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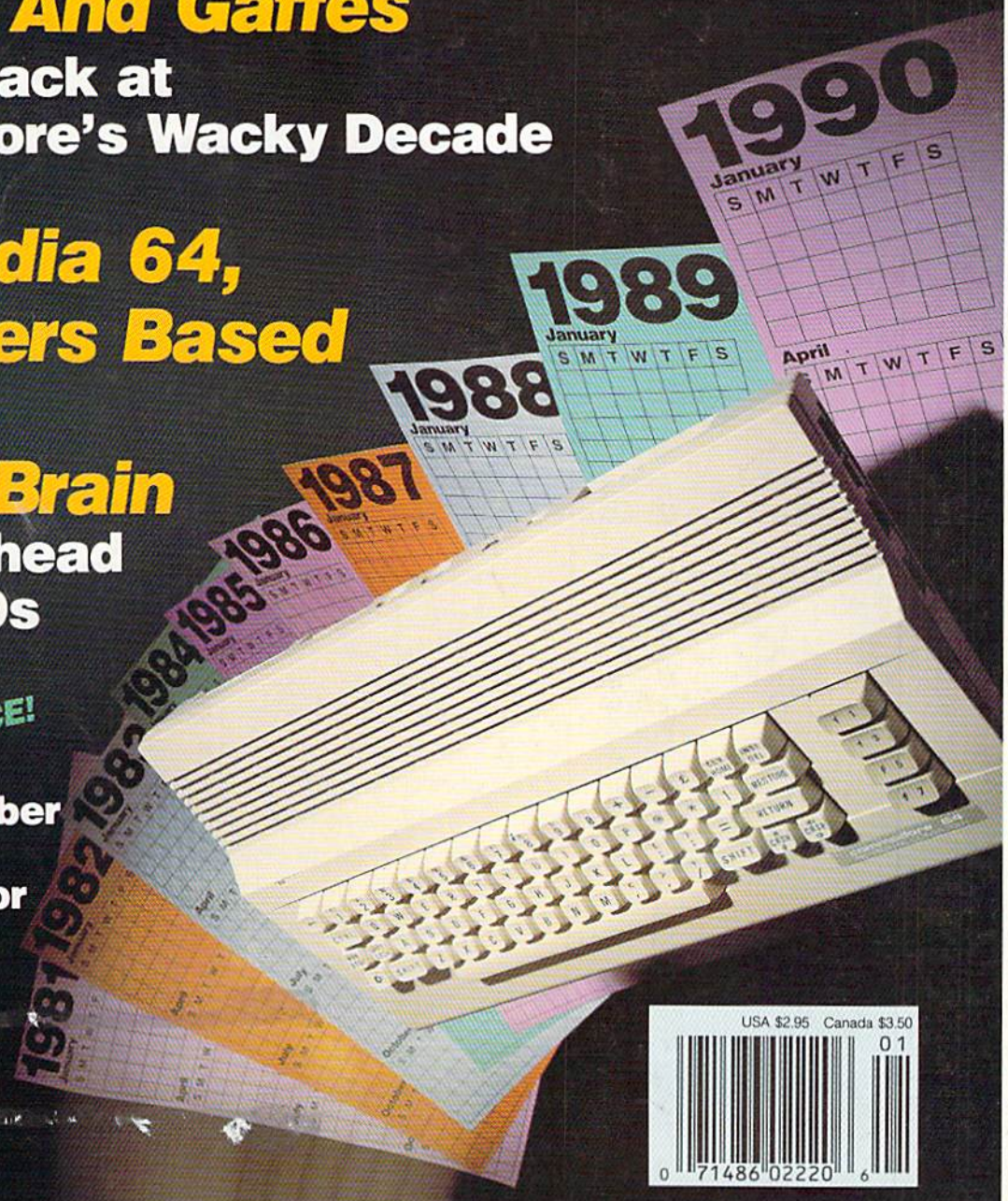

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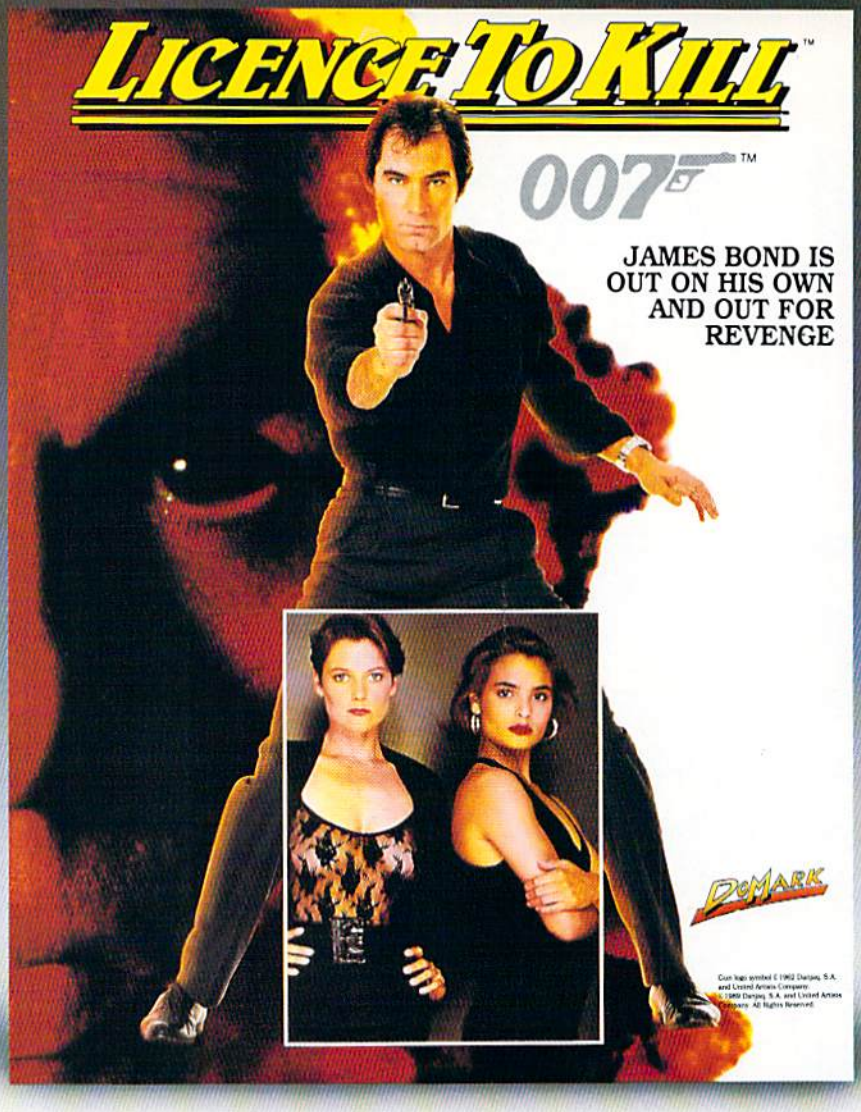

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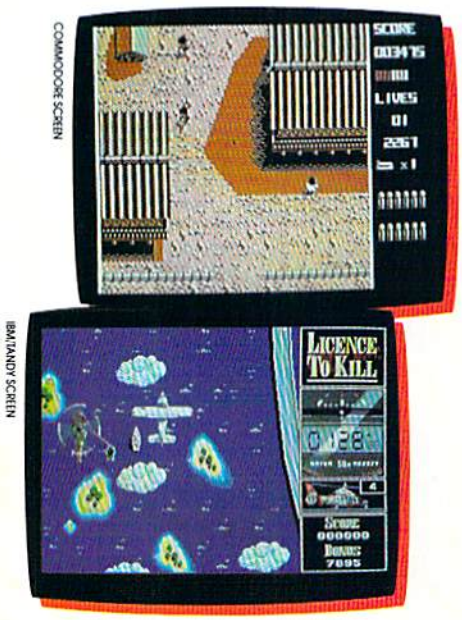

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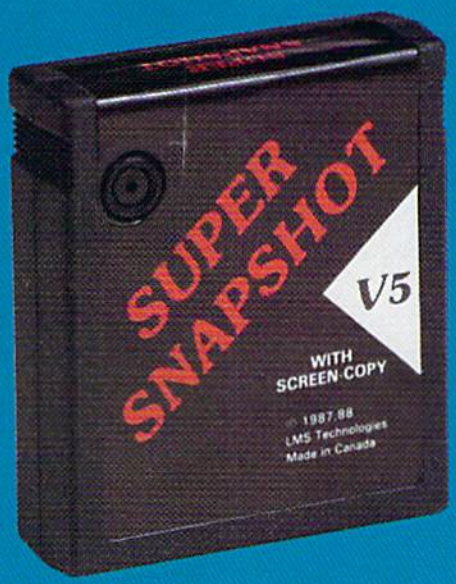

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COMPUTE!'s Gazette (ISSN 0737-3716) is published monthly by COMPUTE! Publications, Inc., ABC Consumer Magazines, Inc., Chilton Company, one of the ABC Publishing Companies, a part of Capital Cities/ABC, Inc., 825 Seventh Ave., New York, NY 10019. © 1990 ABC Consumer Magazines, Inc. All rights reserved. Editorial offices are located at Suite 200, 324 West Wendover Ave., Greensboro, NC 27408. Domestic subscriptions: 12 issues, $24. POSTMASTER: Send Form 3579 to COMPUTE!'s Gazette, P.O. Box 3255, Harlan, IA 51537. Second-class, postage paid at New York, NY and additional mailing offices.

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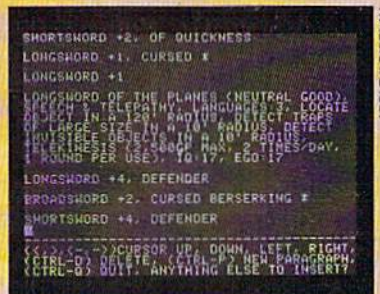

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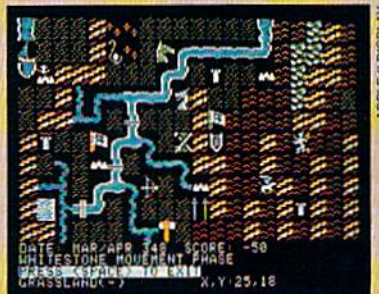

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EDITOR'S notes

A new month, a new year, a new decade. When planning this issue, we decided to quit worrying about Commodore's financial situation, the 128's demise, and the 64's loss of market to Nintendo. We decided to have a little fun. In our cover story, "'80s Ups & Downs" (page 16), we take a trip down memory lane with Commodore. Remember Commodore's Max Machine or its $60 Digi-Drum synthesizer drum kit for the 64? How about the SX-100 portable? Or the Commodore TouchScreen? Whether you're a novice or a veteran user, you're bound to get a kick out of this retrospective of Commodore's notorious first decade.

If we're looking back, we're also looking ahead. "Future Computing: Neural Networks," the first installment in a three-part series, debuts this month (page 23). Neural computing, one of the hottest topics in contemporary computer research, is based on building computer models that emulate the human brain. It's fascinating stuff. But what does it have to do with the 64? Author Kevin Martin, a graphics programmer at Data General, has written several example programs for the 64, which will appear in Parts 2 and 3. If Kevin's name is familiar, it's because he has written a number of popular *Gazette* applications and utilities over the years.

If you're wondering how the 64 might fare in the 1990s, don't bother with Fred D'Ignazio's column this month. In "D'Iversions" (page 20), Fred altogether skips the nineties and looks at the 64 as a multimedia machine in the twenty-first century. He contends that the 64 has great potential as a catalyst for a multimedia workstation with desktop video, slide shows, and music. And, as usual, Fred asks for your opinions.

We have a variety of thought-provoking topics in this issue, and we haven't left out the programmers. If you consider yourself a 128 or 64 hacker, check out Randy Thompson's challenge in his "Programmer's Page" column (page 11). He presents a programming problem and then takes it upon himself to offer a cash reward for the best solution. Randy didn't check this out with anyone here at the office first, so the winner will be getting a personal check or money order directly from the columnist. (Just kidding, Randy.)

Our Editor's Choice programs this month are worth a close look. We have a stellar arcade-style game for the 64 in *Royal Rescue* and an excellent utility for 1581 disk drive users. *1581 FastLoader* gives both 64 and 128 users lightning-fast data transfer rates (up to nine times faster than the standard Kernal load routine) plus the true storage capacity of the 1581. The final Editor's Choice selection is *Screen Grabber*, this month's "GEOS Column" program. This topnotch desk accessory is designed for both GEOS and GEOS 128 users.

We have more exciting plans for our 1990 issues, so stay with us. You'll be glad you did.

Lance Elko
Associate Publisher/Editorial

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feedback

Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, **COMPUTE!'s Gazette,** *P.O. Box 5406, Greensboro, North Carolina 27403. We regret that, due to the volume of mail received, we cannot respond individually to programming questions.*

One-Liners

I would like for my programs to show only a SYS command when I list them. Several of the programs in your magazine contain only one line when they're listed (for example, 10 SYS2061). How do the authors do this?

Paul Belt
Franklin, MA

The programs you mention look like they contain only one line of BASIC because they're written in machine language. The authors of these programs assembled the BASIC line 10 SYS2061 at the beginning of their code so that the programs run as if they were written in BASIC. The SYS2061 command actually executes the machine language program that follows the line of BASIC.

80-Column Slow POKE?

I'm in need of an 80-column screen-blanking routine for the 128. I use my 128 at work to do a number of complex mathematical calculations using data received from an analytical instrument. I've heard that if I were to disable the screen, the time for computations would decrease. Is this true?

Ron Horinek
Phillipsburg, KS

This is true only for the 40-column mode. The 128's microprocessor can operate at two speeds, 1 MHz or 2 MHz. You can select the 2-MHz clock speed, generally known as fast mode, by entering BASIC's FAST command. Entering the SLOW command returns the 128 to its normal operating speed.

The VIC-II chip, which handles video output for the 40-column screen, can only run at 1 MHz, whereas the VDC (Video Display Controller) chip, which supplies the video for the 80-column screen, is capable of operating at the 2-MHz rate. Because of this, only the 80-column screen is usable in fast mode; the VIC-II chip simply can't keep up.

In your case, if your 128 is running in fast mode and you're using the 80-column display, your computer is operating at its maximum speed. On the other hand, if you must use a 40-column display, there are several ways to speed up your programs. In 128 mode, execute a FAST command prior to your calculations. This blanks the 40-column screen while the computer runs at 2 MHz. When your calculations have finished, restore the screen display by executing a SLOW command.

The 2-MHz clock speed is also available from 64 mode on the 128. If you're in 64 mode, use the following commands to blank the screen and speed up calculations:

```
POKE53265,PEEK(53265)AND239:POKE
  53296,1:REM FAST
```

Enter the command line below to restore the screen and return the microprocessor to its normal speed:

```
POKE53265,PEEK(53265)OR16:POKE
  53296,0:REM SLOW
```

Furthermore, if you blank the screen on a normal 64, the computer runs slightly faster since it no longer has to update the video display. To blank the screen on a 64, enter the command

```
POKE53265,PEEK(53265)AND239
```

and

```
POKE53265,PEEK(53265)OR16
```

to restore the screen.

A *Gazette* Index Disk Modification

I've found the *Gazette 5-Year Index* disk very useful. I've changed the default settings to drive number 9 and mouse control. In addition, I've revised program NT to load from drive 9. To complete the modifications, I'd like to revise the INDEX program so that it reads the mouse in joystick port 1, because this is where the mouse is connected for use in GEOS. Could you please let me know what POKEs are necessary to make this change?

J. Hugh Hulse
Burnaby, B.C., Canada

Before modifying any of the programs on the index disk, make a backup copy of the disk. Then, to make port 1 active and to save the new INDEX file to disk, place the backup disk in the drive and enter the following commands in direct mode (without line numbers):

```
LOAD"INDEX",8
POKE 11258,1:POKE 16497,1:POKE
  16623,1:POKE 16720,1
OPEN 15,8,15,"S0:INDEX":CLOSE 15
SAVE"INDEX",8
```

To run the modified program, enter LOAD"BOOT",8,1. You'll notice that there are a couple of quirks associated with using a port 1 mouse. First, the cursor in Edit mode flashes rapidly. Second, it's a little difficult to edit entries because port 1 interferes with keyboard input.

64-to-128 Program Conversions

I'm trying to convert a BASIC program on the 64 to the 128. There are some PEEKs, POKEs, and SYSs in the program that I'm not sure how to translate. For instance, what would be the equivalent of the following line on the 128?

```
100 POKE 781,LN:SYS 59903
```

What books can I get to aid in these conversions? Any information you could give me would be most helpful.

William Kempert
Woodstock, Ont., Canada

The best approach to translating BASIC programs like these is to place a STOP command at various points in your program. Then, try to determine what each PEEK, POKE, or SYS actually does. A memory map of the respective computer is invaluable in this process. In some cases, instead of accessing a machine language routine in ROM, you may find that you can accomplish a particular task with one or more BASIC commands, especially considering the 128's extensive BASIC. Some books you may wish to consider are Mapping the Commodore 64 and 64C, *from COMPUTE! Books, and* Anatomy of the Commodore 64, 128 Internals, *and* BASIC 7.0 Internals, *from Abacus Books.*

As for your line 100: POKE 781,LN places the line number LN in the storage area for the X register, and SYS 59903 calls a routine which clears the screen line that's currently in X. On the 128, the equivalent line would be

```
100 POKE 7,LN:SYS 50341
```

The routine at location 50341 performs the line-clearing operation on whichever display, 40- or 80-column, is currently active. **G**

LETTERS to the editor

Barking Up the Wrong Tree

I've learned that there is a copiers' guild in Indianapolis, but I haven't been able to find its name. Do you know of any there? If not, are there any around Chicago or the St. Louis area?

Andy Stocker
Mt. Vernon, IN

Sorry, Andy, we don't know of any copiers' guild in Indiana (or Chicago or St. Louis). And if we did, we wouldn't tell. We take a strong stance against illegal copying of software and any form of piracy.

Epyx's Exit

My son ruined my *Monster Movie* game disk from Epyx. I tried to reach Epyx, but I don't have the correct address. Can you give me the right address?

Earl Tanner Jr.
Lafayette, LA

Epyx, one of the eighties' most prolific entertainment software publishers, laid off most of its staff last September. Whoever's left at Epyx will reportedly be developing cartridges for dedicated videogame machines. We've heard that current Epyx titles will be marketed through December 31, 1989. By the way, we've had no success getting anyone at Epyx on the phone. If you'd like to write Epyx, we suggest you try this address: Epyx Software, P.O. Box 8020, 600 Galveston Drive, Redwood City, California 94063.

Rows and Columns

What are spreadsheets? What are they used for? I have a 128 and I use GEOS. Does Berkeley Softworks have a spreadsheet for GEOS?

Alan C. Judd
Durham, NC

In basic terms, a spreadsheet is a two-dimensional grid, or matrix, that contains boxes in which you can put information, usually numbers. Here's a simple example of how you might use one: Enter a list of your monthly budget items (mortgage payment, car payment, phone, food, and so on) in the leftmost column. Type in the amounts you expect to pay next month in the column to the right, and then type numbers for the subsequent month in the next column to the right, and so on. Choose a box, or cell, *at the bottom of the list (call it Total) to hold the sum of all the numbers in a single column. When a budget item changes (say you budgeted $300 for food and you actually spend $390), type in the new figure and watch your total change. You can also set up your spreadsheet to carry totals across rows (in this example, you could carry a running total of the amount spent on groceries for three months, six months, a year, or whatever you choose). When you understand the instant what-if scenarios that a spreadsheet can create (What if I save $200 a month? What's left over if I buy a new car with a monthly payment of $300?), you can see why they are must-have tools for businesses, especially in financial and accounting areas. Almost all commercial spreadsheet programs include examples and complete explanations.*

Berkeley Softworks' geoCalc *is a fine spreadsheet that runs under GEOS128. It is currently available.*

Book Biz

I remember when you folks used to advertise your books for the 64. What's happened to them all? Could you please publish a list of books you still have and tell me how to order them?

Allan Bell
St. Maries, ID

For years, COMPUTE! Publications included COMPUTE! Books. In early 1988, the book company became totally separate from our magazine publications group. COMPUTE! Books now carries four titles for the 64: Commodore 64 Games for Kids *($12.95), by Clark and Kathy H. Kidd;* Machine Language Routines for the Commodore 128 and 64 *($18.95), by Todd D. Heimarck and Patrick G. Parrish (a companion disk including all programs in the book is available for an additional $12.95);* Mapping the Commodore 64 and 64C *($18.95), by Sheldon Leemon; and* Music System for the Commodore 128 and 64 *($24.95), a book/disk combo by Craig Chamberlain that features the* Enhanced Sidplayer, *probably the most popular music player and editor ever designed for the 128/64.*

These books may be ordered from The Chilton Book Company, One Chilton Way, Radnor, Pennsylvania 19089 (Attention: Customer Service Department). In addition to the price of the book you order, enclose $2.00 for shipping and handling, plus $0.50 for each additional book in the same order, and the appropriate sales tax for the state in which you reside. **G**

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* Single disks for *COMPUTE!'s Gazette* are $15.00. Disk/magazine combinations are $16.00 NOTE: No disks dated prior to June 1986 are available. The May 1986 and October, 1987 *Gazette* disks are no longer available.
* Back issues of *COMPUTE!'s PC Magazine* are $16.00 each. This publication is available only as a magazine/disk combination. Our back issue inventory consists mainly of magazines with 5.25-inch disks, but we will attempt to supply 3.5-inch disks if requested. The following issues are **NOT** available: ***PC Magazine:*** 9/87, 11/87, 9/88, 11/88.
* Back issues of *COMPUTE!'s Amiga Resouce* magazine are available beginning with Spring, 1989 for $6.00 each. Back issues of *COMPUTE'S Amiga Resource Disk* are available beginning with Summer, 1989 for $10.00 each. Disk/magazine combinations are $12.00.

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horizons

What Are They Up To?

Rhett Anderson

"Horizons" is sometimes frustrating to write. Take this month's column, for example. Try as I might, I was unable to weave the story of how my cat let eight bees into my apartment this past weekend.

Instead of that story (which really gets exciting toward the end because I'm allergic to bee stings), I had to settle for something just a bit more tame: font technology and computer graphics.

Font technology is a big story in the mainstream computer world, largely because of the personalities involved in a recent dispute over the future of how text is displayed and printed in current and future computers.

As is the case with most good computer stories, Steve Jobs and Bill Gates are involved. Steve Jobs is one of the cofounders of Apple and the founder of NeXT. Bill Gates heads Microsoft, supplier of MS-DOS and the BASIC languages built into just about every make and model of personal computer, including your 64 or 128.

Here's the background to the story. (Breathe now.) Steve Jobs used the language PostScript in the Apple LaserWriter. PostScript is written by Adobe. Desktop publishing went though the roof, taking Apple and Adobe with it. Every manufacturer that used PostScript in its printers paid large royalties to Adobe. Adobe's competitors tried to clone PostScript but didn't have much success. Meanwhile, Apple sued Microsoft for copying its desktop interface for Presentation Manager. Jobs used PostScript in his NeXT computer's laser printer and on its screen.

And here are last week's developments. (Breathe again.) Apple announced that Microsoft will be supporting its new font technology (code-named Royal) in exchange for Microsoft's PostScript clone. Adobe's John Warnick got nasty, then said he will release the specifications for the "hints" that Adobe uses to improve the quality of scaled fonts. Jobs (as you might expect) said that Apple and Microsoft are making a huge mistake.

My favorite part is where Apple sues Microsoft and then joins up with them. Capitalism makes for strange bedfellows.

The story isn't easy to follow, especially as I presented it here, but it makes a little more sense if you understand fonts and what they're all about.

About Fonts

The Commodore 64 is one of the many computers that has a character generator built into its video hardware. All other 8-bit computers (I like to include the IBM PC in this group) use this technique. The advantage is speed. To put a character on the screen, just place a single number into video memory.

On more powerful computers like the Mac, Amiga, and NeXT, the display is entirely pixel-based. In other words, the system software has to "draw" each character onto the screen. This approach is slower, but it leads to some nice-looking displays. For instance, you can use proportional fonts. That's how GEOS works on the 64—by using the hi-res screen instead of a text screen.

The problem with bitmap fonts is that they can't be enlarged or shrunk very well. If you enlarge an 8 × 8 pixel character, it will still look like an 8 × 8 pixel character. If you shrink it, critical parts of the letters will disappear.

The solution is outline fonts, fonts which consist of letters made up of straight lines and curves. Take a close look at the letters on this page. Can you see the dots that make up the letters? Not without a microscope. The letters are made up of line segments and curves and are output on a very-high-resolution typesetter. The typesetter has much higher resolution than a PostScript laser printer, but it works in much the same way.

Odds are that you'll never see outline fonts on the 64. It's just not practical. But there's no reason that you couldn't hook up the 64 to a PostScript laser printer and substitute the printer's built-in fonts for your onscreen fonts.

High-End Graphics

Another thing you'll probably never see on the 64 is a high-quality ray-tracing program. A *ray tracing* is a graphic that traces a light ray from every pixel on the screen out into a 3-D model of the real (or unreal) world. If the ray hits something blue, the pixel will be blue. If the ray hits something red, it will be red. The ray may bounce off metallic surfaces or move through glass surfaces.

The 64 could do the calculations, though not very fast. The problem is that the 64 just doesn't have the resolution to make a realistic image. Worse—it has only 16 colors, and those colors cannot be changed.

If you're interested in realistic computer graphics, there's a new book that should be of interest to you. It's called *Visualization: The Second Computer Revolution* by Richard Mark Friedhoff and William Benzon. It's from Abrams and costs $49.95. It has some amazing computer graphics. As a bonus, the text is interesting, if you'd like to know how human vision works.

The book shows how various shading algorithms work (including Lambert, Gouraud, and Phong shading). It also shows examples of texture mapping, bump mapping, and ray tracing. Unfortunately, the algorithms themselves are not given; this is disappointing to the programmers among us.

Some of the graphics are presented as stereo pairs, which means that if you can cross your eyes without becoming nauseous, you're in for a real treat.

Down to Earth

So what is this column all about? Maybe it's about looking outside of our everyday world to see what's going on somewhere else. Maybe a programmer will be inspired to stretch the 64 into doing outline fonts or ray tracing. It wouldn't be the first time that a programmer has brought an idea from the so-called high end to the so-called low end.

But I'd like nonprogrammers to think about the high end, too. Computers are being used to make movies, TV commercials, magazines, and much, much more. No single computer is good at everything. The 64 has its limitations, after all. It's helpful to look up occasionally and see what other computers are being used for. And after all, I suppose that's what "Horizons" is all about. If Commodore decided to make a new 64 with a hi-res screen and a lot of colors, you could see whole new kinds of programs appear.

By the way, if you read last month's "Horizons," you may be interested to know that I received several more suggestions (each one unique) as to who was the first to discover the properties of the sums of consecutive numbers. The world may never know. **G**

THE programmer's page

Two Odd Ideas

Randy Thompson

"The Programmer's Page" is interested in your programming tips and tricks. Send all submissions to The Programmer's Page, COMPUTE!'s Gazette, *P.O. Box 5406, Greensboro, North Carolina 27403. We'll pay $25–$50 for each tip we publish.*

Did you know that there's 4K of RAM hidden beneath the 64's hardware registers? Or that with some Commodore printers you can print disk-based text files while the disk drive and printer are completely disconnected from your computer?

The following is a list of interesting, if not useful, facts about the 64 and its peripherals. It's the type of information that you may have heard at one time or another, thought *Gee, that's neat,* and then quickly forgot because there was no obvious application for such a strange feature.

Tips like these can be quite valuable in certain situations, however, so take a close look and see what you can find. There's bound to be something here to pique your imagination. After all, such arcane pieces of hacking trivia are often the sparks that ignite great new programming ideas.

Rarely Used RAM

Just like BASIC and Kernal ROM, hardware locations 53248–57343 ($D000–$DFFF) hide a block of RAM which can be switched in and out by POKEing memory location 1. (Note: The video chip always sees this memory as character ROM.) Because activating this RAM blocks access to the VIC II chip, SID chip, CIA chips, and even BASIC and Kernal ROM, this is undoubtedly the most unused area of RAM found on the 64.

To switch in the $D000–$DFFF RAM, store a 52 ($34) into location 1. This turns the 64 into an all-RAM machine. Every single byte of memory, from $0000 all the way up to $FFFF, becomes random access memory (this is when your 64 truly becomes a 64K computer). Because the 64's operating system relies heavily on the use of ROM routines and I/O chips, you can't execute this POKE from BASIC and get away with it—your computer will lock up. Using the following instructions, however, you can perform this operation from machine language:

```
SEI
LDA  #$34
STA  $01
```

After feeding this code to your 64, you can access all of the RAM that the computer has to offer. Note that interrupts must be disabled before the RAM is switched in. If they aren't, the 64 attempts to call interrupt routines that no longer exist. And remember, after this RAM is in place, you lose all access to chip registers and ROM routines. You're completely on your own; you can't even change the border color, make a sound, or read a key from the keyboard.

To return the computer to normal, use these instructions:

```
LDA  #$37
STA  $01
CLI
```

The most obvious use for this RAM would be for data storage. Personally, I'd like to see someone execute program code here, although I'm still trying to think up practical reasons why anyone should do so. How about you? Do you have any ideas?

Computerless Printing

Because of the way Commodore peripherals communicate via the serial bus, you can print disk-based text files while the disk drive and printer are completely disconnected from your computer. When the computer wants a device to receive data, it sends that device a LISTEN command. When the computer wants a device to transmit data, it sends that device a TALK command. By sending the printer a LISTEN and the disk drive a TALK, you can get your peripherals to communicate with each other, without having to use the computer as a translator.

For example, the following program prints text files from disk without tying up your computer's microprocessor. In fact, once the initial TALK and LISTEN commands have been sent, you can unplug the disk drive and printer from the computer and the file will continue to print. (Of course, the disk drive and printer must remain connected to each other.)

By default, this program uses locations 49152–49218. The program is completely relocatable, however. To move its starting address, simply change the value assigned to the variable SA in line 110. You might try location 828, the 64's cassette buffer. At 67 bytes, this routine is small enough to fit almost anywhere.

```
SR 100 REM PRINT SPOOLER
PP 110 SA=49152
HQ 120 FOR A=SA TO SA+66
BS 130 READ D:POKE A,D
MM 140 NEXT
SF 150 DATA 32,121,0,240,59,32
       ,231,255
CC 160 DATA 32,212,225,165,183
       ,240,49,169
KR 170 DATA 1,160,2,32,186,255
       ,32,192
KE 180 DATA 255,169,0,32,189,2
       55,169,2
AM 190 DATA 162,4,160,7,32,186
       ,255,32
ER 200 DATA 192,255,162,2,32,2
       01,255,162
PJ 210 DATA 1,32,198,255,32,15
       1,238,169
XJ 220 DATA 0,133,153,169,3,13
       3,154,96
AK 230 DATA 76,8,175
```

To use this program, type it in, run it, and then execute a **SYS 49152** ***"filename",device#*** where *filename* is the name of the sequential ASCII file and *device#* is the device number of your disk drive (usually 8 or 9). The disk drive will whir and the printer should start printing the specified file.

This routine has a couple of quirks, as you'll find out if you run it. First, the disk drive doesn't know when it has finished with its task, so it keeps spinning happily along until you enter the command CLOSE 1. Second, it only works with certain printers. To check whether it works with your printer, you'll have to type in the program, run it, and see what happens.

Now here's a challenge. I'd like to see this technique expanded on, and most of all, I'd like to see it work on all printers. So if any of you adventuresome programmers can get this computer-independent, file-printing routine to work on all Commodore-compatible printers, send it to me at the address listed above and I'll check it out. If it works, I'll print the program here and mail you a check for $50. Get it to work with all printers on both the 64 and 128, and I'll send you $75. So break out your assembler and your programming manuals—you have a job to do. **G**

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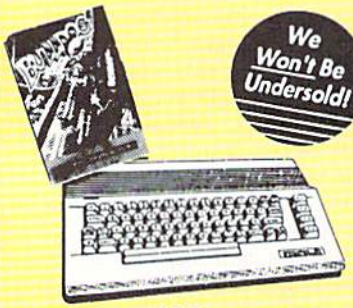

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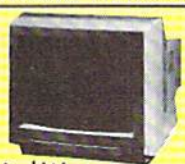

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BASIC for beginners

Lesser-Known Commands

Larry Cotton

Happy New Year! If you've been following this column for any length of time, you may realize that we've covered a lot of BASIC commands (almost 50), and that we've done a lot with them. How could there possibly be more? Well, there are.

This month, I'll begin a series on some of the lesser-known commands of the BASIC language. Although they may be used infrequently, these commands are both powerful and convenient. They are (in no particular order): SIN, COS, TAN, ATN, ABS, SGN, WAIT, POS, LOG, EXP, AND, and OR (and this still doesn't complete even the Commodore 64's basic BASIC!).

SIN, COS, TAN, and ATN are useful in solving certain math problems—especially those that involve triangles and other geometric figures. In turn, solutions to these math problems are often required to draw high-resolution graphics images on the screen.

SIN, COS, TAN, and ATN are used to find lengths of sides and sizes of angles in certain triangles. There is nothing at all mysterious about these commands; they're quite easy to use, as we'll see. The computer, of course, does the hard part.

In order to use these BASIC functions (SIN, COS, TAN, and ATN), the particular triangle you're considering must contain a right (90-degree) angle (or be able to be broken into smaller triangles that do). Figure 1 shows such a triangle—a *right triangle*. Without going into any great trigonometric detail, we first must become familiar with several terms, specifically, the labels for the sides and angles of this triangle.

SOPH, CASH, and TOPA

To calculate any one thing about a triangle, you must know at least two other things besides the fact that one angle is 90 degrees. Let's say we know another angle is 40 degrees and one side is three inches. (Angles are commonly expressed in degrees in both the English and metric systems; lengths are usually expressed in inches, feet, yards, or miles in the United States and Great Britain, while most of the rest of the world expresses them in meters or fractions of meters.)

In Figure 1, we want to find the length of one side (S); it's opposite the known angle and is thus called, appropriately enough, the *opposite* side. We also know the side adjacent to the known angle. It's called, not surprisingly, the *adjacent* side. (The long side, opposite the right angle, is unfortunately not called the long side, but rather the *hypotenuse*.)

Here are the three formulas that you may recall from math classes (past or present) which deal with angles of triangles:

SIN X = opposite/hypotenuse
COS X = adjacent/hypotenuse
TAN X = opposite/adjacent

where X represents the angle. As you can see, SIN (which stands for, and is pronounced like, sine), COS (for cosine), and TAN (for tangent) are simply fractional representations, or ratios, of lengths of a triangle's sides. As a triangle gets larger or smaller while allowing the three angles to remain the same, the ratios of the lengths of the sides remain constant.

A memory aid to help in remembering these basic formulas are three acronyms: SOPH, CASH, and TOPA. The meanings of the acronyms are as follows:

SOPH (Sine = OPposite over Hypotenuse)
CASH (Cosine = Adjacent Side over Hypotenuse)
TOPA (Tangent = OPposite over Adjacent)

Solving the Triangle

Getting back to our problem: Since we know the side adjacent to the 40-degree angle and are looking for the side opposite it, we use the third of the above formulas:

TAN 40 = S/3 (opposite side/adjacent side)

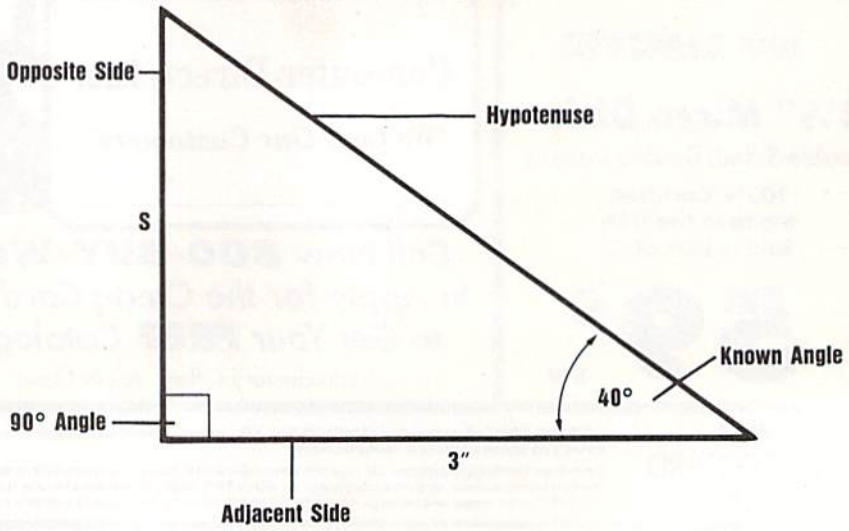
It's extremely important to choose the correct formula of the three, so stop right now and make sure you understand why we picked the third one. It wouldn't have worked to solve for sine because we don't know either the side opposite the 40-degree angle or the hypotenuse. The cosine could have been used to find the hypotenuse—but not the opposite side.

Ready to move on? We want to determine S (which represents our unknown side's length) on the left side of the equation. I use cross-multiplication to achieve this (I'm a firm believer in shortcuts):

TAN 40/1 = S/3

Multiplying S by 1 is equal to TAN 40 times 3. Thus, S equals 3 times TAN 40 degrees. On most hand-held scientific calculators, to find the tangent of 40 degrees, just press 4, and 0, and then hit the TAN key. Unfortunately, we can *not* enter PRINT TAN 40 and press RE-

Figure 1. A Right Triangle



TURN on a computer. The computer works only in *radians*, unlike the calculator, which can usually handle either degrees or radians. (A radian is equal to $180/\pi$ degrees.)

Here's a short program that converts angles from degrees to radians and then calculates the sine, cosine, and tangent of the angle.

```
10 INPUT"ANGLE IN DEGREES";A
20 R=A/(180/π)
30 PRINT"ANGLE IN RADIANS IS"R
40 PRINT"SIN OF"A"DEG. ="SIN(R)
50 PRINT"COS OF"A"DEG. ="COS(R)
60 PRINT"TAN OF"A"DEG. ="TAN(R)
```

To calculate our unknown side S, we simply add one more line:

```
70 S=3*TAN(R):PRINT"SIDE S
   ="S"INCHES."
```

If we enter 40 at the input prompt, we now have a final answer of about 2.5 inches. Does this look like a logical length for side S? (I'm also a firm believer in checking to see whether an answer makes sense.)

Use of Trig Functions in Graphics

In plotting points, or in drawing lines on a computer screen, we often use trigonometric functions (SIN, COS, TAN, ATN) to calculate angles. If a point is located at (160,100) on a Commodore 64's high-resolution screen, it's 160 dots (or *pixels*) from the left edge and 100 pixels down from the top, or approximately in the center of the screen. The following are two of the first steps in plotting a line from that point to another point, say (180,135). (See Figure 2.)

- Find the horizontal distance from one point to the other. In our example, it's 180 − 160, or 20 pixels.

- Find the vertical distance from one point to the other. In our example, it's 135 − 100, or 35 pixels.

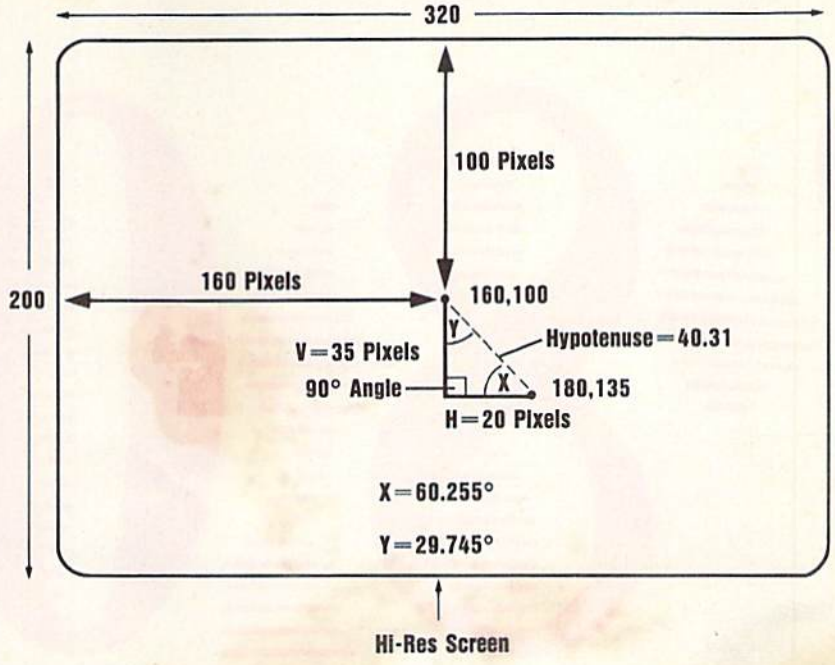
Thus, we now have a triangle with two sides (20 and 35 pixels) and one angle (90 degrees). We should be able to calculate everything else about the triangle. If we want to know the lower angle (call it X), we should again use the TAN function:

TAN X = opposite/adjacent
or
TAN X = 35/20 = 1.75

We now know the angle's tangent, but not the angle itself. How do we determine the angle X? Use ATN (ArcTaNgent), which is actually the inverse of the tangent function. Enter this short program:

```
10 H=20:V=35
20 R=ATN(V/H):REM ANGLE IN
   RADIANS
30 D=R*180/π:REM ANGLE IN
   DEGREES
40 PRINT"ANGLE IS"R"RADIANS"
50 PRINT"OR"D"DEGREES"
```

Figure 2. Plotting a Right Triangle on a 64 Screen



To find the upper angle (call it Y), we write

TAN Y = opposite/adjacent
or
TAN Y = 20/35 = 0.5714 (approximately)

Then change only line 20 in the above program as follows:

```
20 R=ATN(H/V)
```

(Of course, you probably remember that the sum of the angles in a triangle equals 180 degrees. So, once you know angle X, you could easily determine angle Y by mere subtraction.)

The length of the long side—the hypotenuse—can be found by using SIN or COS now that we know the angles. Try these. It can also be found without using any of the trig functions, since we know the two perpendicular sides' lengths. We use the *Pythagorean Theorem*, which says that the hypotenuse is equal to the square root of the sum of the squares of the two perpendicular sides. Translated into BASIC:

```
10 INPUT"HORIZONTAL SIDE";H
20 INPUT"VERTICAL SIDE";V
30 SUM=H↑2+V↑2
40 HYP=SQR(SUM)
50 PRINT"HYPOTENUSE ="HYP
```

Recall that the up-arrow symbol (on the same key as the pi symbol) raises any given number to a power. If we input 20 and 35 at the prompts, the computer squares them, yielding 400 and 1225. Adding 400 and 1225 yields 1625. We then take the square root of 1625 to get 40.31 pixels, the length of a line closing the triangle. Try entering 3 and 4 at the prompts; then enter 5 and 12.

Actually, plotting these high-resolution lines is unfortunately beyond the scope of this column, but it's covered to some extent in the *Commodore 64 Programmer's Reference Guide*. Next month: More trig! **G**

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Mickey McLean

The personal computer industry has just come through its first decade. And what a wacky ten years it has been—a roller-coaster ride of steep peaks and deep valleys. Commodore's trip has been especially long and wild. As an early player—Commodore actually introduced the PET computer in the summer of 1977—Commodore wasn't a household name until the early 1980s, when the rest of the world discovered personal computing. Here's a nostalgic look at an astounding decade of Commodore innovations, laughs, and gaffes.

1981

WINTER

The **VIC-20** is introduced at $299. Personal computing for the masses is now possible, but there are problems—the first units run too hot and radiation emission standards are not met.

1982

WINTER

The **Commodore Unimax** or **Max Machine** is introduced. This $179.95 game machine has a full-size bubble-membrane keyboard and uses the same processor chip, sound chip, video chip, Datassette recorder, joystick, paddles, and game cartridges as the soon-to-be-released 64. It is sold in Japan, but never makes it to the U.S.

SPRING

The **1540 Single-Drive Floppy,** long promised for the VIC, is released.

SUMMER

Evolution becomes revolution with the **Commodore 64.** Its 16-colors, eight sprites, 40-column screen, and sophisticated sound (SID) chip dazzle the computing world. Introductory price is $595.

Commodore announces the P-Series. The **P128** (also called the **P-500**) is to be a souped-up 64 with 128K expandable to 896K that sells for $995.

1983

WINTER

The Consumer Electronics Show becomes Commodore's main venue to introduce new computers and peripherals. At the January Las Vegas show, Commodore debuts the **Commodore SX-100,** a portable 64. Bundled with a black-and-white screen, the introductory price is $995. A version with a color screen and two drives costs $1,295. This machine is never released—although a later incarnation will become available. Commodore's early pre-PET business product, the hand-held calculator, is resurrected in the **HHC-4** (*HHC* is an acronym for *Hand-Held Computer*). This calculator-style unit features a 24-character liquid-crystal display and contains 4K of RAM expandable to 16K. Commodore sets the price at $199 but never offers it for sale. Other products showing at CES include a plug-in synthesizer keyboard and a voice synthesizer, each listing for under $100. Another music peripheral Commodore introduces is **Digi-Drum,** a three-pad synthesized drum kit that sells for $59.95. A four-pen printer plotter for the 64 and VIC ($199.95) and a 13-inch color monitor ($299.95) are also prominent. Commodore also shows an experimental prototype of the VIC-20 with a Sony Watchman built into the keyboard.

Rumors spread about a price reduction of the 64 to $399.

SUMMER

After four years of covering Commodore computers in *COMPUTE!* magazine, COMPUTE! Publications launches a dedicated Commodore magazine, *COMPUTE!'s Gazette*. This magazine, which debuts in July, is an instant hit, tracking as one of the fastest growing magazines in publishing history.

At Summer CES, the redesigned P128 becomes the **B128/256-80,** a monochrome-display, 80-column business computer. Release date is set for 1984, but the machine never makes it. The SX-100 portable is renamed the **Executive 64.** It now includes a six-inch color monitor and sells for $995.

Commodore announces that the wholesale cost of the 64 will be cut to $200.

FALL

Many new peripherals are released by Commodore: the **Datassette,** the **1525-E Printer,** the **1515 Disk Drive,** and the **1541 Disk Drive.** Also debuting are the BMC Color Monitor and the Exactron Stringy Floppy, a high-speed cassette-based data storage device. Third-party software developers bring a flurry of new products for the rapidly growing market.

Commodore tops $1 billion in sales. ▷

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Does Your Computer Need A Cassette Recorder?

The Programmer Behind Galactic Blitz

Liven Up VIC & 64 Programs With Sound

Two music peripherals from Commodore—the Digi-Drum (left), a plug-in synthesized percussion instrument for the 64 and VIC, and a plug-in synthesized keyboard for the 64 (below)—debuted at the January 1983 Winter Consumer Electronics Show.

1984

WINTER

Gazette's January issue introduces *SpeedScript*, the soon-to-be-popular word processor for the VIC and 64.

At January CES, the **Executive 64** is now known as the **SX-64.** This version, priced at $995, features a built-in 5-inch color monitor and a 170K 5¼-inch disk drive. The biggest stirrings at CES center around the **Commodore 264** and **364.** The 264, which is to feature built-in applications software, 60K of RAM, and 128 colors, is expected to be sold for under $500. The 364 is reported to add built-in speech and 48K of ROM. Other product introductions from Commodore include the **1703 Color Monitor, SFS 481 Fast Disk Drive** for the 264 and 364, **1542 Disk Drive,** a plastic screen overlay dubbed the **Commodore TouchScreen,** the **Commodore Light Pen,** and the **Magic Voice Speech Module.**

A scaled-down version (16K) of the 264 named the **TED-16** is introduced after CES with a price point under $100.

In February, Commodore founder Jack Tramiel moves to Atari. Marshall Smith assumes the leadership role.

SPRING

With the May issue, *Gazette* readers can now purchase each month's type-in programs on disk.

SUMMER

The 264 is renamed the **Plus/4.** The TED-16 becomes the **Commodore 16.**

Commodore stops production of the VIC-20.

The 364 is shelved indefinitely.

At Summer CES, Commodore introduces the **DPS 1101** daisywheel printer for the Plus/4 and the **MPS 802** dot-matrix printer. The **MPS 803** dot-matrix printer for the C16 is also displayed. The **1531 Cassette Unit** makes an appearance. Also at CES is a group from the Amiga Corporation, quietly showing a prototype of a new machine code-named Lorraine.

In August, Commodore purchases the Amiga Corporation. Months later, Tramiel files suit on behalf of Atari over rights to the Amiga.

Commodore 16

FALL

Commodore sells its Santa Clara manufacturing center and closes its Dallas Research and Development center.

Commodore announces the **Educator 64** computer. Old PET casings are pulled out of warehouses, dusted off, and used to house the system. A built-in monochrome monitor is included.

Commodore's first MS-DOS machine, the PC10, came to the U.S. after it was already a proven success in Europe and Canada.

1985

WINTER

Commodore introduces the **1551 Disk Drive,** originally announced as the SFS 481 for the Plus/4. The 1551 is not compatible with the 64.

Buzzing at Winter CES centers on the introduction of the **Commodore 128.** Commodore announces that this 80-column computer will sell for less than $300. For the third time in as many years, Commodore attempts to market a portable computer. The under-$600 **Commodore LCD** laptop computer features built-in software, a modem, and a flip-top screen. It never hits the market. Other CES product announcements include the **1571 Disk Drive, 1901 Monochrome Monitor, 1902 RGBI/Composite Monitor, Commodore Mouse,** and **1670 Modem.** Commodore also announces the formation of a national service network that includes 160 RCA service centers, 800 Sears stores, and 1300 other locations.

Pepsi Cola executive Thomas Rattigan replaces Marshall Smith as Commodore president.

SUMMER

Commodore jumps on the PC-compatible bandwagon by announcing availability in the U.S. for the **PC10** and **PC20,** both proven successes in Europe and Canada. The UNIX-based **Commodore 900 Business Computer** is also introduced.

Commodore's booth at Summer CES features the **1572 Disk Drive, MPS 1000 Printer, 1670 Modem,** and **Commodore Mouse Controller.** Third-party software developers pledge to support the 128.

HAVEN'T I SEEN YOU BEFORE?

Commodore usually announces its newest products at the Winter and Summer Consumer Electronics Shows. Many of these products made their debut more than once.

- Commodore attempted several times to market a portable computer. The first of these was the SX-100, which was renamed the Executive 64 a year later. Six months after that, it was rechristened the SX-64. The following year the SX-64 was ditched and the Commodore LCD with a flip-top screen made its debut. The SX-64 was the only model to actually make it to the marketplace.
- The Plus/4 began its life as the Commodore 264, while a scaled-down version of the 264 started out as the TED 16 and was later reintroduced as the Commodore 16.
- The planned P128, a souped-up 64, later became the P-500, and then was reworked as the B128/256-80, a monochrome business computer.
- A strange reincarnation involved the inner workings of a 64 placed inside the outer casing of a PET. This was known as the Educator 64.
- The original 64 took on a new, sleeker exterior and became known as the 64C; the 1541 Disk Drive, which became the 1541C, was also cosmetically changed.
- The 128D was actually a rerelease of the European version of the 128. It was not originally released in the U.S. because the FCC at that time would not approve the computer's configuration.

I COULDA BEEN A CONTENDA

Commodore always had the best of intentions to actually release the products announced at CES, but many were only prototypes and never made it to store shelves.

Like all personal computer companies, Commodore now faces stiff competition from game-machine makers. Most people do not remember that Commodore had a game machine of its own. The Max Machine (sometimes known as the Unimax) was patterned after the 64 but was sold only in Japan.

Commodore, known for hand-held calculators before entering the computer arena, announced but did not release the HHC-4. Like many of the hand-helds being released today, the HHC-4 could exchange data with personal computers, in this case, the 64 and VIC-20.

The Commodore 364 was mostly talk and was patterned after the 264 (or Plus/4). It would feature built-in speech and 48K of ROM. It was scrapped completely a year after Commodore's initial announcement.

The portable SX-100, Executive 64, and Commodore LCD never made it, although the SX-64 portable had modest success. It's now regarded as a collector's item.

The popular Commodore Colt

1986

SPRING

Berkeley Softworks reenergizes the 64 with the introduction of **GEOS.**

Commodore lays off 140 workers at its West Chester, Pennsylvania, headquarters.

SUMMER

Commodore returns to Summer CES armed with the new-look **64C** and confidence bolstered by the popularity of GEOS. Commodore announces the bundling of GEOS with the 64C. Other products on display include the **1541C Disk Drive** (a new color-coordinated version of the 1541 to match the 64C) and the **1802 Monitor** with an 80-column monochrome mode. The Amiga, now positioned by Commodore as a business computer, is conspicuously absent from the show.

FALL

Commodore reveals losses totaling $127.9 million for fiscal 1986.

1987

WINTER

Commodore changes its marketing course and brings the **Amiga 500** and **2000** to Winter CES. The **Commodore 128D,** with detached keyboard and built-in 1571 disk drive, makes its U.S. debut. Other new Commodore products include the $399 **1581 Disk Drive,** which handles 3½-inch disks, and the $129 **1764 RAM Expansion Module.** Commodore extends its PC line with the **PC10-1** and the **PC10-2.**

SPRING

SpeedScript **3.2** is featured in the May issue of *Gazette.*

FALL

Max Toy replaces Thomas Rattigan as president of Commodore.

Commodore announces profits of $28.6 million for fiscal 1987.

1988

SPRING

Commodore's MS-DOS line extends with the introduction of the **Commodore Colt.**

SUMMER

GEOS 2.0 is introduced at Summer CES.

FALL

Commodore introduces the **Amiga 2000HD** and **2500.**

1989

WINTER

Commodore returns to CES with its complete line of Amigas and new PC compatibles.

SPRING

Max Toy resigns, and Harold Copperman is lured away from Apple to replace him.

Toy

Copperman

Commodore announces plans to reassert itself in the education market, with an emphasis on its Amiga line.

SUMMER

Rumors of the 128's death are confirmed in July.

FALL

The Amiga 500 is mass-marketed through outlets such as Sears. G

d'iversions

Computer of the 21st Century

Fred D'Ignazio

This month, we'll take a break from the Great Commodore vs. Nintendo Debate. I'm still getting dozens of letters (sometimes daily!). We'll leave the debate for now and talk about a surprise subject: the 64 as a computer of the future.

The Buzzword of the 1990s

This past Tuesday, I was in Flint, Michigan, teaching a workshop for the Michigan Department of Education. The subject of the workshop was multimedia.

Multimedia is the buzzword of the 1990s. It means being able to hook up all kinds of other electronic gadgets to your computer—things like video cameras, VCRs, musical keyboards, videodiscs, audio compact discs, CD-ROM players, and so on.

By the time you've finished plugging everything in, your computer bears little resemblance to the familiar machine you once used to play adventure games, do word processing, or sign on to a bulletin board.

A "multimedia computer" can do all these things. But it can also display lifelike, color photos, and full-motion video; play high-fidelity music, voices, and sound effects; and run colorful, animated slide shows.

Maybe it's the Nintendo of the twenty-first century!

Commodore's Contender

The computer I use to conduct multimedia workshops is the Amiga. The Amiga is an obvious choice, given its high-quality graphics and sound, its multitasking capabilities, and the large number of hardware and software products that link the computer to video and to electronic music.

Commodore has recently been emphasizing the Amiga's abilities as a multimedia workstation in schools. At the National Educational Computing Conference (NECC) held in Boston last June, the entire Commodore booth was devoted to multimedia applications. Cartoons, video, graphics, and electronic music poured from the Amiga computers sitting around the booth.

You could create Hollywood-style special effects—lights, cameras, action—on a desktop, all on an Amiga computer. It was, to say the least, very impressive.

Surprise, Surprise!

The Amiga is clearly Commodore's multimedia computer of choice. If Nintendo survives the 1990s (see my November column, "The Death of Nintendo"), it will probably have a battle on its hands with the Amiga.

"What sort of computer do you use?" I asked, certain I'd hear him talk about his Mac or his Compaq 386. "This computer right here," he said quietly, pointing at the meek little 64 sitting on the desktop.

But wait. Maybe there's another contender, a computer so modest, so humble, so inexpensive that no one has realized its true potential. No one has taken it seriously as a multimedia machine, but it's a computer that could launch us into the twenty-first century.

Enter the Commodore 64.

When my workshop began, I demonstrated the Amiga as the "multimedia platform of the 1990s." I stressed that, to do real multimedia, a computer had to have a high-speed CPU, incredible memory, and a hard disk with at least 20 million bytes of storage.

At that point, a teacher raised his hand. "I don't mean to disagree with what you've told us, Mr. D'Ignazio," he said politely. "But I've been working on multimedia projects with my students for an entire year, and we haven't been using an Amiga."

"What sort of computer *do* you use?" I asked, certain that I'd hear him tell me about his Apple Macintosh or his Compaq 386.

"This computer right here," he said quietly, pointing at the meek little 64 sitting on the desktop. "With my trusty 64 and a $29.95 program (*Home Video Producer* from Epyx), my students and I can make desktop videos with graphics, sound effects, and animation. And when we want to really spice things up, we use the SAM speech synthesizer. I think that a real multimedia computer of the future should be able to talk to you!"

Everyone in the class was in shock. We gathered around the 64 and watched the teacher as he hooked the computer to a VCR with a simple video dub cable from the monitor jack on the 64 to the VIDEO IN jack on the back of the VCR.

He showed us how he created fancy video titles, credits, and animations on the 64 and transferred them to a blank videotape on the VCR just by pressing the VCR's record button. He used his 64 to play music and generate speech, and he transferred these sound effects to the VCR through the VCR's AUDIO IN jack.

We watched homemade desktop videos, colorful electronic slide shows, and students' music videos, all created with the help of a lowly 64.

A New Debate

So, readers, what do *you* think? What features should a multimedia computer have? And which computer do you think will carry us into the twenty-first century?

The Amiga is a high-performance workhorse, but the 64 has some things going for it, too, including its low cost, its ingenious developers, and its incredible versatility. Which will survive? Write to

Fred D'Ignazio
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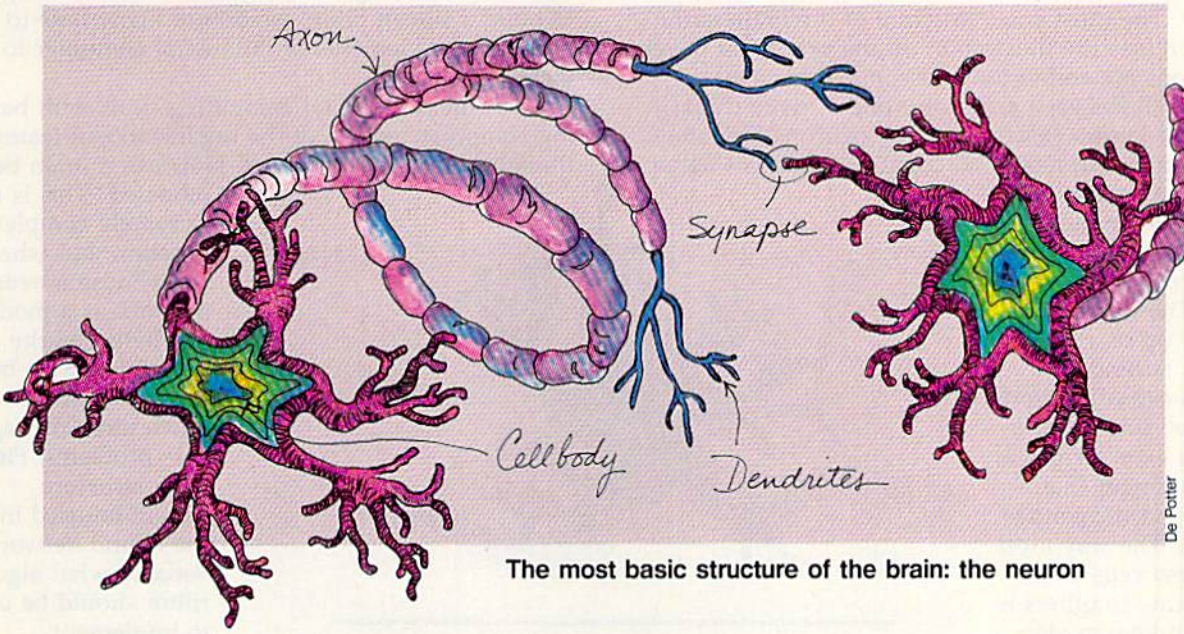


The most basic structure of the brain: the neuron

Neural Networks

Part 1

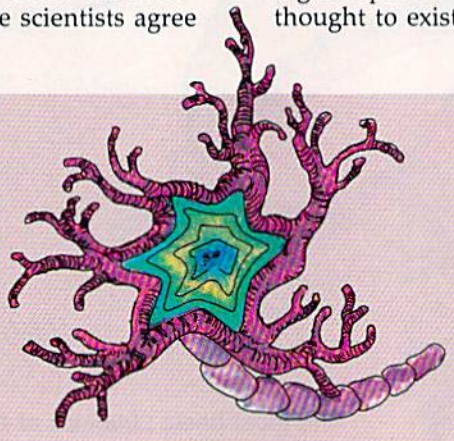
Kevin E. Martin

This month we debut the first in a three-part series on neural networks, probably the most promising line of AI (Artificial Intelligence) research today. Author Kevin E. Martin, currently working on graphics development at Data General, is best known to Gazette *readers as the author of several popular utilities and applications, including* SpeedCalc, Screen-80, MiniFiler, *and* X-BASIC.

Someday, computers will be able to speak, hear, see, and maybe even think. Of course, we're a long way from that day. Today, researchers are trying to discover the workings of the human brain by building computer models similar to structures that are thought to exist in the brain. These structures are called *neural networks.* The search has spawned a new science, neural computing, and we're just now beginning to see some significant advances within this field.

To understand tomorrow's computers, you'll need to understand what we know about the brain today. The most basic structure of the brain is the neuron (see the illustration on the preceding page). Neurons are connected in a complex structure which allows each and every one of us to think. No one knows exactly how the neurons are interconnected, but nearly all cognitive scientists agree that the power of the brain lies in the way that the neurons are interconnected.

The neuron is made up of a cell body, several dendrites extruding from the cell body, and a single axon (which is much longer than the dendritic connections). The way most of these cells communicate to others is by sending an electric pulse down the axon and transmitting it to other cells that have dendrites near the active axon. The region where the chemical interaction takes place is called a *synapse.* When one cell transmits its pulse across the synapse to the another cell's dendrites, an electric potential builds up in the second cell. Once this reaches a certain threshold, a pulse is sent down the second cell's axon to yet another cell's dendrites. This is the process by which the neurons in the brain communicate.



Even the fastest digital computer of today cannot tell the difference between an arm and a leg.

Neural communication is fascinating, but we still haven't discussed the brain's most amazing quality—its ability to learn. In 1949, Donald O. Hebb proposed a technique by which the brain could learn, and it is now commonly known as the *Hebb synapse.* It can be described as a modification of the strengths of the connections between two cells, but Hebb himself described it best: "When an axion of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased."

How close are we to building an electronic brain? Today's technology does allow us to build computers that have the size and complexity of the brain. Computers are made from silicon chips which function at nearly 100,000 times the speed of neurons. You might conclude that the computer would be that much faster and more powerful than a human, but even the fastest digital computer of today cannot tell the difference between an arm and a leg. Although we may have the technology to build a silicon brain, we do not know how to organize the elements of the neural computer to yield intelligence.

The field of neural computing deals with building computer models of the organizational features thought to exist in the brain. How can a brain be modeled? This is an extremely complex question, but when you choose a neural network as a model for the brain, the question can be broken down into two much more manageable problems: First, what structure should be used in the neural network? Second, what algorithm should be used to implement learning?

Many types of neural network models have been developed over the past several years. Most fit into three broad categories: associator networks, optimizing networks, and self-organizing networks. The associator will learn to associate an input and an output pattern so that when you present the network with the input pattern, it will return the correct output pattern. One example of an associator is discussed in the accompanying sidebar, "The Linear Associator."

Optimizing neural networks are used in problems in which an optimum solution is desired, and no easy algorithm exists. This neural network architecture was first explored by physicist J. J. Hopfield in 1982. This type of neural network deals with ideas taken from statistical physics, simulated annealing, and thermodynamics. The basic idea is to minimize the energy in the system. First, introduce a parameter into the neural network for temperature and start the network out at a high temperature. This causes the *processing elements* (PEs) to

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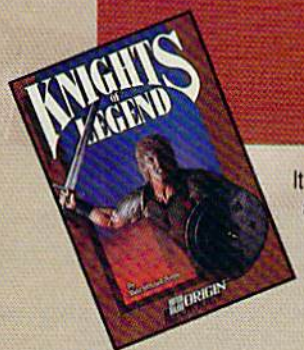

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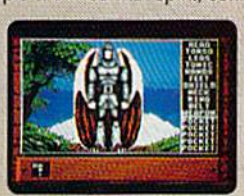

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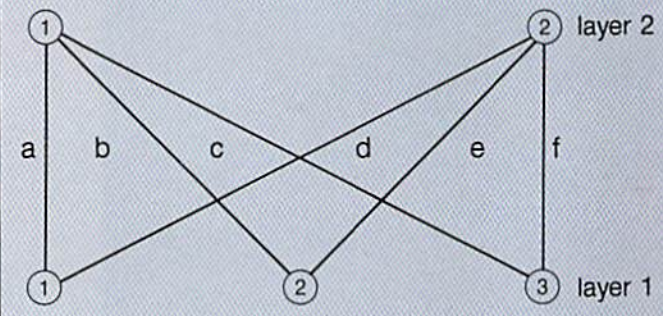
fire rapidly. Then, slowly cool the network down until it settles into a solution.

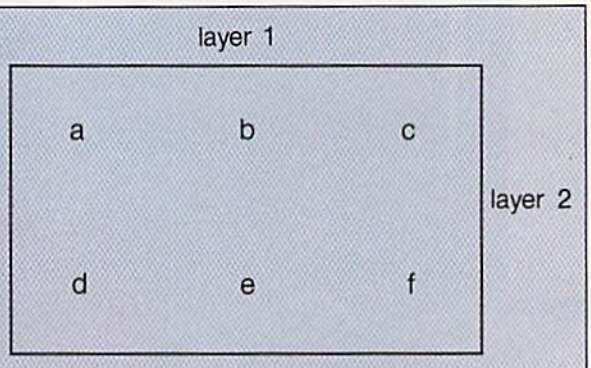
Self-organizing neural networks are much closer to the organizational principle thought to exist in the human brain. Our brain begins in a random state, and as we learn more and more about the world and its complex interrelationships, our brain begins to organize itself in a very structured way. No two brains are exactly alike, but generally they have the same organization. The self-organizing neural networks start from a random state and slowly organize themselves into a very structured pattern.

The LA neural network described in the sidebar learns to associate patterns of inputs and outputs, but there are limitations. Only certain inputs are learnable by the LA. Unfortunately, the number of these inputs it can learn is limited to the number of PEs in the input layer. So, even though you may have five PEs in the first layer and you can present 32 different input patterns to these five PEs, you still can make the network learn only five patterns.

A solution to the problem is found in another type of associating neural network, *back propagation.* This architecture is the most commonly used neural network today, and we'll discuss it in Part 2. G



Processing Elements (PEs) and connections in a simple Linear Associator (LA).



The connection matrix represents the strengths of the connections between PEs in the LA.

The Linear Associator

Let's take a quick look at the linear associator (LA), a simple neural network used to associate inputs and outputs through a single layer of connections.

Although most neural networks have very different structures, some similarities can be found:

- A set of processing elements (PEs)
- A connection matrix containing the weights of each connection between any two PEs
- The level of activation
- The learning and retrieval phases
- An input vector
- An output vector

In a linear associator, each processing element (PE)—represented in the diagram by a circle with a number inside of it—corresponds to the body of the neuron, or in some cases, each PE corresponds to a group of neurons collectively working together. Each PE represents some concept in the real world. Maybe a word, a letter, or even a single pixel in a grid where pictures of letters are presented. The PEs are divided into separate groups, or layers, and they are numbered in order by layers. The lines connecting the PEs of different layers correspond to the axon connections between neurons, and these connections are stored in the connection matrix.

When two PEs from different layers are connected, the strength, or weight, of the connection between them is stored in the connection matrix. The connection matrix is used to determine how to propagate signals between layers. The signal starts in the layer listed on top of the connection matrix and propagates to the layer listed along the side of the matrix. In this LA, the signal starts in layer 1 and goes to layer 2. Normally, the signal moves from a layer with a lower number to a layer with a higher number. This is not the case in all neural networks, but it generally holds true.

The weight of a connection is normally denoted by a number. If the connection is excitatory (that is, if the PE in the first layer excites the PE in the second layer), the weight of the connection is positive. If the connection is inhibitory (that is, if the PE in the first layer inhibits the PE in the second layer), the weight is negative. In the LA (and most other neural networks), you need to have both excitatory and inhibitory connections between PEs.

Every PE can be on, off, or somewhere in between. This is known as its *activation level.* The range of activation is usually between 0 and 1 or between −1 and 1. The LA uses activations between 0 and 1, where 0 is completely off and 1 is completely on. A PE is said to be active when its level of activation is near 1. Then, if the connection between it and another PE in the next layer is excitatory, the PE in the next layer becomes more active (that is, its activation level increases). The opposite happens when the connection is inhibitory.

The purpose of a neural network is to transform inputs to outputs. It does this in two distinct phases: learning and retrieval. During the learning phase in the LA, you present input and output vectors, and the network learns to associate the two patterns. During the retrieval phase, you present an input vector and the network gives you the output vector it has learned.

To teach our LA the correct patterns, we need to have a learning algorithm which will modify the weights in the connection matrix so that during the retrieval phase (as above), the correct output vector will be given. The process of neural network learning is probably the single most important feature of the network model. Without a learning algorithm, the networks could do only what they were designed to do when they were created. The most important feature of the learning algorithm to remember is that it works by modifying the weights in the connection matrix.

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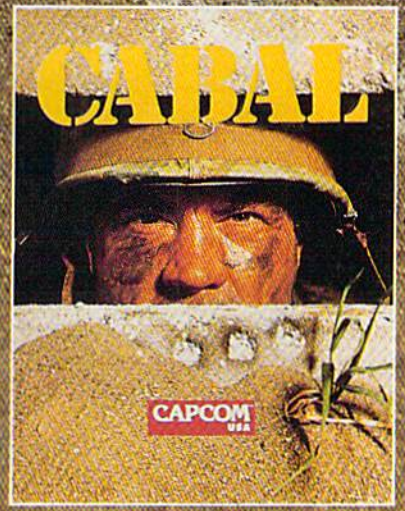

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1581 FASTLOADER

EDITOR'S CHOICE

David W. Martin

Realize the full potential of your 1581 with this fast-load utility for the Commodore 64 and 128.

Beginning with the 1541, the disk drives that accompany the Commodore 64 have always been sluggish, especially when compared to the drives in MS-DOS machines. With the introduction of the 1571 and 1581 drives, special burst routines were added to improve load times. But these were only available to 128 users; the 64 user still had to wait.

Commodore drives are so slow that a whole new class of hardware and software products, called *fast loaders* or *turbo loaders*, has grown up around them. These products come in a wide variety of configurations, ranging from hardware-only products to hardware/software combinations to software-only packages. Until now, most fast loaders have had two things in common: They sped up disk access times dramatically, and they were incompatible with the 1581 disk drive. Now, *1581 FastLoader* gives you the storage capacity of the 1581 plus extra speed.

Using customized DOS routines, *1581 FastLoader* provides high-speed data transfers that are up to nine times faster than the standard Kernal load routine. In some cases, it's almost twice as fast as *Quick!*, the 1541 fast loader published in the December 1988 issue. And it works with both the 64 and the 128 without blanking the screen or locking up non-1581 drives. Furthermore, with the *1581 FastLoader* installation program, you can relocate the program to nearly any memory location and create autoboot files that take full advantage of the fast loader.

Typing It In

1581 FastLoader is written in machine language, but we've listed it here as a BASIC installation program that runs on both the 64 and the 128. To ensure accurate typing, use *The Automatic Proofreader*, found elsewhere in this issue, to enter the program. When you've finished, be sure to save a copy of the program to disk.

When you run the program, it reads in the machine language routines and then displays the Fast Loader Options menu shown below.

```
Fast Loader Options
A) Install fast loader at $C000/49152
B) Install fast loader at $CD00/52480
C) Create fast loader binary file
D) Create fast loader autoboot file
S) Select device number
X) Exit to BASIC
     Default device: 8
     Computer: C64
```

The installation program automatically senses whether it's running on a 64 or a 128 and configures itself accordingly. If you're using a 128, options A and B install the fast loader at $1300/4864 and $1900/6400, respectively.

Options A and B install the fast loader in memory at the specified addresses and then turn it on. The SYS commands necessary to turn the fast loader on and off are displayed on the screen.

Option C allows you to write the fast-loader machine language to disk, and option D lets you create an autoboot file using *1581 FastLoader*. Both of these options are explained in detail below.

Option S allows you to select the disk drive on which *1581 FastLoader* creates its files. Pressing S increments the drive number by 1. When the number reaches 11, pressing S cycles back to 8.

Option X simply returns you to BASIC.

Installing Binary Files

Pressing C from the Fast Loader Options menu causes the following menu to be displayed:

```
Create 1581 Fastload Binary File
+) Increment memory location
-) Decrement memory location
R) Toggle run on bootup
I) Install fast loader on disk
X) Exit to options menu
Fast loader memory location: 52480
Run fast loader: YES
Computer: C64
```

You can use the + and − keys to change the starting address of *1581 FastLoader*. Pressing + increments the starting address by 256 bytes; pressing − decrements it by 256.

The 64 version of *1581 FastLoader* can reside in two areas of memory: from $0400 (1024) to $9D00 (40192) and from $C000 (49152) to $CD00 (52480). The installation program allows you to place the fast loader anywhere above $0400 (1024). This feature allows experienced users to place the *1581 FastLoader* under the BASIC or Kernal ROMs. If you do place the fast loader under the ROMs, you're responsible for switching them out before loading a file.

The 128 version of *1581 FastLoader* can be located anywhere in bank 0

RAM. However, it works best if located between $1300 (4864) and $1900 (6400). If you place the 128 version of *1581 FastLoader* below $1300 (4864), it may conflict with other programs. Also, it may not work with some bank configurations. Experimentation is the only sure way to determine whether the fast loader will work with your program.

The R option allows you to select whether or not the fast loader will be turned on after it's loaded. In some instances, you may want to load *1581 FastLoader* without activating it. If so, set the R option to No.

The I option installs the fast loader on disk. Before pressing I, place the disk to contain *1581 FastLoader* in the drive. (You can select the drive from the Fast Loader Options menu.) The installation program writes two files to your disk: BOOT.*xxxxx* and F*yyyy*, where *xxxxx* is the decimal starting address of the fast loader and *yyyy* is the hexadecimal starting address. The first file is an autoboot file that automatically loads and runs the second file. The second file is the code for the fast loader.

To use *1581 FastLoader* from either the 64 or the 128, use a command of the form LOAD"BOOT.*xxxxx*",*devno*,1. For example, to load and run *1581 FastLoader* with a starting address of 49152 from the disk in drive 8, type LOAD-"BOOT.49152",8,1. Note that *1581 FastLoader* isn't compatible with BLOAD, so 128 users also should use the LOAD command.

Creating Autoboot Files

Option D of the Fast Loader Options menu allows you to create a *1581 FastLoader* autoboot file. The installation program displays the following menu when you select the D option:

```
Create 1581 Fastload Autoboot File
A) Fast loader at $C000/49152
B) Fast loader at $CD00/52480
R) Toggle run fastload after booting
I) Install autoboot fast loader
X) Exit to options menu
Fast loader memory location: 52480
Turn fast loader off after booting: YES
Computer: C64
```

Options A and B allow you to select where the fast loader will reside while the autobooted file (the file that the autobooter loads) is loaded. If you're creating a 128 autoboot file, the fast loader must reside at $1300 (4864), so neither of these options is offered.

Option R toggles the fast loader on and off after the file is loaded. *1581 FastLoader* is used to load the autobooted file regardless of how this option is set. This option determines whether or not the fast loader remains activated after the autobooted file has been loaded. You should turn off the fast loader if there's a possibility that the autobooted file will overwrite it. Otherwise, leave it on to speed up subsequent loads.

Option I installs the autoboot file on the disk. Before you press I, place the disk containing the file to be autobooted in the disk drive. The installation program puts *1581 FastLoader* in memory and then prompts you for the name of the file. Type the name and press RETURN. Next, it asks whether the program you intend to boot is written in BASIC or machine language. If it's a machine language file, you'll have to enter its starting address.

After you answer all the questions, the program creates the autoboot file on your disk. On the 64, the installation program creates one file with the name BOOT64. To autoboot and run your program with *1581 FastLoader*, simply type LOAD"BOOT64",*devno*,1, where *devno* is the device number of the disk drive.

On the 128, the installation program creates two files, AB128 and BOOT128. To autoboot and run your program, you must type LOAD"AB-128",*devno*,1, where *devno* is the disk drive number. *1581 FastLoader* isn't compatible with BLOAD. If you try to autoboot your program by typing BLOAD"AB128," your program may crash unpredictably.

Fast Loading

Once *1581 FastLoader* is activated, no special commands are required to use it. Simply type LOAD"*filename*",8 or LOAD"*filename*",8,1 as usual. DLOAD is supported on the C128, but BLOAD may behave strangely. Relocation isn't supported by *1581 FastLoader*, so all files loaded with it are loaded at their saved address. In other words, *1581 FastLoader* always loads as if you had typed LOAD"*filename*",8,1.

The difference between loading with the standard load routine and loading with *1581 FastLoader* will amaze you. The first thing that you'll notice is that the green light on the disk drive flashes during a fast load. Don't panic; this is normal. You'll also find that, unlike other fast loaders, the screen doesn't blank during the load. The normal system-loading messages are displayed on the screen. Of course, the most important thing that you'll notice about *1581 FastLoader* is its speed. With the fast loader activated, load times can be as little as one-tenth as long as those achieved by the standard load routine.

Occasionally, you may need to disable *1581 FastLoader* and use the normal load routine (for example, when the file you're loading uses the same area of memory as the fast loader). You can disable *1581 FastLoader* by typing SYS*xxxxx*+3, where *xxxxx* is the fast loader's activation address. The installation program saves the activation address as part of the filename of the binary file, so you can always determine the deactivation address by looking at the disk directory. A less elegant way to disable *1581 FastLoader* is by pressing RUN/STOP-RESTORE.

Although *1581 FastLoader* speeds up disk loads from within programs, it doesn't speed up saves, verifies, or other file-handling commands (OPEN, PRINT#, GET#, and so on). Also, it may not work with commercial programs which are copy-protected.

How It Works

1581 FastLoader initially redirects the ILOAD vector at locations 816–817 ($0330–$0331) to itself. Henceforth, whenever you load from the disk drive, the program jumps to its own custom routine. Otherwise, it executes the normal Kernal routines.

Like the Kernal load routine, *1581 FastLoader* reads data from the drive in 256-byte sectors. But, unlike the Kernal routine, it uses both the DATA and CLK lines so that twice as much data (two bits) is transferred at a time. In effect, *1581 FastLoader* turns the serial bus into a two-bit parallel bus.

Some fast loaders store data in a temporary buffer as it's received. *1581 FastLoader* skips this step and transfers the data directly to its final memory location. Another unusual characteristic of this program is that it resides in both the computer and the disk drive. Each time you load a file using the fast loader, the computer sends a 200-byte machine language routine to the drive. The time required to transfer this program before each fast load explains why *1581 FastLoader* improves the load times for large files more than it does for smaller ones.

1581 FastLoader

```
HQ 10 REM COPYRIGHT 1990 COMPU
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       ALL RIGHTS RESERVED
RF 20 DIMTL(746),FL(57),AB(97)
      ,FM(153),CB(95),ZB(180):
      YN$="YES":DV=8
GJ 30 H$="0123456789ABCDEF":HD
      $="":DN=0:VE=PEEK(772)+2
      56*PEEK(773)
BK 40 SS$="{16 SHIFT-SPACE}":R
      EM SHIFTED SPACES
MK 50 CM$="C64":CL=52480:IFVE=
      17165THENCM$="C128":CL=6
      400
FS 60 GOSUB180:PRINTSPC(13);"
      {5 DOWN}PLEASE WAIT..."
PP 70 FORI=52480TO53226:READXL
      :TL(I-52480)=XL:NEXTI
FH 80 FORI=0TO57:READXL:FL(I)=
      XL:NEXTI
QB 90 FORI=0TO96:READXL:AB(I)=
      XL:NEXTI
EA 100 FORI=0TO152:READXL:FM(I
      )=XL:NEXTI
HJ 110 FORI=0TO78:READXL:CB(I)
      =XL:NEXTI
SP 120 FORI=0TO179:READXL:ZB(I
      )=XL:NEXTI
```

```
XQ 130 GOTO710
HJ 140 FORX=1TO1000:NEXTX:RETU
       RN
SQ 150 IFCM$="C128"THEN170
PE 160 FORI=52480TO53226:POKEI
       ,TL(I-52480):NEXTI:RETU
       RN
JR 170 FORI=6400TO7146:POKEI,T
       L(I-6400):NEXTI:RETURN
XH 180 POKE53280,0:POKE53281,0
       :PRINT"{CLR}{HOME}{7}
       {N}{H}{6 SPACES}"CM$" 1
       581 FAST LOADING SYSTEM
       "
ER 190 PRINT"{DOWN}";TAB(10);"
       INSTALL PROGRAM V2.0"
QM 200 PRINT"{DOWN}{5}
       {3 SPACES}COPYRIGHT 199
       0 COMPUTE! PUBL., INC."
MA 210 PRINTSPC(10);"ALL RIGHT
       S RESERVED.":RETURN
CA 220 IFCM$="C128"THEN1880
SR 230 IFYN$="NO "THENFL(33)=2
       34:FL(34)=234:FL(35)=23
       4
JH 240 IFYN$="YES"THENFL(33)=3
       2:FL(34)=0:FL(35)=CL/25
       6
PD 250 F$=STR$(CL):FM$=MID$(F$
       ,2,16)
BB 260 OPEN8,DV,15,"S0:BOOT."+
       FM$:CLOSE8:OPEN8,DV,8,"
       0:BOOT."+FM$+",P,W"
PS 270 DN=CL:GOSUB430:GOSUB480
DP 280 PRINT#8,CHR$(202);CHR$(
       02);
DQ 290 FORI=0TO57:PRINT#8,CHR$
       (FL(I));:NEXTI:CLOSE8:R
       ETURN
CC 300 IFCM$="C128"THEN1950
ED 310 OPEN8,DV,15,"S0:F"+HD$:
       CLOSE8:OPEN8,DV,8,"0:F"
       +HD$+",P,W"
PJ 320 PRINT#8,CHR$(AL);CHR$(A
       H);
JR 330 FORI=52480TO53226:PRINT
       #8,CHR$(PEEK(I));:NEXTI
       :CLOSE8:RETURN
MD 340 IFCM$="C64"THENBF$="BOO
       T64":GOTO360
RX 350 BF$="BOOT128"
KX 360 GOSUB180:PRINT"{DOWN}EN
       TER NAME OF FILE TO BOO
       T:";:INPUTOF$
SJ 370 IFLEN(OF$)<1ORLEN(OF$)>
       16THEN360
KS 380 GOSUB180:PRINT"{DOWN}BA
       SIC OR MACHINE LANGUAGE
       (B/M):";
FD 390 GETFT$:IFFT$<>"B"ANDFT$
       <>"M"THEN390
KH 400 PRINTFT$:IFFT$="B"THENM
       F=0:RETURN
RM 410 F=1:GOSUB180:PRINT"
       {DOWN}INPUT ML EXECUTIO
       N ADDRESS:";:INPUTEA:IF
       EA<1024THEN410
KA 420 RETURN
AQ 430 H1=DN/4096:H2=(DN-INT(H
       1)*4096)/256
FB 440 H3=(DN-INT(H1)*4096-INT
       (H2)*256)/16
MS 450 H4=(DN-INT(H1)*4096-INT
       (H2)*256-INT(H3)*16)
QP 460 HD$=MID$(H$,INT(H1)+1,1
       )+MID$(H$,INT(H2)+1,1)+
       MID$(H$,INT(H3)+1,1)
BQ 470 HD$=HD$+MID$(H$,INT(H4)
       +1,1):RETURN
FE 480 FL(50)=ASC(MID$(HD$,1,1
       )):FL(51)=ASC(MID$(HD$,
       2,1))
EB 490 FL(52)=ASC(MID$(HD$,3,1
       )):FL(53)=ASC(MID$(HD$,
       4,1)):RETURN
QK 500 FM(50)=ASC(MID$(HD$,1,1
       )):FM(51)=ASC(MID$(HD$,
       2,1))
RH 510 FM(52)=ASC(MID$(HD$,3,1
       )):FM(53)=ASC(MID$(HD$,
       4,1)):RETURN
HH 520 IFCM$="C128"THENPL=6400
       :GOTO540
SG 530 PL=52480
JQ 540 HI=AD/256:LO=AD-HI*256
EA 550 POKEPL+2,HI:POKEPL+5,HI
       :POKEPL+8,HI+1
KG 560 POKEPL+10,HI:HI=HI+1:PO
       KEPL+22,HI
AC 570 POKEPL+29,HI-1:POKEPL+4
       6,HI
MS 580 POKEPL+49,HI:POKEPL+80,
       HI
SX 590 POKEPL+128,HI:POKEPL+13
       1,HI
RR 600 POKEPL+138,HI:POKEPL+14
       1,HI
KJ 610 POKEPL+146,HI:POKEPL+16
       9,HI+1
GK 620 POKEPL+172,HI:POKEPL+18
       9,HI
DG 630 POKEPL+198,HI:POKEPL+21
       3,HI
SD 640 POKEPL+342,HI:POKEPL+34
       5,HI
FC 650 POKEPL+362,HI:POKEPL+38
       0,HI
SR 660 POKEPL+385,HI:POKEPL+39
       9,HI
KE 670 POKEPL+405,HI:POKEPL+41
       5,HI
MS 680 POKEPL+429,HI:POKEPL+70
       8,HI+1
RR 690 POKEPL+723,HI+1:RETURN
BJ 700 DV=DV+1:IFDV>11THENDV=8
DQ 710 GOSUB180:PRINT"{DOWN}";
       TAB(11);"{7}FAST LOADER
       OPTIONS"
CR 720 PRINTTAB(10)"{BLU}
       {21 Y}{5}":IFCM$="C64"T
       HEN750
MJ 730 PRINT"{5}{2 SPACES}A) I
       NSTALL FAST LOADER AT $
       1300/4864"
XR 740 PRINT"{DOWN}{2 SPACES}B
       ) INSTALL FAST LOADER A
       T $1900/6400":GOTO770
KM 750 PRINT"{2 SPACES}A) INST
       ALL FAST LOADER AT $C00
       0/49152"
KD 760 PRINT"{DOWN}{2 SPACES}B
       ) INSTALL FAST LOADER A
       T $CD00/52480"
QG 770 PRINT"{DOWN}{2 SPACES}C
       ) CREATE FAST LOADER BI
       NARY FILE"
KF 780 PRINT"{DOWN}{2 SPACES}D
       ) CREATE FAST LOADER AU
       TOBOOT FILE"
BB 790 PRINT"{DOWN}{2 SPACES}S
       ) SELECT DEVICE NUMBER"
CG 800 PRINT"{DOWN}{2 SPACES}X
       ) EXIT TO BASIC"
EP 810 PRINT"{DOWN}";SPC(11);"
       DEFAULT DEVICE:{WHT}";D
       V
KA 820 PRINTSPC(11);"{DOWN}{5}
       COMPUTER: {WHT}";CM$
PQ 830 GETA$
HC 840 IFA$="A"THEN960
HS 850 IFA$="B"THEN910
QS 860 IFA$="C"THENGOSUB1790:G
       OTO1110
FH 870 IFA$="S"THEN700
XA 880 IFA$="D"THENMF=0:GOSUB1
       790:GOTO1340
SD 890 IFA$="X"THENPRINT"{CLR}
       ":END
AX 900 GOTO830
EK 910 IFCM$="C128"THEN1020
PA 920 GOSUB180:PRINT"{3 DOWN}
       INSTALLING 1541 FASTLOA
       D AT $CD00/52480"
QE 930 PRINT"{DOWN}{5 SPACES}S
       YS52480 TURNS FASTLOAD
       {SPACE}ON"
BB 940 PRINT"{DOWN}{6 SPACES}S
       YS 52483 TURNS FASTLOAD
       OFF{DOWN}"
GC 950 GOSUB150:SYS52480:GOSUB
       140:GOTO710
BC 960 IFCM$="C128"THEN1060
ER 970 GOSUB180:PRINT"{3 DOWN}
       INSTALLING 1581 FASTLOA
       D AT $C000/49152"
RD 980 PRINT"{DOWN}{6 SPACES}S
       YS 49152 TURNS FASTLOAD
       ON"
PG 990 PRINT"{DOWN}{6 SPACES}S
       YS 49155 TURNS FASTLOAD
       OFF{DOWN}"
JG 1000 GOSUB150:AD=49152:GOSU
        B520:GOSUB1010:SYS4915
        2:GOSUB140:GOTO710
SQ 1010 FORI=0TO746:FL=PEEK(I+
        52480):POKEI+49152,FL:
        NEXTI:RETURN
GJ 1020 GOSUB180:PRINT"
        {3 DOWN} INSTALLING 15
        81 FASTLOAD AT $1900/6
        400"
RS 1030 PRINT"{DOWN}{7 SPACES}
        SYS 6400 TURNS FASTLOA
        D ON"
PP 1040 PRINT"{DOWN}{7 SPACES}
        SYS 6403 TURNS FASTLOA
        D OFF{DOWN}"
KP 1050 GOSUB150:AD=6400:CL=AD
        :GOSUB520:GOSUB1820:SY
        S6400:GOSUB140:GOTO710
JX 1060 GOSUB180:PRINT"
        {3 DOWN} INSTALLING 15
        81 FASTLOAD AT $1300/4
        864"
HE 1070 PRINT"{DOWN}{7 SPACES}
        SYS 4864 TURNS FASTLOA
        D ON"
AS 1080 PRINT"{DOWN}{7 SPACES}
        SYS 4867 TURNS FASTLOA
        D OFF{DOWN}":GOSUB150:
        AD=4864:CL=AD
EK 1090 GOSUB520:GOSUB1820:GOS
        UB1100:SYS4864:GOSUB14
        0:GOTO710
PK 1100 FORI=0TO746:FL=PEEK(I+
        6400):POKEI+4864,FL:NE
        XTI:RETURN
QX 1110 GOSUB180:PRINT"{DOWN}
        {7}{4 SPACES}CREATE 15
        81 FASTLOAD BINARY FIL
        E{BLU}"
FM 1120 PRINT"{3 SPACES}{34 Y}
        "
PC 1130 PRINT"{5}{3 SPACES}+)
        {SPACE}INCREMENT MEMOR
        Y LOCATION
FD 1140 PRINT"{DOWN}{3 SPACES}
        -) DECREMENT MEMORY LO
        CATION"
HJ 1150 PRINT"{DOWN}{3 SPACES}
        R) TOGGLE RUN FAST LOA
        DER ON BOOTUP"
DH 1160 PRINT"{DOWN}{3 SPACES}
        I) INSTALL FAST LOADER
        ON DISK"
BE 1170 PRINT"{DOWN}{3 SPACES}
        X) EXIT TO OPTIONS MEN
        U"
XB 1180 PRINT"{DOWN}{3 SPACES}
```

```
      FAST LOADER MEMORY LOC
      ATION:{WHT}";CL
PD 1190 PRINT"{5}{DOWN}
      {3 SPACES}RUN FAST LOA
      DER: {WHT}";YN$:PRINT"
      {DOWN}{5}{3 SPACES}COM
      PUTER: {WHT}";CM$
BC 1200 GETA$
MA 1210 IFA$="X"THEN710
CJ 1220 IFA$="R"THENGOTO1270
DX 1230 IFA$="I"THEN1290
RF 1240 IFA$="-"THENCL=CL-256:
      GOTO1110
JA 1250 IFA$="+"THENCL=CL+256:
      GOTO1110
HX 1260 GOTO1200
JD 1270 IFYN$="YES"THENYN$="NO
      ":GOTO1110
EG 1280 YN$="YES":GOTO1110
GS 1290 GOSUB180:PRINT"
      {3 DOWN}{5 SPACES}CREA
      TING 1581 FASTLOAD ON
      {SPACE}DISK"
MD 1300 PRINT"{DOWN}{5 SPACES}
      SYS";CL;"TURNS FAST LO
      ADER ON"
KB 1310 PRINT"{DOWN}{5 SPACES}
      SYS";CL+3;"TURNS FAST
      {SPACE}LOADER OFF
      {DOWN}"
ED 1320 GOSUB150:AD=CL:GOSUB52
      0:AH=CL/256:AL=CL-(256
      *INT(AH)):GOSUB220:GOS
      UB300
GD 1330 GOTO1110
SF 1340 GOSUB180:PRINT"{DOWN}
      {7}{3 SPACES}CREATE 15
      81 FASTLOAD AUTOBOOT F
      ILE{BLU}"
CB 1350 PRINT"{2 SPACES}{36 Y}
DR 1360 IFCM$="C128"THENCL=486
      4:GOTO1390
PK 1370 PRINT"{5}{2 SPACES}A)
      {SHIFT-SPACE}FAST LOAD
      ER AT $C000/49152"
PA 1380 PRINT"{DOWN}{2 SPACES}
      B) FAST LOADER AT $CD0
      0/52480"
QG 1390 PRINT"{5}{DOWN}
      {2 SPACES}R) TOGGLE RU
      N AFTER BOOTING "
BE 1400 PRINT"{DOWN}{2 SPACES}
      I) INSTALL AUTOBOOT FA
      ST LOADER"
QK 1410 PRINT"{DOWN}{2 SPACES}
      X) EXIT TO OPTIONS MEN
      U"
HC 1420 PRINT"{DOWN}{2 SPACES}
      FAST LOADER MEMORY LOC
      ATION:{WHT}";CL
KK 1430 PRINT"{DOWN}{5}
      {2 SPACES}TURN FASTLOA
      D OFF AFTER BOOTING:
      {WHT}";YN$
QC 1440 PRINT"{DOWN}{5}
      {2 SPACES}COMPUTER:
      {WHT}";CM$
PC 1450 GETA$
MH 1460 IFA$="X"THEN710
SA 1470 IFA$="A"ANDCM$="C64"TH
      ENCL=49152:GOTO1570
FS 1480 IFA$="B"ANDCM$="C64"TH
      ENCL=52480:GOTO1570
RJ 1490 IFA$="R"THENGOTO1520
BQ 1500 IFA$="I"THENAD=CL:GOSU
      B1580:GOTO1620
FA 1510 GOTO1450
PF 1520 IFYN$="YES"THENYN$="NO
      ":GOTO1340
RR 1530 YN$="YES":GOTO1340
FE 1540 GOSUB180:PRINT"
      {3 DOWN}{3 SPACES}INST
      ALLING 1581 FASTLOAD A
      T"CL
SG 1550 PRINT"{DOWN}{5 SPACES}
      SYS"CL" TURNS FAST LOA
      DER ON"
EF 1560 PRINT"{DOWN}{5 SPACES}
      SYS"CL+3" TURNS FAST L
      OADER OFF":PRINT:RETUR
      N
PB 1570 AD=CL:GOSUB1540:GOSUB1
      50:GOTO1340
XJ 1580 IFCM$="C64"THEN1610
KR 1590 CL=4864:AD=CL:GOSUB154
      0:GOSUB150:GOSUB520:GO
      SUB1820:GOSUB1100:GOSU
      B1820
BF 1600 RETURN
CH 1610 GOSUB1540:GOSUB150:AD=
      CL:GOSUB520:RETURN
KF 1620 GOSUB180:GOSUB340:PRIN
      T"{3 DOWN}"TAB(9)"CREA
      TING 1581 FASTLOAD"
GE 1630 PRINTTAB(12);"AUTOBOOT
       ON DISK"
EK 1640 PRINT"{DOWN}{6 SPACES}
      SYS";CL;"TURNS FASTLOA
      D ON"
CE 1650 PRINT"{DOWN}{6 SPACES}
      SYS";CL+3;"TURNS FASTL
      OAD OFF":PRINT
GA 1660 IFCM$="C128"THENGOSUB1
      990:GOTO1340
KA 1670 OPEN8,DV,15,"S0:"+BF$:
      CLOSE8:OPEN8,DV,8,"0:"
      +BF$+",P,W"
FG 1680 AH=CL/256:AL=CL-(256*A
      H)
FP 1690 PRINT#8,CHR$(38);CHR$(
      03);
CH 1700 AB(22)=4:AB(56)=AH:AB(
      87)=AH:AB(30)=AH:AB(51
      )=AH+3
CG 1710 IFYN$="YES"THENAB(85)=
      32:AB(86)=3:AB(87)=AH
HE 1720 IFYN$="NO "THENAB(85)=
      234:AB(86)=234:AB(87)=
      234
PQ 1730 MH=EA/256:ML=EA-(256*I
      NT(MH)):IFMF=1THENAB(8
      8)=76:AB(89)=ML:AB(90)
      =MH
CS 1740 IFMF=0THENAB(88)=32:AB
      (89)=96:AB(90)=166
DM 1750 AB(68)=LEN(OF$):FORI=0
      TO96:PRINT#8,CHR$(AB(I
      ));:NEXTI
QX 1760 IFLEN(OF$)<16THENOF$=O
      F$+LEFT$(SS$,16-LEN(OF
      $))
HJ 1770 PRINT#8,OF$;:FORI=1TO1
      05:PRINT#8,CHR$(I);:NE
      XTI
JP 1780 FORI=52480TO53226:PRIN
      T#8,CHR$(PEEK(I));:NEX
      TI:CLOSE8:GOSUB140:GOT
      O1340
GC 1790 IFCM$="C64"THENCL=5248
      0:YN$="YES":GOTO1810
XF 1800 CL=6400:YN$="YES"
HD 1810 RETURN
MD 1820 POKEPL+24,242:POKEPL+2
      6,108:POKEPL+42,110:PO
      KEPL+43,242:POKEPL+69,
      15
BS 1830 POKEPL+70,245:POKEPL+7
      6,203:POKEPL+77,240:PO
      KEPL+98,132:POKEPL+99,
      246
GJ 1840 POKEPL+112,51:POKEPL+1
      13,245:POKEPL+121,207:
      POKEPL+122,242:POKEPL+
      307,17
BG 1850 POKEPL+308,243:POKEPL+
      324,181:POKEPL+325,245
      :POKEPL+266,32:POKEPL+
      267,194
HF 1860 POKEPL+268,(CL/256)+2:
      POKEPL+269,234:RETURN
QM 1870 STOP:REM INSTALL C128
      {SPACE}AUTOBOOT
SH 1880 F$=STR$(CL):FM$=MID$(F
      $,2,16)
RG 1890 IFYN$="NO "THENFM(33)=
      234:FM(34)=234:FM(35)=
      234
KB 1900 IFYN$="YES"THENFM(33)=
      32:FM(34)=0:FM(35)=CL/
      256
JS 1910 OPEN8,DV,15,"S0:BOOT."
      +FM$:CLOSE8:OPEN8,DV,8
      ,"0:BOOT."+FM$+",P,W"
RF 1920 DN=CL:GOSUB430:GOSUB50
      0
PX 1930 PRINT#8,CHR$(107);CHR$
      (02);
KD 1940 FORI=0TO152:PRINT#8,CH
      R$(FM(I));:NEXTI:CLOSE
      8:RETURN
DK 1950 OPEN8,DV,15,"S0:F"+HD$
      :CLOSE8:OPEN8,DV,8,"0:
      F"+HD$+",P,W"
PA 1960 PRINT#8,CHR$(AL);CHR$(
      AH);
GR 1970 IFCM$="C128"THENPL=640
      0:GOSUB1820
QF 1980 FORI=6400TO7146:PRINT#
      8,CHR$(PEEK(I));:NEXTI
      :CLOSE8:RETURN
GH 1990 GOSUB2110:OPEN8,DV,15,
      "S0:"+BF$:CLOSE8:OPEN8
      ,DV,8,"0:"+BF$+",P,W"
DE 2000 AH=CL/256:AL=CL-(256*A
      H)
QK 2010 PRINT#8,CHR$(00);CHR$(
      19);
QF 2020 IFYN$="YES"THENCB(39)=
      32:CB(40)=3:CB(41)=AH
HA 2030 IFYN$="NO "THENCB(39)=
      234:CB(40)=234:CB(41)=
      234
ES 2040 MH=EA/256:ML=EA-(256*I
      NT(MH)):IFMF=1THENCB(4
      5)=76:CB(46)=ML:CB(47)
      =MH
EE 2050 IFMF=0THENCB(45)=76:CB
      (46)=13:CB(47)=22
DK 2060 FORI=4864TO5590:PRINT#
      8,CHR$(PEEK(I));:NEXTI
JS 2070 CB(13)=LEN(OF$):FORI=0
      TO78:PRINT#8,CHR$(CB(I
      ));:NEXTI
EQ 2080 IFLEN(OF$)<16THENOF$=O
      F$+LEFT$(SS$,16-LEN(OF
      $))
HF 2090 PRINT#8,OF$;
BC 2100 CLOSE8:GOSUB140:GOTO13
      40
AB 2110 FORI=1TO16:ZB(64+I)=AS
      C(MID$(BF$,I,1)):NEXTI
      :ZB(28)=LEN(BF$)
QH 2120 IFCM$="C64"THENZF$="AB
      64":GOTO2140
XR 2130 ZF$="AB128"
MP 2140 OPEN8,DV,15,"S0:"+ZF$:
      CLOSE8:OPEN8,DV,8,"0:"
      +ZF$+",P,W"
GF 2150 PRINT#8,CHR$(80);CHR$(
      02);
AF 2160 FORI=0TO179:PRINT#8,CH
      R$(ZB(I));:NEXTI:CLOSE
      8:RETURN
GJ 2170 REM FASTLOADER DATA C6
      4/128
JH 2180 DATA76,6,205,76,20,205
      ,32,155,206,169,205,16
      0,30,141,49,3
MH 2190 DATA140,48,3,96,32,169
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```
         ,206,169,244,160,165,7
         6,13,205,133,147
GR 2200 DATA168,208,6,133,144,
         165,183,208,3,76,167,2
         44,32,122,206,173
MK 2210 DATA154,206,201,3,208,
         243,201,3,208,239,160,
         0,177,187,201,36
KC 2220 DATA240,231,166,185,32
         ,175,245,169,96,133,18
         5,32,213,243,32,70
GF 2230 DATA206,32,165,255,133
         ,174,32,165,255,133,17
         5,165,144,74,74,144
JA 2240 DATA3,76,4,247,138,208
         ,8,165,195,133,174,165
         ,196,133,175,32
FJ 2250 DATA210,245,165,175,20
         1,4,176,3,76,243,244,3
         2,171,255,32,122
DF 2260 DATA206,173,154,206,20
         1,3,240,3,76,41,205,32
         ,53,206,160,0
BQ 2270 DATA185,218,206,32,168
         ,255,200,192,41,144,24
         5,32,174,255,120,162
BE 2280 DATA5,200,208,253,202,
         208,250,185,2,207,32,8
         0,206,200,208,247
XR 2290 DATA173,0,221,41,3,141
         ,0,221,173,21,208,141,
         32,206,140,21
HQ 2300 DATA208,173,17,208,141
         ,37,206,41,248,9,3,141
         ,17,208,173,0
XF 2310 DATA221,41,3,141,6,206
         ,9,48,170,44,0,221,112
         ,251,80,57
RX 2320 DATA173,18,208,233,50,
         144,4,41,7,240,245,142
         ,0,221,138,41
QH 2330 DATA3,141,0,221,173,0,
         221,250,74,74,77,0,221
         ,250,74,74
RF 2340 DATA77,0,221,74,74,73,
         0,77,0,221,145,174,230
         ,174,208,2
CD 2350 DATA230,175,173,0,221,
         201,64,176,199,173,0,2
         21,16,247,72,169
CA 2360 DATA0,141,21,208,169,0
         ,141,17,208,104,10,10,
         176,17,169,64
AG 2370 DATA133,144,76,43,245,
         165,186,32,177,255,169
         ,111,76,147,255,169
KQ 2380 DATA0,133,144,76,51,24
         6,165,186,32,180,255,1
         65,185,76,150,255
DC 2390 DATA162,8,74,72,32,111
         ,206,32,111,206,173,0,
         221,41,19,73
AJ 2400 DATA48,176,2,41,19,141
         ,0,221,32,111,206,104,
         202,208,227,96
HM 2410 DATA165,186,32,180,255
         ,169,111,76,150,255,32
         ,53,206,160,0,185
RH 2420 DATA212,206,32,168,255
         ,200,192,6,144,245,32,
         174,255,32,112,206
CD 2430 DATA32,165,255,141,154
         ,206,32,171,255,96,0,1
         60,0,185,183,206
RB 2440 DATA32,210,255,200,192
         ,14,208,245,96,160,0,1
         85,197,206,32,210
HE 2450 DATA255,200,192,15,208
         ,245,96
GR 2460 DATA13,49,53,56,49,32,
         84,85,82,66,79,32,79,7
         8,13,49,53,56,49
RF 2470 DATA32,84,85,82,66,79,
         32,79,70,70
JB 2480 DATA77,45,82,254,255,1
         ,77,45,69,5,2
CQ 2490 DATA120,162,0,142,1,64
         ,160,8,152,10,10,77,1,
         64,41,4
FH 2500 DATA240,246,173,1,64,7
         4,126,0,6,136,208,236,
         232,208,231,76
MX 2510 DATA0,6,250,173,139,2,
         133,16,165,76,133,15,1
         69,222,141,1
XA 2520 DATA64,169,128,133,4,0
         ,250,120,165,4,48,249,
         201,2,144,49
SR 2530 DATA160,0,162,0,136,20
         8,253,202,208,250,162,
         208,176,2,162,216
QP 2540 DATA142,1,64,200,208,2
         53,232,208,250,176,18,
         88,96,15,7,13
KQ 2550 DATA5,11,3,9,1,14,6,12
         ,4,10,2,8,0,88,76,202
AD 2560 DATA175,173,0,64,73,96
         ,141,0,64,174,1,5,134,
         16,173,0
SX 2570 DATA5,133,15,208,4,232
         ,142,163,6,160,4,169,2
         ,141,1,64
QR 2580 DATA185,0,5,41,15,170,
         169,4,44,1,64,240,251,
         189,58,6
RD 2590 DATA141,1,64,10,250,25
         0,41,15,250,170,185,0,
         5,142,1,64
AA 2600 DATA74,74,250,74,250,7
         4,170,189,58,6,141,1,6
         4,10,250,41
SB 2610 DATA15,250,200,250,250
         ,192,0,141,1,64,208,19
         1,162,2,142,103
BJ 2620 DATA6,162,10,250,165,1
         5,24,142,1,64,240,3,76
         ,14,6,76,29,6,0
RQ 2630 DATA142,193,207,162,1,
         142,0,255,145,174,162,
         0,142,0,255,174,193,20
         7
PF 2640 DATA230,174,96,0,0,0,0
         ,0,0,0,0,0,0,0,0,0,0,0
         ,0,0,0,0,0
JR 2650 REM FASTLOAD BOOT DATA
         C64/128
JB 2660 DATA162,3,189,247,2,15
         7,0,3,202,16,247,169,5
         ,168,166,186
SS 2670 DATA32,186,255,169,5,1
         62,251,160,2,32,189,25
         5,169,0,32,213
SR 2680 DATA255,32,0,128,234,2
         34,234,234,234,88,108,
         2,160,139,227,131,164
MR 2690 DATA70,48,48,48,48,202
         ,2,202,2
DR 2700 REM FASTLOAD AUTOBOOT
         {SPACE}DATA C64
BK 2710 DATA54,3,237,246,62,24
         1,47,243,102,254,165,2
         44,237,245,169,202
FS 2720 DATA32,138,255,169,0,1
         60,4,133,251,132,252,1
         69,0,160,192,133
MK 2730 DATA253,132,254,160,0,
         177,251,145,253,200,20
         8,249,230,252,230,254
DM 2740 DATA165,254,201,196,20
         8,239,32,0,192,32,68,2
         29,166,186,160,1
HM 2750 DATA32,186,255,169,16,
         162,135,160,3,32,189,2
         55,169,0,32,213
RX 2760 DATA255,134,45,132,46,
         32,3,192,32,94,166,32,
         142,166,76,174,167
PM 2770 REM BOOT FASTLOADER C1
         28
AX 2780 DATA162,3,189,152,2,15
         7,0,3,202,16,247,169,5
         ,168,166,186
PS 2790 DATA32,186,255,169,5,1
         62,156,160,2,32,189,25
         5,169,0,32,213
EH 2800 DATA255,32,0,19,169,0,
         141,0,255,88,76,9,64,6
         3,77,198
RE 2810 DATA77,70,49,51,48,48,
         0,173,0,255,142,0,255,
         170,177,172
CE 2820 DATA142,0,255,96,72,17
         3,0,255,142,0,255,170,
         104,145,102,142
GM 2830 DATA0,255,96,72,173,0,
         255,142,0,255,170,104,
         209,96,142,0
EJ 2840 DATA255,96,32,227,2,13
         3,6,134,7,132,8,8,104,
         133,5,186
KP 2850 DATA134,9,169,0,141,0,
         255,96,162,0,181,3,72,
         232,224,3
GM 2860 DATA144,248,166,2,32,1
         07,255,141,0,255,165,6
         ,166,7,164,8
GX 2870 DATA64,120,76,0,32,107
         ,2,107,2
ME 2880 REM AUTOBOOT FASTLOADE
         R C128
FD 2890 DATA32,7,22,32,138,255
         ,32,0,19,32,66,193,169
         ,6,162,38
MK 2900 DATA160,22,32,86,2,169
         ,1,166,186,160,1,32,18
         6,255,169,0
RQ 2910 DATA32,213,255,134,47,
         132,48,32,3,19,32,7,22
         ,76,13,22
BJ 2920 DATA169,0,141,0,255,96
KG 2930 DATA32,243,81,32,129,9
         0,32,246,74,96
MB 2940 DATA67,79,80,89,82,46,
         49,57,56,57,32,68,87,7
         7,0
RH 2950 DATA169,0,170,76,104,2
         55,32,189,255,32,80,2,
         96,68,87,77
AQ 2960 DATA162,3,189,141,2,15
         7,0,3,202,16,247,169,7
         ,162,145,160
CH 2970 DATA2,32,189,255,234,2
         34,234,169,5,168,166,1
         86,32,186,255,169
FX 2980 DATA0,32,213,255,234,2
         34,234,234,234,234,76,
         215,21,63,77,198
BB 2990 DATA77,66,79,79,84,49,
         50,56,0,0,0,0,0,0,0,0
SM 3000 DATA0,0,173,0,255,142,
         0,255,170,177,172,142,
         0,255,96,72
QH 3010 DATA173,0,255,142,0,25
         5,170,104,145,102,142,
         0,255,96,72,173
AB 3020 DATA0,255,142,0,255,17
         0,104,209,96,142,0,255
         ,96,32,227,2
AB 3030 DATA133,6,134,7,132,8,
         8,104,133,5,186,134,9,
         169,0,141
FJ 3040 DATA0,255,96,162,0,181
         ,3,72,232,224,3,144,24
         8,166,2,32
GG 3050 DATA107,255,141,0,255,
         96,6,96,7,164,8,64,120
         ,76,0,32
MC 3060 DATA96,2,96,2
```

G

BITMAP EFFECTS

Give your artwork the finishing touches it needs with this powerful utility for the 64. Joystick required.

Keith M. Groce

While working with your favorite paint program, you decide that an image should be duplicated in several places on the screen. Or maybe you find that it should be turned upside down or twisted. That's when you'll appreciate *Bitmap Effects*. This handy utility lets you copy or cut an image from a hi-res screen; flip, rotate, or twist it; and then paste it back to the screen. To make your work even easier, the program features a hidden hi-res screen that can serve as a scratch pad or a backup screen.

With *Bitmap Effects*, you can touch up screens from *Doodle*, *The Print Shop*, or almost any other hi-res drawing program. And when you've finished, you can reload your screens into these programs to print the final product.

Getting Started

Bitmap Effects comes in two parts: a BASIC program, Bitmap FX, and a machine language program, BFX.ML. To avoid typing errors while entering Bitmap FX, use *The Automatic Proofreader*, located elsewhere in this issue.

To enter BFX.ML, use *MLX*, the machine language entry program, also located elsewhere in this issue. When *MLX* prompts you, respond with the values given below.

Starting address: C034
Ending address: C84B

When you've finished typing in the data, be sure to save a copy of it to disk before exiting *MLX*. Use the filename BFX.ML when you save the program.

When you're ready to get started, plug a joystick into port 2; then load and run Bitmap FX. After the machine language program loads, a help screen that summarizes the program's commands will appear. These commands fall into three categories: screen, edit, and draw/erase.

Screen Commands

The screen commands are used to manipulate the entire hi-res screen area. These include load and save functions as well as commands which clear and invert the screen. Also in this group are two commands—exchange and reproduce (or copy)—designed specifically for use with the hidden hi-res screen.

A demo screen created using Bitmap Effects.

When you're ready to begin working with *Bitmap Effects*, move from the help screen to the hi-res screen by pressing the RETURN key (to recall the help screen, press RETURN again). Because the program doesn't clear the hi-res screen area when it's first run, you'll probably find the screen filled with garbage unless you've previously loaded a screen using another program. To clear the hi-res screen area, hold down the Commodore key and press B. (If your computer has a reset button, you may be able to capture a screen from another program without having to load it from *Bitmap Effects*. Just hit the reset button while the screen is visible, and then load and run *Bitmap Effects*. The screen in memory should then appear undisturbed.)

To load a hi-res screen into the program, hold down the Commodore key and press L; to save a screen, hold down the Commodore key and press S. You'll be prompted for a filename; enter one that's 16 or fewer characters long. If you wish to return to the help screen without loading or saving, just press RETURN at the prompt.

To load or to save a *Doodle* file, use the prefix *DD* at the beginning of the filename. When a *Doodle* file is loaded, *Bitmap Effects* replaces the foreground and background colors with its own default colors (black on light gray). If a filename doesn't begin with *DD*—that is, it doesn't refer to a *Doodle* file—the program loads only the bitmap data. If you wish to convert a screen to *Doodle* format, prefix the filename with *DD* when you save the screen.

Bitmap Effects has three other screen commands. Commodore-X exchanges the visible screen with one in memory. Commodore-R copies the visible screen to the hidden screen. Commodore-I inverts the visible screen; pixels which are on are turned off and vice versa.

Edit Commands

Any modifications to a screen are done within a rectangular region known as the *edit area*. A flashing, crosshairs cursor marks the limits of the edit area. To move the cursor around the screen, push the joystick in any direction. You can slow the cursor's movement by pressing the fire button while you move the cursor.

To copy the image in the edit area to the cursor itself, press the C key. Then move the cursor to the desired location and stamp the image on the screen by pressing either P, E, or T. The P key copies the cursor image directly

to the screen; the E key erases pixels directly beneath the image. And the T key toggles the pixels under the image—on pixels are turned off and vice versa. Press O to outline the image within the cursor, or press SHIFT-CLR/HOME to clear the edit area and restore the cursor to the crosshairs pattern.

Once an image is stored to the cursor, you can be rotate and stretch it. Press the + key to flip the cursor vertically or the − key to flip it horizontally. The £ key rotates the cursor 90 degrees clockwise (note that this crops a few pixels off the edge, since the edit area is taller than it is wide).

Pressing f5 twists the cursor horizontally, moving the top to the right and the bottom to the left, as in italicized text. Pressing f5 repeatedly increases the amount of the twist. The f7 key twists the cursor in the opposite direction. The f1 and f3 keys twist the cursor vertically, moving the left and right sides up and down.

By twisting the cursor horizontally and vertically, you can effectively rotate it. A more efficient way to do this is with the f2 and f4 keys. To rotate the cursor clockwise, press f2; to rotate it counterclockwise, press f4.

If you're not satisfied with a twisted image, you can restore it by pressing CLR/HOME. This will not, however, restore an image that has been flipped.

Draw and Erase Commands

Bitmap Effects has two commands for changing individual pixels on the screen, draw and erase. To enter draw mode, press f6. The cursor will assume the form of a flashing pointer. To draw, press the fire button while you move the pointer. To enter erase mode, press f8. Erase mode works like draw mode, except that pixels are erased instead of drawn.

To exit draw or erase mode, press any key. To exit the program itself, press X.

Bitmap FX

```
KF 10 POKE51,0:POKE52,88:POKE5
      5,0:POKE56,88
DH 20 IFA=0THENA=1:LOAD"BFX.ML
      ",8,1
RK 30 POKE784,76:POKE785,54:PO
      KE786,198:REM USR TO POI
      NT TO JOYMOV
GP 40 SYS50561:REM RESET
PP 50 SYS50715:REM GOTEXT
FK 60 POKE53280,PEEK(646)
XS 70 PRINT"{CLR}{RVS}BITMAP E
      FFECTS - (C)1990 COMPUTE
      ! PUB.{2 SPACES}{OFF}";
SP 80 PRINT" [RETURN]=HELP TOG
      GLE{4 SPACES}X = EXIT":P
      RINT
ER 90 PRINT"{RVS}SCREEN COMMAN
      DS; USE COMMODORE KEY WI
      TH {OFF}";
QQ 100 PRINT" [L]=LOAD INTO 1
       {8 SPACES}[S]=SAVE FROM
       1"
SG 110 PRINT" [X]=EXCHANGE 1 A
       ND 2{3 SPACES}[B]=BLANK
       1"
QG 120 PRINT" [R]=REPRODUCE 1
       {SPACE}ON 2{3 SPACES}[I
       ]=INVERT 1":PRINT
RM 130 PRINT"{RVS}EDIT; JOYSTI
       CK=MOVE BUTTON=SLOW
       {9 SPACES}{OFF}";
AA 140 PRINT" [CLR]=RESET
       {9 SPACES}[P]=PASTE AT
       {SPACE}DOTS"
RB 150 PRINT" [C]=CUT-COPY
       {8 SPACES}[E]=ERASE AT
       {SPACE}DOTS"
AR 160 PRINT" [O]=OUTLINE EDGE
       S{3 SPACES}[T]=TOGGLE A
       T DOTS"
XP 170 PRINT" [£]=FLIP 90 DEG
       REES"
CJ 180 PRINT" [+]=FLIP AROUND
       {SPACE}VERTICAL CENTERL
       INE"
AB 190 PRINT" [-]=FLIP AROUND
       {SPACE}HORIZONTAL CENTE
       RLINE"
XQ 200 PRINT" [F1/F3]=TWIST VE
       RTICALLY"
FJ 210 PRINT" [F5/F7]=TWIST HO
       RIZONTALLY"
DM 220 PRINT" [F2/F4]=ROTATE"
CQ 230 PRINT" [HOME]=UNTWIST/U
       NROTATE":PRINT
DJ 250 PRINT"{RVS}DRAW/ERASE;
       {SPACE}JOYSTICK=MOVE
       {15 SPACES}{OFF}";
EQ 260 PRINT" [F6]=DRAW MODE,
       {SPACE}FIREBUTTON=DRAW"
QR 270 PRINT" [F8]=ERASE MODE,
        FIREBUTTON=ERASE"
AK 280 PRINT" ANY KEY TO RETUR
       N TO EDIT MODE"
DQ 290 REM
JP 300 REM
SH 310 A=USR(0)
QA 320 IFA=182THENPRINT"{CLR}
       {DOWN} LOAD SCREEN:":GO
       TO360
PM 330 IFA=174THENPRINT"{CLR}
       {DOWN} SAVE SCREEN:":GO
       TO360
RQ 340 IFA=13THEN430
XK 345 IFA=88THENSYS50715:END
MJ 350 GOTO310
MF 360 PRINT" (USE 'DD' PREFIX
        FOR DOODLE FORMAT)"
QA 370 INPUT" FILENAME";F$
MH 380 S=96+4*(LEFT$(F$,2)="DD
       ")
FR 390 POKE50612,S:POKE50631,S
SF 400 IFA=182THENSYS50604F$,8
       ,0
FH 410 IFA=174THENSYS50623F$,8
       ,0
JX 420 GOTO60
FH 430 SYS50684:REM GOHIRZ
HS 440 A=USR(0)
BC 450 IFA=13THEN50
MQ 460 IFA=182ORA=174THENSYS50
       715:GOTO320
PG 470 IFA=67THENSYS50315:REM
       {SPACE}CUT
RX 480 IFA=80THENSYS50397:REM
       {SPACE}PASTE DOTS
FS 490 IFA=69THENSYS50394:REM
       {SPACE}PASTE HOLES
HP 500 IFA=84THENSYS50400:REM
       {SPACE}PASTE TOGGLE
XF 510 IFA=43THENSYS50032:REM
       {SPACE}VERT
SP 520 IFA=45THENSYS49987:REM
       {SPACE}HORIZ
PA 530 IFA=92THENSYS50080:REM
       {SPACE}ROTATE
KQ 540 IFA=133THENSYS49318:REM
       GOUP
CS 550 IFA=134THENSYS49325:REM
       GODOWN
XC 560 IFA=135THENSYS49332:REM
       GORITE
HS 570 IFA=136THENSYS49339:REM
       GOLEFT
KE 580 IFA=147THENSYS50561:REM
       RESET
SM 590 IFA=137THENSYS49346:REM
       RT3UP2
FK 600 IFA=138THENSYS49353:REM
       LT3DN2
SE 610 IFA=19THENSYS50587:REM
       {SPACE}HOME
HP 620 IFA=162THENSYS51152:REM
       INVERT
PB 630 IFA=178THENSYS51193:REM
       SCOPY
RK 640 IFA=189THENSYS51215:REM
       SSWAP
HM 650 IFA=191THENSYS51174:REM
       SBLANK
GQ 660 IFA=79THENSYS51006:REM
       {SPACE}TRACE
GB 670 IFA=139THENSYS50908:REM
       DRAW
GG 680 IFA=140THENSYS50905:REM
       ERASE
CJ 685 PRINTA
EH 690 IFA=88THENSYS50715:END
AX 700 GOTO440
```

BFX.ML

```
C034:80 40 20 10 08 04 02 01 60
C03C:80 40 20 10 08 04 02 01 68
C044:80 40 20 10 08 04 02 01 70
C04C:3C 3C 3C 3C 3C 3C 3C 3C CD
C054:3D 3D 3D 3D 3D 3D 3D 3D D5
C05C:3E 3E 3E 3E 3E 3E 3E 3E DD
C064:0D 00 0F FC 00 3F E0 00 DC
C06C:07 B0 00 0D 98 00 19 0C 71
C074:00 31 06 00 60 03 00 C0 D2
C07C:00 00 00 00 10 00 00 10 8E
C084:00 00 7C 00 00 10 00 00 D5
C08C:10 00 00 00 00 03 00 C0 E2
C094:06 00 60 0C 00 31 98 00 DB
C09C:19 B0 00 0D E0 00 07 FC B9
C0A4:00 3F A2 01 A0 00 4C CD C5
C0AC:C0 A2 FF A0 00 4C CD C0 CE
C0B4:A2 00 A0 01 4C CD C0 A2 69
C0BC:00 A0 FF 4C CD C0 A2 03 E4
C0C4:A0 02 4C CD C0 A2 FD A0 AA
C0CC:FE 8A 18 6D 00 C0 8D 00 68
C0D4:C0 10 10 49 FF 8D 06 C0 54
C0DC:EE 06 C0 A9 FF 8D 08 C0 11
C0E4:4C EF C0 8D 06 C0 A9 00 FF
C0EC:8D 08 C0 98 18 6D 01 C0 12
C0F4:8D 01 C0 10 10 49 FF 8D C9
C0FC:07 C0 EE 07 C0 A9 FF 8D BA
C104:09 C0 4C 11 C1 8D 07 C0 E9
C10C:A9 00 8D 09 C0 AD 07 C0 32
C114:8D 0B C0 D0 06 20 7A C1 AD
C11C:4C 48 C1 20 89 C1 A9 18 D0
C124:85 FE 20 CF C1 A0 00 8C 48
C12C:0A C0 AD 09 C0 D0 0C 20 AC
C134:93 C2 20 A1 C1 20 47 C2 30
C13C:4C 48 C1 20 47 C2 20 A1 59
C144:C1 20 93 C2 AD 06 C0 8D E3
C14C:0B C0 D0 03 4C 79 C1 A9 45
C154:15 85 FE 20 CF C1 A0 00 6C
C15C:8C 0A C0 AD 08 C0 D0 0C 8C
C164:20 14 C3 20 94 C1 20 E3 47
C16C:C2 4C 79 C1 20 E3 C2 20 E5
C174:94 C1 20 14 C3 60 A2 3F 1C
C17C:A0 00 B9 C0 5B 99 40 5B B0
C184:C8 CA D0 F6 60 A2 3F A9 5E
C18C:00 9D 40 5B CA 10 FA 60 22
C194:AC 0A C0 C8 B9 1B C0 F0 42
C19C:FA 8C 0A C0 60 AC 0A C0 98
C1A4:B9 1B C0 F0 01 60 B9 34 24
C1AC:C0 8D 0E C0 B9 4C C0 29 6B
C1B4:03 A8 B9 C0 5B 2D 0E C0 93
```

```
C1BC:19 40 5B 99 40 5B C8 C8 AB
C1C4:C8 C0 40 90 ED EE 0A C0 ED
C1CC:4C A1 C1 A5 FE 18 4A 8D EB
C1D4:0F C0 8D 10 C0 AE 0B C0 5A
C1DC:8E 0C C0 8A 0A AA E8 8E C6
C1E4:0B C0 A9 00 AC 0F C0 99 10
C1EC:1B C0 AC 10 C0 99 1B C0 28
C1F4:EE 0F C0 CE 10 C0 10 08 64
C1FC:A9 00 A4 FE 99 1B C0 60 F4
C204:AD 0F C0 85 FD AD 0B C0 12
C20C:85 FC 18 A9 00 A2 08 6A 36
C214:66 FC 90 03 18 65 FD CA 6B
C21C:10 F5 85 FD 18 A2 08 A5 B8
C224:FD 26 FC 2A B0 04 C5 FE 94
C22C:90 03 E5 FE 38 CA D0 F1 E7
C234:26 FC 85 FD 38 A5 FC ED DC
C23C:0C C0 C5 FE 90 02 A5 FE 77
C244:4C E8 C1 AC 0A C0 BE 1B 19
C24C:C0 D0 01 60 B9 34 C0 8D 3A
C254:0E C0 B9 4C C0 8D 0D C0 24
C25C:38 E9 03 CA D0 FB 8D 0C 23
C264:C0 AC 0C C0 B9 C0 5B 2D B7
C26C:0E C0 F0 09 AC 0D C0 19 0C
C274:40 5B 99 40 5B AE 0D C0 98
C27C:CA CA CA 8E 0D C0 AE 0C 31
C284:C0 CA CA CA 8E 0C C0 10 59
C28C:D8 EE 0A C0 4C 47 C2 AC 39
C294:0A C0 BE 1B C0 D0 01 60 84
C29C:B9 34 C0 8D 0E C0 B9 4C 30
C2A4:C0 29 03 8D 0C C0 18 69 0B
C2AC:03 CA D0 FB 8D 0D C0 AC 0F
C2B4:0D C0 B9 C0 5B 2D 0E C0 A0
C2BC:F0 09 AC 0C C0 19 40 5B 99
C2C4:99 40 5B AE 0C C0 E8 E8 9B
C2CC:E8 8E 0C C0 AE 0D C0 E8 0C
C2D4:E8 E8 8E 0D C0 E0 3F 90 44
C2DC:D6 EE 0A C0 4C 93 C2 AC B9
C2E4:0A C0 B9 1B C0 D0 01 60 34
C2EC:8D 0B C0 98 0A 18 6D 0A 33
C2F4:C0 69 02 8D 0C C0 AC 0B 16
C2FC:C0 AE 0C C0 1E 40 5B CA 8F
C304:3E 40 5B CA 3E 40 5B 88 05
C30C:D0 EF EE 0A C0 4C E3 C2 38
C314:AC 0A C0 B9 1B C0 D0 01 A6
C31C:60 8D 0B C0 98 0A 18 6D 2F
C324:0A C0 8D 0C C0 AC 0B C0 E2
C32C:AE 0C C0 5E 40 5B E8 7E CB
C334:40 5B E8 7E 40 5B 88 D0 09
C33C:EF EE 0A C0 4C 14 C3 A9 A8
C344:02 8D 17 C0 18 AD 17 C0 85
C34C:AA 69 3C A8 BD C0 5B 48 85
C354:B9 C0 5B 9D C0 5B 68 99 0C
C35C:C0 5B 88 88 88 E8 E8 E8 57
C364:E0 1E 90 E8 CE 17 C0 10 E8
C36C:DB 4C 11 C1 A2 00 A0 02 8B
C374:BD C0 5B 48 B9 C0 5B 9D 20
C37C:C0 5B 68 99 C0 5B E8 E8 10
C384:E8 C8 C8 C8 C0 41 D0 E8 ED
C38C:A2 3E A0 08 3E C0 5B 6A 9F
C394:88 D0 F9 9D C0 5B CA 10 C6
C39C:F1 4C 11 C1 20 89 C1 A9 C2
C3A4:00 8D 11 C0 A9 80 8D 12 3A
C3AC:C0 A9 02 8D 13 C0 A9 04 0B
C3B4:8D 14 C0 AC 11 C0 B9 C0 AA
C3BC:5B 2D 12 C0 F0 0C AC 13 AF
C3C4:C0 B9 3D 5B 0D 14 C0 99 4C
C3CC:3D 5B 4E 12 C0 90 11 6E 8D
C3D4:12 C0 AE 11 C0 E8 8E 11 54
C3DC:C0 E0 3F D0 03 4C 07 C4 0E
C3E4:18 AD 13 C0 69 03 8D 13 D7
C3EC:C0 C9 48 90 C6 AD 13 C0 2D
C3F4:E9 48 8D 13 C0 0E 14 C0 8D
C3FC:90 B9 2E 14 C0 CE 13 C0 6A
C404:4C B7 C3 A2 3F A0 00 B9 7A
C40C:40 5B 99 C0 5B C8 CA D0 30
C414:F6 4C 11 C1 AD 03 C0 29 8E
C41C:F8 85 FB A9 28 85 FC 18 07
C424:A9 00 A2 08 6A 66 FB 90 CC
C42C:03 18 65 FC CA 10 F5 85 C1
C434:FC AD 04 C0 29 F8 18 65 F6
C43C:FB 85 FB 90 02 E6 FC AD 01
C444:05 C0 29 01 F0 02 E6 FC 10
C44C:AD 03 C0 29 07 18 65 FB 77
C454:85 FB 90 02 E6 FC 18 A9 D6
C45C:00 65 FB 85 FB A9 60 65 C3
C464:FC 85 FC 60 38 AD 01 D0 BE
C46C:E9 32 8D 03 C0 38 AD 00 9B
C474:D0 E9 18 8D 04 C0 AD 10 4B
C47C:D0 E9 00 8D 05 C0 AD 04 4C
C484:C0 29 07 8D 15 C0 60 20 FE
C48C:68 C4 A9 00 8D 16 C0 20 17
C494:18 C4 A0 00 AE 16 C0 B1 70
C49C:FB 9D C0 5B E8 18 98 69 9B
C4A4:08 A8 C0 20 D0 F1 AC 15 33
C4AC:C0 F0 15 CA 8A 1E C0 5B CB
C4B4:CA 3E C0 5B CA 3E C0 5B 2D
C4BC:CA 3E C0 5B AA 88 D0 ED 10
C4C4:EE 03 C0 AE 16 C0 E8 E8 F7
C4CC:E8 8E 16 C0 E0 3F F0 03 26
C4D4:4C 93 C4 4C 11 C1 A9 00 A9
C4DC:2C A9 01 2C A9 80 8D 02 36
C4E4:C0 20 68 C4 A9 00 8D 16 AE
C4EC:C0 AE 16 C0 A0 00 BD 40 12
C4F4:5B 99 17 C0 E8 C8 C0 03 70
C4FC:D0 F4 A9 00 99 17 C0 AC B8
C504:15 C0 F0 14 A2 00 5E 17 92
C50C:C0 E8 7E 17 C0 E8 7E 17 31
C514:C0 E8 7E 17 C0 88 D0 EC 32
C51C:20 18 C4 AD 02 C0 F0 1A 40
C524:30 32 A2 00 A0 00 BD 17 40
C52C:C0 11 FB 91 FB 98 18 69 D0
C534:08 A8 E8 E0 04 D0 EF 4C A8
C53C:6D C5 A2 00 A0 00 BD 17 DB
C544:C0 49 FF 31 FB 91 FB 98 4C
C54C:18 69 08 A8 E8 E0 04 D0 6D
C554:ED 4C 6D C5 A2 00 A0 00 4A
C55C:BD 17 C0 51 FB 91 FB 98 70
C564:18 69 08 A8 E8 E0 04 D0 85
C56C:EF EE 03 C0 AE 16 C0 E8 50
C574:E8 E8 8E 16 C0 E0 3F F0 DA
C57C:03 4C ED C4 60 A0 3E B9 62
C584:67 C0 99 C0 5B 88 10 F7 48
C58C:A9 00 8D 10 D0 A9 AC 8D B3
C594:00 D0 A9 8C 8D 01 D0 A9 0E
C59C:00 8D 00 C0 8D 01 C0 8D 17
C5A4:06 C0 8D 07 C0 4C 11 C1 A0
C5AC:20 D4 E1 A9 00 85 C3 A9 9B
C5B4:5C 85 C4 A9 00 20 A2 F4 BD
C5BC:4C D6 C5 20 D4 E1 A9 00 60
C5C4:85 C1 A9 5C 85 C2 A9 00 09
C5CC:85 AE A9 80 85 AF 20 EA 1A
C5D4:F5 60 AD 65 C0 0A 0A 0A CB
C5DC:0A 0D 66 C0 A2 00 86 FB A7
C5E4:A2 5C 86 FC A2 04 A0 00 DF
C5EC:91 FB C8 D0 FB E6 FC CA A6
C5F4:D0 F6 A9 6D 8D F8 5  60 22
C5FC:A9 20 0D 11 D0 8D 11 D0 C7
C604:A9 79 8D 18 D0 AD 00 DD 13
C60C:29 FC 09 02 8D 00 DD A9 80
C614:01 8D 15 D0 4C D6 C5 A9 28
C61C:DF 2D 11 D0 8D 11 D0 A9 10
C624:15 8D 18 D0 AD 00 DD 09 E1
C62C:03 8D 00 DD A9 00 8D 15 F9
C634:D0 60 A9 40 8D 19 C0 A9 77
C63C:FE 8D 1A C0 20 58 C6 A0 8C
C644:02 8A 29 10 D0 02 A0 20 8B
C64C:20 CF C6 20 E4 FF A8 F0 22
C654:EB 4C A2 B3 AE 00 DC AC 56
C65C:64 C0 CE 17 C0 CE 17 C0 C7
C664:10 03 AC 65 C0 8C 27 D0 FD
C66C:8A 29 08 D0 19 AD 10 D0 08
C674:29 01 F0 08 AD 00 D0 CD 52
C67C:19 C0 F0 0A EE 00 D0 D0 6F
C684:05 A9 01 8D 10 D0 8A 29 F9
C68C:04 D0 1E AD 10 D0 29 01 06
C694:D0 07 AD 00 D0 C9 18 F0 D0
C69C:10 AD 00 D0 D0 08 AD 10 BC
C6A4:D0 29 FE 8D 10 D0 CE 00 FE
C6AC:D0 8A 29 02 D0 0C AC 01 9B
C6B4:D0 CC 1A C0 F0 04 C8 8C E2
C6BC:01 D0 8A 29 01 D0 0B AC F0
C6C4:01 D0 C0 32 F0 04 88 8C 77
C6CC:01 D0 60 EA CE 18 C0 D0 F2
C6D4:FA 88 D0 F7 60 A9 00 2C 71
C6DC:A9 01 8D 02 C0 20 89 C1 AC
C6E4:A2 08 A0 00 B9 67 C0 99 60
C6EC:40 5B C8 C8 CA 10 F4 9D
C6F4:A9 57 8D 19 C0 A9 F9 8D 9E
C6FC:1A C0 20 58 C6 8A 29 10 14
C704:F0 05 A0 08 4C 33 C7 20 C0
C70C:68 C4 20 18 C4 AE 15 C0 52
C714:A9 80 E0 00 F0 05 CA 4A 30
C71C:4C 16 C7 A0 00 AE 02 C0 D9
C724:F0 05 11 FB 4C 2F C7 49 47
C72C:FF 31 FB 91 FB A0 20 20 63
C734:CF C6 20 E4 FF F0 C3 4C 47
C73C:81 C5 20 89 C1 A0 00 8C B7
C744:0A C0 20 7F C7 20 97 C7 BA
C74C:0E 19 C0 2E 18 C0 2E 17 5B
C754:C0 20 97 C7 20 7F C7 4E 98
C75C:17 C0 6E 18 C0 6E 19 C0 A9
C764:20 97 C7 C8 8C 0A C0 C0 3E
C76C:3F D0 D7 88 B9 C0 5B 59 34
C774:40 5B 99 C0 5B 88 D0 F4 CD
C77C:4C 11 C1 AC 0A C0 B9 C0 01
C784:5B 8D 17 C0 C8 B9 C0 5B 1E
C78C:8D 18 C0 C8 B9 C0 5B 8D A2
C794:19 C0 60 AC 0A C0 88 88 A4
C79C:88 30 03 20 B2 C7 AC 0A F6
C7A4:C0 C8 C8 C8 20 B2 C7 AC 74
C7AC:0A C0 20 B2 C7 60 AD 17 D2
C7B4:C0 19 40 5B 99 40 5B C8 F5
C7BC:AD 18 C0 19 40 5B 99 40 B5
C7C4:5B C8 AD 19 C0 19 40 5B C1
C7CC:99 40 5B 60 20 2F C8 B1 AB
C7D4:FB 49 FF 91 FB C8 D0 F7 6A
C7DC:E8 86 FC E0 80 D0 F0 4C A5
C7E4:28 C8 20 2F C8 98 91 FB 79
C7EC:C8 D0 FB E8 86 FC E0 80 8D
C7F4:D0 F4 4C 28 C8 20 2F C8 24
C7FC:B1 FB 91 FD C8 D0 F9 E6 DA
C804:FE E8 86 FC E0 80 D0 F0 8B
C80C:4C 28 C8 20 2F C8 B1 FB E4
C814:48 B1 FD 91 FB 68 91 FD B1
C81C:C8 D0 F3 E6 FE E8 86 FC D8
C824:E0 80 D0 EA A5 01 09 01 53
C82C:85 01 60 A5 01 29 FE 85 57
C834:01 A2 00 86 FD A2 A0 86 99
C83C:FE A2 00 86 FB A2 60 86 10
C844:FC A0 00 60 00 00 00 00 82
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SCREEN POINTER

Mark Turner

Give your programs a friendly, Macintosh-like interface with this clever machine language routine for the 64. Joystick required.

Every programmer, from time to time, has a need for an options menu in his or her program. After displaying a menu, most rely on the INPUT or GET statements to enter the user's selection. Although both statements are easy to use, each has its own limitations.

Another way to accept menu selections within a program is to use an on-screen pointer. Not only does a pointer make programs easier to use, it also gives them a more professional appearance. Now, with this short utility for the 64, you can add a joystick-driven pointer to all your BASIC programs.

Getting Started

Screen Pointer consists of three programs: Pointer, Demo, and Setup. Pointer is written entirely in machine language. To enter it, use *MLX*, the machine language entry program found elsewhere in this issue. When *MLX* prompts you, respond with the values given below.

Starting address: C000
Ending address: C20F

Be sure to save a copy of the program to disk as POINTER.ML before exiting *MLX*.

Demo and Setup are written in BASIC. Use *The Automatic Proofreader*, also in this issue, to type them in. Be sure to save a copy of both programs to the disk that contains POINTER.ML.

To see *Screen Pointer* in action, plug a joystick into port 2; then load and run Demo. Sixteen colored diamonds representing the foreground, border, and background color choices are displayed in the middle of the screen, along with a flashing sprite pointer. To change an existing color, move the pointer using the joystick onto a diamond of the desired color; then press the fire button. Note that the pointer can't be moved out of the color menu. Select either of the bottom two dots to exit the demo.

Using the Program

Any program that uses *Screen Pointer* must first load POINTER.ML from disk and execute a SYS 49152. Setup contains the statements that are necessary to use the pointer in your own programs. This program loads POINTER.ML, initializes it, and then sets several default parameters for the pointer. These parameters determine its shape, how far the pointer can move vertically and horizontally, how fast it can move, and so on. Your own program code would start at line 510. Anytime you need a response from the user, draw a menu on the screen and execute the statements WAIT 56320,16,16:WAIT 56320,16. Then PEEK locations 49654 and 49655 to reveal the row and column the pointer was on when the user pressed the fire button.

Of course, you may want to specify certain parameters for the pointer yourself. These values are POKEd into various memory locations. The pertinent memory locations and their functions are described in the following list.

49619 This location controls the top boundary of the pointer's movement. Values can range from 0 to 255. The natural sprite boundary for the top of the screen is 50, but since the pointer is not permitted to move off the screen, values less than 50 are treated as 50.

49620 This location determines the bottom boundary of the pointer. Again, values can range from 0 to 255. The bottom boundary should be below the top boundary.

49621,49622 This pair of locations controls how far left the pointer can move. Two bytes are needed because the screen's width (320 pixels) is too large to be stored in a single byte. Location 49621 is the high byte of the left boundary and should be either 0 or 1. Location 49622 is the low byte of the boundary and can range from 0 to 255.

49623,49624 This pair of locations determines how far right the pointer can move. Location 49623 is the high byte (it should be either 0 or 1); location 49624 is the low byte (it ranges from 0 to 255). The right boundary should be to the right of the left boundary.

49649 Location 49649 controls how fast the pointer can move. The speed can range from 0 to 255, with 255 being the fastest and 1 being the slowest. A speed of 0 prevents the pointer from moving. The best speeds for moving the pointer around the screen range between 2 and 5. Higher speeds could be used to jump the pointer between items in a menu.

49651 The pointer's blink speed is ▷

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controlled by this memory location. A value of 1 produces a rapid blink, and 255 produces a slow blink. A value of 0 disables pointer blinking.

49657 This is the starting location of a color-cycling table. *Screen Pointer* starts by setting the pointer's color to the first value in this table. It then changes the pointer's color to the next value in the table, and so on until it encounters a value of 16. At this point, it starts over from the beginning of the table. If you only want one color, POKE that color into memory location 49657 and then POKE 16 into memory location 49658.

49654,49655 These two addresses contain the current location (row,column) of the pointer on the screen. The value POKEd into 49654 can range from 0 to 39, while the value in 49655 ranges from 0 to 24.

49656 Memory location 49656 contains the screen code for the character that the pointer was on when the fire button was last pressed. It's updated only when the fire button is pressed.

49409,49410 This pair of memory locations contains the screen address of the pointer. The screen address is found with the equation *ADDRESS* = PEEK (49410)+256*PEEK(49409).

Other Important Memory Locations

Screen Pointer uses sprite 7 for its pointer. Here are a number of memory locations that control this sprite.

53269 This location determines whether all sprites are on or off. Bit 7 of location 53269 controls the visibility of the pointer. The statement POKE 53269,PEEK(53269) OR 128 turns the pointer on, while POKE 53269,PEEK (53269) AND 127 turns it off.

2047 This address is a pointer to the shape definition for sprite 7. The number that is stored here is multiplied by 256 and then added to the starting address of the current 16K video block (by default, the first 16K block). The default value is 255, so the normal location for the pointer shape data is at memory locations 16320–16383 (255 * 64 + 0 = 16320). Experienced programmers may want to change the shape of the pointer or use a different area for its shape data.

53262,53264 These locations determine the pointer's horizontal position. The high bit for the pointer's position is represented by bit 7 of location 53264. Thus, to reposition the pointer, POKE a number in the range 0–255 to 53262 when bit 7 of location 53264 is 0, and POKE a number 0–87 to 53262 when bit 7 of location 53264 is 1.

53263 This location determines the pointer's vertical position. It should be somewhere in the range 50–249 for the pointer to be visible.

Pointer

```
C000:4C 06 C0 4C 1F C0 AD 14 71
C008:03 8D D9 C1 AD 15 03 8D 1B
C010:DA C1 78 A9 2E 8D 14 03 EB
C018:A9 C0 8D 15 03 58 60 78 54
C020:AD D9 C1 8D 14 03 AD DA E2
C028:C1 8D 15 03 58 60 A9 7F D7
C030:38 ED 00 DC 29 0F 0A A8 59
C038:B9 DB C1 8D 4D C0 B9 DC 5C
C040:C1 8D 4E C0 A0 00 CC F1 6C
C048:C1 F0 07 C8 20 BA C1 4C 10
C050:46 C0 AD F4 C1 CD F3 C1 19
C058:F0 06 EE F4 C1 4C 80 C0 02
C060:A9 00 8D F4 C1 18 AD F2 74
C068:C1 C9 0F 90 05 A9 00 8D 84
C070:F2 C1 A8 B9 F9 C1 C9 10 07
C078:F0 0C 8D 2E D0 EE F2 C1 F3
C080:20 8F C0 4C 31 EA A9 00 5B
C088:8D F2 C1 A8 4C 72 C0 AD AB
C090:00 DC 29 10 F0 01 60 20 DB
C098:14 C1 20 07 C1 60 AD 0F 03
C0A0:D0 38 E9 32 4A 4A 4A 8D 96
C0A8:F7 C1 60 AC 0E D0 AE 10 8E
C0B0:D0 8A 29 80 D0 05 98 38 6E
C0B8:E9 18 A8 98 4A 4A 4A A8 8C
C0C0:8A 29 80 F0 05 98 18 69 15
C0C8:1D A8 98 8D F6 C1 60 18 86
C0D0:A0 00 A9 00 A2 00 8D 02 0A
C0D8:C1 CC F7 C1 F0 11 C8 8A 71
C0E0:18 69 28 AA AD 02 C1 69 DA
C0E8:00 8D 02 C1 4C D9 C0 18 8D
C0F0:8A 6D F6 C1 8D 01 C1 AD AF
C0F8:02 C1 69 04 8D 02 C1 60 B1
C100:AD DB 07 8D F8 C1 60 20 BA
C108:9E C0 20 AB C0 20 CF C0 B0
C110:20 00 C1 60 AD F5 C1 F0 9B
C118:05 A9 00 8D F1 C1 60 AD 66
C120:0F D0 CD D3 C1 F0 07 C9 FF
C128:32 F0 03 CE 0F D0 60 AD 78
C130:0F D0 CD D4 C1 F0 07 C9 20
C138:F9 F0 03 EE 0F D0 60 18 D8
C140:AD 10 D0 29 80 D0 17 AD 6E
C148:D5 C1 D0 31 AD 0E D0 CD 69
C150:D6 C1 F0 29 C9 18 F0 25 16
C158:CE 0E D0 4C 7D C1 AD D5 C9
C160:C1 F0 08 AD 0E D0 CD D6 03
C168:C1 F0 12 CE 0E D0 AD 0E 55
C170:D0 C9 FF D0 08 AD 10 D0 C3
C178:29 7F 8D 10 D0 60 18 AD 09
C180:10 D0 29 80 F0 17 AD D7 84
C188:C1 F0 2F AD 0E D0 CD D8 12
C190:C1 F0 27 C9 57 F0 23 EE 66
C198:0E D0 4C BA C1 AD D7 C1 C2
C1A0:D0 08 AD 0E D0 CD D8 C1 56
C1A8:F0 10 EE 0E D0 AD 0E D0 91
C1B0:D0 08 AD 10 D0 09 80 8D 8E
C1B8:10 D0 60 20 1F C1 4C 3F 5E
C1C0:C1 20 2F C1 4C 3F C1 20 32
C1C8:1F C1 4C 7E C1 20 2F C1 6C
C1D0:4C 7E C1 00 FF 00 00 01 53
C1D8:FF 31 EA BA C1 1F C1 2F EE
C1E0:C1 BA C1 3F C1 BB C1 C1 62
C1E8:C1 BA C1 7E C1 C7 C1 CD 9A
C1F0:C1 03 04 0A 04 00 1B 18 A5
C1F8:20 00 0B 0C 0F 01 0F 0C 55
C200:0B 10 00 00 00 00 00 00 0F
C208:00 FF 00 00 00 00 00 00 8D
```

Demo

```
EA 10 IFPEEK(49152)<>76THENLOA
      D"POINTER.ML",8,1
MJ 20 PRINT"{CLR}";TAB(8)"COPY
      RIGHT 1990 COMPUTE!
ER 30 PRINTTAB(10)"PUBLICATION
      S,{2 SPACES}INC."
AA 40 PRINTTAB(10)"ALL RIGHTS
      {SPACE}RESERVED"
QG 50 FOR JF=1TO2000:NEXT
BX 60 GOSUB470:EN=100
BC 70 PRINT"{CLR}"
QR 80 A$="{BLK}Z{WHT}Z{RED}Z
      {CYN}Z{PUR}Z{GRN}Z{BLU}Z
      {YEL}Z{1}Z{2}Z{3}Z{4}Z
      {5}Z{6}Z{7}Z{8}Z":DIMA$(
      15)
FD 90 FORI=0TO15:A$(I)=MID$(A$
      ,(I+1)*2-1,1):NEXT:C=PEE
      K(646)AND15
AG 100 GOTO200
XM 110 PRINTTAB(13)A$(C)"SELEC
       T COLORS{7 DOWN}"
RF 120 PRINT"{22 SPACES}111111
       "
DJ 130 PRINT"{12 SPACES}012345
       6789012345"
CG 140 PRINT"{11 SPACES}UCCCCC
       CCCCCCCCCCI"
BF 150 PRINT" FOREGROUNDB"A$A$
       (C)"B"
BR 160 PRINT"{5 SPACES}BORDERB
       "A$A$(C)"B"
SK 170 PRINT"{2 SPACES}CHARACT
       ERB"A$A$(C)"B"
JB 180 PRINT"{7 SPACES}QUITB
       {7 SPACES}QQ{7 SPACES}-
       "
SD 190 PRINT"{11 SPACES}JCCCCC
       CCCCCCCCCCCK":RETURN
DH 200 TB%=146:LB%=120:RB%=247
       :RH%=0:BB%=177:GOSUB760
       :GOSUB110
BH 210 POKE 53269,128:POKE5326
       2,120:POKE53263,146:POK
       E2047,254:SYS 49152
PS 220 GOSUB730
RX 230 ONPEEK(PY)-11GOTO240,25
       0,260,270
EP 240 POKE53281,PEEK(PX)-12:G
       OTO220
EP 250 POKE53280,PEEK(PX)-12:G
       OTO220
HP 260 C=PEEK(PX)-12:PRINT"
       {HOME}":GOSUB110:GOTO22
       0
FX 270 I=PEEK(PX)-12:IFI<7ORI>
       8THEN220
KJ 280 POKE 53269,0:TB%=98:BB%
       =201:LB%=104:RB%=111:RH
       %=0:GOSUB760:POKE53262,
       104
GS 290 POKE53263,114:POKE53269
       ,128:POKESP,2:POKEBS,0
DE 300 SYS49155:PRINT"{CLR}";:
       POKE53269,0:END
BR 310 DATA128,000,000,096,000
       ,000,088,000
DQ 320 DATA000,038,000,000,033
       ,128,000,017
HQ 330 DATA000,000,017,000,000
       ,014,128,000
PX 340 DATA009,064,000,000,160
       ,000,000,080
SM 350 DATA000,000,032,000,000
       ,000,000,000
QF 360 DATA000,000,000,000,000
       ,000,000,000
JG 370 DATA000,000,000,000,000
       ,000,000,000
EG 380 DATA000,000,000,000,000
       ,000,000,000
GJ 390 DATA128,000,000,096,000
       ,000,120,000
CK 400 DATA000,062,000,000,063
       ,128,000,031
ES 410 DATA000,000,031,000,000
       ,015,128,000
QS 420 DATA009,192,000,000,224
       ,000,000,112
DS 430 DATA000,000,032,000,000
       ,000,000,000
JM 440 DATA000,000,000,000,000
       ,000,000,000
QP 450 DATA000,000,000,000,000
       ,000,000,000
AP 460 DATA000,000,000,000,000
       ,000,000,000
XD 470 FORI=0TO15:FORT=0TO7:RE
```

```
        ADA:POKE254*64+I*8+T,A:
        NEXT:NEXT
GD 480  DATA 000
RP 490  DATA 255
GG 500  DATA 000,000
SD 510  DATA 001,255
BF 520  DATA 001
HJ 530  DATA 004
EF 540  DATA 0,1,16
HH 550  DATA 000
DK 560  TB=49619:READA:POKETB,A
GQ 570  BB=49620:READA:POKEBB,A
DD 580  LH=49621:READA:POKELH,A
DJ 590  LB=49622:READA:POKELB,A
BH 600  RH=49623:READA:POKERH,A
KQ 610  RB=49624:READA:POKERB,A
DQ 620  SP=49649:READA:POKESP,A
ER 630  FL=49651:READA:POKEFL,A
RR 640  CL=49657:I=0
XF 650  READA:POKECL+I,A:I=I+1:
        IFA<>16THENGOTO650
QH 660  BS=49653:READA:POKEBS,A
HM 670  PX=49654:REM POINTER CO
        LUMN (X)
KX 680  PY=49655:REM POINTER RO
        W (Y)
PX 690  CH=49656:REM CHARACTER
        {SPACE}POINTED TO
FK 700  LL=49409:REM SCRN POS (
        LOW BYTE)
FJ 710  LH=49410:REM SCRN POS (
        HIGH BYTE)
FC 720  RETURN
PK 730  WAIT56320,16,16:WAIT563
        20,16
KK 740  CH%=PEEK(CH)
KE 750  RETURN
PH 760  POKERH,RH%:POKELH,LH%
DX 770  POKETB,TB%:POKEBB,BB%:P
        OKERB,RB%:POKELB,LB%:PO
        KE53269,128:RETURN
```

Setup

```
JJ 1    IFPEEK(49152)<>76THENLOAD
        "POINTER.ML",8,1
SX 5    GOSUB 260
JX 10   POKE 53269,128:POKE 5326
        2,24:POKE53263,50:POKE20
        47,255:SYS 49152
FA 20   END
GA 100  DATA128,000,000,096,000
        ,000,088,000
JX 110  DATA000,038,000,000,033
        ,128,000,017
SX 120  DATA000,000,017,000,000
        ,014,128,000
CB 130  DATA009,064,000,000,160
        ,000,000,080
HQ 140  DATA000,000,032,000,000
        ,000,000,000
MJ 150  DATA000,000,000,000,000
        ,000,000,000
GJ 160  DATA000,000,000,000,000
        ,000,000,000
CK 170  DATA000,000,000,000,000
        ,000,000,000
XP 180  DATA128,000,000,096,000
        ,000,120,000
ER 190  DATA000,062,000,000,063
        ,128,000,031
KB 200  DATA000,000,031,000,000
        ,015,128,000
BA 210  DATA009,192,000,000,224
        ,000,000,112
CB 220  DATA000,000,032,000,000
        ,000,000,000
FQ 230  DATA000,000,000,000,000
        ,000,000,000
BR 240  DATA000,000,000,000,000
        ,000,000,000
RS 250  DATA000,000,000,000,000
        ,000,000,000
EB 260  FORI=0TO15:FORT=0TO7:RE
        ADA:POKE254*64+I*8+T,A:
        NEXT:NEXT
JG 270  DATA 000:REM TOP BOUNDA
        RY
MM 280  DATA 255:REM BOTTOM BOU
        NDARY
AE 290  DATA 000,000:REM LEFT B
        OUNDARY
MM 300  DATA 001,255:REM RIGHT
        {SPACE}BOUNDARY
MD 310  DATA 002:REM POINTER SP
        EED
FX 320  DATA 004:REM FLASH SPEE
        D
HC 330  DATA 0,11,12,15,1,15,12
        ,11,16:REM COLOR DATA
CX 340  DATA 000::REM BUTTON ST
        OP
CM 350  TB=49619:READA:POKETB,A
XK 360  BB=49620:READA:POKEBB,A
CQ 370  LH=49621:READA:POKELH,A
KF 380  LB=49622:READA:POKELB,A
FD 390  RH=49623:READA:POKERH,A
BJ 395  RB=49624:READA:POKERB,A
GS 400  SP=49649:READA:POKESP,A
RX 410  FL=49651:READA:POKEFL,A
CQ 420  CL=49657:I=0
JS 430  READA:POKECL+I,A:I=I+1:
        IFA<>16THENGOTO430
DG 440  BS=49653:READA:POKEBS,A
AQ 450  PX=49654:REM POINTER CO
        LUMN (X)
JR 460  PY=49655:REM POINTER RO
        W (Y)
GR 470  CH=49656:REM CHARACTER
        {SPACE}POINTED TO
BQ 480  LL=49409:REM SCRN POS (
        LOW BYTE)
KR 490  LH=49410:REM SCRN POS (
        HIGH BYTE)
QF 500  RETURN
```

G

Statement of Ownership, Management, and Circulation as Required by 39 U.S.C. 3685

1A. COMPUTE!'s Gazette
1B. 699710
2. 9-28-89
3. Monthly
3A. Twelve
3B. $24.00
4. 825 7th Ave., New York, NY 10019
5. Same
6. Publisher, William Tynan, 825 7th Ave., New York, NY 10019; Editor, Lance Elko, 324 W. Wendover Ave., Suite 200, Greensboro, NC 27408; Managing Editor, Kathleen Martinek, 324 W. Wendover Ave., Suite 200, Greensboro, NC 27408
7. ABC Consumer Magazines, Inc., a division of ABC Publishing, Inc., a Capital Cities/ABC Inc. Company, 77 West 66 Street, New York, NY 10023; 825 7th Ave., New York, NY 10019
8. N/A
9. N/A
10. Extent and Nature of Circulation

	Avg. no. copies each issue during preceding 12 months	Actual no. copies of single issue published nearest to filing date
A. Total no. Copies (Net Press Run)	317,723	278,922
B. Paid Circulation		
1. Sales through dealers and carriers, street vendors, and counter sales	48,526	43,785
2. Mail subscriptions	136,226	110,000
C. Total Paid Circulation	184,752	153,785
D. Free Distribution by mail, carrier, or other means, samples, complimentary and other free copies	2,403	3,370
E. Total Distribution	187,155	157,155
F. Copies not Distributed		
1. Office use, left over, unaccounted for, spoiled after printing	3,366	1,952
2. Returns from news agents	127,202	119,815
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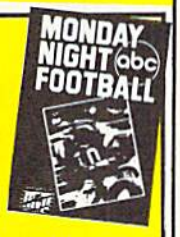

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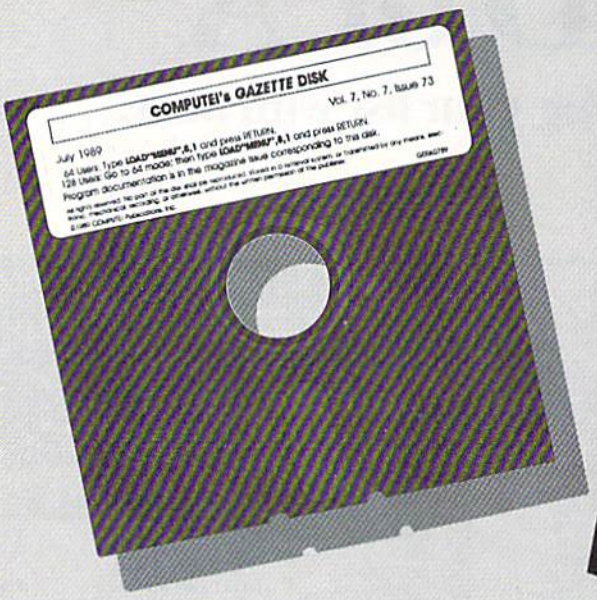

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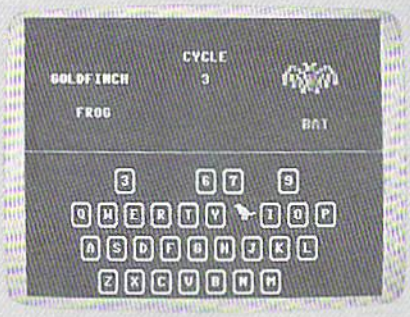

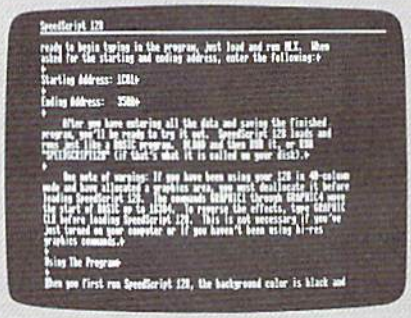

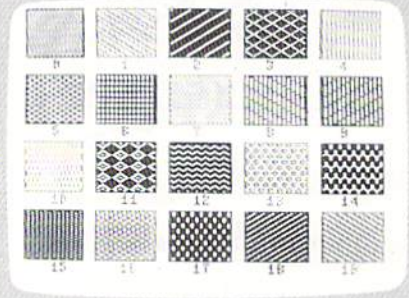

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FLAGS

Peter M. L. Lottrup

Flags are used to represent all the nations of the world. Each one is unique in its appearance. Some have stripes, some have many colors, and some even have symbols on them. But for most of us, they all have one thing in common: They're easily confused with one another. *Flags* is a one- or two-player educational game that will help you learn to identify the flags from many countries.

Learn the flags of more than 40 different countries with this educational trivia game for the 64. A joystick is required.

Getting Started

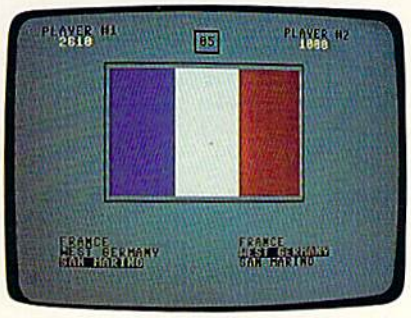
Flags is written entirely in BASIC. To ensure accurate typing, enter the program using *The Automatic Proofreader*, found elsewhere in this issue. When you've finished typing, be sure to save a copy of the program to tape or disk.

The game is played with two joysticks. Plug them in, load the program, and type RUN. (If you have only one joystick, plug it into port 2.) A menu will appear, prompting you for a practice round, a one-player game, or a two-player game. If you choose the practice round, you can cycle through all the flags by pressing the + or − key. Each flag and the country it represents will be displayed. To return to the menu, press Q.

Playing the Game

When you're ready to play *Flags*, specify option 2 for a one-player game or option 3 for a two-player game. The game screen will appear with the scores and a timer at the top. Press the space bar to begin.

At the start of each round, a flag is displayed in the center of the screen. A list of three countries is shown at the bottom left. If you're playing head-to-head, the list also appears at the bottom right. Players have 15 seconds to match the flag with the corresponding country. To select a country from the list, use the joystick to move the highlight bar over your choice and then press the fire button.



In Flags, *test your knowledge of world flags in head-to-head competition.*

The sooner you provide the answer, the more points you score. Be careful though; points are deducted for incorrect choices. If no one gives the correct response in the allotted time, the answer is given and the game continues with the next flag.

A one-player game ends after ten flags have been displayed. A two-player game ends when one of the players reaches 5000 points. To abort a game at any time, press the f7 key.

Flags

```
FF 5 REM COPYRIGHT 1989 COMPUT
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FC 10 FORI=1TO24:L2$=L2$+"*":N
     EXT:L1$=LEFT$(L2$,17)
XQ 20 FORI=54272TO54296:POKEI,
     0:NEXT
RB 30 PRINT"{CLR}";:AA$="{2}
     {RVS} ":FORI=1TO20:AA$=A
     A$+"{DOWN}{LEFT} ":NEXT:
     X=RND(-TI)
JS 40 MX=41:DIMFL$(MX),FL(MX),
     V$(24),AA(MX),CL(MX):FOR
     I=1TOMX:READZ,A,B,C,D$
HQ 50 FL(I)=Z:FL$(I)=CHR$(A)+C
     HR$(B)+CHR$(C)+D$:NEXT
RG 60 POKE53280,12:POKE53281,1
     2
XQ 70 V$(0)="{HOME}":FORI=1TO2
     4:V$(I)=V$(I-1)+"{DOWN}"
     :NEXT
SC 80 FORI=1TO30:SP$=SP$+" ":S
     3$=S3$+"{O}":S4$=S4$+"
     {U}":NEXT:S2$=LEFT$(SP$,
     20)
JB 90 S5$="{RVS}"+LEFT$(SP$,24
     ):CL(1)=7:CL(2)=6:CL(3)=
     2:CL(4)=0:CL(5)=5:CL(27)
     =2
SC 100 S=53248:FORI=704TO704+6
     3:POKEI,0:NEXT
AA 110 FORI=832TOI+63:POKEI,0:
     NEXT
CM 120 FORI=704TO725:READA:POK
     EI,A:NEXT
EJ 130 FORI=833TO860:READA:POK
     EI,A:NEXT
BR 140 POKE2040,11:POKE2041,13
     :PRINT"{CLR}";:PRINTV$(
     6)TAB(10)"{BLK}"LEFT$(S
     3$,19)"{F}"
SR 150 PRINTV$(15)TAB(10)LEFT$
     (S4$,19)"{V}"
EA 160 PRINTV$(7)TAB(10)"{RVS}
     {BLU}{A}"L1$"{S}"
KX 170 POKES+21,0:PRINTTAB(10)
     "{RVS}-{6 SPACES}FLAGS
     {6 SPACES}-"
EM 180 PRINTTAB(10)"{RVS}-
     {17 SPACES}-"
FM 190 PRINTTAB(10)"{RVS}- (1)
      LEARN FLAGS -"
FH 200 PRINTTAB(10)"{RVS}- (2)
      ONE PLAYER{2 SPACES}-"
PQ 210 PRINTTAB(10)"{RVS}- (3)
```
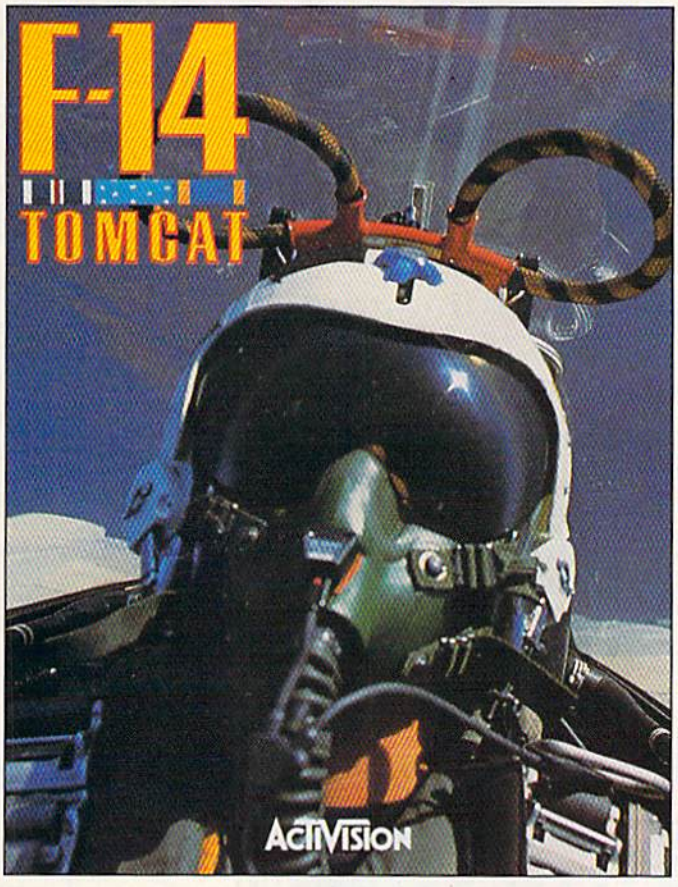

```
      TWO PLAYERS -"
PQ 220 PRINTTAB(10)"{RVS}-
       {17 SPACES}-"
AH 230 PRINTTAB(10)"{RVS}{Z}"L
       1$"{X}{OFF}"V$(7);
ME 240 FORI=7TO14:PRINTTAB(29)
       "{6}{BLK}{J}":NEXT
SA 250 PRINTV$(6)TAB(9)LEFT$(A
       A$,LEN(AA$)-9)
GX 260 PRINTV$(5)TAB(9)"{YEL}A
       "
PG 270 GETCH$:IFCH$<"1"ORCH$>"
       3"ORCH$=""THEN270
GF 280 IFCH$="1"THEN900
HQ 290 PL=1:GS=0:PRINT"{CLR}
       {BLK}PLAYER #1":PRINT"
       {2 SPACES}{YEL}0000"
FG 300 PRINT"{HOME}"TAB(18)"
       {BLK}{A}**{S}"V$(1)TAB(
       18)"-{2 SPACES}-"V$(2)T
       AB(18)"{Z}**{X}"
JJ 310 IFCH$="3"THENPRINT"
       {HOME}"TAB(30)"{BLK}PLA
       YER #2"V$(1)TAB(32)"
       {YEL}0000"
RJ 320 PRINTV$(12)TAB(12)"
       {RVS}{BLK} <SPACE> TO S
       TART ":SC(1)=0:SC(2)=0:
       RR=0
PC 330 GETA$:IFA$<>" "THEN330
JB 340 RR=RR+1:IFRR>10ANDCH$="
       2"THENRR=0:GOTO2000
HD 350 CC=0:FORI=1TOMX:IFAA(I)
       =0THENCC=1
CB 360 NEXT:IFCC=0THENFORI=1TO
       MX:AA(I)=0:NEXT
BH 370 X=INT(RND(1)*MX)+1:IFAA
       (X)=1THEN370
JK 380 AA(X)=1:YY=X:Z$=MID$(FL
       $(YY),4):GOSUB1050
KS 390 GOSUB1080:A$(1)=MID$(FL
       $(YY),4)
BF 400 X1=INT(RND(1)*MX)+1:IFX
       1<>YYTHENA$(2)=MID$(FL$
       (X1),4):GOTO420
GP 410 GOTO400
EK 420 X2=INT(RND(1)*MX)+1:IFX
       2<>X1ANDX2<>YYTHENA$(3)
       =MID$(FL$(X2),4):GOTO44
       0
QS 430 GOTO420
FP 440 IFRND(1)<.5THENT$=A$(1)
       :A$(1)=A$(2):A$(2)=T$
KB 450 IFRND(1)<.5THENT$=A$(2)
       :A$(2)=A$(3):A$(3)=T$
RC 460 IFRND(1)<.5THENT$=A$(1)
       :A$(1)=A$(3):A$(3)=T$
XS 470 T=15:T$="15":RV$="{RVS}
       "
KR 480 FORI=1TO3:PRINTV$(19+I)
       S2$MID$(S2$,2):PRINTV$(
       19+I)"{2 SPACES}"RV$"
       {BLK}"A$(I)
KC 490 IFCH$="3"THENPRINTV$(19
       +I)TAB(24)RV$A$(I)
PJ 500 RV$="{OFF}":NEXT:P1=1:P
       2=1
CR 510 X1=NOTPEEK(56321)AND15:
       X2=NOTPEEK(56320)AND15
GJ 520 GETA$:IFA$="{F7}"THEN14
       0
MM 530 IFX1=0ANDX2=0THEN670
QJ 540 IFX1<>1ANDX1<>2THEN560
FQ 550 PRINTV$(P1+19)"
       {2 SPACES}{OFF}"A$(P1)
XG 560 IFX2<>1ANDX2<>2THEN580
HG 570 IFCH$="3"THENPRINTV$(P2
       +19)TAB(24)"{OFF}"A$(P2
       )
EM 580 IFX1=1THENP1=P1-1
AX 590 IFX2=1THENP2=P2-1
EK 600 IFX2=2THENP2=P2+1
AP 610 IFX1=2THENP1=P1+1
EQ 620 IFP1<1THENP1=3
HC 630 IFP2<1THENP2=3
RC 640 IFP1>3THENP1=1
XA 650 IFP2>3THENP2=1
CH 660 PRINTV$(P1+19)"
       {2 SPACES}{RVS}"A$(P1):
       IFCH$="3"THENPRINTV$(P2
       +19)TAB(24)"{RVS}"A$(P2
       )
PC 670 TM=TM+1:IFTM>5THENT=T-1
       :TM=0:GOSUB1960
FJ 680 IFT<0THEN890
XG 690 T$=RIGHT$("0"+MID$(STR$
       (INT(T)),2),2):PRINT"
       {HOME}{DOWN}"TAB(19)T$
FP 700 B1=(PEEK(56321)AND16)/1
       6:B2=1:IFCH$="3"THENB2=
       (PEEK(56320)AND16)/16
HM 710 IFB1ANDB2THEN510
EQ 720 PP=P2:PL=2:IFB1=0THENPP
       =P1:PL=1
CE 730 TB=17:IFPL=1THENTB=0
EH 740 FORI=20TO22:PRINTV$(I)S
       2$MID$(S2$,2):NEXT
EK 750 PRINTV$(22)TAB(2+TB)"
       {BLK}*** {BLU}"A$(PP)"
       {SPACE}{BLK}***"
PQ 760 IFA$(PP)=Z$THEN810
QQ 770 GOSUB1990
CP 780 PRINTV$(18)TAB(8)"WRONG
       ! IT WAS "Z$:SC(PL)=SC(
       PL)-INT(T*30)
PF 790 IFSC(PL)<0THENSC(PL)=0
CG 800 GOTO820
XB 810 PRINTV$(18)TAB(16)"CORR
       ECT!":SC(PL)=SC(PL)+INT
       (T*50):GOSUB1970
QD 820 S$=RIGHT$("0000"+MID$(S
       TR$(SC(1)),2),4)
HA 830 PRINT"{HOME}{DOWN}
       {2 SPACES}{YEL}"S$:IFCH
       $="2"THEN860
BH 840 S$=RIGHT$("0000"+MID$(S
       TR$(SC(2)),2),4):PRINT"
       {HOME}{DOWN}{YEL}"TAB(3
       2)S$
AF 850 IFSC(1)>5000ORSC(2)>500
       0THEN2000
SQ 860 FORDY=1TO1500:NEXT
HK 870 FORI=18TO23:PRINTV$(I)S
       2$MID$(S2$,2):NEXT
QM 880 GOTO340
QG 890 GOSUB1990:PRINTV$(18)TA
       B(5)"OUT OF TIME! IT WA
       S "Z$:GOTO860
EX 900 PRINT"{CLR}{BLK}LEARN M
       ODE{2}":X=1:PRINTV$(3)T
       AB(6)AA$
KE 910 PRINTV$(2)TAB(6)"A"
SD 920 PRINT"{HOME}{DOWN}{BLK}
       {10 Y}"
GX 930 PRINTV$(21)TAB(10)"
       {BLK}(+) NEXT FLAG"
RR 940 PRINTTAB(10)"(-) PREVIO
       US FLAG"
DS 950 PRINTTAB(10)"(Q) QUIT"
PF 960 GOSUB1050:GOSUB1080
FH 970 GETA$:IFA$="+"THEN1010
EP 980 IFA$="Q"THEN140
DH 990 IFA$<>"-"THEN970
BQ 1000 GOTO1030
EX 1010 X=X+1:IFX>MXTHENX=1
FA 1020 GOTO960
BF 1030 X=X-1:IFX<1THENX=MX
XD 1040 GOTO960
JM 1050 POKES+21,0:E=7:PRINTV$
       (3);:PRINTTAB(E)"{4}
       {A}"L2$"{S}"
RS 1060 FORI=1TO12+EU:PRINTTAB
       (E)"{OFF}{4}-"MID$(S5$
       ,2)"-":NEXT
RC 1070 PRINTTAB(E)"{4}{Z}"L2$
       "{X}":RETURN
AR 1080 AA(X)=1
GM 1090 IFCH$="1"THENPRINTV$(1
       8)TAB(15)"{BLU}"MID$(F
       L$(X),4)LEFT$(S2$,10)
QB 1100 A$=FL$(X):A=FL(X)
PA 1110 ONAGOTO1120,1210,1270,
       1310,1350,1390,1420,14
       30,1470,1500
RJ 1120 PRINTV$(4);:FORI=1TO4:
       PRINTTAB(8)LEFT$(A$,1)
       S5$:NEXT
RB 1130 FORI=1TO4:PRINTTAB(8)M
       ID$(A$,2,1)S5$:NEXT
RS 1140 FORI=1TO4:PRINTTAB(8)M
       ID$(A$,3,1)S5$:NEXT
XE 1150 IFX<10ORX>12THEN1170
GX 1160 POKES,173:POKES+1,122:
       POKES+39,CL(X-9):POKES
       +23,1:POKES+29,1:POKES
       +21,1
FM 1170 IFX<14ORX>15THEN1200
SJ 1180 POKES+2,158:POKES+3,12
       0:POKES+40,CL(X-10):PO
       KES+23,3:POKES+29,3
EP 1190 POKES+40,A:POKES+21,2
PP 1200 RETURN
QE 1210 PRINTV$(4);:FORI=1TO12
       :PRINTTAB(8)LEFT$(A$,1
       )"{RVS}{8 SPACES}"MID$
       (A$,2,1);
QC 1220 PRINT"{8 SPACES}"MID$(
       A$,3,1)"{8 SPACES}":NE
       XT
GA 1230 IFX=20THENPRINTV$(9)TA
       B(19)"{BLK}R"
AR 1240 IFX<25THENRETURN
CC 1250 POKES+2,158:POKES+3,12
       0:POKES+23,3:POKES+29,
       3:A=7:IFX=25THENA=5
XS 1260 POKES+40,A:POKES+21,2:
       RETURN
EF 1270 PRINTV$(4);:FORI=1TO6:
       PRINTTAB(8)LEFT$(A$,1)
       S5$:NEXT
XF 1280 FORI=1TO6:PRINTTAB(8)M
       ID$(A$,2,1)S5$:NEXT
RX 1290 IFX=30THENFORI=4TO15:P
       RINTV$(I)TAB(8)"{RVS}
       {WHT}"LEFT$(S2$,8):NEX
       T
AA 1300 RETURN
AP 1310 PRINTLEFT$(A$,1):GOSUB
       1490
JG 1320 PRINTMID$(A$,2,1);
SB 1330 FORI=4TO15:PRINTV$(I)T
       AB(15)"{RVS}{2 SPACES}
       ":NEXT
GQ 1340 PRINTV$(9)TAB(8)S5$:PR
       INTTAB(8)S5$:RETURN
RC 1350 PRINTLEFT$(A$,1);:GOSU
       B1490
KJ 1360 FORI=6TO13:PRINTV$(I)T
       AB(19)"{RVS}{WHT}
       {2 SPACES}";:NEXT
MA 1370 FORI=9TO10:PRINTV$(I)T
       AB(14)"{RVS}"LEFT$(S2$
       ,12):NEXT
JG 1380 RETURN
BX 1390 PRINTLEFT$(A$,1);:GOSU
       B1490
EK 1400 POKES+2,158:POKES+3,12
       0:POKES+40,1:POKES+23,
       3:POKES+29,3
DH 1410 POKES+21,2:RETURN
QE 1420 PRINTLEFT$(A$,1):GOSUB
       1490:GOTO1160
EF 1430 PRINT"{BLU}":GOSUB1490
DQ 1440 PRINTV$(4)TAB(8)"{RED}
       "S5$V$(5)TAB(8)S5$V$(1
       4)TAB(8)S5$V$(15)TAB(8
```

Will they call you "Tinkerbell" or "Deadeye"?



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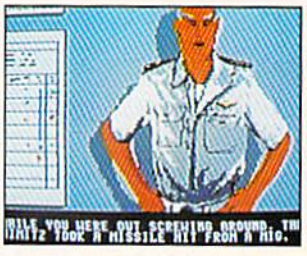

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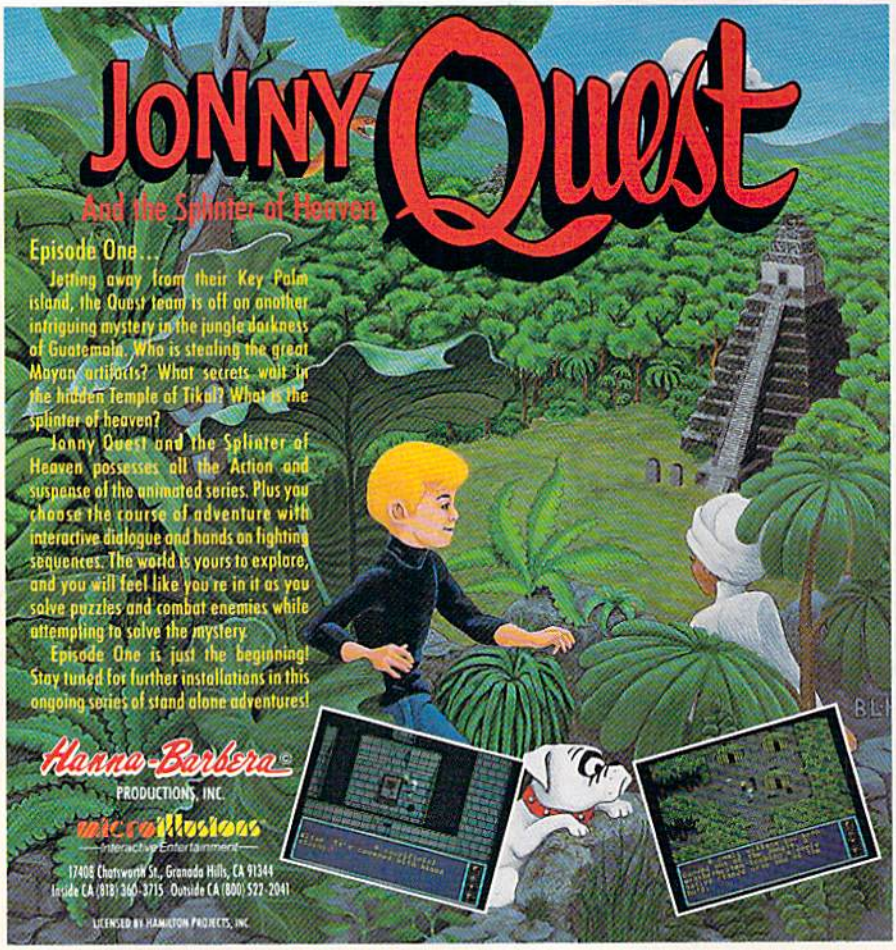
```
)S5$
JG 1450 PRINTV$(6)TAB(8)"{WHT}
        "S5$V$(7)TAB(8)S5$V$(1
        2)TAB(8)S5$V$(13)TAB(8
        )S5$
QR 1460 RETURN
XA 1470 PRINT"{WHT}":GOSUB1490
        :FORI=4TO15
XF 1480 PRINTV$(I)TAB(20)"
        {RED}{RVS}"MID$(S5$,14
        ):NEXT:PRINTV$(5)TAB(9
        )"{BLK}+":RETURN
RE 1490 FORI=4TO15:PRINTV$(I)T
        AB(8)S5$:NEXT:RETURN
GH 1500 PRINT"{RED}":GOSUB1490
FK 1510 FORI=4TO7:PRINT"{YEL}
        {RVS}"V$(I)TAB(14)MID$
        (S5$,8):NEXT
JF 1520 FORI=12TO15:PRINT"
        {RVS}{GRN}"V$(I)TAB(14
        )MID$(S5$,8):NEXT:RETU
        RN
FR 1530 DATA1,28,5,31,"NETHERL
        ANDS"
XJ 1540 DATA1,158,31,28,"VENEZ
        UELA"
MA 1550 DATA1,28,5,28,"AUSTRIA
        "
EJ 1560 DATA1,28,158,28,"SPAIN
        "
QX 1570 DATA1,28,5,30,"HUNGARY
        "
BH 1580 DATA1,28,5,154,"LUXEMB
        OURG"
AF 1590 DATA1,28,5,144,"LIBYA"
JQ 1600 DATA1,30,158,28,"ETHIO
        PIA"
AR 1610 DATA1,30,158,31,"GABON
        "
XF 1620 DATA1,154,5,154,"ARGEN
        TINA"
FB 1630 DATA1,28,5,30,"INDIA"
AK 1640 DATA1,28,5,30,"NIGER"
CC 1650 DATA1,144,28,158,"WEST
         GERMANY"
BH 1660 DATA1,28,158,30,"GHANA
        "
SD 1670 DATA1,28,5,144,"YEMEN"
KJ 1680 DATA1,5,30,28,"BULGARI
        A"
JR 1690 DATA2,31,158,28,"CHAD"
FG 1700 DATA2,28,158,144,"BELG
        IUM"
BG 1710 DATA2,31,5,28,"FRANCE"
PK 1720 DATA2,28,158,30,"RWAND
        A"
PX 1730 DATA2,30,5,28,"ITALY"
JS 1740 DATA2,28,158,30,"NEW G
        UINEA"
KF 1750 DATA2,30,5,30,"NIGERIA
        "
BJ 1760 DATA2,28,5,30,"IVORY C
        OAST"
FG 1770 DATA2,30,28,158,"CAMER
        OON"
CG 1780 DATA2,30,158,28,"SENEG
        AL"
GS 1790 DATA3,5,154,1,"SAN MAR
        INO"
SK 1800 DATA3,28,5,1,"INDONESI
        A"
XG 1810 DATA3,5,28,1,"POLAND"
MK 1820 DATA3,28,30,1,"MADAGAS
        CAR"
AC 1830 DATA4,28,5,1,"DENMARK"
DB 1840 DATA4,31,158,1,"SWEDEN
        "
AQ 1850 DATA4,5,31,1,"FINLAND"
HB 1860 DATA5,28,5,1,"SWITZERL
        AND"
PJ 1870 DATA6,154,1,1,"SOMALI
        {SPACE}REP."
KQ 1880 DATA7,144,1,1,"BANGLAD
        ESH"
QA 1890 DATA8,1,1,1,"THAILAND"
JM 1900 DATA9,1,1,1,"MALTA"
MH 1910 DATA10,1,1,1,"OMAN"
DE 1920 DATA1,144,5,28,"UPPER
        {SPACE}VOLTA"
EK 1930 DATA1,30,5,28,"SIERRA
        {SPACE}LEONE"
XE 1940 DATA60,0,0,126,0,0,126
        ,0,0,255,0,0,255,0,0,1
        26,0,0,126,0,0,60,16,0
        ,0
ES 1950 DATA16,0,0,56,0,0,56,0
        ,3,255,128,1,255,0,0,1
        24,0,0,124,0,0,198,0,1
        ,1
RQ 1960 POKE54273,70:POKE54278
        ,70:POKE54296,15:POKE5
        4276,17:POKE54276,16:R
        ETURN
MM 1970 POKE54278,96:POKE54296
        ,15
DB 1980 FORI=1TO100STEP3:POKE5
        4273,50+I:POKE54276,33
        :POKE54276,0:NEXT:RETU
        RN
GD 1990 FORT=1TO15:POKE54296,1
        5:POKE54296,0:NEXT:RET
        URN
BS 2000 GOSUB1970:FORI=18TO23:
        PRINTV$(I)S2$MID$(S2$,
        2):NEXT
HB 2010 PRINTV$(18)TAB(15)"GAM
        E OVER!":GOSUB1970
AD 2020 PRINTV$(20)TAB(8)"
        {BLK}{RVS} PRESS <SPAC
        E> FOR MENU "
DJ 2030 GETA$:IFA$<>" "THEN203
        0
XM 2040 GOTO140
```

G



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Circle Reader Service Number 151

Royal Rescue

EDITOR'S CHOICE

Ligia Latino

Rescue the princess from a fire-breathing dragon in this challenging action-adventure game for the 64. Joystick required.

The kingdom is in a royal mess. It's almost time for your wedding, but the princess is nowhere to be found. Word has it that she has been kidnapped by a fire-breathing dragon and taken to its lair—the dreaded Dark Castle.

Hmm, sounds like the king is behind this one. But you have no choice; you must fulfill your destiny and prove yourself worthy of his daughter's hand. So, off you ride on yet another perilous adventure.

In *Royal Rescue*, you search the Dark Castle for the princess and attempt to rescue her from the fiery dragon. The castle is a labyrinth of rooms connected by halls, doorways, and stairs. Each room is filled with treasures, keys, and the keepers of the castle—the deadly Pink Marshmallows. So get ready. If you're not quick *and* quick-witted, you'll soon find yourself well done!

Getting Started

Royal Rescue is written entirely in machine language. To type it in, you'll need to use *MLX*, the machine language entry program located elsewhere in this issue. When *MLX* prompts you, respond with the values listed below.

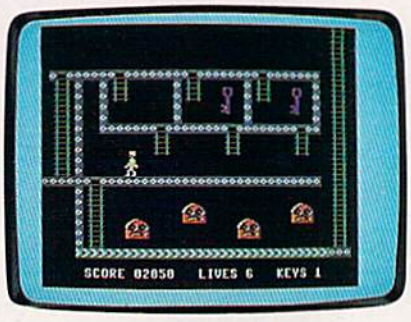
Starting address 0801
Ending address 1C20

When you've finished typing in the data, be sure to save a copy of it before exiting *MLX*.

Although *Royal Rescue* is written in machine language, it loads and runs like a BASIC program. When you're ready to play, plug a joystick into port 2; then load the program and type RUN.

Save the Princess

The princess is hidden somewhere within the Dark Castle's 16 rooms. To move around in the castle, push the joystick in the direction you wish to go. Press the fire button to jump over any obstacles.



Royal Rescue *reveals a particularly precarious passageway. To advance, you must ride a moving sidewalk through a series of bobbing Pink Marshmallows.*

Some rooms in the castle have doors that are locked. To unlock a door, you need a key. Keys and other treasures—cherries, flowers, and bells—are scattered throughout the castle. Whenever you come across a treasure, pick it up by touching it. Points are awarded for each treasure you capture. Cherries are worth 50 points; flowers, 100 points; bells, 200 points; and keys, 500 points. Also, every door you open gives you 1000 points.

You begin the game with six lives. Each bell you capture gives you an extra life. You can have as many as nine lives at any point in the game.

As you move from room to room, be sure to avoid the Pink Marshmallows—the dragon's unconditional allies. There are two types of Pink Marshmallows: roving marshmallows, which you can destroy, and stationary marshmallows, which you never can get rid of. If you collide with either, you'll lose a life.

A game ends when you reach the princess or lose all of your lives. Press f1 at any time to start a new game.

Game Strategy

To increase your chances of success, closely watch the Pink Marshmallows. These fiendish blimps always appear at the same locations in rooms and follow the same paths. A good strategy is to enter a room, observe the Marshmallows for a moment, and then quickly exit the room. Repeat this procedure until you've learned where the safe spots in the room are.

Some rooms in the castle have areas that appear impossible to reach, even by jumping. But be patient. As you become more familiar with the castle, you'll find ways to reach these areas from other rooms.

Royal Rescue

```
0801:0A 08 00 00 9E 32 30 36 6C
0809:31 00 00 00 20 44 A6 78 89
0811:A9 33 85 01 A2 08 A0 00 F9
0819:B9 00 D0 99 00 38 C8 D0 FC
0821:F7 EE 1B 08 EE 1E 08 CA 97
0829:D0 EE A2 3F BD C0 0A 9D 48
0831:C8 3F 98 9D C0 0A 9D 40 0C
0839:03 CA 10 F0 4C 00 0D 00 0B
0841:00 00 00 00 00 00 A8 00 A2
0849:00 A8 00 00 AC 00 00 BC A5
0851:00 00 3C 00 00 20 00 00 69
0859:A8 00 00 A8 00 00 A8 00 99
```

```
0861:00 A8 00 00 A8 00 00 69 4A
0869:00 00 69 00 00 28 00 00 47
0871:28 00 00 28 00 00 14 00 40
0879:00 14 00 00 15 00 00 00 37
0881:00 00 00 00 00 00 A8 00 E2
0889:00 A8 00 00 AC 00 00 BC E5
0891:00 00 3C 00 00 20 00 00 A9
0899:A8 00 00 A8 00 00 A8 00 D9
08A1:00 AA 00 02 AA 00 01 AA 7E
08A9:40 01 28 40 00 28 00 00 C3
08B1:2A 00 00 A2 00 00 41 00 83
08B9:00 41 00 00 51 40 00 00 A5
08C1:00 00 00 00 00 00 A8 00 23
08C9:00 A8 00 00 E8 00 00 F8 44
08D1:00 00 F0 00 00 20 00 00 80
08D9:A8 00 00 A8 00 00 A8 00 1A
08E1:00 A8 00 00 A8 00 01 A4 08
08E9:00 01 A4 00 00 A0 00 00 51
08F1:A0 00 00 A0 00 00 50 00 FC
08F9:00 50 00 01 50 00 00 00 B0
0901:00 00 00 00 00 00 A8 00 64
0909:00 A8 00 00 E8 00 00 F8 85
0911:00 00 F0 00 00 20 00 00 C1
0919:A8 00 00 A8 00 00 A8 00 5B
0921:02 A8 00 02 AA 00 06 A9 89
0929:00 04 A1 00 00 A0 00 02 F4
0931:A0 00 02 28 00 01 04 00 62
0939:01 04 00 05 14 00 00 00 BD
0941:00 00 00 00 00 04 A8 00 B4
0949:04 A8 00 08 A8 00 08 A8 06
0951:40 08 30 40 0A A8 80 0A 8D
0959:AA 80 00 AA 80 00 A8 00 E0
0961:00 A8 00 00 A8 00 00 A8 8B
0969:00 00 88 00 00 84 00 00 9E
0971:84 00 00 85 00 00 40 00 9E
0979:00 40 00 01 40 00 00 00 AD
0981:00 00 00 00 00 00 A8 40 25
0989:00 A8 40 00 A8 80 04 A8 C5
0991:80 04 30 80 08 AA 80 0A E8
0999:AA 80 0A A8 00 00 A8 00 3E
09A1:00 A8 00 00 A8 00 00 A8 CB
09A9:00 00 88 00 00 48 00 00 ED
09B1:48 00 01 48 00 00 04 00 94
09B9:00 04 00 00 05 00 00 28 1D
09C1:00 0A 2A 00 2A 0A 80 A8 BE
09C9:0A AA A8 0A AA A8 08 48 91
09D1:48 0A 2A 28 0A AA A8 0A A8
09D9:AA A8 0A AA 98 AA AA 68 84
09E1:59 69 A8 44 56 A8 55 5A AE
09E9:A8 99 AA A8 11 02 A8 00 78
09F1:00 A8 00 00 A8 00 00 28 9B
09F9:00 00 28 00 00 28 00 28 D9
0A01:00 0A 2A 00 2A 0A 80 A8 FF
0A09:0A AA A8 0A AA A8 08 48 D2
0A11:48 0A 2A 28 0A AA A8 0A E9
0A19:AA A8 0A AA 98 AA AA 58 B5
0A21:59 69 D8 44 57 D8 55 5F C3
0A29:68 99 9F 68 11 1F 68 00 28
0A31:7D A8 00 7D A8 00 7D 28 6E
0A39:01 F4 28 01 54 28 00 00 63
0A41:50 00 00 54 00 00 A8 00 14
0A49:00 AA 00 00 FA 00 00 FA DA
0A51:80 00 FA 80 00 1A 80 00 76
0A59:5A 80 01 5A 00 01 58 00 35
0A61:00 54 00 00 54 00 00 54 81
0A69:00 01 55 00 05 55 40 05 6B
0A71:55 40 15 55 50 15 55 50 0A
0A79:15 55 50 15 55 50 15 1F FD
0A81:FF F8 3F FF FC 7F FF FE A0
0A89:FF FF FF DA 2E 1B DA EE CD
0A91:DB C2 6E 1B DA EE FF DA 31
0A99:22 FB FF FF FF 7F FF FE BA
0AA1:3F FF FC 1F FF F8 00 FF CA
0AA9:00 00 3F 80 00 0F C0 00 6B
0AB1:03 E0 00 00 F0 00 00 38 3F
0AB9:00 00 0C 00 00 02 00 55 AC
0AC1:55 65 99 99 65 55 55 FF D1
0AC9:FA EB AF AF EB FA FF FF 92
0AD1:AF EB FA FA EB AF FF 03 E8
0AD9:03 0F 03 03 03 0F 03 C0 DE
0AE1:C0 F0 C0 C0 C0 F0 C0 55 57
0AE9:55 FF 00 00 00 FF 00 00 A8
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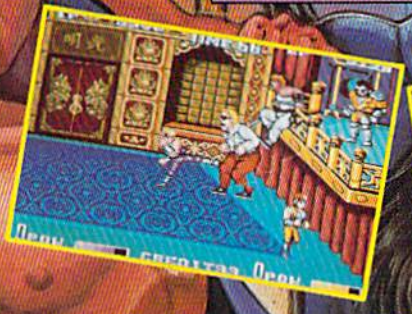

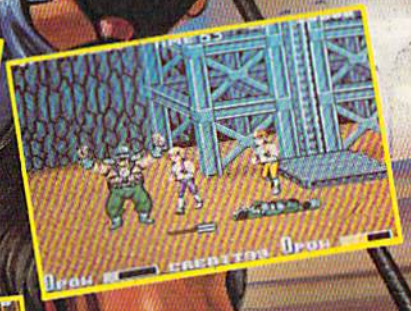

Virgin Games

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1849:C9 05 90 06 20 B8 19 4C 74
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Royal Rescue

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1851:46 1B A9 00 85 B0 85 B1 4C
1859:20 50 19 AD A0 50 18 69 8B
1861:03 29 F8 38 E9 03 8D A0 17
1869:50 A9 05 F0 02 85 AA A5 FC
1871:B0 C9 01 D0 35 A2 00 A5 73
1879:B1 C9 01 F0 0E C9 02 D0 90
1881:29 20 F9 1A C9 FE B0 22 FC
1889:4C 93 18 20 FC 1A C9 FE AC
1891:B0 18 A9 00 85 B0 85 B1 01
1899:20 50 19 AD 43 19 8D 00 85
18A1:50 8D F8 07 A9 05 F0 02 32
18A9:85 AA A9 0A CD 98 50 90 1F
18B1:0C F0 0A A4 B0 30 5F C6 7B
18B9:02 A9 A3 D0 0F A9 A3 CD 0B
18C1:98 50 B0 0D A4 B0 30 4E CF
18C9:E6 02 A9 0A 8D 98 50 D0 04
18D1:37 A9 2D CD A0 50 90 19 0B
18D9:F0 17 A4 B0 10 05 8D A0 38
18E1:50 30 40 A5 02 18 69 04 EF
18E9:85 02 A9 CB 8D A0 50 D0 AF
18F1:17 A9 CB CD A0 50 B0 33 49
18F9:A4 B0 30 32 A5 02 38 E9 61
1901:04 85 02 A9 2D 8D A0 50 A2
1909:A9 4C 8D CA 15 A9 00 85 56
1911:B3 8D 15 D0 F0 15 8D 98 BF
1919:50 A9 00 8D E0 50 8D B8 D2
1921:50 F0 08 A9 00 8D E8 50 AB
1929:8D C0 50 4C 46 1B A2 00 05
1931:20 9D 19 A9 03 85 B3 A9 D7
1939:4C 8D CA 15 D0 ED 00 25 03
1941:25 23 21 01 02 02 02 02 21
1949:00 00 00 FC 04 00 00 A6 12
1951:B1 BD 3F 19 F0 06 8D 00 FF
1959:50 8D F8 07 BD 44 19 8D 65
1961:10 50 8D B0 50 A9 04 8D 2B
1969:08 50 A9 00 8D A8 50 BC 55
1971:49 19 BD 4B 19 A2 00 20 6E
1979:0E 1A 98 20 8A 19 9D E0 23
1981:50 A5 A9 29 C0 9D B8 50 4B
1989:60 18 69 80 4A 66 A9 4A B0
1991:66 A9 38 E9 20 60 A8 F0 CB
1999:FC 88 D0 18 AD 15 D0 3D A8
19A1:3E 1B 8D 15 D0 8A F0 0B 5A
19A9:A4 02 B9 00 60 3D 3E 1B 75
19B1:99 00 60 60 88 D0 0A A9 08
19B9:4C 8D CA 15 A9 02 85 B3 34
19C1:60 88 D0 0C A5 B8 C9 0A CE
19C9:B0 05 E6 B8 38 66 B9 60 2D
19D1:88 D0 13 A5 B8 F0 0A C6 9D
19D9:B8 A9 64 20 BE 1A A9 08 1B
19E1:2C A9 07 85 A3 60 88 D0 4E
19E9:1F A5 B8 D0 AF A9 00 8D EA
19F1:B8 50 8D E0 50 A9 05 BC 44
19F9:98 50 CC 98 50 90 02 A9 22
1A01:FA 7D 98 50 8D 98 50 60 F9
1A09:88 D0 10 A9 E9 20 8A 19 50
1A11:9D E8 50 A5 A9 29 C0 9D C3
1A19:C0 50 60 A9 01 85 B3 A9 97
1A21:4C 8D CA 15 60 BD B8 50 45
1A29:49 FF 18 69 01 9D B8 50 DB
1A31:BD E0 50 49 FF 69 00 9D 5E
1A39:E0 50 60 BD C0 50 49 FF B3
1A41:18 69 01 9D C0 50 BD E8 81
1A49:50 49 FF 69 00 9D E8 50 27
1A51:60 BD 00 50 9D F8 07 BD C6
1A59:08 50 9D A8 50 BD 10 50 CD
1A61:D0 02 A9 01 9D B0 50 60 74
1A69:A0 1C 2C A0 1D 4A B9 00 0A
1A71:D0 3D 3E 1B 90 03 1D 36 D7
1A79:1B 99 00 D0 60 A0 17 D0 33
1A81:EC 8A 0A A8 BD C8 50 0A 56
1A89:BD 98 50 2A 99 00 D0 BD 9B
1A91:A0 50 99 01 D0 A0 10 D0 67
1A99:D5 BC 60 50 BD 68 50 20 49
1AA1:78 19 20 52 1A BD 18 50 C9
1AA9:9D 27 D0 BD 20 50 20 69 58
1AB1:1A BD 28 50 20 6C 1A BD 11
1AB9:30 50 4C 7E 1A 18 65 F7 7F
1AC1:85 F7 90 02 E6 F8 38 66 DA
1AC9:B9 60 A9 0A BC E0 50 30 03
1AD1:02 A9 04 A0 1E D0 0C BC 05
1AD9:E0 50 10 03 A9 0E 2C A9 4C
1AE1:00 A0 1D 20 00 1B C9 20 04
1AE9:F0 06 C9 FE F0 03 C9 FC 65
1AF1:60 18 60 BD E8 50 30 03 30
1AF9:A0 1D 2C A0 1E A9 07 8D 88
1B01:0B 1B 8C 19 1B BD 98 50 F7
1B09:38 E9 00 4A 4A A8 A9 01 C3
1B11:8D 34 1B BD A0 50 38 E9 FA
1B19:00 29 F8 8D 33 1B 0A 2E D9
1B21:34 1B 0A 2E 34 1B 6D 33 78
1B29:1B 8D 33 1B 90 03 EE 34 0B
1B31:1B B9 FF FF 60 01 02 04 72
1B39:08 10 20 40 80 FE FD FB 77
1B41:F7 EF DF BF 7F A2 0D BD C5
1B49:F8 50 9D 00 D4 CA 10 F7 AD
1B51:A2 07 B4 A3 F0 40 88 98 9D
1B59:8D 60 1B 0A 0A 0A 69 00 BD
1B61:A8 A9 00 95 A3 9D 05 D4 22
1B69:9D 06 D4 BD FC 50 29 FE E0
1B71:9D 04 D4 A9 07 85 A6 8E D6
1B79:88 1B B9 C3 1B 9D F8 50 BF
1B81:C8 E8 C6 A6 D0 F4 A2 00 39
1B89:B9 C3 1B 95 A5 C8 B9 C3 D1
1B91:1B 95 A4 4C B9 1B D6 A4 A0
1B99:D0 08 BD FC 50 29 FE 9D 84
1BA1:FC 50 BD F9 50 18 75 A5 35
1BA9:9D F9 50 6A 55 A5 10 08 47
1BB1:A9 00 9D 06 D4 9D FE 50 3C
1BB9:8A F0 04 A2 00 F0 93 4C 53
1BC1:31 EA 00 02 00 08 81 00 8E
1BC9:FA 00 05 00 11 00 08 81 38
1BD1:20 65 00 02 00 08 00 08 B9
1BD9:41 00 FF 06 03 00 86 00 36
1BE1:08 41 00 FF FC 03 00 8E EE
1BE9:00 08 81 00 F5 00 02 00 06
1BF1:C0 00 08 41 00 F3 F2 0D 60
1BF9:00 03 00 08 21 10 F3 00 A2
1C01:10 00 30 00 08 41 02 FA 8B
1C09:00 06 00 09 00 08 21 00 B5
1C11:F9 00 14 00 0A 00 08 15 3E
1C19:00 FC 00 01 00 00 00 00 A0
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THE RAMBOard

Beyond Super

RAMBOard does just what the other copy card on the market does: it adds RAM to your 1541 disk drive. This RAM is used to create a workspace where custom software can work its magic. Copy protection is evolving past the point of nibblers and other software-only solutions. Believe us, card based copiers are the future of archival technology.

So how do you decide between our card and "Brand X"? Don't compare the similarities - compare the differences. Their card is just "out there". You buy it, and that's pretty much it. RAMBOard was designed from the very beginning as an integral component in Maverick ™, a complete system of archival tools and products. Their card puts the burden of the work on you. Are you good at soldering? You better be - their card REQUIRES it. On the other hand RAMBOards require NO soldering to install, the only exception being a handful of older 1541C's. That's not all - the other guys say they don't use parameters, but what they really mean is they don't WRITE parameters. The user is required to make special critical "copy adjustments" to copy software. Sounds like creating parameters to us. On the other hand, RAMBOard uses Maverick parameters, designed by experts to instantly and easily copy today's toughest titles. So when the other guys say that their card will copy "everything", that may be true - providing that you can figure out the proper "copy adjustment" settings for everything. Good luck!

The differences go beyond the product itself. Software Support International is the company that began with the award winning Kracker Jax series of archival parameters. Our customer support system has earned industry praise, and we've established a reputation for honesty and integrity. A close look at the track record of the other guys will show just how deep our differences run. So when you're ready to get involved with the future of archival technology, pick RAMBOard - a product you can trust, from a company you can trust.

The RAMBOard
1541/1541C Version: $34.95
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ATTN. C-128D Owners — The 1571 RAMBOard is for external drives only.
The RAMBOard is an optional Maverick accessory

ALL NEW

FasTrac/128 by Mike J. Henry

Look Who's Come Out Of The Basement

ALL NEW

At Software Support International, we've gained a reputation for providing Commodore owners with the products they need to get the most out of their computers. We've never hesitated to do whatever it took to provide you with the best software on the market. So when we decided to produce the ultimate 128 utility system, we went looking for one of the ultimate programmers.

We found him.

Mike J. Henry, the brilliant young programmer who was the driving force behind the "Basement Boys", the software team that created the phenomenal Fast Hack 'Em, has turned his considerable talents onto the 128. The result: FasTrac/128, the TOTAL utility system for your 128.

Here's a list of the major features found in FasTrac/128. ALL use both 40 and 80 column outputs and are PAL compatible for our overseas users. Read carefully -FasTrac/128 does some truly amazing things:

- **FasTrac/128 Disk Copy:** Single or dual drive / Copy with or without verify / Copy in 1541, 1581, or true 1571 formats / 1764-1750 RAM expansion support / 64K video RAM support / Uses the 128's additional memory.
- **FasTrac/128 File Copy:** Single or dual drive / File Copy between ANY two Commodore compatable Drives including the SFD-1001, MSD drives, hard drives, and others / Copy in 1541 or true 1571 formats / 1581 file copy with partition support / 1764-1750 RAM expansion support / 64K video RAM support / Uses the 128's additional memory.
- **FasTrac/128 M/L Monitor:** Go ANYwhere in memory / Access both main banks / Full scrolling in both directions / Includes scrolling DriveMon.
- **FasTrac/128 Directory Editor:** Edit and organize ANY standard directory / Edit 1541 or true 1571 formats / Edit 1581 directories with full partition support.
- **FasTrac/128 IBM ™/MFM Disk Copier:** Copy standard IBM formatted 360K 5.25" disks with your 1571 drive (required) / 1764-1750 RAM expansion support / 64K video RAM support / Uses the 128's extra memory to copy in fewer passes.
- **FasTrac/128 1581 Duplicator:** Single or dual drive / 1764-1750 RAM expansion support / 64K video RAM support / Uses the 128's additional memory / This is the fastest 1581 to 1581 copier ever created!

Quite a package, eh? We don't want to mislead you - FasTrac/128 is NOT for copying protected software. Our own Maverick ™ already has those bases more than covered. FasTrac/128 was designed to allow serious 128 users to get total control of their computers. If you want to own the finest set of utilities ever made for the Commodore 128, we've just made it a lot easier - we've told you the name...

Mike J. Henry's FasTrac/128
Only $34.95

ATTN. REGISTERED Maverick Owners ONLY: You may buy ONE (1) copy of FasTrac/128 for only $20.00
This offer is ONLY for orders placed with Software Support.

ALL NEW

THE 1581 TOOLKIT V2

If You've Been Waiting For A Sign, This Is It.

ALL NEW

Introducing the 1581 Toolkit Version 2, the newest incarnation of the best program you can buy for your 1581 disk drive. How good is it? Well, V1 received 4 1/2 of a possible 5 stars from INFO ™ magazine - and V2 is even better. What can it do for you? Picture using your 1581 with a:

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- ★ **Byte Pattern Search**
- ★ **Partition Creator**
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- ★ **Track & Sector Editor**
- ★ **Directory Editor**
- ★ **Error Scanner**
- ★ **Relocatable Fast Loader**
- ★ **File Track & Sector Tracer**

And V2 adds many new or enhanced features, like the fact that both our single drive fast data copier and fast file copier now support the 1764/1750 RAM expansion units for super-fast one pass copies, or like our 64k video RAM support for 128 owners! And remember also that all of our 1581 Toolkit utilities use hyperfast read/write routines and, wherever appropriate, allow full access to partitions.

So whether you're thinking about buying a 1581 drive or you already own a 1581 drive, we guarantee you'll never really USE a 1581 drive until you've got your hands on the 1581 Toolkit.

NEW LOW PRICE:
THE 1581 TOOLKIT (3.5 disk) . . . . . NOW ONLY $24.95!

VERSION 1 OWNERS: Upgrade to V2 by Sending us your Original Toolkit V1 disk along with $9.95 plus S/H

Ever wish you knew more about your 1581? David Martin's book, "The 1581 DOS Reference Guide", is what you've been wishing for. Martin's invaluable resource holds over 100 pages of detailed information that took over a year of solid research to compile. This exhaustive manual will show you the inner workings of the 1581 as nothing else can. Order now, and we'll include some additional utilities like a machine language monitor with DriveMon - the perfect companion to The 1581 DOS Reference Guide!

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SPECIAL OFFER: GET BOTH THE 1581 REFERENCE GUIDE AND THE 1581 TOOLKIT FOR ONLY $34.95

THE 1750 CLONE

Are You Overdrawn At The Memory Bank?

Ah, the venerable Commodore 64/128. Stock, it has better sound than an Atari ST. Better graphics than a CGA equipped IBM. And more memory than....

Uh-oh.

As powerful as the Commodore is, memory has always been its weak spot. Some brilliant programmers have found some ingenious ways to work within the computer's very limited available RAM, but the fact remains that you can only go so far with 64 or even 128K. But you can go MUCH further with 512K.

The bad news is that Commodore's own 1750 512K RAM Expansion Unit (REU) is expensive and almost impossible to find. The good news is, we did something about it.

We bought brand new Commodore 1764 REU's, which come with only 256K of RAM. Next, we installed a 256K upgrade which was custom engineered to our demanding specifications. Once modified, we tested each and every unit and warranted them to be free from defects. The final product is called the 1750 Clone, and it's all the room you'll ever need on a simple plug in cartridge.

Once on board, you'll have a whopping 512K of RAM - the SAME amount of memory found on the Amiga 500. Your Commodore will operate at advanced levels of performance that the original designers never even r"eamed of! You'll be amazed at the enhanced capabilities of software that takes advantage of the 1750 Clone, programs like GEOS, PaperClip III, and our own Maverick, to name a few.

The 1750 Clone works EXACTLY like the original 1750. It will open the door on years of extended use from your Commodore as even newer, more powerful software appears on the horizon, software that requires the room the 1750 Clone can provide.

Twin Cities 128 magazine says they "can completely recommend the 1750 Clone." Once you see it work, you'll feel the same way. So don't buy a whole new computer just to get more memory. Get the 1750 Clone instead -and get another decade of satisfaction from your Commodore.

IMPORTANT NOTES - READ CAREFULLY

C-64/64c (but NOT C128/128D) owners MUST buy a heavy-duty power supply to use these units. The power supply is NOT included - it is available from us separately. If you ALREADY own a 1764 RAM cartridge, we can upgrade it for you. Your unit MUST be in perfect working order for us to upgrade it. The turnaround time on upgrades is approx. 2 weeks. It will NOT be necessary for you to purchase a new power supply - the one that came with your 1764 will still work fine.

THE 1750 CLONE ONLY $199.95
1764 UPGRADE ONLY $124.95

C-128 VIDEO RAM UPGRADES

For 128 Owners Who Refuse To Be Left Behind

When Commodore first released the new 128D, we got one, opened it up, and took a good look. It didn't take long to discover one MAJOR difference. The standard C-128 has just 16K of video RAM, while the newer 128D has 64K: 400% more! We knew that there were tremendous advantages to the extra RAM. Like being able to scroll through video memory or the potential for greatly enhanced color resolution. And, since Commodore had seen fit to make it a standard feature on all new 128D's, we knew it was only a matter of time before new software started taking advantage of the full 64K.

That time has arrived. Programs like BASIC 8, the BASIC 8 Toolkit, Spectrum 128, Sketchpad 128, and News Maker 128 have all been coded to utilize the full 64K of video RAM found on the 128D's. So if you've got a regular C-128 with only 16K of video RAM, you've got a problem. And we've got the solution.

You could upgrade on your own - but if thoughts of splattered solder and heat-damaged motherboards bother you, relax: we've developed a module that just plugs right in to your C- 128. No soldering, no hassles. Now your computer can have the same 64K video RAM as the new machines. And you'll be ready for whatever the future holds.

PLUG-IN 64K VIDEO RAM UPGRADE FOR C-128's

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NEW LOW PRICE

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Each Volume of Kracker Jax allows you to make Unprotected versions of around 100 specific popular titles. No special knowledge or tools are required. Each Volume originally sold for $19.95. So if you wanted all 7 Volumes, it would have cost you $139.65. But now, you can buy each Volume for only $9.95 or, for you bargain hunters, you can buy **ALL 7 VOLUMES FOR ONLY $29.95!** That works out to a cost of only **$4.28** each!

We've also cut the price on The Shotgun II, one of the most powerful nibblers ever produced. Originally $14.95, you can now own it for only **$9.95!**

And just because there's a remote chance that it might be your birthday, we'll go one step further: Buy the Kracker Jax Volume 1 -7 package for **$29.95,** and we'll throw in The Shotgun II nibbler **FREE!** Quite a deal, huh? But if you want it, better hurry - supplies are limited. After all, nothing good lasts forever.

SOFTWARE SUPPORT INTERNATIONAL

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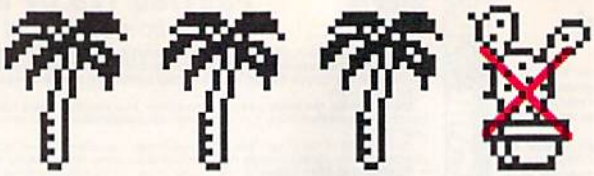

ERROR TRAPPER

David Kokorowski

ADD POWERFUL, ERROR-TRAPPING CAPABILITIES TO YOUR BASIC PROGRAMS WITH THIS SHORT MACHINE LANGUAGE UTILITY FOR THE 64.

Computers are wonderful things. Every second, they flawlessly execute thousands or even millions of instructions. Unfortunately, a computer is only as good as the program it's running. Because programs are written by humans, who are not perfect, computers must be equipped with ways to handle errors. When something unexpected happens on the Commodore 64, the computer frequently locks up or interrupts the program with an unfriendly error message.

Some BASICs have tried to overcome this problem. Microsoft BASIC has the ON ERROR GOTO statement; Applesoft BASIC uses ONERR GOTO. With these statements, program control can be transferred to an error-handling routine whenever something goes wrong. Until recently, BASIC 2.0 lacked such a statement. But now there's *Error Trapper*, a utility that traps errors for you.

Getting Started

Error Trapper is written entirely in machine language. To type it in, you'll need to use *MLX*, the machine language entry program located elsewhere in this issue. When *MLX* prompts you, respond with the values listed below.

Starting address C000
Ending address C1CF

When you've finished typing in the data, be sure to save a copy of it to disk before exiting *MLX*. Use the name ERROR TRAPPER when you save the program.

Installing *Error Trapper* is a two-step process. First, load the program with the statement LOAD"ERROR TRAPPER",8,1. Next, type SYS 49152: NEW. To have your programs install *Error Trapper*, include the following as the first two lines of your program:

```
10 IF A=0 THEN A=1:LOAD"ERROR
   TRAPPER",8,1
20 SYS 49152
```

Error Trapper adds two statements to BASIC: TRAP and RESUME. These statements can be used only in program mode, not in direct mode. Furthermore, *Error Trapper* must be installed in memory for these commands to work properly.

Trapping Errors

The heart of *Error Trapper* is the TRAP statement. Its syntax is

TRAP *line number*

After this statement executes, program execution is automatically transferred to the specified line whenever an error occurs. For example, the statement TRAP 1000 tells *Error Trapper* to jump to line 1000 whenever an error occurs. The statement TRAP 0 disables *Error Trapper*.

Error Trapper adds three reserved variables to BASIC: EN, LN, and EM$. The variable EN holds the number of the error that occurred. For example, when a syntax error occurs, EN will contain an 11 (see "Table of BASIC Error Messages" for a complete list of error numbers), LN contains the line number the error occurred in, and EM$ holds the error message. By testing the values of these three variables, your error-trapping routine can recover gracefully from most BASIC errors.

The second Error Trapping statement is RESUME. Its syntax is

RESUME *line number*

This statement lets your program resume execution after an error has occurred. It's like a GOTO in that variables remain intact. However, unlike most GOTO statements, it can calculate line numbers. For example, on the 64, RESUME LN+10 is legal, but GOTO LN+10 is not.

An interesting effect of RESUME is that if the specified line is the line the error occurred in, *Error Trapper* automatically jumps to the next line. For example, consider the following program:

```
10 TRAP 100
20 PRONT "HI"
30 PRINT "I'M A COMPUTER"
40 PRINT "GOODBYE"
50 STOP
100 RESUME LN
```

Error Trapper catches the syntax error in line 20 and jumps to line 100. Line 100 is a RESUME LN (LN is 20). Since this is the line the error occurred in, *Error Trapper* returns to line 30 instead.

There are several errors *Error Trapper* can't catch. The OUT OF MEMORY and FORMULA TOO COMPLEX errors are not trapped, because doing so could cause the computer to crash. Disk errors are not trapped, either. See "Table of

Table of BASIC Error Messages

1	Too Many Files
2	File Open
3	File Not Open
4	File Not Found
5	Device Not Present
6•	Not Input File
7•	Not Output File
8•	Missing Filename
9	Illegal Device Number
10	NEXT Without FOR
11	Syntax Error
12	RETURN Without GOSUB
13•	Out of Data
14	Illegal Quantity
15	Overflow
16•	Out of Memory
17	Undefined Statement
18	Bad Subscript
19	Redimensioned Array
20	Division by Zero
21•	Illegal Direct
22	Type Mismatch
23	String Too Long
24•	File Data
25•	Formula Too Complex
26•	Can't Continue
27	Undefined Function
28	VERIFY Error
29•	LOAD Error

Errors marked with a • are untrappable.

BASIC Error Messages" for a list of trappable errors.

How It Works

Error Trapper first wedges itself into the CHRGET routine at address $73. As your program executes, it checks all statements for a TRAP command. Once one is found, it changes the Kernal error routine pointer at $300 and $301 to point to its own error-trapping routine and saves the target line number. When an error occurs, *Error Trapper* intercepts it, updates the variables EN, LN, and EM$, and then jumps to the target line number. When a RESUME command is found, *Error Trapper* jumps to the specified line (or the following line if the specified line is where the error occurred).

Error Trapper

```
C000:A9 4C 85 73 A9 0D 85 74 52
C008:A9 C0 85 75 60 E6 7A D0 FA
C010:02 E6 7B 20 79 00 C9 54 71
C018:F0 06 C9 52 F0 02 D0 4D 70
C020:A5 3A C9 FF F0 47 98 48 5A
C028:8A 48 A5 7A 8D 34 03 A5 46
C030:7B 8D 35 03 20 79 00 C9 5A
C038:54 F0 12 A0 00 20 73 00 D3
C040:D9 C6 C1 D0 1A C8 C0 05 20
C048:D0 F3 4C 5B C1 A0 00 20 1F
C050:73 00 D9 C3 C1 D0 08 C8 2D
C058:C0 03 D0 F3 4C 70 C0 AD A7
C060:34 03 85 7A AD 35 03 85 E2
C068:7B 68 AA 68 A8 4C 79 00 07
C070:20 A7 C1 A5 14 D0 04 A5 10
C078:15 F0 17 A9 9F 8D 00 03 74
C080:A9 C0 8D 01 03 A5 14 8D 2D
C088:36 03 A5 15 8D 37 03 4C 87
C090:69 C0 A9 8B 8D 00 03 A9 01
C098:E3 8D 01 03 4C 69 C0 8A D3
C0A0:10 03 4C 74 A4 A5 3A C9 B5
C0A8:FF D0 03 4C 3A A4 E0 10 B9
C0B0:F0 F9 E0 19 F0 F5 85 FF 41
C0B8:8D 39 03 A5 39 85 FE 8D 75
C0C0:38 03 8E 3A 03 A9 4C A0 8C
C0C8:4E 20 B1 C1 85 49 84 4A 70
C0D0:A4 FE A5 FF 20 91 B3 20 E7
C0D8:2B BC C9 FF D0 11 A9 B9 30
C0E0:A0 C1 20 67 B8 20 58 BC 51
C0E8:A9 BE A0 C1 20 50 B8 20 F2
C0F0:D0 BB A9 45 A0 4E 20 B1 83
C0F8:C1 85 49 84 4A AC 3A 03 AA
C100:20 A2 B3 20 D0 BB A9 45 C2
C108:A0 CD 20 B1 C1 85 F9 84 0B
C110:FA CE 3A 03 AD 3A 03 0A A2
C118:A8 B9 28 A3 85 FB B9 29 56
C120:A3 85 FC A0 00 B1 FB 85 C4
C128:FD 29 7F 99 CB C1 A5 FD 2D
C130:30 03 C8 D0 F0 C8 98 A0 2F
C138:00 91 F9 C8 A9 CB 91 F9 85
C140:C8 A9 C1 91 F9 AD 36 03 D9
C148:85 14 AD 37 03 85 15 18 2D
C150:20 13 A6 90 47 20 A3 A8 31
C158:4C AE A7 20 A7 C1 A5 14 48
C160:CD 38 03 D0 EA A5 15 CD 2C
C168:39 03 D0 E3 20 13 A6 A0 DC
C170:00 B1 5F 85 FE C8 B1 5F 82
C178:85 FF 88 B1 FE D0 05 C8 F8
C180:B1 FE F0 18 A5 FE 69 01 39
C188:85 FE A5 FF 69 00 85 FF 99
C190:B1 FE 85 14 C8 B1 FE 85 2F
C198:15 4C 4F C1 A2 11 A9 39 A5
C1A0:48 A9 A4 48 4C 8B E3 20 44
C1A8:73 00 20 8A AD 20 F7 B7 28
C1B0:60 85 45 84 46 20 E7 B0 E9
C1B8:60 81 00 00 00 00 90 7F 6D
C1C0:FF 00 00 52 41 50 45 53 92
C1C8:55 4D 45 00 00 00 00 00 F2
```

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EDITOR'S CHOICE

THE geos column

Screen Grabber

Richard A. Rardin

Grab all or a portion of any graphics screen with this outstanding desk accessory for GEOS and GEOS 128, versions 1.3 and higher.

Looking for a way to copy graphics from just about any GEOS screen? Maybe there's a certain file or tool icon that has caught your eye. Or perhaps there's a graphics image in a *geoWrite* file that you'd like to use. With *Screen Grabber*, you can do this and much more.

Screen Grabber is a versatile desk accessory that allows you to copy graphics from the deskTop and most applications to a photo scrap. Once in this form, you can import the scrap into *geoPaint*, *geoWrite*, *geoPublisher*, or any other GEOS program that supports graphics cut-and-paste.

Typing It In

Screen Grabber is written in machine language, so you'll need to use *MLX*, the machine language entry program found elsewhere in this issue, to type it in. The *MLX* prompts, and the values you should type in, are as follows:

Starting address: 1503
Ending address: 1D8A

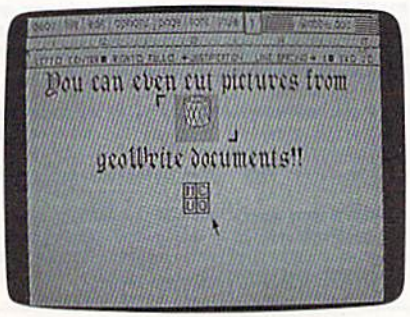
When you've entered all the data for *Screen Grabber*, save two copies to a GEOS work disk. Save the first with the filename GRABBER and the second with the name GRABBER.BKUP. One copy will be converted by *GeoConverter* into a GEOS desk accessory. The other is a backup copy in case you have a problem with the conversion.

Now, type in *GeoConverter*. (This is the new version of *GeoConverter*, updated in the December 1989 issue of *COMPUTE!'s Gazette*.) Be sure to use *The Automatic Proofreader*, found elsewhere in this issue, to prevent typing mistakes when you enter the program. Save a copy of *GeoConverter* to the disk that contains *Screen Grabber*. Be very careful when typing in *GeoConverter*. It writes directly to your disk, so a typing error could cause it to scramble your disk.

To prepare *Screen Grabber* for use with GEOS, load *GeoConverter* and type RUN. When prompted for a filename, enter GRABBER. *GeoConverter* then converts the file into a GEOS desk accessory.

Using the Program

To use *Screen Grabber* from the deskTop, double-click on its icon or select the grabber option from the geos menu. If you want to fetch graphics from a page of the deskTop other than the one *Screen Grabber* is on, you'll have to open *Screen Grabber* from the geos menu. To use the program from within an application, select grabber from the geos menu. Because *Screen Grabber* is a desk accessory, you can't copy graphics from other desk accessories or from applications that don't support desk accessories.



Cut and paste photo scraps from a variety of applications with Screen Grabber.

Once *Screen Grabber* is opened, a small icon will appear in the upper left corner of the screen. The icon contains four letters: *M*, *C*, *U*, and *Q*. The M (Move) option allows you to move the icon to anywhere on the screen. Simply click on *M* to pick up the icon. Move it to the new location and click again to put it down. If you try to drop the icon at a point where it's off the screen, it will automatically reposition itself so that the entire icon remains on the screen. It doesn't matter if the region you're copying includes the Screen Grabber icon or not. *Screen Grabber* copies the original screen, not the icon.

The C (Copy) option allows you to copy any portion of the screen to a photo scrap. First identify the area you'd like to copy. Click the pointer at the upper left corner of the region. A small corner marker will appear on the nearest byte boundary that includes the point selected. You won't be able to move the cursor above or to the left of the marker after you've placed it. Next, select the lower right corner of the region by clicking again. A second corner marker will appear on the nearest byte boundary, and the cursor will be free to move over the whole screen. Now, click on the C in the *Screen Grabber* icon. The program creates a photo scrap containing the graphics region selected and places it on the current disk. When the copy is finished, the two corner markers disappear.

The U (Undo) option allows you to cancel the copy command at any time. If the icon is above or to the left of the first marker, you'll have to set the second marker before canceling the copy.

The Q (Quit) option allows you to exit *Screen Grabber* and return to the deskTop or application.

After you exit *Screen Grabber*, you can paste the photo scrap into any GEOS application such as *geoWrite* or into a photo album via the Photo Manager. Of course, you can also paste it into a *geoPaint* document, modify it, and put it back into the photo scrap using *geoPaint*'s cut command.

Screen Grabber

```
1503:BF FF FF FF 90 00 09 BF 63
150B:FF FD E0 00 07 A7 C0 05 2E
1513:AC 00 05 AC 00 05 AF 00 72
151B:05 A7 87 C5 A0 CC 65 A0 A2
1523:CC 05 A0 CC 05 AF 8C E5 BB
152B:A0 0C 65 A0 0C 65 A0 0C A2
1533:65 A0 07 C5 E0 00 07 BF 4A
153B:FF FD 90 00 09 FF FF FF 3F
1543:83 05 00 00 10 4A 3C 00 92
154B:10 53 63 72 65 65 6E 47 CA
1553:72 61 62 20 20 56 31 2E 48
155B:30 00 00 00 00 52 69 63 1D
1563:68 61 72 64 20 41 2E 20 31
156B:52 61 72 64 69 6E 20 20 11
1573:00 00 00 00 00 00 00 00 9D
157B:00 00 00 00 00 00 00 00 A5
1583:00 00 00 00 00 00 00 00 AD
158B:00 00 00 00 00 00 00 00 B5
1593:00 00 00 00 00 00 00 00 BD
159B:00 00 00 00 44 65 73 6B CF
15A3:20 41 63 63 65 73 73 6F 20
15AB:72 79 20 74 6F 20 67 72 F5
15B3:61 62 20 67 72 61 70 68 04
15BB:69 63 73 20 66 72 6F 6D 2D
15C3:20 61 6E 79 20 73 63 72 C3
15CB:65 65 6E 2E 00 00 00 00 B2
15D3:00 00 00 00 00 00 00 00 FD
15DB:00 00 00 00 00 00 00 00 06
15E3:00 00 00 00 00 00 00 00 0E
15EB:00 00 00 00 00 00 00 00 16
15F3:00 00 00 00 00 00 00 00 1E
15FB:00 00 00 00 A5 3B 8D 44 9F
1603:10 A5 3A 8D 43 10 A5 3C A2
160B:8D 45 10 A9 10 85 03 A9 32
1613:42 85 02 20 5A C1 A9 00 31
161B:8D 8F 17 8D 90 17 20 4E 1D
1623:10 A9 00 8D 8D 17 A9 00 B6
162B:8D 8C 17 A9 00 8D 8E 17 29
1633:20 C3 12 A9 10 8D AA 84 CD
163B:A9 D4 8D A9 84 60 01 00 65
1643:00 00 00 00 00 00 01 01 72
164B:00 00 20 B7 C1 C1 84 97 AC
```

```
1653:17 40 00 20 B4 C1 80 00 CA
165B:40 8A 00 A9 10 85 03 A9 2B
1663:A0 85 02 20 81 C1 20 B4 8B
166B:C1 40 00 80 8B FF A9 13 53
1673:85 0B A9 48 85 0A A9 05 8B
167B:85 08 20 C6 C1 A6 01 A9 31
1683:35 85 01 AD 00 8C 8D 2D 21
168B:D0 4A 4A 4A 4A 8D 2C D0 52
1693:AD 27 D0 8D 28 D0 8D 29 1C
169B:D0 86 01 60 40 8A 16 FF 50
16A3:00 00 FF 00 00 C0 00 00 D2
16AB:C0 00 00 C0 00 00 C0 00 C5
16B3:00 C0 00 00 C0 80 8A 16 43
16BB:03 00 00 03 00 00 03 00 9F
16C3:00 03 00 00 03 00 00 03 CB
16CB:00 00 FF 00 00 FF 00 00 F7
16D3:AD 05 85 10 01 60 A5 3B D9
16DB:85 03 A5 3A 85 02 A5 3C 9F
16E3:85 04 AD 8F 17 F0 03 4C 51
16EB:03 13 AD 8E 17 85 06 85 5D
16F3:07 18 A9 15 65 07 85 07 89
16FB:AD 8D 17 85 09 AD 8C 17 CC
1703:85 08 AD 8D 17 85 0B AD 17
170B:8C 17 85 0A 18 A9 18 65 93
1713:0A 85 0A 90 02 E6 0B 20 D3
171B:B3 C2 C9 00 F0 35 A5 02 B6
1723:38 ED 8C 17 85 02 A5 03 6E
172B:ED 8D 17 85 03 38 A5 04 37
1733:ED 8E 17 85 04 A5 04 C9 BF
173B:0A 90 0C A5 02 C9 0C 90 4E
1743:03 4C E5 12 4C 69 11 A5 B3
174B:02 C9 0C 90 03 4C 87 13 E2
1753:4C E8 12 AD 90 17 C9 03 76
175B:D0 01 60 C9 00 F0 03 4C F0
1763:1D 12 4C 9B 11 A9 01 8D A6
176B:BD 84 A9 3F 8D BC 84 A9 D4
1773:C7 8D B9 84 A9 02 85 08 D0
177B:20 D5 C1 A9 00 8D BB 84 34
1783:A9 00 8D BA 84 A9 00 8D 3C
178B:B8 84 A9 01 85 08 20 D5 DE
1793:C1 A9 00 8D 90 17 60 A9 31
179B:01 8D 90 17 A5 3A 85 02 54
17A3:8D 95 17 A5 3B 85 03 8D BE
17AB:96 17 A5 3C 85 04 8D 94 4F
17B3:17 A9 00 85 05 A9 00 85 84
17BB:0B A9 08 85 0A A2 02 A0 B2
17C3:0A 20 69 C1 AD 95 17 38 72
17CB:E5 12 8D 95 17 AD 96 17 30
17D3:E5 13 8D 96 17 A9 00 85 B9
17DB:0B A9 08 85 0A A2 04 A0 D6
17E3:0A 20 69 C1 38 AD 94 17 21
17EB:E5 12 8D 94 17 AD 96 17 40
17F3:85 0B AD 95 17 85 0A AD 47
17FB:94 17 85 0C A9 01 85 08 10
1803:20 CF C1 20 D2 C1 AD 96 01
180B:17 8D BB 84 AD 95 17 8D 69
1813:BA 84 AD 94 17 8D B8 84 A5
181B:60 A9 03 8D 90 17 A9 01 54
1823:8D BD 84 A9 3F 8D BC 84 E2
182B:A9 C7 8D B9 84 A9 00 8D C7
1833:BB 84 A9 00 8D BA 84 A9 A1
183B:00 8D B8 84 A5 3A 85 02 51
1843:8D 92 17 A5 3B 85 03 8D 9F
184B:93 17 A5 3C 85 04 8D 91 6C
1853:17 A9 00 85 05 A9 00 85 26
185B:0B A9 08 85 0A A2 02 A0 54
1863:0A 20 69 C1 A5 12 49 07 F8
186B:18 6D 92 17 8D 92 17 A9 55
1873:00 6D 93 17 8D 93 17 A9 75
187B:00 85 0B A9 08 85 0A A2 16
1883:04 A0 0A 20 69 C1 A5 12 D0
188B:49 07 18 6D 91 17 8D 91 91
1893:17 AD 93 17 85 0B AD 92 E4
189B:17 85 0A A5 0A 38 E9 07 60
18A3:85 0A A5 0B E9 00 85 0B E3
18AB:AD 91 17 85 0C 38 A5 0C EA
18B3:E9 07 85 0C A9 02 85 08 74
18BB:20 CF C1 20 D2 C1 60 A9 32
18C3:06 85 08 AD 8D 17 85 0B 13
18CB:AD 8C 17 85 0A AD 8E 17 6C
18D3:85 0C 20 CF C1 20 D2 C1 C0
18DB:C6 08 20 CF C1 20 D2 C1 68
18E3:60 4C 3E C2 A9 01 8D 8F 47
18EB:17 A9 05 85 08 20 D5 C1 39
18F3:E6 08 20 D5 C1 20 B7 C1 BA
18FB:48 13 C1 84 40 00 60 20 78
1903:B7 C1 97 17 C1 84 40 00 86
190B:A9 00 8D 8F 17 A5 3B 8D 10
1913:8D 17 A5 3A 8D 8C 17 A5 9C
191B:3C 8D 8E 17 AD 8D 17 C9 AD
1923:01 D0 05 AD 8C 17 C9 29 03
192B:90 0A A9 01 8D 8D 17 A9 E7
1933:28 8D 8C 17 AD 8E 17 C9 7F
193B:B4 90 05 A9 B3 8D 8E 17 2F
1943:20 C3 12 60 FF FF FF C0 7F
194B:18 03 D8 D9 F3 DD DB 1B EC
1953:DA DB 03 D8 DB 03 D8 DB 50
195B:03 D8 DB 1B D8 D9 F3 C0 49
1963:18 03 FF FF FF C0 18 03 98
196B:D8 D9 F3 D8 DB 1B D8 DB 65
1973:1B D8 DB 1B D8 DB 1B D8 DB
197B:DB 5B CF 99 F3 C0 18 13 EB
1983:FF FF FF AD 90 17 C9 03 08
198B:F0 01 60 A9 00 8D 39 3C 02
1993:A9 00 8D 3C 3C A9 00 8D 26
199B:37 3C A9 17 8D 49 3C A9 D2
19A3:D7 8D 48 3C AD 91 17 38 0C
19AB:ED 94 17 8D 3D 3C AD 94 80
19B3:17 8D 3E 3C AD 93 17 85 CF
19BB:03 AD 92 17 85 02 A5 02 20
19C3:38 ED 95 17 85 02 A5 03 34
19CB:ED 96 17 85 03 A9 00 85 1A
19D3:05 A9 08 85 04 A2 02 A0 9B
19DB:04 20 69 C1 A5 02 8D 3F F0
19E3:3C 18 69 01 A0 00 20 33 EF
19EB:16 AD 3D 3C 18 69 01 20 88
19F3:33 16 A9 00 20 33 16 AE 23
19FB:3E 3C 20 3C C1 E8 8E 3E 31
1A03:3C AD 95 17 18 65 0C 85 D8
1A0B:0C AD 96 17 65 0D 85 0D 6C
1A13:AD 3F 3C 8D 43 3C A0 00 9A
1A1B:B1 0C A2 00 20 42 14 18 C9
1A23:A9 08 65 0C 85 0C 90 02 1B
1A2B:E6 0D CE 43 3C 10 E7 AD C3
1A33:91 17 CD 3E 3C B0 C0 20 D9
1A3B:6B 15 20 69 11 60 8C 45 6D
1A43:3C A0 00 8D 3A 3C A5 0D B1
1A4B:48 A5 0C 48 AD 39 3C D0 AE
1A53:13 AD 3A 3C 8D 3B 3C A9 03
1A5B:01 8D 39 3C A9 00 8D 3C 03
1A63:3C 4C F6 14 AD 3C 3C F0 B0
1A6B:38 AD 3A 3C CD 3B 3C D0 D6
1A73:0D EE 39 3C AD 39 3C C9 69
1A7B:7F F0 12 4C F6 14 AD 39 4F
1A83:3C 20 33 16 AD 3B 3C 20 98
1A8B:33 16 B8 50 C4 20 33 16 1E
1A93:AD 3B 3C AC 45 3C 20 33 4E
1A9B:16 A9 00 8D 39 3C 4C 21 92
1AA3:15 AD 3A 3C CD 3B 3C F0 9D
1AAB:16 20 28 15 EE 39 3C AD CB
1AB3:39 3C C9 5C F0 09 AD 3A D3
1ABB:3C 8D 3B 3C 4C F6 14 CE D1
1AC3:39 3C F0 0B AD 39 3C 09 46
1ACB:80 20 33 16 20 3C 15 AD D9
1AD3:3A 3C CD 3B 3C F0 0E A9 0D
1ADB:01 8D 39 3C AD 3A 3C 8D 3B
1AE3:3B 3C 4C F6 14 A9 02 8D 96
1AEB:39 3C A9 01 8D 3C 3C 4C 33
1AF3:F6 14 E0 00 F0 27 AD 3C 80
1AFB:3C D0 13 AD 39 3C 09 80 0D
1B03:20 33 16 CE 39 3C F0 0C 6E
1B0B:20 3C 15 B8 50 06 AD 39 BD
1B13:3C 20 33 16 AC 45 3C AD D7
1B1B:3B 3C 20 33 16 68 85 0C 9E
1B23:68 85 0D 60 8C 46 3C AC 39
1B2B:37 3C AD 3B 3C 99 DA 3B AE
1B33:C8 8C 37 3C AC 46 3C 60 F2
1B3B:8E 47 3C 8C 46 3C A9 00 51
1B43:8D 38 3C AE 38 3C BD DA C9
1B4B:3B A2 00 A0 00 20 33 16 CE
1B53:EE 38 3C AD 38 3C CD 37 F6
1B5B:3C D0 E8 A9 00 8D 37 3C 7C
1B63:AE 47 3C AC 46 3C 60 AD A6
1B6B:3D 3C 85 0C A9 00 85 0D 26
1B73:A9 00 85 05 A9 08 85 04 FB
1B7B:A2 0C A0 04 20 69 C1 A5 2A
1B83:0C 8D 40 3C AD 96 17 85 6A
1B8B:0D AD 95 17 85 0C A2 0C 85
1B93:A0 04 20 69 C1 A5 0D 8D 02
1B9B:42 3C A5 0C 8D 41 3C AD 0F
1BA3:94 17 85 0C A9 00 85 0D C0
1BAB:A2 0C A0 04 20 69 C1 A9 5E
1BB3:00 85 05 A9 28 85 04 A2 88
1BBB:0C A0 04 20 66 C1 18 A9 B6
1BC3:00 65 0C 85 0C A9 8C 65 B2
1BCB:0D 85 0D A5 0C 18 6D 41 C2
1BD3:3C 8D 41 3C A5 0D 6D 42 F5
1BDB:3C 8D 42 3C AD 40 3C 8D 14
1BE3:43 3C AD 3F 3C 8D 44 3C 51
1BEB:AD 42 3C 85 0D AD 41 3C 47
1BF3:85 0C A2 00 A0 00 B1 0C B8
1BFB:48 AD 43 3C D0 09 AD 44 38
1C03:3C D0 04 A2 01 A0 01 68 2D
1C0B:20 42 14 18 A9 01 65 0C 10
1C13:85 0C 90 02 E6 0D CE 44 90
1C1B:3C 10 D7 18 A9 28 6D 41 FB
1C23:3C 8D 41 3C 90 03 EE 42 79
1C2B:3C CE 43 3C 10 B4 60 48 BD
1C33:AD 49 3C 85 03 AD 48 3C 10
1C3B:85 02 18 A9 01 6D 48 3C DE
1C43:8D 48 3C 90 03 EE 49 3C 87
1C4B:68 8C 46 3C A0 00 91 02 91
1C53:AC 46 3C F0 26 A9 16 85 93
1C5B:03 A9 80 85 02 20 38 C2 AB
1C63:AD 49 3C 8D D6 16 AD 48 D7
1C6B:3C 8D D5 16 A9 16 85 15 07
1C73:A9 8C 85 14 A9 01 85 16 08
1C7B:20 ED C1 60 50 68 6F 74 F4
1C83:6F 20 53 63 72 61 70 00 16
1C8B:80 16 03 15 BF FF FF FF 39
1C93:80 40 01 80 60 01 80 60 AC
1C9B:01 80 60 0D 80 50 35 80 81
1CA3:50 D9 80 53 21 80 5C C1 45
1CAB:80 59 01 87 CE 01 9F C8 95
1CB3:01 B8 F8 01 B1 FC 01 BF 0D
1CBB:6E 01 9C 66 01 80 66 01 3D
1CC3:80 6C 01 80 38 01 80 00 46
1CCB:01 FF FF FF 83 04 00 D7 88
1CD3:17 D7 17 D7 17 50 68 6F 28
1CDB:74 6F 20 53 63 72 61 70 7B
1CE3:20 56 31 2E 31 00 00 00 54
1CEB:00 52 69 63 68 61 72 64 2E
1CF3:20 41 2E 20 52 61 72 64 B5
1CFB:69 6E 20 20 00 00 00 00 8A
1D03:00 00 00 00 00 00 00 00 3D
1D0B:00 00 00 00 00 00 00 00 45
1D13:00 00 00 00 00 00 00 00 4D
1D1B:00 00 00 00 00 00 00 00 55
1D23:00 00 00 00 00 00 00 00 5D
1D2B:00 00 00 00 00 00 00 00 65
1D33:00 00 00 00 00 00 00 00 6D
1D3B:00 00 00 00 00 00 00 00 75
1D43:00 00 00 00 00 00 00 00 7D
1D4B:00 00 00 00 00 00 00 00 85
1D53:00 00 00 00 00 00 00 00 8D
1D5B:00 00 00 00 00 00 00 00 95
1D63:00 00 00 00 00 00 00 00 9D
1D6B:00 00 00 00 00 00 00 00 A5
1D73:00 00 00 00 00 00 00 00 AD
1D7B:00 00 00 00 00 00 00 00 B5
1D83:00 00 00 00 00 00 00 00 BD
```

GeoConverter

```
HQ 10 REM COPYRIGHT 1990 COMPU
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DK 20 PRINT"{CLR}{GRN}"CHR$(14
      2):VE=PEEK(772)+256*PEEK
      (773)
HA 30 IFVE=42364THENPOKE53280,
      0:POKE53281,0:GOTO50
MK 40 LIST0,1:LIST4,1:LIST6,1
ES 50 FORI=1TO10:PRINT"{DOWN}"
      :NEXT
KQ 60 PRINTTAB(5)"{4}UDI COPYR
      IGHT 1990"
FP 70 PRINTTAB(5)"GCH COMPUTE!
       PUBLICATIONS INC."
DP 80 PRINTTAB(5)"JFK ALL RIGH
      TS RESERVED{HOME}"
QG 90 PRINT"{DOWN}{RVS}{8}GEOC
      ONVERTER 1.3{OFF}{DOWN}
      {GRN}"
```

```
QF 100 N=8:PRINT"DRIVE NUMBER
       {SPACE}"N"{4 LEFT}";:IN
       PUTN
MP 110 IFN<8ORN>11THEN100
AH 120 PRINT"IS DRIVE"N"A 1581
       ? ";:T$=CHR$(18):S$=CHR
       $(1)
PF 130 GETK$:IFK$<>"Y"ANDK$<>"
       N"THEN130
QX 140 PRINTK$:IFK$="Y"THENT$=
       CHR$(40):S$=CHR$(3)
MX 150 INPUT"FILE TO CONVERT";
       GF$
MP 160 PRINT"{DOWN}SEARCHING F
       OR "GF$
DF 170 HD$="":FOR I=1 TO 4:REA
       D HE:HD$=HD$+CHR$(HE):N
       EXT
RE 180 FOR I=1TO5:READIE:ID$=I
       D$+CHR$(IE):NEXT
MJ 190 NL$="":OPEN 15,N,15,"I0
       :":OPEN 2,N,2,"#"
GJ 200 GOSUB430:GET #2,NT$,NS$
EF 210 FOR E=0 TO 7
RD 220 D$=NL$:GET#2,B$:I=1:IFB
       $=NL$ THEN280
JM 230 IF ASC(B$)<>130 OR I=19
        THEN280
QG 240 GET#2,HT$,HS$:I=3:IF HS
       $="" THEN HS$=CHR$(0)
XP 250 GET#2,B$:I=I+1:IF B$=""
        THEN B$=CHR$(0)
RJ 260 IFASC(B$)=160ORI=19THEN
       280
BA 270 D$=D$+B$:GOTO250
EC 280 FOR I=I TO 31:GET#2,B$:
       NEXT
EQ 290 IF D$=GF$ THEN320
AD 300 NEXT E:IF NT$=NL$ THEN3
       20
ES 310 T$=NT$:S$=NS$:GOTO200
QJ 320 IF D$=NL$ THENPRINT"
       {DOWN}{RVS}FILE NOT FOU
       ND{OFF}":GOTO420
ME 330 PRINT"{DOWN}CONVERTING
       {SPACE}"GF$
BH 340 DT$=T$:SS$=S$:T$=HT$:S$
       =HS$:GOSUB430
CR 350 GET#2,MT$,MS$:IF MS$=""
        THEN MS$=CHR$(0)
JG 360 FOR I=0 TO 65:GET #2,B$
       :NEXT
AH 370 GET#2,CT$,GT$:GOSUB430:
       PRINT#2,HD$;:GOSUB440:T
       $=DT$:S$=SS$:GOSUB430
EQ 380 FOR I=1 TO 32*E+2:GET#2
       ,B$:NEXTI
JS 390 PRINT#2,CT$;MT$;MS$;:FO
       RI=0 TO 15:GET#2,B$:NEX
       T
KJ 400 PRINT#2,HT$;HS$;CHR$(0)
       ;GT$;
SP 410 PRINT#2,ID$;:GOSUB440:P
       RINT:PRINTGF$" CONVERTE
       D"
AC 420 CLOSE2:CLOSE15:END
SA 430 U$="U1":GOTO450
PA 440 U$="U2"
QJ 450 PRINT#15,U$;2;0;ASC(T$+
       "0");ASC(S$+"0")
KD 460 RETURN
QG 470 DATA 0,255,3,21,87,10,1
       ,0,0
```

G

BEFORE TYPING . . .

Before typing in programs, please refer to "How to Type In COMPUTE!'s Gazette Programs," elsewhere in this issue.

bug-swatter

• *Smart Disassembler* (January 1989 and the *Power Tools* disk) has two problems. The first causes the program to calculate forward branches incorrectly. The second causes portions of hexadecimal disassemblies to print in decimal. To correct both problems, simply load your copy of *Smart Disassembler* and enter the following lines:

```
PS 300 B=LEN(P$+OP$(J)+A$):C=2
       3:B$="":FORI1=TCTOPC-1
KB 310 A$=STR$(USR(I1)):IFHTHE
       NGOSUB820
FE 320 PRINTTAB(C)A$:PRINT"
       {UP}";:B$=B$+A$:C=C+4:N
       EXTI1
AB 330 IF PR THEN PRINT#3,RIGH
       T$(SP$,28-B);B$
DK 660 N=USR(PC+1):IFN>127THEN
       N=N-256
XK 665 AD=PC+N+2:A$=STR$(AD):I
       FHTHENGOSUB780
```

Once you've entered the corrections, be sure to save the program with a new filename.

• In the December 1989 "GEOS Column," we stated that *GeoConverter* was new and improved. Unfortunately, we listed the older version of the program (version 1.2) in the column, and we left it off the *Gazette Disk* entirely. To those of you who typed in the "new" version of *GeoConverter*, we apologize. Version 1.3 of *GeoConverter* is listed in this month's "GEOS Column" and is also included on the *Gazette Disk*.

If you haven't typed in the new version of *GeoConverter*, you may want to wait for the March issue before doing so. In that issue, we'll be introducing an all-new, more user-friendly version of *GeoConverter* (version 2.0). *GeoConverter* 2.0 will include features such as automatic drive sensing, simplified file searching, and better error handling.

• The September 1989 *Gazette Disk* contains a file that isn't documented in the magazine. This file, SLIDES, was created by *GEOS SlideShow* when the disk was being tested. SLIDES was later overwritten by the 128 boot block and now causes *GEOS SlideShow* to crash when you run it from the disk. Actually, *GEOS SlideShow* is fine; it only crashes when you load the corrupted SLIDES file. The easiest way to correct the problem is to copy *GEOS SlideShow* to another disk using GEOS.

Another solution to the problem is to remove the file SLIDES from the disk. The following program removes SLIDES from the *Gazette Disk* without destroying the 128 boot block. Be very careful when you enter it. A typing mistake could ruin your *Gazette Disk*.

```
CE 10 INPUT"{CLR}DRIVE NUMBER
      {2 SPACES}8{3 LEFT}";DN
RQ 20 PRINT"{3 DOWN}INSERT A
      {RVS}COPY{OFF} OF THE"
RK 30 PRINT"SEPTEMBER 1989 GAZ
      ETTE"
HH 40 PRINT"DISK AND PRESS <SP
      ACE>{3 DOWN}"
RR 50 GETA$:IFA$<>" "GOTO50
CM 60 OPEN1,DN,15,"I0":GOSUB12
      0
RP 70 OPEN2,DN,2,"#0":GOSUB120
CR 80 PRINT#1,"U1:2 0 18 5":GO
      SUB120
MP 90 PRINT#1,"B-P:2,66":PRINT
      #2,CHR$(0);
DH 100 PRINT#1,"U2:2 0 18 5":G
       OSUB120
DS 110 PRINT#1,"I0":GOSUB120:C
       LOSE1:CLOSE2:PRINT"DONE
       !":END
XG 120 INPUT#1,EN,EM$,ET,ES:IF
       EN=0THENRETURN
XR 130 PRINTEN;EM$ET;ES:CLOSE1
       :CLOSE2:STOP
```

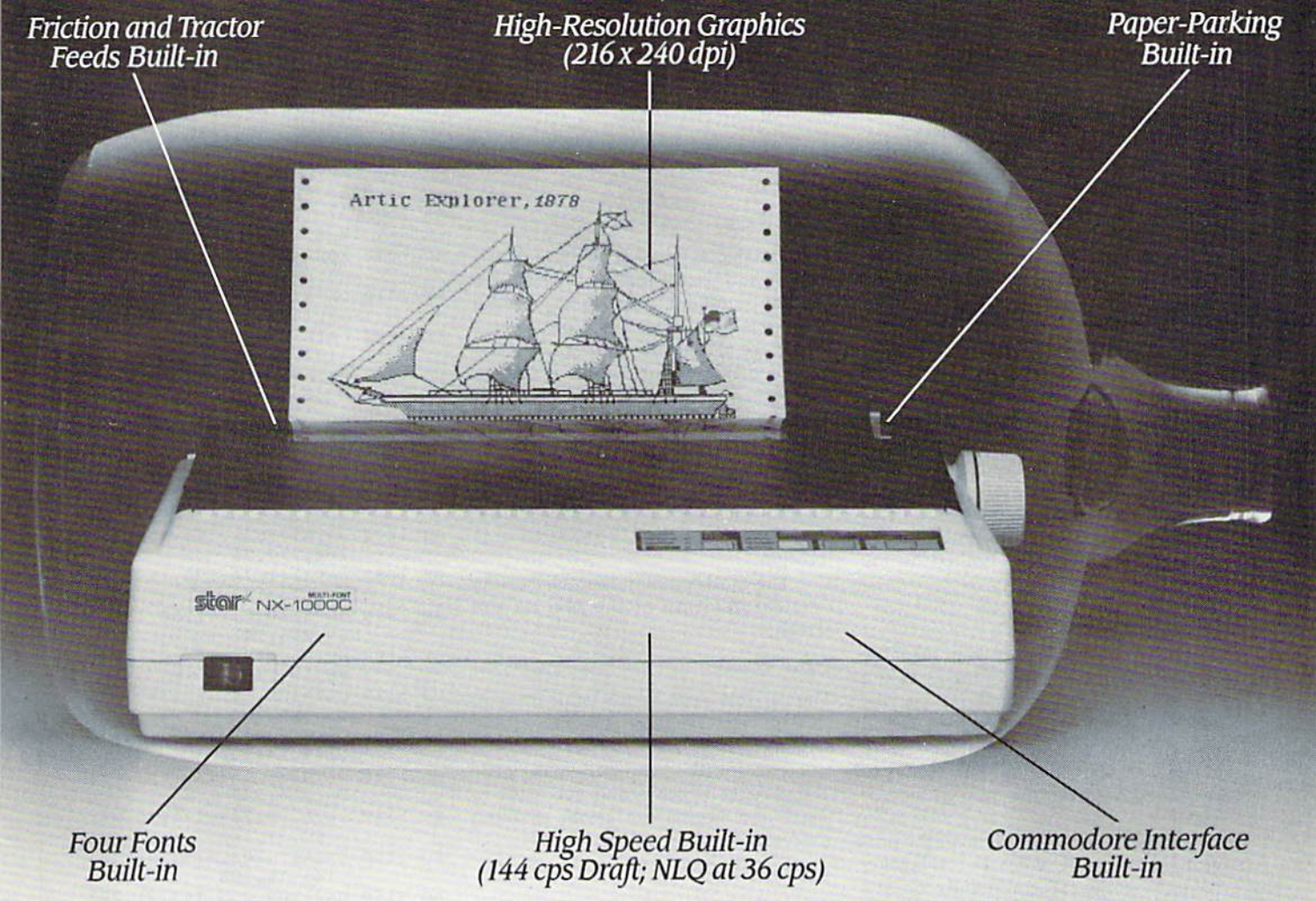
Because our disk is write-protected, you'll first have to copy its contents to another disk. After you've copied the disk, simply load and run the correction program.

• *Triple Search* (October 1989) allows you to create your own word-search puzzles and print them on your printer. One of the program's limitations is that you can't use compound words or phrases in the puzzles. This is because *Triple Search* fills all the spaces in the puzzle with random characters. If you'd like to include compound words in your word-search puzzles, the following changes and additions to the program will do the trick:

```
FP 250 DIM L$(NW),LL$(NW):IF C
       =1 THEN 290
EX 320 PRINT Z;:INPUT L$(Z):LL
       $(Z)=L$(Z):L=LEN(L$(Z))
       :IFL>=S THEN 310
GX 604 FOR J=1 TO NW:L$="":FOR
        JJ=1 TO LEN(L$(J))
AX 605 IF MID$(L$(J),JJ,1)<>CH
       R$(32) THEN L$=L$+MID$(
       L$(J),JJ,1)
XQ 606 NEXT JJ:L$(J)=L$:NEXT J
FP 1230 X=X+1:PRINT#1,SPC(INT(
        TA/2))LL$(X)SPC(INT(WD
        /2)-LEN(LL$(X))+INT(TA
        /2));
DS 1250 X=X+1:PRINT#1,LL$(X):I
        F X<>NW THEN 1230
```

G

The new Star Multi-Font. How did Star get it all in there?



It wasn't easy. But, we built an incredible number of features into the Star NX-1000C Multi-Font™. So now you and your Commodore can be as creative as you like.

The best feature in this new Star printer is built into its name—Multi-Font. It has four built-in type fonts that give you twenty different print style options. Just mix these fonts in with its high-resolution graphics to make great looking reports, greeting cards, posters—whatever you want.

And the list of built-in features goes on—there's impressive speed in both draft and near letter quality. And an automatic single sheet feed. Plus, a paper-parking mechanism that lets you use single sheets without removing tractor paper. And the Multi-Font's easy-to-use push button control panel gives you command of over thirty-five functions.

Whether it's for serious work or serious play, the Star NX-1000C Multi-Font has so much built-in, you'll get more out of your Commodore. To find out where you can see the Multi-Font, call 1-800-447-4700.

star micronics

The ImagePower™ Printers

Multi-Font printout produced by Flexidraw 5.5 graphics software by Inkwell Systems.

Circle Reader Service Number 109

power BASIC

Sprite Text Scroller

Shao-Tien Pan

Add a bit of flair to your programs with this short text-scrolling routine for the 64.

Have you ever tried to scroll a huge banner across the top of the screen without resorting to bitmapped graphics? Or have you attempted to place a status line at the bottom of the screen that wouldn't disappear when the screen scrolled? If you've been frustrated by programming problems like these, then *Sprite Text Scroller* could be your answer.

Sprite Text Scroller is a machine language routine that uses sprites to scroll character strings across the screen. It lets you display strings containing up to 256 standard or redefined characters anywhere on the screen. And unlike similar routines, *Sprite Text Scroller* redefines each sprite on the fly so that string size isn't limited by the number of sprites.

Getting Started

Sprite Text Scroller is written in machine language, but it's listed in the form of a BASIC loader. To prevent typing errors, use *The Automatic Proofreader*, found elsewhere in this issue, to type it in. When you've finished typing, be sure to save a copy of the program to tape or disk.

To get started, simply load the program and type RUN. *Sprite Text Scroller* prints a series of commands on the screen and then POKEs the machine language into memory. Once the routine is installed, you'll see the familiar READY prompt. At this point, move the cursor up to the line of text that starts with A$ = . Then press RETURN over this line and the three that follow it. If everything works correctly, a scrolling message will appear at the bottom of the screen. Press RETURN over the next line to erase the scrolling string.

Using the Program

Sprite Text Scroller is very easy to use. Once the machine language routine is installed, only four commands are needed to scroll text across the screen. Each of the commands is discussed below. They may be entered from direct mode or from a program.

The first command defines the string you wish to scroll:

```
A$ = " SPRITE TEXT SCROLLER "
```

Here, A$ represents any valid string variable. The string can contain a maximum of 256 characters.

The next command points *Sprite Text Scroller* to the character set that you want to use:

```
POKE 49534,n
```

The variable *n* is the high byte of the starting address for the character set. To use the standard uppercase/graphics characters, set *n* to 208; for lower-/uppercase characters, set *n* to 216.

To display your text in a custom character set, first place the character definitions in memory. Then divide the starting address of the character set by 256 and POKE the resulting value into location 49534. For example, if your custom character set is at 12288, you'd POKE a 48 (12288/256) into this location.

The third command establishes the vertical position of the text on the screen.

```
POKE 49252,y
```

The variable *y* can be any value from 50 to 234 (this range covers the visible screen).

The fourth command tells *Sprite Text Scroller* which string you wish to scroll and begins the actual scrolling process:

```
SYS 49152,A$
```

A fifth and final command erases the string and halts the scrolling.

```
SYS 49588
```

To add *Sprite Text Scroller* to your own programs, include lines 1000–1550; then use the commands listed above to create the scrolling effect.

Sprite Text Scroller

```
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KG 20 POKE53280,0:POKE53281,0
RJ 30 PRINT"{WHT}{CLR}{DOWN}"T
      AB(14)"SPRITE TEXT{DOWN}
      "
EH 40 PRINTTAB(13)"COPYRIGHT 1
      990"
DB 50 PRINTTAB(7)"COMPUTE! PUB
      LICATIONS, INC."
DG 60 PRINTTAB(11)"ALL RIGHTS
      {SPACE}RESERVED"
QE 70 PRINT"{2 DOWN}A$="CHR$(3
      4)" SPRITE TEXT "CHR$(34
      )":REM DEFINE STRING"
EH 80 PRINT"{2 DOWN}POKE 49534
      ,208:REM SELECT FONT"
RQ 90 PRINT"{2 DOWN}POKE 49252
      ,234:REM SELECT Y POS"
ME 100 PRINT"{2 DOWN}SYS 49152
       A$:REM SCROLL STRING"
AR 110 PRINT"{2 DOWN}SYS 49588
       :REM ERASE STRING"
HC 1000 FORA=49152TO49620:READ
        AA:POKEA,AA:NEXTA
DK 1010 DATA120,169,173,141,20
        ,3,169,192
DK 1020 DATA141,21,3,162,7,189
        ,157,192,157
JQ 1030 DATA248,7,202,16,247,1
        62,0,169,0
MP 1040 DATA157,0,62,157,0,63,
        232,208,247
XS 1050 DATA32,139,176,32,133,
        177,160,0
BB 1060 DATA177,71,240,108,141
        ,64,193,200
JB 1070 DATA177,71,141,73,193,
        200,177,71
DX 1080 DATA141,74,193,169,3,1
        41,177,192
BM 1090 DATA169,8,141,50,193,1
        69,255,141
QF 1100 DATA62,193,169,0,141,1
        06,193,162,7
BS 1110 DATA160,14,189,165,192
        ,153,0,208
BJ 1120 DATA202,136,136,16,245
        ,162,14,169
QG 1130 DATA234,157,1,208,202,
        202,16,249
EJ 1140 DATA169,224,141,16,208
        ,169,27,141
KQ 1150 DATA17,208,173,100,192
        ,141,18,208
AG 1160 DATA169,255,141,21,208
        ,141,23,208
CB 1170 DATA141,29,208,169,1,1
        41,26,208
HF 1180 DATA162,7,169,1,157,39
        ,208,202,16
JE 1190 DATA250,169,127,141,13
        ,220,88,96
KP 1200 DATA248,249,250,251,25
        2,253,254
AM 1210 DATA255,24,72,120,168,
        216,8,56,104
CR 1220 DATA206,177,192,169,3,
        208,8,169,3
XM 1230 DATA141,177,192,206,20
        3,192,169,16
EP 1240 DATA72,173,18,208,141,
        211,192,238
QX 1250 DATA203,192,162,7,169,
        0,157,39,208
FP 1260 DATA202,16,250,169,234
        ,205,18,208
FP 1270 DATA240,249,104,56,233
        ,1,208,223
JB 1280 DATA162,21,30,194,63,6
        2,193,63,62
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        2,129,63,62
HF 1300 DATA128,63,62,66,63,62
        ,65,63,62,64
GG 1310 DATA63,62,2,63,62,1,63
        ,62,0,63,62
KK 1320 DATA194,62,62,193,62,6
        2,192,62,62
HA 1330 DATA130,62,62,129,62,6
        2,128,62,62
EK 1340 DATA66,62,62,65,62,62,
        64,62,62,2
JC 1350 DATA62,62,1,62,62,0,62
        ,202,202,202
PF 1360 DATA16,179,206,50,193,
        169,8,208
QH 1370 DATA111,169,8,141,50,1
        93,238,62
DJ 1380 DATA193,162,255,224,0,
        208,5,162,0
MS 1390 DATA142,62,193,189,0,1
        92,168,41
KR 1400 DATA127,201,32,176,11,
        173,106,193
JR 1410 DATA73,128,141,106,193
        ,76,58,193
KE 1420 DATA152,74,74,74,74,74
        ,170,152,56
JA 1430 DATA253,172,193,9,0,16
        2,3,10,46
CF 1440 DATA145,193,202,208,24
        9,141,144
DX 1450 DATA193,173,145,193,41
        ,7,24,105
GK 1460 DATA208,141,145,193,16
        9,0,141,14
RS 1470 DATA220,169,35,133,1,1
        62,7,160,21
HG 1480 DATA189,0,208,153,194,
        63,202,136
DM 1490 DATA136,136,16,244,169
        ,39,133,1
SB 1500 DATA169,1,141,14,220,1
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BA 1510 DATA208,76,49,234,0,0,
        64,32,0,64
GP 1520 DATA128,128,120,169,49
        ,141,20,3
PP 1530 DATA169,234,141,21,3,1
        69,27,141,17
RQ 1540 DATA208,169,0,141,21,2
        08,169,0,141
HD 1550 DATA26,208,169,129,141
        ,13,220,88,96
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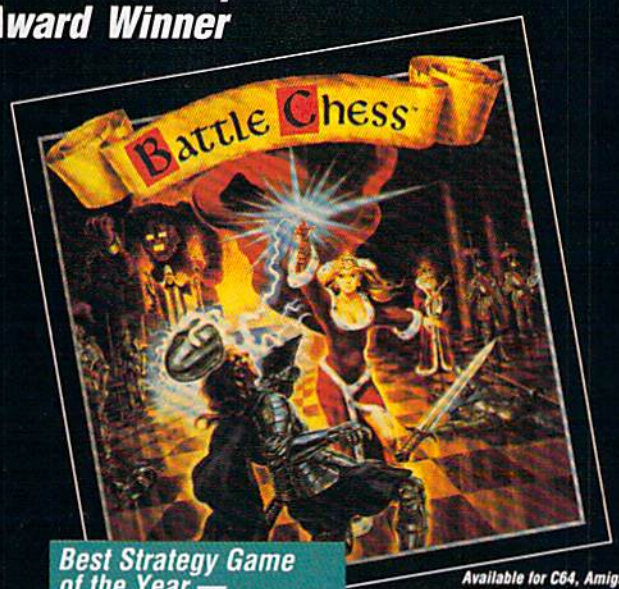

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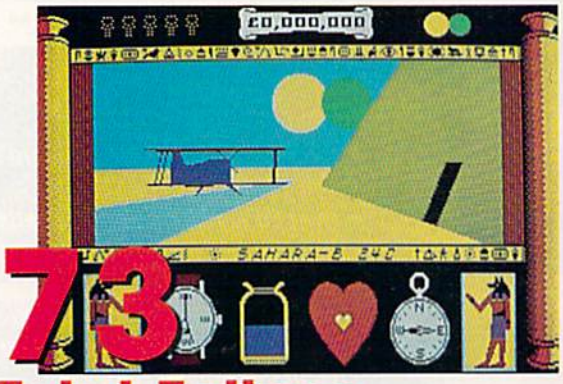
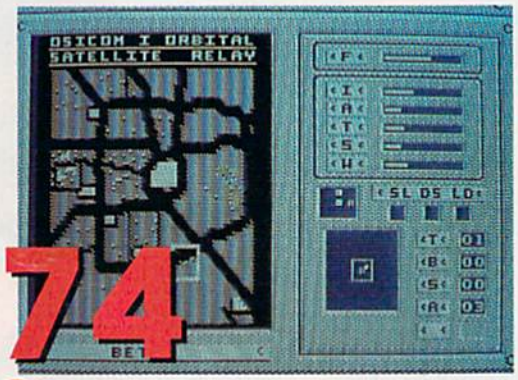
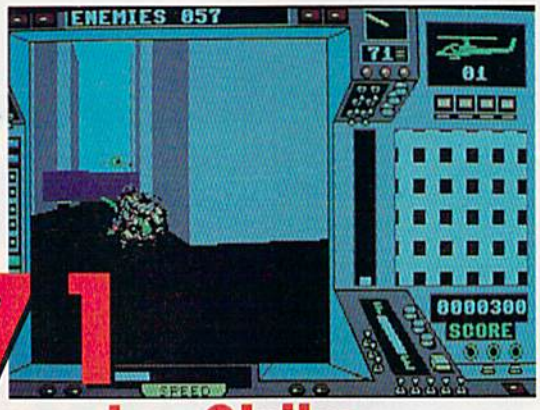


73 Total Eclipse



74 Omega



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Apache Strike

It has been a tension-filled day, but it's not over yet. You slide into your chair, pulse jumping in anticipation. Turn on your machine and slip in the disk that carries your mission data for *Apache Strike*, a hot helicopter game for the 64 from Activision.

After you enter crucial commands, music more than vaguely reminiscent of the theme from *Airwolf* surrounds you. A screen lights with images and a list of choices: Review the roster of those who have flown before or list those who planned these missions and got you into this mess. (It's possible you'll want to get even with them later.)

> *This game has levels easy enough to tempt the novice and ones tough enough to challenge the expert.*

If you're feeling cocky, you might choose to fly a high-priority mission. You may choose one of five levels. Starting at the third level or above gives you a bonus—if you complete your mission. You choose to play. The music ceases. Images fade.

Then, you hear it. Rotors commence spin-up. Mission instructions appear on the CRT. In a flash, you're piloting your AH-64 Apache helicopter armed with machine guns and missiles through an enemy city in search of the Strategic Defense Computer (SDC). You must seek and destroy SDCs in three cities in order to save the world from (what else?) complete nuclear destruction.

With one hand wrapped around your joystick and another poised at the keyboard, your eyes are glued to the Apache instrument panel. This panel is the key to the game. It provides a goodly amount of information which you must view, digest, and respond to with keystroke or joystick maneuvers. The panel includes a radar screen in the form of a grid representing city blocks. This grid helps you know where you are in relation to the enemy and to your target.

Below is the message center which keeps you apprised of your Apache's condition and other pertinent information. The distance and bearing indicator uses a compasslike pointer that homes in on the SDC. A digital display indicates how close you are to the target. Additional displays track how many Apaches you have left, how many enemies remain in the current mission, fuel consumption, speed and altitude, and scoring.

The remainder of the screen represents what is supposed to be a view from the Apache's cockpit. By far the weakest component of the game, this scene appears more like a computerized targeting device than a genuine view of the landscape. Buildings are represented by line drawings; enemy tanks and helicopters look less realistic than the ones in, say, Brøderbund's *Choplifter*. This screen adequately does the job, but it isn't the kind of view the manual and a 64's capabilities lead you to expect. More about this later.

Maintain the helicopter's position with the joystick. Control speed and hovering with the function keys. Shoot bullets with the fire button, missiles with the space bar.

Everyone is saving the world these days, whether from aliens, monsters, ghosts, or our own determined drive toward self-destruction. This premise has become a classic among game producers, so it takes something more to make a game different. *Apache Strike* finds its niche in the cockpit. It permits enough extra input for the pilot to advance the game from a simple race-against-time shoot-'em-up to a product that hovers on the brink of being a strategic simulation. It is still a game, after all, with levels easy enough to tempt the novice and ones tough enough to challenge the expert.

In the game's higher levels, you face more enemies and start farther away from your SDC target. In addition, the target dances about when you're trying to blast it. Your Apache also sustains more crippling damage, forcing you to limp along, trying to overcome your disabilities and complete your mission. While *Apache Strike* probably isn't as tough as some games, it's a lot of fun.

We found problems with the manual. In laying out the premise, it gives the impression that the game is over once SDCs in three cities are destroyed. Not so. Continue as long as you can; each successfully completed mission advances you to the next level. The manual also notes that to run at slow speed, you should press F2; for fast speed, press F3. Instead, F3 and F5, respectively, are the keys that work here. These errors are not enough to ruin your game—experimentation soon puts you on the right track—but they indicate a lack of attention to detail in the editing of the manual.

A further discrepancy brings up a complaint that applies to many other programs. The *Apache Strike* package shows three really good screen shots from the MS-DOS version. A small notation states that screen appearances will vary from computer to computer. No doubt you've seen this technique used on other games. It's a packaging device. Use one box—make sure it carries the most attractive screen shots—and slap a label on it to indicate which computer the game is for.

It looks good and saves time and money for the packager, but it can be misleading for the consumer, as in this case. The MS-DOS screens are better designed with greater detail than the 64's are. The package leads you to expect a certain quality screen, but it isn't there. The disclaimer is supposed to cover this discrepancy, but when there is this much difference between two versions of the same program, a second version of the package is in order.

These problems are peripheral—the game itself is fun and has the right kind of challenges for a variety of abilities. If you're not looking for a simulation but for an enjoyable game that's more than a shoot-'em-up, this is a game to turn to.

—David and Robin Minnick

Apache Strike
Activision
Distributed by Mediagenic
3885 Bohannon Pl.
Menlo Park, CA 94025
$14.95

Action Replay 5.0

One of the most recent and powerful entries into the 64 utility cartridge arena is Action Replay 5.0 from Datel Computers. Like many English products, AR5 is not high on glitz, bells, or whistles—it's just solid, dependable, and easy to use.

Though anyone can find items to quibble over, AR5 offers one of the finest all-around assortments of features available anywhere. Indeed, it's difficult to think of any important function Datel has omitted. Here's a list of what's included: disk turbo, tape turbo, DOS wedge, directory list to screen, load/run from directory, programmed function keys and other single-stroke commands, reset button, freeze button, extensive freeze/backup capability, BASIC toolkit, screen dump (multiple varieties), file and disk copy, disk drive monitor, and track-and-sector editor.

Turning on the computer or pressing the cartridge reset presents a startup screen with four options: configuring memory for a freeze, reset with turbo functions, reset without turbo functions, and exit to utilities. Pressing the Commodore key during reset takes you directly to BASIC with turbo enabled.

The utilities include excellent file- and disk-copy routines. The file copier handles batches of files (all kinds except relative) and permits multiple copies as well as mixed drive types. It also can convert files to a proprietary WARP*25

format for superfast loading either with or without Action Replay. As a bonus, the conversion process compacts files by 20–25 percent, making additional disk space available. The disk copy program is designed for the 1541 drive only (one or two drives). An attractive feature of the routine is its ability to do either complete or BAM copies. The latter saves copy time.

> *Action Replay 5.0 is not high on glitz, bells, or whistles—it's just solid, dependable, and easy to use.*

The disk turbo is particularly speedy (one of the fastest serial systems on the market) because the cartridge contains 8K of RAM as well as 32K of ROM. The RAM is used as a disk cache during disk operations, shaving several seconds off the load time of an ordinary turbo. An alternate WARP*25 system is even faster. However, the WARP*25 storage format is not compatible with Commodore DOS, and it requires either the presence of AR5 or a special loader program. (The loader routine is dumped directly from cartridge to disk and resides in extra space in the disk directory.) All functions, including Fast Format, are sped up except for Validate and Scratch. Turbo load displays both starting and ending addresses in hex.

Here are a few notes that document the great effectiveness of AR5's turbo load and save. It's just about the fastest cartridge I've encountered. For a 64-block program file, a standard load takes 42 seconds; AR5 does it in 8. (After an AR5 resave, it takes only 5 seconds.) Saving the same file normally takes 48 seconds; with AR5, it takes 10. The same file saved in WARP*25 format then loads in 4 seconds. These are just about the fastest serial load and save times I've encountered. In comparison, a much more expensive parallel system can load a comparable program in 2.5 seconds and save it in 6.5.

The freezer capability includes a number of advanced and unique features. Besides the standard sprite killer, a sprite monitor lets you to view all sprites, save them, load them, and/or wipe them out. In short, you can change, personalize, or simplify the sprite content of any running program.

The frozen-screen text editor is another singular feature. Delete or add text anywhere on a frozen screen and then save the screen, dump it to a printer, and continue—the 8K of RAM allows you to pick up exactly where you stopped. The full-featured monitor also permits you to scroll through memory looking for text, freely editing it as well.

Besides allowing you to enter published POKEs while a game is in a frozen state, AR5 includes an intriguing Pokefinder routine. Pokefinder is billed as "an automatic infinite lives finder" that will give game players a considerable advantage. This feature consists of a series of steps to determine which memory location(s) hold the number of lives in a game. The routine determines the particular POKE(s) required, installs them, and tells you what they are for future reference. The manual claims a better-than-80-percent success rate.

The eight function keys are programmed to load and load/run from a directory list to the screen (the directory list is also available through a function key). *List, run, monitor,* and *freezer* commands are also programmed for instant access. Shorthand (single-key) wedge options are implemented, including a WARP*25 save. The disk-error channel is accessed via the @ key. Though it would be nice to be able to redefine the function keys, particularly for special programming applications, this, as with most cartridges, is not possible.

One of AR5's many welcome nuances is a unique wedge command that allows you to change a disk name and ID easily without altering the directory.

Toolkit commands are relatively few in number but represent a standard collection. Notably missing from the essentials are *find* (or *change*) and *renumber*, although the *merge* command offers a *renumber prior to MERGE* option. While this routine may be used as a *renumber* from disk, it does not alter GOTO and GOSUB line destinations—a major limitation.

Both *append* and *merge* are included. In addition, *linesave* stores a portion of a program to tape or disk, and *boot* loads a machine language file and then does a SYS to the beginning of code. (*Linesave* and *merge with renumber* are clearly designed to be used together—another thoughtful design feature.)

Plist and *Slist* transfer any BASIC program (or disk directory) from disk to printer or screen without overwriting memory. *Copy* (disk file) and *backup* are also executable from BASIC. The toolkit permits hex and other number types to be directly incorporated into BASIC statements.

The manual, like Datel's production work generally, is not spectacular—but its documentation does offer all essential information, is reasonably well organized, and contains only occasional misinformation and typos.

ROM upgrades cost $16.99 (the ROM is socketed). Version 5.0, as compared to version 4.0, adds a full-screen text editor and the Pokefinder. (However, AR5 apparently no longer offers an optional parameters disk for programs otherwise impossible to back up. The freezer menu continues to include a parameters option, which requests entry of a parameter code.)

The strengths of AR5 are its comprehensiveness, flexibility, ease of use, and upgrade possibility. It is a fine, apparently bug-free, all-around utility/backup cartridge. In a field crowded with worthy products, Action Replay 5.0 is a top contender.

—Art Hunkins

Action Replay 5.0
Datel Computers
3430 E. Tropicana #67
Las Vegas, NV,89121
$64.99

The Final Cartridge III

The cartridge war continues. First, we had the 8K accelerator cartridge; then came the 16K utilities, followed by the 32K supercartridge. Several of the later 32K multifunction cartridges also contained 8K of RAM for faster disk access and a more flexible freeze/backup function.

Now, with The Final Cartridge III (FCIII), comes the first 64K megacartridge. And its features are impressive—almost overwhelming. Most importantly, the additional 32K is devoted to a totally new feature for a multifunction cartridge—a set of desktop utilities. The desktop is the most important part of the FCIII, according to the manual.

Inspired by the Amiga and Macintosh, the desktop utilities are accessed through pull-down menus and multiple relocatable windows. You have a choice of keyboard, joystick, or mouse operation. I recommend a mouse. Using the keyboard's function keys instead of the cursor keys can be confusing, and joystick mode is nearly impossible, even when you slow down the speed.

Included in the desktop are a complete window-driven DOS wedge, a notepad, a calculator, and an alarm clock. Up to three disk directories can be displayed at once. The one-minute alarm is a real attention-getter—its sweeping sound emulates a car's burglar alarm. The notepad includes a range of features, including a choice of onscreen fonts that will save you from having to load a word processor much of the time. However, if you have a parallel printer and interface, you may experience problems. You must have a relatively recent parallel interface, one with internal switches which you can set to transparent mode. This is because

FCIII contains its own Centronics interface, and there is no way to send appropriate secondary address codes to it. The Cardco A and B interfaces will not work properly (Cardco A has no switches at all), but the Grappler and Cardco G+ units can be properly set.

The difficulty is that a double conversion of the Commodore character set prints a reversal of upper- and lowercase letters. The extra interface is more a hindrance than a blessing here in the U.S.; the situation is presumably quite different abroad, where FCIII is made. (An alternative is to try a serial-to-Centronics cable, but these cables are difficult to locate.)

In two desktop preferences menus, you can change many default options, such as pointer velocity and acceleration, default device number (including tape), key repeat and click (on or off), screen, border, and pointer colors. There are multiple screen-dump choices, pin densities, and printer types. FCIII is the only general utility cartridge with the ability to dump to a color printer. Simple text screen dumps are also available from BASIC.

You won't find more features in any other cartridge.

The cartridge's freezer capability is satisfactory, if not spectacular by today's standard. The freezer allows you to defeat sprite-to-sprite and sprite-to-background collision detection and to use either joystick port, plus it offers unlimited firepower. It does not grant infinite game lives.

What I like most about FCIII is that it's easy to work with. In particular, the programmed function keys are laid out logically and are easy to remember. Though the desktop is fairly complex and can be cumbersome without a mouse, the standard utility portion of FCIII is clear and straightforward, and it saves time and effort.

The BASIC toolkit is by far the largest BASIC extension of any cartridge—it features nearly 30 commands. Unfortunately *replace/change* is not one of them, contrary to what it says on the package cover and the desktop toolkit menu.

Among the toolkit additions are commands to list files directly from disk to printer or screen without corrupting memory, and an *order* command, which makes *dappend* act like a bona fide *merge* (lacking in FCIII). There are also *dump* (for displaying variable values) and *array* (for displaying array values). *Pack* and *unpack*, as well as *trace*, may be helpful to the BASIC programmer.

The cartridge monitor is both useful and extensive. It allows data display and alteration in five different formats. Among them are text, sprite, and character representation, plus a kind of disassembled program option. Data is modified simply by overtyping. The monitor even contains sprite and character editors.

Automatic forward and backward scrolling of BASIC program listings is a small item, but a most welcome one to programmers. Scrolling is particularly easy when combined with a single-keystroke method for getting the cursor to the bottom left of the screen. These are significant timesavers. To my knowledge, FCIII is the only cartridge that implements BASIC list scrolling.

Like other European products, the FCIII fully supports tape and contains a full tape turbo. Since normal BASIC commands default to tape, D-prefixes are used for disk (*dload, dsave, dappend,* for example).

There are a few drawbacks. The major one is a glaring omission: FCIII lacks file-copy and disk-backup routines, except from the freezer. One can certainly argue that these functions can be handled by other products as needed, but this case doesn't hold water: FCIII offers 64K. Even 16K cartridges find room for these routines.

Be aware, too, that FCIII is not upgradable. It doesn't have a socket to replace the version III ROM with any future version. This might have been more of an issue earlier in the 64's product life; it seems less so now.

FCIII includes a parameters disk, indicating that there are a number of heavily protected programs that FCIII by itself cannot archive. The disk contains Utilities Unlimited's 100 *free* parameters and two nibbler programs. Making backups of difficult disks is a problem faced by all cartridges, including those with 8K of RAM. It is helpful to have the disk to deal with many of them.

If, like me, you're not particularly in love with desktops and mice, you may want to consider another option. Final Cartridge II is still available at less than half the cost of FCIII. If you go this route, you'll have to do without some other features as well: only half the Toolkit (but with all essential commands) and no BASIC LIST scroll. Also, a less extensive monitor (no alternate representations of data, no character or sprite monitor), and no screen dumps to a color printer.

In summary, if you want a mega-cartridge, Final Cartridge III is for you. You won't find more features in any other cartridge. Since it doesn't cost any more than other supercartridges, it's a good buy. If you don't need the desktop and you're willing to settle for fewer features, drastic price reductions on the Final Cartridge II make it an excellent buy, too.

—Art Hunkins

Final Cartridge III
Home and Personal Computers
99 Washington St. and Park Ave.
East Orange, NJ 07017
$69.95 (includes parameters disk)

Total Eclipse

If you prefer Indiana Jones to Star Wars, King Tut to Princess Leia, and desert sands to docking spacecraft, then *Total Eclipse* is just what the Pharaoh ordered. Published by Spotlight Software and distributed by Cinemaware, this European program features enough puzzles, mummies, traps, and treasures to keep a computer Egyptologist busy for quite some time.

Like the knuckleheaded story lines of most computer adventures, *Total Eclipse* sports a plot worthy of a B movie. Long ago, a wicked high priest, Hahmid III, laid a curse on the sacred shrine of Ra, the sun god. Any object that passes between the rays of the sun and the shrine will be destroyed.

As the archaeologist who discovered Hahmid's Scroll of Curses, you know that all the other prophecies the wicked priest made have come true. Soon a total eclipse of the sun will occur over the pyramid. This will place the moon directly between a rock and a hard place. Not only will the loss of the moon leave songwriters nothing to rhyme with *June, tune,* and *spoon,* but it will also spell doom to civilization as we know it.

In order to save civilization, you must journey to Egypt, find the shrine, and destroy it before the eclipse is complete. This entails exploring rooms filled with booby traps, killer mummies, hidden passages, and treasures too valuable to be overlooked.

Survival requires having a sure hand on the trigger, resting when your energy runs low, satisfying your thirst with regular visits to water troughs, and keeping an eye on your onscreen wristwatch. For some dumb reason, you allowed yourself only two realtime hours to succeed. Oh, well—what would an adventure be without some handicaps?

Firing your pistol and walking are controlled easily via joystick or keyboard. Keyboard-specific options include the ability to speed up, make U-turns, look up or down, stand or crouch, rest, and increase or decrease lengths of steps and the angles at which you turn. Ascending staircases, walking on narrow paths, and moving through doorways often require careful manipu-

lation of these step-length and angle-of-turn features.

To open doors, fill your water bottle, collect ankhs (which open locked entrances), and accumulate treasure, just move onto each item. Frequently, it is necessary to fire your gun at treasure chests to gain access to their riches. Fire also at structural pieces to move walls or to drop staircases, and shoot at hieroglyphics to enter some chambers. Malignant mummies may also be eliminated in this fashion. Be forewarned, however, that what works in one screen may be ineffective in another. Sometimes shooting at mummies can backfire.

The game screen, which is framed within the likeness of an ancient scroll, consists of four sections. Your inventory of treasure and ankhs and a graphic representation of the eclipse's progress appear on top. Directly below is a large action screen and a message window in which your current location, step length, angle-of-turn size, and other pertinent information appear. The action screen presents a first-person perspective, with a 3-D view of your surroundings. Objects grow in size as you approach them and get smaller as you move away; views vary according to your position, whether upright, crouching, or looking up or down.

The difficulty of the puzzles and the sheer volume of activities give **Total Eclipse** *a great deal of depth.*

The bottom third of the screen displays time, water, direction, and health gauges depicted by attractive drawings of a wristwatch, water bottle, compass, and beating heart, respectively. A rapidly pulsating heart must be slowed down by immediate rest; otherwise, death will come in a matter of seconds. Resting is so important that the authors have included a sound effect so players who glue their eyes to the action screen can hear how healthy or unhealthy they are.

Press a pause key to stop the action and display a menu from which you may save or load a game to disk or tape, reboot the system, and turn off the appropriate yet irritating music.

Total Eclipse's documentation is brief yet comprehensive. It includes background on Hahmid's curse and your mission and easy-to-comprehend instructions and diagrams related to gameplay. Best of all, game hints and a map of the multilevel, 40-room pyramid are included in the package.

Although *Total Eclipse* carries the Cinemaware label, its graphics are neither as crisp nor as colorful as those of most Cinemaware titles. Because of this, some figures occasionally are difficult to recognize. The problem is easily solved by taking a few steps backward, thereby gaining a different perspective.

In other ways, *Total Eclipse* is more substantial than some of Cinemaware's visually impressive yet ultimately superficial efforts (*Sinbad and the Throne of the Falcon*, for example). The difficulty of the puzzles and the sheer volume of activities—avoiding pitfalls and traps, replenishing your water supply, maintaining your health, defeating enemies, solving puzzles, discovering hidden rooms, negotiating illogical mazes, traversing multitiered chambers, and making your way to the shrine—give the program a great deal of depth.

Instead of pretty pictures and petty challenges, *Total Eclipse* creates a claustrophobic yet ever-changing environment in which you exercise great control while encountering the unknown.

—Len Poggiali

Total Eclipse
Spotlight Software
Distributed by Cinemaware
4165 Thousand Oaks Blvd.
Westlake Village, CA 91362
$29.95

Omega

Forget about blasting through columns of Panzers or T-80s. And don't even think about recreating famous tank battles of the past. *Omega*, a unique and entertaining tank game from Origin, instead lets you design computer-operated tanks that fight simulated battles of the future.

Omega puts you in the role of a cybernetics engineer, recently hired by the Organization of Strategic Intelligence (OSI), a firm billed as the leading developer of cybertanks. Computers run these battlefield chariots—there's no help needed from a human crew. It's your job to design the most powerful cybertank possible and program its artificial intelligence.

As a rookie engineer, with both a limited budget and security clearance, you must start with a fairly basic tank chassis. Next, add a drive system; then specify your tank's fuel capacity, primary weapon, and electronic instrumentation. In order to gain the funding to access the high-priced tools and toys of the cybernetic trade, you have to demonstrate a proficiency at your tank's artificial intelligence. Remember, these tanks don't have a crew. They depend on your program to guide them around a hostile battlefield.

A special Cybertank Command Language gives you a powerful programming tool for controlling your tank's actions. You want to design a program that will enable your tank to avoid obstacles, yet track down and destroy enemy tanks. When you think you have an operational program, give your tank a shakedown on a battlefield against tanks designed by other OSI engineers or yourself.

Omega *is a do-it-yourself kind of program—that's the beauty of its design and what makes it so much fun.*

Select a battlefield, add several tanks of various design, and then sit back and watch the action from an overhead perspective. Tanks start rumbling across the landscape, searching for adversaries. As they plow into buildings, trees, or streams, and exchange shots with enemy tanks, you can monitor the damage to any tank's interior, exterior, weapons, and tread. When damage becomes too great, the tank explodes, leaving only a crater to mark its position.

The key ingredient to *Omega* is in designing a tank's artificial intelligence. When you feel you have a successful design, it's possible to challenge other *Omega* players via modem, even those with IBM, Apple, or Atari versions. Cybertanks can be uploaded and downloaded to electronic bulletin boards for further enjoyment and for tournaments.

Omega packs a lot of entertainment into its two-disk package, but the game is not the kind you can jump right into. When I first received *Omega*, I knew it was a tank program, but it took me some time to figure out what I was supposed to do. I was even confused about which manual to read first. (There are three of them. Start with the maroon-colored one called New Personnel Orientation Guide.)

Two of the manuals are marked *Classified*, extending the OSI scenario even to the documentation. Instructions go on and on about security clearances, passwords, retina scans, and providing an "ID disc suitable for imprinting personal identification data." A work disk, in other words. This jargon—clever though it may be—can be confusing. The Security Clearance Console talks about an *orient* button to format a disk. A High-Capacity Storage Device is a hard drive, and an Access Slot refers to a floppy drive. In some cases, you press

the back-arrow key to activate a command; at other times, you press RETURN. Don't expect to master this game with a light skimming of the instructions.

Be prepared to put up with a little initial confusion and slowly work your way through the chapters in the Cybertank Engineer's Handbook. This thick (more than 100 pages) manual guides you through the cybertank design process and does it quite well once you've mastered the OSI jargon and terminology.

Keep the handy 64/128 reference guide nearby, however. This 13-page booklet explains keyboard, mouse, and joystick controls; clicking; dragging; pull-down menus; and other practical features not covered in the handbook.

Omega is a do-it-yourself kind of program. You get the tools and trappings, but it's up to you to furnish the meat of the program. Programmers have often said that the most difficult challenge to producing an entertaining game is designing its artificial intelligence. Origin sidesteps this problem entirely by leaving it up to you—but that's the beauty of this program and what makes it so much fun.

Omega uses a structured command language modeled after the English language. Previous programming experience is helpful but not absolutely necessary. Here's a short program example that involves finding and firing at an enemy tank.

```
FindTank
     Scan for Enemy Tank
     If Enemy Tank Was Found Then
       Branch to CheckRange
     Rotate Scanner Right 1
     Branch to FindTank

CheckRange
     If Enemy Tank Is Beyond
Weapon
       Range Then TooFar
     Fire Weapon at Enemy Tank

Branch to FindTank

TooFar
     Resume
```

Use this language to direct your tank across a battlefield, scanning for tanks and obstacles, retreating if fired upon, making repairs if damaged, and communicating between tanks if engaged in team competition. Select and build commands from a menu or type them in directly. Your tank's intelligence can be as simple or as complex as you care to make it. The language is extremely flexible, and there's even a manual mode if you need to issue immediate instructions. Even an inexperienced programmer can have a tank up and running with the preprogrammed intelligence modules and a little study.

Don't worry about syntax errors or other programming mistakes. *Omega* checks your instructions and lets you know if there is a serious problem. Also included is a debugger that lets you watch your tank perform as your program runs one line at a time. This is handy for fine-tuning your tank's performance.

Omega is an outstanding product that combines tank tactics and structured programming in a role-playing format that equals pure entertainment. Its unique design and execution make this game a sure winner. Check it out.

—Tom Netsel

Omega
Origin
P.O. Box 161750
Austin, TX 78716
$49.95

G

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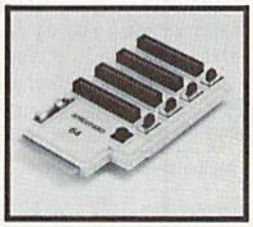

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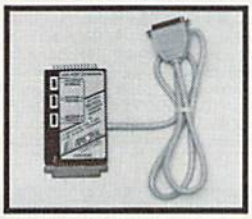

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machine language programming

A File Scanner

Jim Butterfield

This month and next, we'll examine a marvelous programming technique known as *256-tables*. Using this technique, you can eliminate many complex loops, tests, and table searches from your programs and make them amazingly efficient.

A 256-table, as the name suggests, is a table of 256 bytes. Each byte will contain some type of information. The interesting thing about such tables is the way they are used; the table index (0–255) is put into the X or Y register, and then the appropriate table entry is referenced by means of absolute, indexed addressing. Thus, if you wanted to read the fifth entry of a table at address $3000, you'd use the instructions

```
LDX #$04:LDA $3000,X
```

Remember, of course, that the first entry is index number 0, so that the fifth entry would call for an index of 4.

You can read or write such tables. The trick is to get the index to flow "naturally" into register X or Y. Many kinds of data will fit neatly into a 256-table—the ASCII set, which contains 256 possible characters, and a single byte of memory, which can have as many as 256 different values, for instance.

Program *File Scan*

It's sometimes handy to know what kind of characters are in a file. Text files, for example, contain mostly alphanumeric characters, some punctuation and spaces, and RETURN characters. A few special text files may also include some unusual format characters such as TAB or FORMFEED. BASIC programs contain a considerable number of null characters (CHR$(0)) along with unusual characters used as BASIC keyword tokens. Binary and machine language files can contain anything. It would be nice to take a look at a given file, if only to make a guess as to whether it's printable. Let's write a program that runs on both the Commodore 64 and the 128 to do this simple type of analysis.

We'll use a 256-table to scan through a file, counting how many times each of the 256 possible bytes appear. If character number 13 appears (the RETURN character), we add 1 to item 13 in our table. In fact, we'll use a double table (one with both a high- and a low-order byte) because the count might exceed 255. Massive files could even call for three-byte counters, if the count could possibly go higher than 65,535. But in our sample program, we'll stick with a two-byte counter.

BASIC POKEs our machine language program into memory at location $2500 (9472 decimal) and then opens the file as logical device number 1. You could, of course, prompt for the filename and then open the file in machine language. But it's easier to do this in BASIC.

Once the file is open, BASIC calls the machine language routine, and we're off and running. The first thing to do is to clear our two counter tables, high and low.

```
;Clear all 256 counters.
2500  LDX  #$00     ;start at 0
2502  LDA  #$00     ;value 0
2504  STA  $3000,X  ;clear low order
2507  STA  $3100,X  ;clear high order
250A  INX           ;next table item
250B  BNE  $2504    ;loop if not done
```

Our counters, high and low, are now cleared to 0. Let's connect to the file, using the Kernal routine CHKIN:

```
250D  LDX  #$01     ;logical file 1
250F  JSR  $FFC6    ;define input
                     channel
```

Here comes our read loop. We grab a character from the file with GETIN:

```
2512  JSR  $FFE4    ;get a character
```

Now we must classify the character and add 1 to the proper counter. Beginners might go through a grim sequence of comparing for each character in turn. But we just put the character into the table index, and we're there.

```
2515  TAX           ;put into index
2516  INC  $3000,X  ;increment appro-
                     priate counter
2519  BNE  $251E    ;skip ahead if not
                     overflow
```

If the counter has just gone "over the top" and rolled back to 0, we must bump the high-order part of the counter.

```
251B  INC  $3100,X  ;bump high-order
                     count
```

Now we check the status word (location $90) to see if we're at the end of the file. If it contains a 0, we haven't reached the end of the file, so we branch back and do it all again.

```
251E  LDA  $90      ;status byte
2520  BEQ  $2512    ;back to read more
```

If the status byte is nonzero (normally, end-of-file will change it to 64 decimal), we disconnect the input using the Kernal routine CLRCHN and return to BASIC. The BASIC program will close the file for us.

```
2522  JSR  $FFCC    ;disconnect input
2525  RTS
```

After the machine language program returns, BASIC does a good bit of summary work. For example, the individual alphabetic character totals are added together to give a total alpha count.

Overview

We have written a simple program that builds a table of 256 counters. Next time, we'll write another one that reads a predefined 256-table. But we have only touched the potential of such tables.

Long ago, Hal Chamberlin built musical waveforms into 256-tables on Commodore computers. To generate a sound at a given frequency, he would leap through this table using an index register and extract the right value for the waveform at that moment. We don't use such methods with the SID chip, since it contains its own waveform generator; but Hal's coding was fast and elegant.

Reading through programs or documents can be greatly aided by "parsing" with a 256-table. Text, punctuation, end-of-line, operators, special punctuation—all of these can be identified at dazzling speed using the 256-index method. **G**

File Scan

```
MA 100 DATA 162,0,169,0,157,0,
       48,157,0,49,232,208,247
XF 110 DATA 162,1,32,198,255,3
       2,228,255
DG 120 DATA 170,254,0,48,208,3
       ,254,0,49
ES 130 DATA 165,144,240,240,32
       ,204,255,96
RP 200 FOR J=9472 TO 9509
DP 210 READ X
CG 220 T=T+X
FQ 230 POKE J,X
QF 240 NEXT J
PK 250 IF T<>4954 THEN STOP
```

```
BA 300 INPUT "FILE NAME";F$
JQ 310 OPEN 15,8,15
FJ 320 OPEN 1,8,2,F$
MF 330 INPUT#15,A,B$,C,D
JM 340 IF A<>0 THEN PRINT B$:E
       ND
GK 350 SYS 9472
CB 360 CLOSE 1
CD 370 CLOSE 15
XJ 400 C=0:P=0:N=0:FOR J=0 TO
       {SPACE}95
RB 410 IF J>64 AND J<91 GOTO 5
       20
KR 420 V=PEEK(12288+J)+256*PEE
       K(12544+J)
MC 430 IF J=0 THEN PRINT "NULL
       S:";V:GOTO 520
RS 440 IF J=13 THEN PRINT "RET
       URNS:";V:GOTO 520
MG 450 IF J=32 THEN PRINT "SPA
       CES:";V:GOTO 520
BF 460 IF J=34 THEN PRINT "QUO
       TES:";V:GOTO 520
EJ 470 IF J=44 THEN PRINT "COM
       MAS:";V:GOTO 520
RH 480 IF J=58 THEN PRINT "COL
       ONS:";V:GOTO 520
KX 490 IF J<32 THEN C=C+V:GOTO
        520
FH 500 IF J>47 AND J<58 THEN N
       =N+V:GOTO 520
JF 510 P=P+V
CG 520 NEXT J
BF 530 PRINT "CONTROL:";C
AK 540 PRINT "NUMERICS:";N
QC 550 PRINT "PUNCTUATION:";P
HF 560 L=0:U=0:FOR J=65 TO 90
JH 570 V=PEEK(12288+J)+256*PEE
       K(12544+J)
EH 580 L=L+V
BH 590 V=PEEK(12288+128+J)+256
       *PEEK(12544+128+J)
FR 600 U=U+V
PQ 610 NEXT J
GF 620 PRINT "UPPER CASE ALPHA
       :";U
PG 630 PRINT "LOWER CASE ALPHA
       :";L
PX 640 T=0:FOR J=96 TO 255
CF 650 IF J>128+64 AND J<128+9
       1 GOTO 680
AR 660 V=PEEK(12288+J)+256*PEE
       K(12544+J)
EC 670 T=T+V
GB 680 NEXT J
MK 690 PRINT "UNUSUAL CHARACTE
       RS:";T                    G
```

COMPUTE!'s Gazette is looking for utilities, games, applications, educational programs, and tutorial articles. If you've created a program that you think other readers might enjoy or find useful, send it, on disk, to

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Please enclose an SASE if you wish to have the materials returned. Articles are reviewed within four weeks of submission.

The Automatic Proofreader

Philip I. Nelson

The Automatic Proofreader helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in the *Proofreader exactly* as listed. Because the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy before running it.

Next, type RUN and press RETURN. After the program displays the message "Proofreader Active," you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the *Proofreader* displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If not, check for your mistake and correct the line.

The *Proofreader* ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. However, spaces inside quotes are almost always significant, so the program pays attention to them.

The *Proofreader* does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it, moving the cursor back to the line, and pressing RETURN.

If you're using the *Proofreader* on the 128, *do not perform any GRAPHIC commands while the* Proofreader *is active*. When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the *Proofreader*—to another memory area, causing the *Proofreader* to crash. The same thing happens if you run any program with a GRAPHIC command while the *Proofreader* is in memory.

Though the *Proofreader* doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (65341 for the 128, 64738 for the 64). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

When using the *Proofreader* with another utility, disable *both* programs before running a BASIC program. While the *Proofreader* seems unaffected by most utilities, there's no way to promise it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The Automatic Proofreader

```
10 VE=PEEK(772)+256*PEEK(773):LO
   =43:HI=44:PRINT "{CLR}{WHT}AU
   TOMATIC PROOFREADER FOR ";
20 IF VE=42364 THEN PRINT"C-64"
30 IF VE=17165 THEN LO=45:HI=46:
   WAIT CLR:PRINT "128"
40 SA=(PEEK(LO)+256*PEEK(HI))+6:
   FOR J=SA TO SA+166:READ B:POK
   E J,B:CH=CH+B:NEXT
50 IF CH<>20570 THEN PRINT "*ERR
   OR* CHECK TYPING IN DATA STAT
   EMENTS":END
60 FOR J=1 TO 5:READ RF,LF,HF:RS
   =SA+RF:HB=INT(RS/256):LB=RS-(
   256*HB)
70 CH=CH+RF+LF+HF:POKE SA+LF,LB:
   POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT "*ERR
   OR* RELOAD PROGRAM AND CHECK
   {SPACE}FINAL LINE":END
90 IF VE=17165 THEN POKE SA+14,2
   2:POKE SA+18,23:POKESA+29,224
   :POKESA+139,224
100 POKE SA+149,PEEK(772):POKE S
   A+150,PEEK(773):PRINT "{CLR}P
   ROOFREADER ACTIVE"
110 SYS SA:POKE HI,PEEK(HI)+1:PO
   KE (PEEK(LO)+256*PEEK(HI))-1,
   0:NEW
120 DATA120,169,73,141,4,3,169,3
   ,141,5,3,88,96,165,20,133,167
130 DATA165,21,133,168,169,0,141
   ,0,255,162,31,181,199,157,227
140 DATA3,202,16,248,169,19,32,2
   10,255,169,18,32,210,255,160
150 DATA0,132,180,132,176,136,23
   0,180,200,185,0,2,240,46,201
160 DATA34,208,8,72,165,176,73,2
   55,133,176,104,72,201,32,208
170 DATA7,165,176,208,3,104,208,
   226,104,166,180,24,165,167
180 DATA121,0,2,133,167,165,168,
   105,0,133,168,202,208,239,240
190 DATA202,165,167,69,168,72,41
   ,15,168,185,211,3,32,210,255
200 DATA104,74,74,74,74,168,185,
   211,3,32,210,255,162,31,189
210 DATA227,3,149,199,202,16,248
   ,169,146,32,210,255,76,86,137
220 DATA65,66,67,68,69,70,71,72,
   74,75,77,80,81,82,83,88
230 DATA13,2,7,167,31,32,151,116
   ,117,151,128,129,167,136,137
                                  G
```

MLX Machine Language Entry Program for Commodore 64

Ottis R. Cowper

MLX is a labor-saving utility that allows almost fail-safe entry of Commodore 64 machine language programs.

Type in and save some copies of *MLX*—you'll want to use it to enter future ML programs from *COMPUTE!'s Gazette*. When you're ready to enter an ML program, load and run *MLX*. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the *MLX*-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in *MLX*) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters *A–F*. But even if you know nothing about ML or hex, you should have no trouble using *MLX*.

After you've entered the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering a Listing

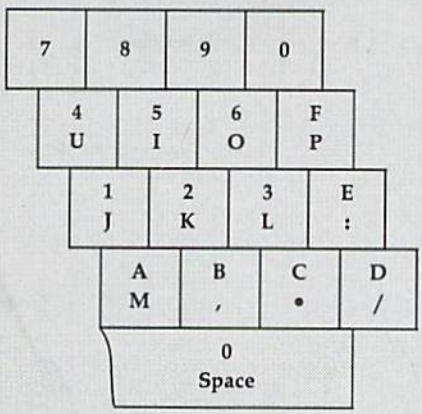
Once you're in Enter mode, *MLX* prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an *MLX*-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows *MLX* to check your typing.

When you enter a line, *MLX* recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if *MLX* detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; *MLX* automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; *MLX* automatically enters and checks the line after you type the last digit.

Only the numerals 0–9 and the letters *A–F* can be entered. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, a numeric keypad function is included. The keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figure below shows the keypad configuration.



MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, *MLX* will catch your mistake. There is one error that can slip past *MLX*: Because of the checksum formula used, *MLX* won't notice if you accidentally type *FF* in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. If you mess up a line badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character, *MLX* disables RETURN until the cursor returns to the start of a line. Remember, press CLR/HOME to quickly get to a line number prompt.

To make corrections in a line that *MLX* has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor-left and -right keys provide the normal cursor controls. (The INST/ DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells *MLX* to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, *MLX* asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. *MLX* displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (*MLX* finishes printing the current line before halting.) Press the space bar again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE. When you press S or L, *MLX* asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save. This is normal behavior. *MLX* opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Also note that the drive prefix 0: is added to the filename (line 750), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so be sure to give each version saved a different name.

Remember that *MLX* saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. It also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran *MLX*; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started *MLX*; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started *MLX*. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun *MLX*, being careful to enter the correct starting and ending addresses.

The QUIT menu option has the obvious effect—it stops *MLX* and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or press any other key to return to the menu. After quitting, you can type RUN again and reenter *MLX* without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready for the results. Refer to the corresponding article for details on loading and running the program.

An Ounce of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use *The Automatic Proofreader* to type the new *MLX*, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses; then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape.

MLX for Commodore 64

```
EK 100 POKE 56,50:CLR:DIM IN$,I,
       J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z4=
       254:Z5=255:Z6=256:Z7=127
CJ 120 FA=PEEK(45)+Z6*PEEK(46):B
       S=PEEK(55)+Z6*PEEK(56):H$
       ="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}":S
       $=" ":D$=CHR$(20):Z$=CHR$
       (0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD+2
       3:POKE I,0:NEXT:POKE SD+2
       4,15:POKE 788,52
FC 150 PRINT"{CLR}"CHR$(142)CHR$
       (8):POKE 53280,15:POKE 53
       281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}{2 SPACES}
       "SPC(28)"{2 SPACES}{OFF}
       {BLU} MLX II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}{3 SPACES}C
       OMPUTE!'S MACHINE LANGUAG
       E EDITOR{3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADDRE
       SS{4}";:GOSUB300:SA=AD:GO
       SUB1040:IF F THEN180
GF 190 PRINT"{BLK}{2 SPACES}ENDI
       NG ADDRESS{4}";:GOSUB300:
       EA=AD:GOSUB1030:IF F THEN
       190
KR 200 INPUT"{3 DOWN}{BLK}CLEAR
       {SPACE}WORKSPACE [Y/N]{4}
       ";A$:IF LEFT$(A$,1)<>"Y"T
       HEN220
PG 210 PRINT"{2 DOWN}{BLU}WORKIN
       G...";:FORI=BS TO BS+EA-S
       A+7:POKE I,0:NEXT:PRINT"D
       ONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND ME
       NU {DOWN}{4}":PRINT T$"
       {RVS}E{OFF}NTER DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISPLA
       Y DATA":PRINT T$"{RVS}L
       {OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE F
       ILE":PRINT T$"{RVS}Q{OFF}
       UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=MI
       D$("EDLSQ",I,1)THEN A=I:I
       =5
FD 270 NEXT:ON A GOTO420,610,690
       ,700,280:GOSUB1060:GOTO25
       0
EJ 280 PRINT"{RVS} QUIT ":INPUT"
       {DOWN}{4}ARE YOU SURE [Y/
       N]";A$:IF LEFT$(A$,1)<>"Y
       "THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IFLE
       N(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$=M
       ID$(IN$,3):GOSUB320:AD=AD
       *256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID$(
       B$,J,1):B=ASC(A$)-C4+(A$>
       "@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=0:
       A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(H$
       ,B+1,1);:B=A-B*C6:PRINT M
       ID$(H$,B+1,1);:RETURN
RR 360 A=INT(AD/Z6):GOSUB350:A=A
       D-A*Z6:GOSUB350:PRINT":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*CK
       +Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
       {4}";:GOSUB300:IF IN$<>N$
       THEN GOSUB1030:IF F THEN
       400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA ":
       GOSUB400:IF IN$=N$ THEN22
       0
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F T
       HEN PRINT IN$:PRINT"{UP}
       {5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$=S
       $:FOR J=1 TO 2:IF F THEN
       {SPACE}B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<24
       THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A$>
       "@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-3*
       (A$=".")-4*(A$="/")-5*(A$
       ="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":")
       -9*(A$="U")-10*(A$="I")-1
       1*(A$="O")-12*(A$="P")
CM 487 A=A-13*(A$=S$):IF A THEN
       {SPACE}A$=MID$("ABCD123E4
       56F0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J=1
       )OR F)THEN PRINT B$;:J=2:
       NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRINT
       B$:J=2:NEXT:I=24:NEXT:F=
       0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF THEN
       PRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR((
       I=0)AND(J=1))THEN GOSUB10
       60:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;:J
       =2-J:IF J THEN PRINT L$;:
       I=I-3
QS 540 PRINT A$;:NEXT J:PRINT S$
       ;
PM 550 NEXT I:PRINT:PRINT"{UP}
       {5 RIGHT}";:INPUT#3,IN$:I
       F IN$=N$ THEN CLOSE3:GOTO
       220
QC 560 FOR I=1 TO 25 STEP3:B$=MI
       D$(IN$,I):GOSUB320:IF I<2
       5 THEN GOSUB380:A(I/3)=A
PK 570 NEXT:IF A<>CK THEN GOSUB1
       060:PRINT"{BLK}{RVS} ERRO
       R: REENTER LINE {4}":F=1:
       GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FOR
       {SPACE}I=0 TO 7:POKE B+I,
       A(I):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN CLO
       SE3:PRINT"{DOWN}{BLU}** E
       ND OF ENTRY **{BLK}
       {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
```

```
QA 610 PRINT"{CLR}{DOWN}{RVS} DI
       SPLAY DATA ":GOSUB400:IF
       {SPACE}IN$=N$ THEN220
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAUSE,
        {RVS}RETURN{OFF} TO BREA
       K{4}{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FORI=
       BTO B+7:A=PEEK(I):GOSUB35
       0:GOSUB380:PRINT S$;
CC 640 NEXT:PRINT"{RVS}";:A=CK:G
       OSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA THEN
       PRINT"{DOWN}{BLU}** END O
       F DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GOSU
       B1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOSUB
       1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD DA
       TA ":OP=1:GOTO710
PC 700 PRINT"{DOWN}{RVS} SAVE FI
       LE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILENA
       ME{4}";IN$:IF IN$=N$ THEN
       220
PR 720 F=0:PRINT"{DOWN}{BLK}
       {RVS}T{OFF}APE OR {RVS}D
       {OFF}ISK: {4}";
FP 730 GET A$:IF A$="T"THEN PRIN
       T"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8,1
       5,"I0:":B=EA-SA:IN$="0:"+
       IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":GOS
       UB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(AH*
       256):PRINT#1,CHR$(AL);CHR
       $(AH);
PE 780 FOR I=0 TO B:PRINT#1,CHR$
       (PEEK(BS+I));:IF ST THEN8
       00
FC 790 NEXT:CLOSE1:CLOSE15:GOTO9
       40
GS 800 GOSUB1060:PRINT"{DOWN}
       {BLK}ERROR DURING SAVE:
       {4}":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":GOS
       UB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z$)
       +256*ASC(B$+Z$):IF AD<>SA
        THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:POK
       E BS+I,ASC(A$+Z$):IF(I<>B
       )AND ST THEN F=2:AD=I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F>0
       )+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN C
       LOSE1:CLOSE15:GOSUB1060:P
       RINT"{RVS}ERROR: "A$
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE18
       7,PEEK(FA+3):POKE188,PEEK
       (FA+4):IFOP=0THEN920
HJ 890 SYS 63466:IF(PEEK(783)AND
       1)THEN GOSUB1060:PRINT"
       {DOWN}{RVS} FILE NOT FOUN
       D ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(830
       ):IF AD<>SA THEN F=1:GOTO
       970
SC 910 A=PEEK(831)+256*PEEK(832)
       -1:F=F-2*(A<EA)-3*(A>EA):
       AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:POK
       E780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOSUB
       1010:ON OP GOTO950:SYS 63
       591
AE 940 GOSUB1080:PRINT"{BLU}** S
       AVE COMPLETED **":GOTO220
XP 950 POKE147,0:SYS 63562:IF ST
       >0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}** L
       OAD COMPLETED **":GOTO220
DP 970 GOSUB1060:PRINT"{BLK}
       {RVS}ERROR DURING LOAD:
       {DOWN}{4}":ON F GOSUB980
       990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTING
       {SPACE}ADDRESS (";:GOSUB3
       60:PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:AD
       =SA+AD:GOSUB360:PRINT D$:
       RETURN
FD 1000 PRINT"TRUNCATED AT ENDIN
       G ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH*2
       56):POKE193,AL:POKE194,A
       H
FF 1020 AH=INT(B/256):AL=B-(AH*2
       56):POKE174,AL:POKE175,A
       H:RETURN
FX 1030 IF AD<SA OR AD>EA THEN10
       50
HA 1040 IF(AD>511 AND AD<40960)O
       R(AD>49151 AND AD<53248)
       THEN GOSUB1080:F=0:RETUR
       N
HC 1050 GOSUB1060:PRINT"{RVS} IN
       VALID ADDRESS {DOWN}
       {BLK}":F=1:RETURN
AR 1060 POKE SD+5,31:POKE SD+6,2
       08:POKE SD,240:POKE SD+1
       ,4:POKE SD+4,33
DX 1070 FOR S=1 TO 100:NEXT:GOTO
       1090
PF 1080 POKE SD+5,8:POKE SD+6,24
       0:POKE SD,0:POKE SD+1,90
       :POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:POKE
        SD+4,0:POKE SD,0:POKE S
       D+1,0:RETURN
```

G

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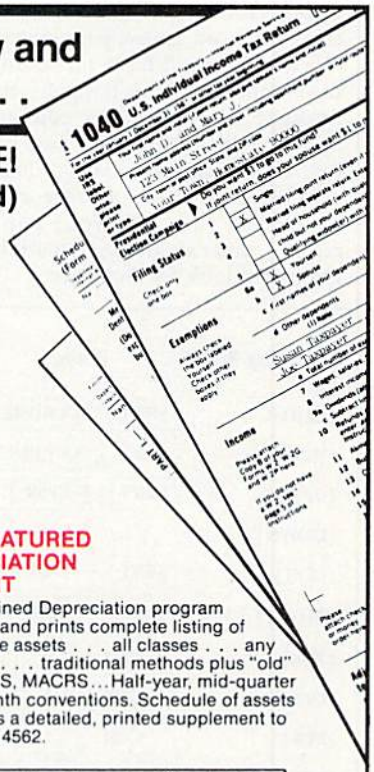

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How to Type In *COMPUTE!'s Gazette* Programs

Each month, *COMPUTE!'s Gazette* publishes programs for the Commodore 128 and 64. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We regularly publish two programs designed to make typing easier: *The Automatic Proofreader*, for BASIC programs, and *MLX*, for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off and then on, erasing what was in memory. This could cause you to lose valuable data, so be sure to *save a program before you run it*. If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from *Gazette*, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor-down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be shifted (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight shifted A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is the *quote mode*.

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a graphics symbol for cursor left. In this case, you can use the DEL key to back up and edit the line. Type another quotation mark and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
SHIFT ↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1	
[2]	COMMODORE + 2	
[3]	COMMODORE + 3	
[4]	COMMODORE + 4	
[5]	COMMODORE + 5	
[6]	COMMODORE + 6	
[7]	COMMODORE + 7	
[8]	COMMODORE + 8	

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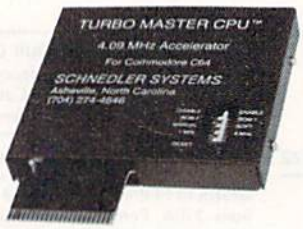

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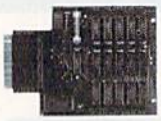

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COMMODORE CLIPS

NEWS, NOTES, AND NEW PRODUCTS

Edited by Mickey McLean

Super Bonus and Super Sweepstakes May Lead to Super Bowl

Data East USA and *USA Today* have teamed up for a special sports promotion. Inside the first 100,000 packages of Data East's MVP Sports *ABC's Monday Night Football* game, you'll find a free $50 bonus offer for the USA Today Sports Center online computer sports network.

The bonus includes free membership to the Sports Center, free USA Today SportsWare communications software, one hour of free online time, and discount offers on brand-name computer modems. The USA Today Sports Center provides up-to-the-minute sports scores and late-breaking news, as well as statistics, fantasy sports leagues, and online board and card games.

In addition to the bonus offer, Data East has announced the Data East MVP Sports sweepstakes, in which one lucky fan will win a trip for four to Super Bowl XXIV in the New Orleans Superdome.

Sweepstakes ads have appeared in leading computer magazines including *Gazette*'s sister publication *COMPUTE!*. To enter, cut out the game piece from the ad, go to a participating software dealer, and compare the prize symbol in the ad with those on the back of the *ABC's Monday Night Football* game package. If they match, you win. The sweepstakes deadline is January 10, 1990.

In addition to the grand-prize trip to the Super Bowl, prizes include a cash award of $5,000, Sony entertainment sets, Data East's "ABC Monday Night Football" pinball machines, and "ABC Monday Night Football" videos.

Cinemaware Affiliates with EA

Electronic Arts has announced an agreement with Cinemaware that provides EA with exclusive sales and distribution rights to current and future Cinemaware computer software products in the United States and Canada.

Products to be distributed under the agreement include popular titles such as *Rocket Ranger* and *Speedball* from Cinemaware's Spotlight Software label.

Taxing Times Ahead

It's tax time, which means updates for tax software packages are now available.

Taxaid Software (800 Middle Road, P.O. Box 340, La Pointe, Wisconsin 54850) has released a new version of the *Taxaid* ($49.95, 1990 update $18.00) income-tax preparation program for the Commodore 64, 128, and Plus/4 computers. The new editions include all current changes in the tax laws for the tax year 1989.

The program prepares IRS Form 1040 and prepares and prints Schedules A, B, C, D, E, SE, and Form 2441 for child care. Schedules and forms can be printed out in IRS-approved format on plain paper that can be submitted directly to the IRS. Form 1040 can also be printed out but must be transferred to the official IRS form.

The 1989 version of *Tax Command* ($59.95) from Practical Programs (Box 93104, Milwaukee, Wisconsin 53203) has also been released. The 1989 edition includes Forms 4562 for depreciation and 6251 for alternative minimum tax in addition to Form 1040; Schedules A through F (including D and D-1), R, and SE; and Forms 2106, 2119, 2441, 3903, and 8615; as well as estimated-tax work sheets. *Tax Command* has been updated to correspond to all changes in the tax laws.

Education Costs Down

Springboard Software (7808 Creekridge Circle, Minneapolis, Minnesota 55435) has made the Commodore 64 more affordable as a teaching tool by reducing the prices of its four best-selling educational programs.

Early Games for Young Children ($12.95) and *Easy as ABC* ($12.95) introduce computer learning while teaching children ages 2½ to 6 basic concepts such as letter and number recognition, comparisons, and the alphabet. *Piece of Cake Math* ($12.95) and *Fraction Factory* ($12.95) help children ages 7 to 14 learn math topics such as addition, subtraction, multiplication, division, and fractions. G

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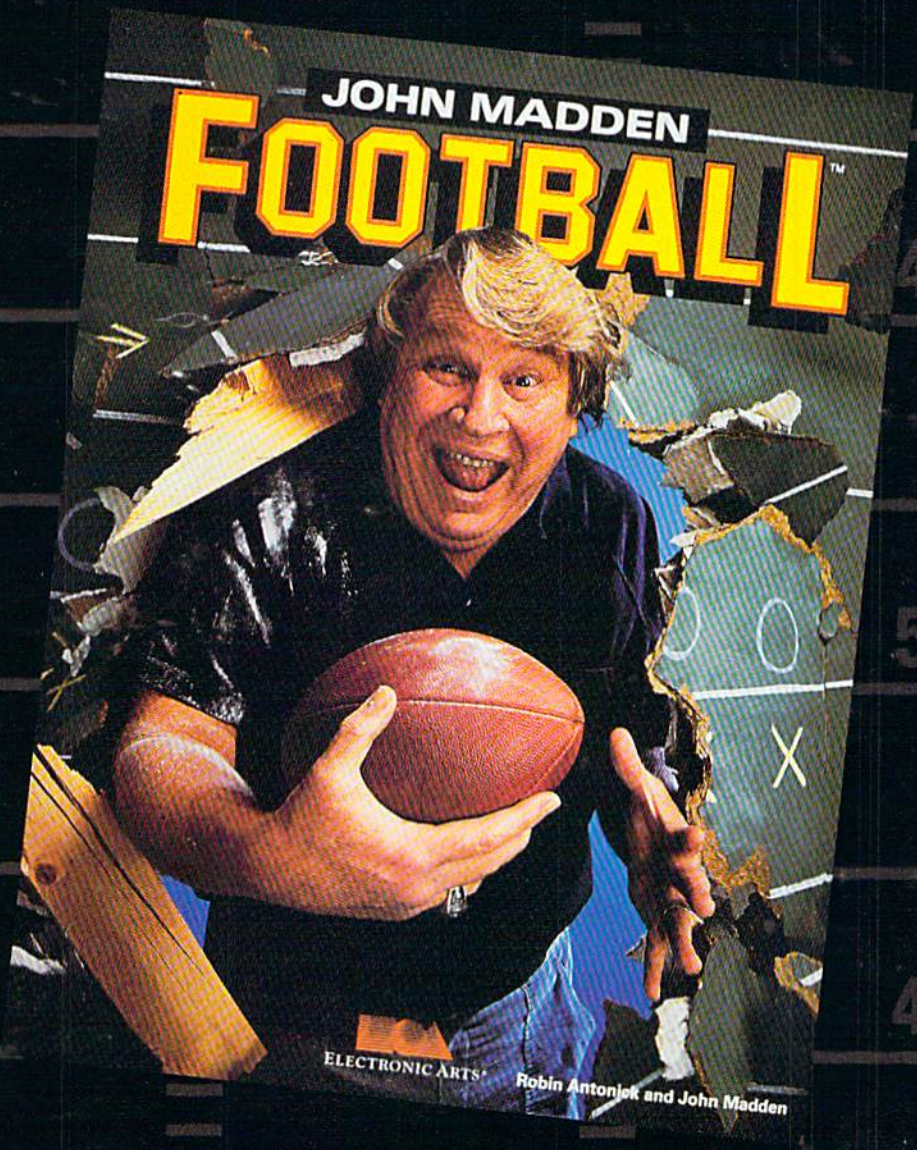

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