer equipment, you have little hope of recovering it in the event that it is stolen. ❐

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☐ Other IBM/PC Compatible (5) ☐ Laptop/Notebook (6)

B. At home, do you use your computer mostly for ☐ Personal Finance (7) ☐ Work/Home Business (8)
☐ Entertainment (9) ☐ All of the Above (10)

C. Would you classify yourself as a(n) ☐ Entrepreneur (11) ☐ Telecommuter (12) ☐ Moonlighter (13)
☐ Corporate Employee who brings work home (14)

D. Which online service(s) do you use? ☐ CompuServe (15) ☐ GEnie (16) ☐ America Online (17) ☐ Prodigy (18)

E. What other computer magazines do you subscribe to? ☐ PC/Computing (19) ☐ MPC World (20)
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F. Which Graphical User Interface do you use? ☐ Windows (25) ☐ GeoWorks (26) ☐ Other (27) ☐ None (28)

G. Total time you spend reading COMPUTE? ☐ < 30 min (29) ☐ 30+ min (30) ☐ 60+ min (31) ☐ 90+ min (32)

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J. What is your total household income? ☐ <$30,000 (37) ☐ $30,000+ (38) ☐ $50,000+ (39) ☐ $75,000+ (40)

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