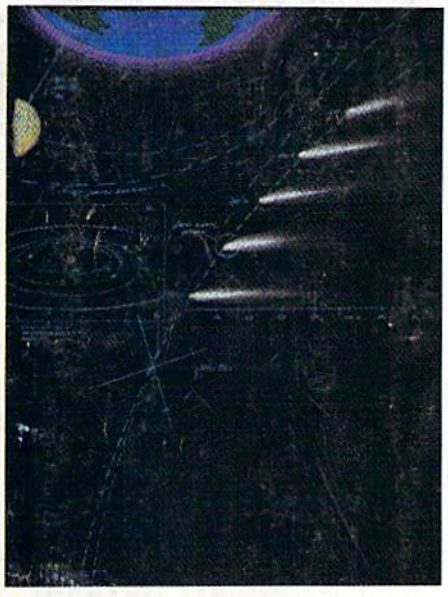
GEOS: A Look At An Exciting, New Commodore 64 Operating System

COMPUTE!'s GAZETTE

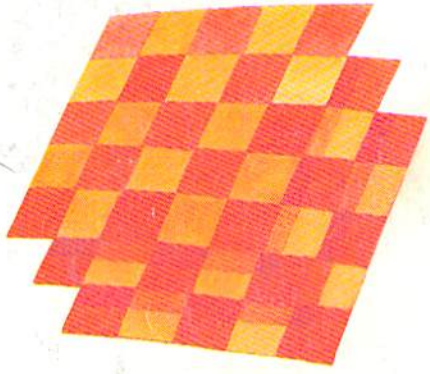
$3.00
June 1986
Issue 36, Vol. 4, No. 6
02220 $3.95 Canada

FOR **COMMODORE** PERSONAL COMPUTER USERS



Power BASIC: Help Screens

Easily create up to eight help screens for your BASIC or machine language programs using this handy utility for the Commodore 64 and 128.



Switcheroo

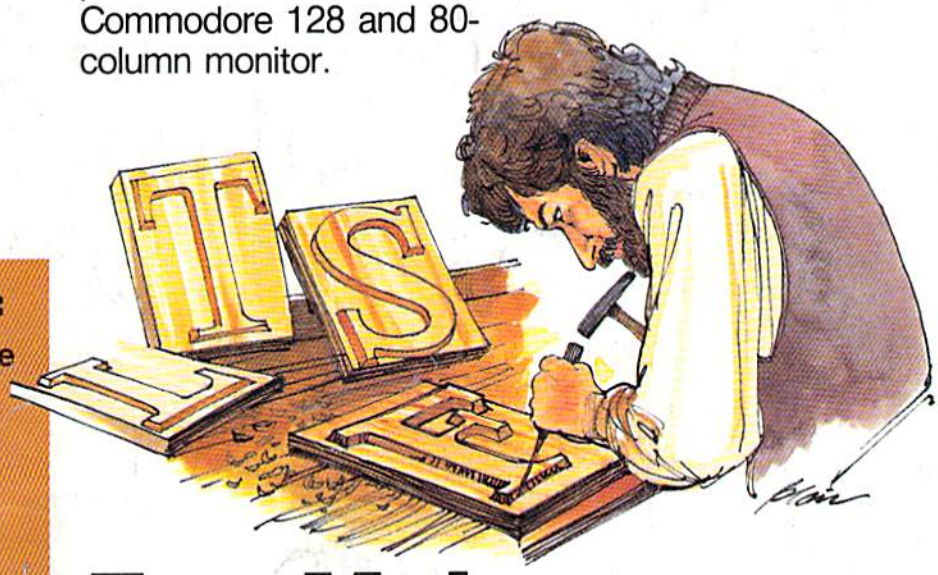
Your fortune changes fast in this two-player strategy game for the 64.

SpeedScript-80

Convert *SpeedScript* into an 80-column word processor with a Commodore 128 and 80-column monitor.

Solarpix

Set the solar system in motion, see the orbits of comets, and much more with this excellent simulation for the 64.



Also In This Issue:

A Guide To Commodore User Groups, Part 2
Software Reviews
New Products
And More

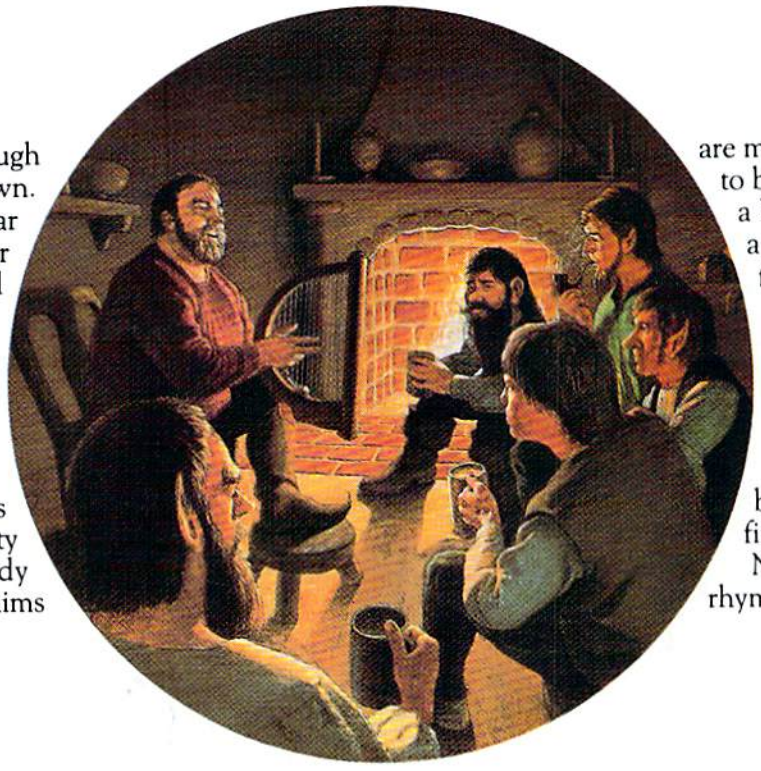
FontMaker

Design your own character sets and print them out with this versatile two-program package for the 64.

0 71486 02220

(No I.D. required for half-elves.)

When the Going Gets Tough, the Bard Goes Drinking.



And the going is tough in Skara Brae town. The evil wizard Mangar has cast an eternal winter spell. Monsters control the streets and dungeons beneath. Good citizens fear for their lives. What's worse, there's only one tavern left that serves wine.

But the Bard knows no fear. With his trusty harp and a few rowdy minstrel songs he claims are magic, the Bard is ready to boogie. All he needs is a band of loyal followers: a light-fingered rogue to find secret doors, a couple of fighters to bash heads, a conjurer to create weird allies, a magician for magic armor.

Then it's off to combat, as soon as the Bard finishes one more verse. Now what's a word that rhymes with "dead ogre?"

4 classes of magic user, including wizard and sorceror. 85 new magic spells in all.

128 color monsters, many animated. All challenging.

Full-color scrolling dungeons. 16 levels, each better than the one before. 3-D city, too.

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Specs: 100% machine language, 400K worth on 2 disks. 64K RAM minimum; enhanced for 128K. Now available for Apple II family for $44.95, C-64 & 128 for $39.95.
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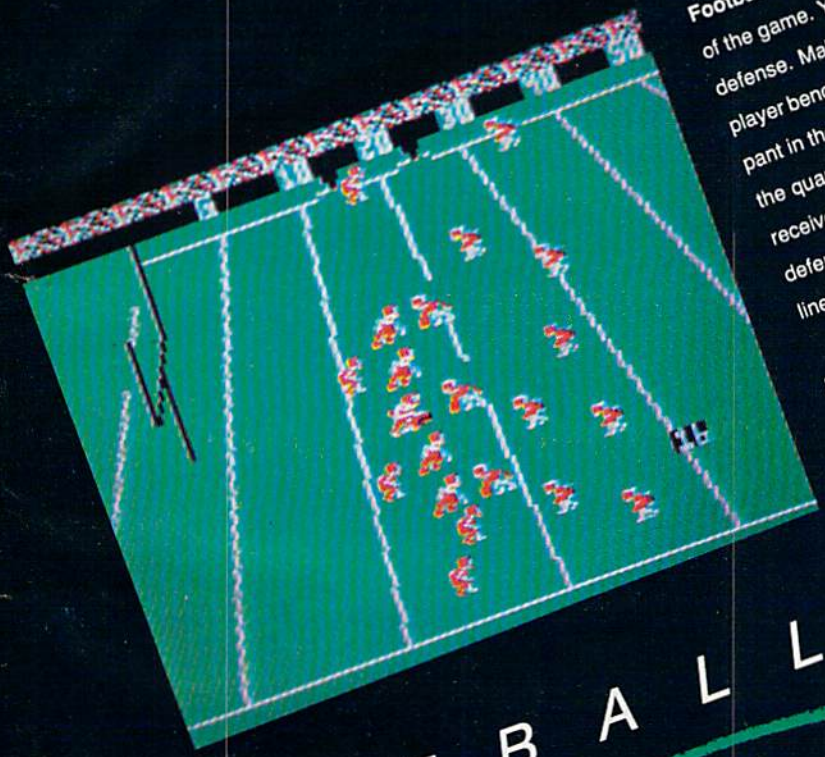

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Football puts you in control of every aspect of the game. You call the plays, offense and defense. Make substitutions from your 18-player bench. Then become an active participant in the play you've selected. You control the quarterback, then the running back or receiver once the ball is transferred. On defense, you become the in-action safety or linebacker for the play you've selected.

Discover how enjoyable a football simulation game can be. You will agree that **Football** is the first real football game on a computer. Available on disk for the Commodore 64/128 computers.

See Your Dealer ...

or write or call for more information. For direct order please enclose $39.95 plus $2.00 for shipping and specify UPS or first class mail delivery. Visa, MasterCard, American Express, Diners Club cards accepted.

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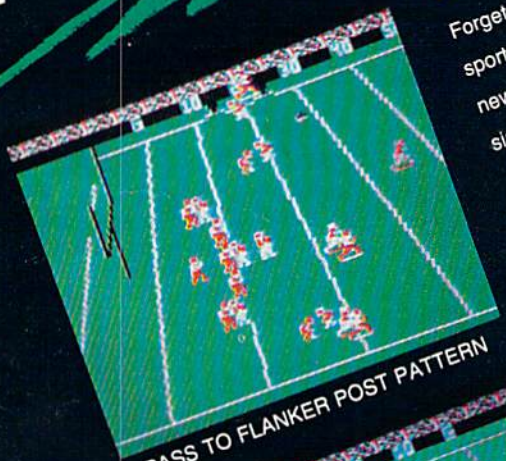
A True-to-Life Simulation ...

Forget everything you've seen or heard about sports simulation programs; **Football** sets new standards in realism and playability by simulating the real physics of the game.

Every offensive and defensive player has individual physical attributes (speed, power, and catching ability). Each quarterback's passing abilities are different. Players act and move individually on each play. And you can adjust the performance characteristics of any player, any way you like.

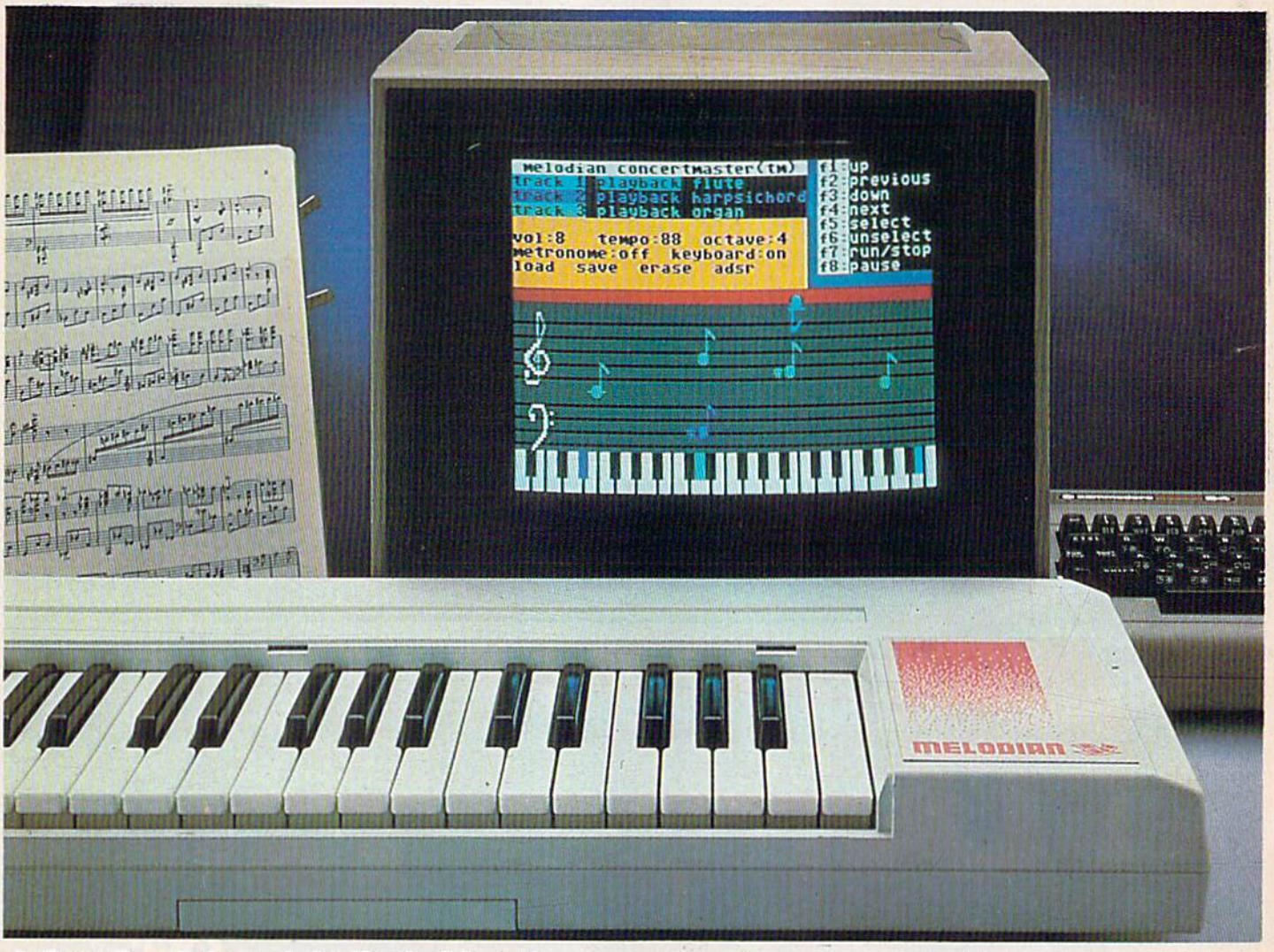
Football's overhead 3D perspective gives you a clear view of the entire field. The ball carrier is always highlighted for easy identification. And **Football's** real-time 30-second clock means fast-moving action from start to finish, with no game-slowing disk access.



PASS TO FLANKER POST PATTERN

COMPLETE PASS TO TIGHT END

Melodian will teach you to play, compose,



A True Breakthrough In Music Education

At last, a program that makes it not only easy but fun to learn music. The Melodian keyboard and software were designed by Harry Mendell who designs custom synthesizer electronics and software for professional musicians such as **Stevie Wonder** and Eric Himy, an award winning concert pianist. The Melodian boasts many of the professional features found only on more expensive equipment. These features include multitrack recording, the ability to create custom instrument sounds and most importantly, ease of use.

Start your lesson with **RhythmMaster** Software. With its built-in metronome, RhythmMaster will display the treble and bass musical staffs and a picture of a piano keyboard. RhythmMaster will then play a measure of music and you must try to play the same measure back on the Melodian keyboard. You're not familiar with the keyboard or can't read music? No problem. RhythmMaster displays the notes you are to play on the musical staff and on the keyboard pictured on the monitor. If you strike the wrong key the note on the musical staff turns red and shows you which key you played wrong, making it ever so easy to correct what you played.

If you should hold a key too long a turtle runs across the screen. Inversely if you should release a key too quickly a rabbit scurries by. If you don't play it correctly RhythmMaster knows it and repeats the measure for you to play.

ConcertMaster teaches you how to play 35 pre-recorded songs from Bach to Rock. With ConcertMaster you can analyze music note by note, instrument by instrument and learn how a music composition is put together. Then you can compose your own music and record it right onto your floppy disks.

There are nineteen different instrument sounds to choose from in over a seven octave range giving you a wide choice of instruments to suit your musical taste and expression. You can also create your own instrument sounds.

ScoreMaster enables you to print out your music in standard music notation for other musicians to play, or for yourself.

New York Times Says . . .

Erik Sandberg-Diment of the New York Times states "really useful and instructive item ... Tanya, our 10 year old beginner quickly caught the spirit of matching the dance of her fingers to the measured metronome." "One piece of educational software that, unlike most of its kinfolk, actually delivers. These software-hardware combinations offer a lot of entertainment to the Commodore owner."

RUN Magazine Says . . .

Tom Benford of RUN notes "Whenever a selection of products of the same genre is available, one among the bunch rises head and shoulders above the rest. Such is the case with Melodian ConcertMaster keyboard and software. The combined features of RhythmMaster and ConcertMaster give you a complete music tutorial."

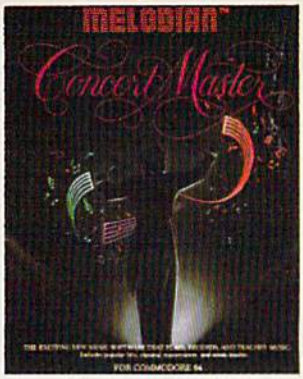
AHOY! Magazine Says . . .

Peggy Herrington of AHOY! said "The system is so easy to use that I didn't need the documentation". "It's fun, challenging, and educational, and for playability and ease of use it is nothing short of spectacular."

Satisfaction Guaranteed When You Buy Direct

By selling directly to you, we are able to give you the Melodian Keyboard and Software at far lower prices than ever offered before. You take no risk. **If the Melodian keyboard or any of the programs don't please you, for any reason whatsoever, send it back within 60 days for a full refund!**

and record music in just one evening!!



RhythmMaster Software rm-01 — $29.95

RhythmMaster teaches a beginner how to read music and play it correctly and in rhythm on the musical keyboard.

RhythmMaster will have you reading and playing musical notes in minutes with fun and excitement.

RhythmMaster Features:

Trumpet, organ, violin, and synthesizer instrument sounds. Built in metronome. Pause/Play control. Set-up menu for customizing RhythmMaster.

RhythmMaster Teaches:

How to read notes on the treble and bass musical staffs,the names of the notes, where the notes are on the keyboard how to play whole notes, half notes, quarter notes, eighth notes and sixteenth notes in combinations, in both 3/4 and 4/4 time. How to play in different tempos.

RhythmMaster Requires:

A Commodore 64 or Commodore 128 with disk drive. Melodian Musical Keyboard kb-01 is required to study the reading and playing of musical notes.

Melodian Musical Keyboard kb-01 — $99.95

40 Keys (A-C) in professional gauge spring loaded to give the feel and response of a real keyboard instrument. Polyphonic.

Registers (with ConcertMaster)

Organ, Trumpet, Flute, Clarinet, Piano, Harpsicord, Violin, Cello, Bass, Banjo, Mandolin, Calliope, Concertino, Bagpipe, Synthesizer 1, Synthesizer 2, Clavier 1, Clavier 2, which can be played over a 7 octave range. Programmable sounds as well.

Recording (with ConcertMaster)

Three track sequencer (recorder) with overdubbing and multitimbral (different instrument sounds at the same time) effects.

Interface

Built in interface for Commodore 64, Commodore 128, plugs right in to joystick port no. 2 and user port.

Power Supply

Powered direct by the computer, no batteries and cords required.

Finish

Table Model in white high-impact material, with carrying handle, protective key cover, and built in music stand. Size 29 -1/8 X 9-9/16 X 3-11/16, weighs 9 pounds.

Programmer's Tool Kit pt-01 — $29.95

Contains programs, and BASIC source listings for reading the Melodian Musical Keyboard, and for reading and creating music files for Melodian ConcertMaster.

ConcertMaster Software cm-01 — $29.95

ConcertMaster teaches how a composition is put together, note by note, instrument by instrument. You learn to play 35 pre-recorded songs from Bach to Rock. Then you can compose your own songs and record them right onto your floppy disk.

ConcertMaster Teaches:

Scales, Bass lines, Familiar Beginner Songs such as "Jingle Bells", Easy classical songs such as "Bach Minuet" and Ravel's "Bolero", Advanced classics like "A Midsummer's Night Dream" by Mendelssohn, Popular hits such as "Thriller"

Instruments Sounds

Organ, Trumpet, Flute, Clarinet, Piano, Harpsicord, Violin, Cello, Bass, Banjo, Mandolin, Calliope, Concertina, Bagpipe, Synthesizer 1, Synthesizer 2, Clavier 1, Clavier 22, which can be played over a 7octave range. Programmable sounds as well.

Recording Functions:

Three track sequencer (recorder) with overdubbing and multitimbral (different instrument sounds at the same time) effects.
Each track can be set to one of seven different functions:

- **Monitor:** Lets you use a track to play music live, without recording it.
- **Record:** Records a track as you play.
- **Playback:** Lets you hear whatever has been recorded or loaded into the track. You may playback one track while recording another to build layers of instruments.
- **Mute:** Turns a track off. This is useful when you want to listen to or record one or two tracks at a time.
- **Save:** Stores a track to the disk.
- **Load:** Loads a track from the disk.
- **Protect:** Write protects a track.

Create New Instrument Sounds

Choose from pulse, sawtooth, triangle and noise sound sources. Control the sound envelope with attack, decay, sustain, and release times. Ring Modulation and Syncronization effects. Set Low pass, band pass, and high pass filter frequencies.

ConcertMaster Requires:

A Commodore 64 or Commodore 128 with disk drive. Melodian Musical Keyboard kb-01 is required to study the reading and playing of musical notes.

Melodian ScoreMaster sm-01 — $29.95

With the ScoreMaster program your music can be printed out in music notation, which other musicians can read and play. Any music recorded with the ConcertMaster program can be printed by ScoreMaster.

ScoreMaster Requires:

A Commodore 64 or Commodore 128 with disk drive and printer compatible with the Commodore graphics mode such as the Commodore MPS 803, 1515, and 1525.
Melodian ConcertMaster program.

ACCESSORIES

Headphones	$12.95
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Christmas Carols	$12.95
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Classical Favorites	$12.95

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The new, fast way to learn, play and compose music.

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A Printer For All Reasons

Search For The Best High Quality Graphic Printer

If you have been looking very long, you have probably discovered that there are just too many claims and counter claims in the printer market today. There are printers that have some of the features you want, but do not have others. Some features you probably don't care about, others are vitally important to you. We understand. In fact, not long ago, we were in the same position. Deluged by claims and counter claims. Overburdened by rows and rows of specifications, we decided to separate all the facts — prove or disprove all the claims to our own satisfaction. So we bought printers. We bought samples of all the major brands and tested them.

Our Objective Was Simple

We wanted to find that printer which had all the features you could want and yet be sold directly to you at the lowest price. We didn't want a "close-out special" of an obsolete product that some manufacturer was dumping, so we limited our search to only those new printers that had the latest proven technology. We wanted to give our customers the **best** printer on the market today at a low price.

The Results Are In

Our search is over. We have reduced the field to a single printer that meets all our goals (and more). The printer is our SP-1000 manufactured by a Division of Seiko, the world class manufacturer of many fine products from Japan. We ran this printer through our battery of tests and it came out shining. This printer *can* do it all. Standard draft printing at a respectable 100 characters per second, and with a very readable 12 (horizontal) by 9 (vertical) character matrix. This is a full feature, bi-directional, logic seeking, true descender printer.

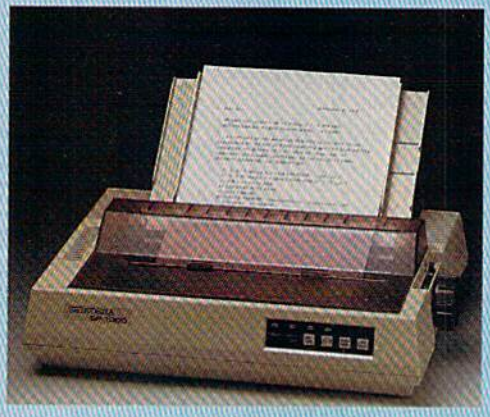
"NLQ" Mode

One of our highest concerns was about print quality and readability. This printer has a print mode termed Near Letter Quality printing (NLQ mode). This is where we outshine all the competition. Hands down! The character matrix in NLQ mode is a very dense 24 (horizontal) by 18 (vertical). This equates to 41,472 addressable dots per square inch. Now we're talking ***quality*** printing. It looks like it was done on a typewriter. You can even print graphics using the standard graphics symbols built into your computer. The results are the best we've ever seen. The only other printers currently available having resolution this high sell for hundreds more.

Features That Won't Quit

Your computer can now print 40, 48, 68, 80, 96, or 136 characters per line. You can print in ANY of scores of styles including double width and reversed (white on black) styles. You not only have the standard Pica, Elite, Condensed and Italics, but also true Superscripts and Subscripts. Never again will you have to worry about how to print H_2O or X^2. This fantastic machine will do it automatically, through easy commands right from your keyboard. Do you sometimes want to emphasize a word? It's easy, just use **bold** (double strike) or use *italics* to make the words stand out. Or, if you wish to be even more emphatic, underline the words. You can combine many of these modes and styles to make the variation almost endless. Do you want to express something that you can't do with words? Use graphics with your text — even on the same line. You have variable line spacing of 1 line per inch to infinity (no space at all) and 143 other software selectable settings in between. You can control line spacing on a dot-by-dot basis. If you've ever had a letter or other document that was just a few lines too long to fit a page, you can see how handy this feature is. Simply reduce the line spacing slightly and . . . VOILA! The letter now fits on one page.

Special only **$219.95** For Commodore



Forms? Yes! Your Letterhead? Of Course!

Do you print forms? No problem. This unit will do them all. Any form up to 10 inches wide. The tractors are adjustable from 4 to 10 inches. Yes, you can also use single sheets. Plain typing paper, your letterhead, short memo forms, labels, anything you choose. Any size to 10" in width. In fact this unit is so advanced, it will load your paper automatically. Multiple copies? Absolutely! Use forms (up to 3 thick). Do you want to use spread sheets with many columns? Of course! Just go to condensed mode printing and print a full 136 columns wide. Forget expensive wide-carriage printers and changing to wide carriage paper. You can now do it all on a standard 8½" wide page, and you can do it quietly, it's only 55dB. This is much quieter than any other impact dot matrix printer that we know of and is quieter than the average office background noise level.

Consistent Print Quality

Most printers have a ribbon cartridge or a single spool ribbon which gives nice dark printing when new, but quickly starts to fade. To keep the printers output looking consistently dark, the ribbons must be changed quite often. We solve this problem by using a wide (½") ribbon cartridge that will print thousands of pages before needing replacement. (When you finally do wear out your ribbon, replacement cost is only $11.00. Order *#2001. (Also Locally Available.)*

The Best Part

When shopping for a printer with this quality and these features, you could expect to pay much more. *Not now!* We sell this fantastic printer for **only $219.95! You need absolutely nothing else to start printing — just add paper (single sheet or fanfold tractor).**

No Risk Offer

We give you a 2-week satisfaction guarantee. If you are not completely satisfied for any reason we will promptly refund your purchase. The warranty has now been extended to 2 years. The warranty repair policy is to repair or replace and reship to the buyer within 72 hours of receipt.

The Bottom Line

Be sure to specify the order # for the correct version printer designed for your computer.

Commodore C-64 & C-128, Order **#2200**, graphics interface & cable built in. $219.95

IBM-PC and compatibles, Order **#2100**, $239.95 plus 8' shielded cable **#1103**, $26.00

Apple IIc & Macintosh Order **#2300**, $239.95 with cable.

Standard Parallel with 36 pin Centronics connector, Order **#2400**, $239.95 no cable.

Standard Serial with RS-232 (DB-25) Connector, Order **#2500**, $239.95 no cable.

We also have interfaces and cables for many other computers not listed. Call Customer Service at 805/987-2454 for details.

Shipping and insurance is $10.00 — UPS within the continental USA. If you are in a hurry, UPS Blue (second day air), APO or FPO is $22.00. Canada, Alaska, Mexico are $30.00 (air). Other foreign is $70.00 (air). California residents add 6% tax. The above are cash prices — VISA and MC add 3% to total. We ship the next business day on money orders, cashiers' checks, and charge cards. A 14-day clearing period is required for checks.

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editor's notes

You may recall that just last month (the May GAZETTE "Editor's Notes") we requested that you write in on a variety of topics. What we can't figure out is how your letters have already begun to arrive—by the dozens these first couple of days. As promised, here's a sampling of the early arrivals.

Under the heading of what's happening to the VIC-20s, as well as how you're using your computer (VIC-20 or otherwise):

Yes, I have one, and I still use it, although admittedly somewhat irregularly. I use it because it is easier to program than the 64, plus the characters are large and easy for little children to use.

Columbus, Ohio

I use my VIC-20 for Cub Scout records; educational programs for my eight children; and a few games....

Clarksville, Tennessee

After five years of retirement from an active life as an accounting executive and CPA...I purchased a VIC-20 (in 1982) for the purpose of teaching myself to program. I needed the mental stimulation. I have not been bored since then....

Athens, Alabama

Thanks for asking! Your magazine is the finest on the market and if a satisfied reader's opinion can help it stay that way then I, for one, am pleased to contribute.

I own a Commodore 64... this letter is being written on it....I just refigured my home mortgage last week and I am setting up a program to do my restaurant inventory as well....

Holly Springs, North Carolina

Here's one of the most colorful responses, and we were pleased to discover it was from old friends who had contributed a major feature article to the very first issue of COMPUTE!.

We are taking advantage of your promise to read what we...have done with computers since purchasing a PET 2001 in 1978.... We are retiring from teaching this year....

We've had several computers since 1978 when we ran the first course in BASIC for teachers in our area. We forecast at that time that there would be 753 computers in the 13-school system by 1985. The estimate proved a little conservative. There are over 800 in use.

The computers we acquired for personal use include:

1. *Two VIC-20s with Datassettes and monitor TVs.*
2. *Two PETs (2001 and 4032) with dual disk drives and an Epson MX-80 printer with an IEEE interface.*
3. *Commodore 64 with 1702 monitor, 1541 floppy, and an MPS-803 printer.*
4. *Timex/cassette and monochrome monitor.*
5. *Pioneer MSX with a Hitachi 3¼-inch floppy drive, laser disk game, and graphics tablet.*
6. *Commodore 64/128 with a 1702 monitor, 1571 floppy, and Comrex printer.*

We have used the equipment in the following ways:

1. *One VIC-20 and the 64 (used in teaching at first) went to our grandchildren and daughter....*
2. *The Timex is in a Corn Flakes box, with an advertising page pasted on the outside showing the price of $250. We use it in lectures to show that computers may one day become premiums in cereal boxes.*
3. *Our remaining VIC-20 with a Datassette is reserved for a weather station to read the current barometric pressure, the outdoor temperature, wind velocity and direction, calculate the Delta T and Delta P, and prepare a weather forecast for 6–24 hours with an accuracy of about 85 percent.*
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Frankfort, New York

Again, thank you for your continued contributions, and within the next few months we'll put together an article sharing in greater detail some of your input.

Robert C. Lock

Editor In Chief

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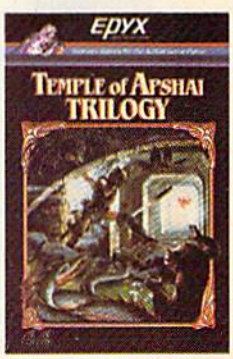

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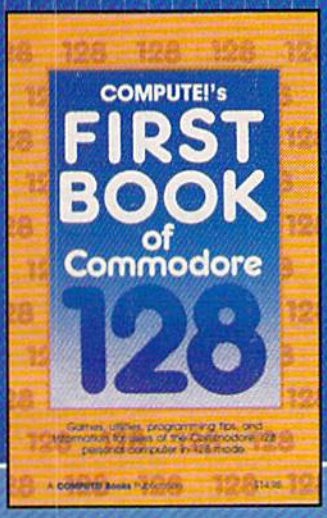

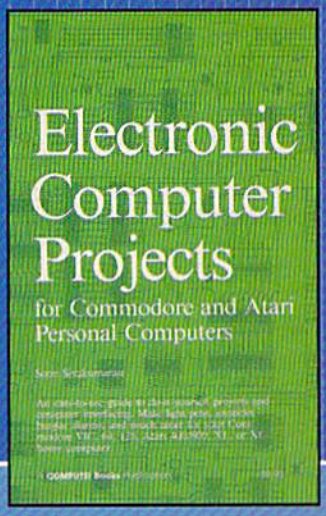

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume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

Loading From Disk

I purchased a disk drive less than a month ago. Everytime I try to load a program I either get a syntax error or it says PRESS PLAY ON TAPE. I can't seem to figure out what the problem is.

J. Sarli

If you type ***LOAD "PROGRAMNAME"*** *you should see the PRESS PLAY ON TAPE message. You haven't indicated where the program is. In the absence of explicit instructions, your computer assumes you want to load the program from a tape drive, thus the prompt to press the play button.*

To load from a disk drive, you must include the device number. A disk drive fresh from the factory is always device 8. Enter ***LOAD "PROGRAMNAME",8*** *to load a BASIC program (the number 8 tells the computer to search for that program on the disk drive). You can then run the program.*

Sometimes you'll need to follow a slightly different format, especially if you have either commercial software or a machine language program. ***LOAD "PROGRAMNAME",8,1*** *forces the program to load into the same section of memory from which it was saved. You often won't be able to run such a program. In some cases, the program loads and automatically runs by itself. Other times you may have to type in SYS and a memory address where the program is located.*

Nutrition Software

I am a new diabetic and diet is an important part of controlling blood sugar. I would like to know if there are any programs for the 64 to assist in planning menus for a diabetic.

Robert L. Cole

We don't know of any software that analyzes meals for diabetics, but that doesn't necessarily mean such a program doesn't exist. Perhaps our readers can help. We'll publish answers as we receive them.

Proofreader Load Problems

After using the new "Automatic Proofreader" on a 64, I noticed that it sets the beginning of BASIC memory up one page to 2305. This causes problems with programs that are "Turbosaved" to tape at 2049. How can I get around this problem?

James L. English

I have discovered a problem with the new "Automatic Proofreader." When I load the Proofreader from "Auto File" (November 1985), then type in a program and save it, the program will not load correctly from "Auto File." The first line of the typed-in program says 43266 NEWCLOSE, which is wrong. But if the program is loaded without Auto File, it works fine. Is there a way to correct this?

John Kinary

The Automatic Proofreader program is a machine language "wedge" that helps readers double check their typing when they're entering programs. It temporarily intercepts the characters typed, calculates a checksum, and prints the checksum on the top line of the screen.

Like any other program, it must occupy some portion of memory. The free area at 679 was ruled out because it wasn't large enough. Placing the routine in the cassette buffer interferes with tape access. High memory locations such as 32768, 36864, or 49152 are often occupied by programming utilities.

By moving the beginning of BASIC up 256 bytes, from 2049 to 2305 (on the 64), several potential memory conflicts are avoided. But no answer is perfect. Datassette users will not be able to load TurboSaved programs into memory while Proofreader is resident. And disk drive users will have problems using the menu program from Auto File.

Here's the answer for users of TurboTape: When you're first typing in a program, don't use TurboTape at all. Save the program to tape as you did before TurboTape. When you've finished the last line of the program, perform a normal save. This version will have the address that's 256 bytes too high. Now turn your computer off and back on. Load and run TurboTape and reload the program; it will be relocated to the standard start of BASIC. Now you can TSAVE to tape. Keep the other version of the program in case there's a correction you need to make at a later time. Remember, you can't TurboLoad a standard BASIC program from tape while Proofreader is running.

Auto File assumes that BASIC programs for the 64 always load at 2049 (a safe assumption that's nearly always true). Any program that doesn't start at 2049 must be written in machine language, so Auto File performs a SYS to the address where the program loads. If you save a program with Proofreader active, the disk file is marked for loading at 2305, which causes problems with Auto File. To correct it, turn off your 64 and turn it back on. Type ***LOAD"programname",8*** *(not ,8,1) and the BASIC program will be relocated to the normal address of 2049. Now save back to disk. This resaved program will run correctly when loaded from Auto File.*

The Earthquake Effect

In your September 1985 issue, you published a game called "Maze-Mania." One of the game options made the screen shake. I'd like to know how this was done.

Danny Gardner

Here's a short program to give your 64 screen the jitters:

```
10 POKE53265,PEEK(53265)AND248
   ORRND(1)*8:POKE53270,PEEK(5
   3270)AND240ORRND(1)*8
20 GOTO 10
```

The lower three bits of location 53265 on the Commodore 64 (location 36864 on the VIC) control the horizontal fine scrolling of the screen. The value in these three bits represents the number of pixels right of the normal screen position.

To scroll the screen from left to right seven pixels (almost a full character), use the following line:

FOR A=0 TO 7: POKE 53265,PEEK (53265) AND 248 OR A: NEXT

Note that the upper five bits of 53265 are preserved using the AND and OR statements. This is important since these other bits are used to control other features of the video chip.

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Location 53270 (location 36865 on the VIC) is used similarly to control the vertical fine scrolling of the screen.

Where's The Rest Of The Memory?

I'm writing a program which requires a lot of memory capacity. After reading an article about the 128, I went right out and bought one (122,365 available bytes). When I turn it on, there it is right on the screen, 122365. But when I try PRINT FRE(0), it says 58109. Is there more memory available? What do I have to do to access it?

Al Donahue

Your letter stated that you previously owned a 64, which contains the FRE(0) function for finding out how much memory remains. On the 64, the number inside parentheses is a dummy *value, meaning it doesn't matter which number you use. The 64's FRE function disregards the value in parentheses.*

The 128 can address up to 16 banks of 64K each. BASIC programs occupy bank 0 and variables are stored in bank 1. The character set is in bank 14, while ROMs and I/O chips use bank 15. The memory in between is reserved for memory expansion and programs on cartridge.

Because of the way the 128 is split into different banks, BASIC 7.0 handles the FRE function a little differently. Entering PRINT FRE(0) tells you how much memory is available in bank 0—58109 bytes for holding programs. But if you PRINT FRE(1), you'll see 64256, the number of bytes reserved for variables in bank 1. Adding the two together gives you 122,365, the total memory of the unexpanded 128.

Calculating Volume

I've been trying to figure out a formula that tells you how many gallons would fill a container if you input the length, width, and height. It would be nice to also get the total weight of the container when it's full.

Terry Moore

Multiply together the three measurements length, width, and height, and (assuming they're all in inches) the result will be the volume of the container in cubic inches. A gallon is just another way of measuring volume, so we need to know how cubic inches translate to gallons. According to an almanac we consulted, there are 231 cubic inches in a gallon. So to discover how many gallons fit into a container, multiply the three dimensions and divide that number by 231.

Weight is not quite as simple. Consider a gallon of water and a gallon of mercury. Both are liquids and both have the same volume, but the mercury will weigh much more than the water because it has a higher density. In other words, the weight depends on what you're storing in the container. In addition, you may or may not want to consider the additional weight of the container itself.

The following short program, for all Commodore computers, asks you to input the height, width, and length of a rectangular container. It then calculates the volume in gallons, the weight of the liquid, and the total weight (container plus liquid).

```
10 D=.0360:CW=5.10:REM DENSITY
   OF WATER (LBS/CUBIC INCH),
   CONTAINER WT (LBS)
20 PRINT"{CLR}INPUT HEIGHT, WI
   DTH, AND LENGTH OF CONTAINE
   R (IN INCHES)":INPUTH,W,L
30 V=INT(W*L*H*10+.5)/10
40 WE=INT(V*D*10+.5)/10:V=INT(
   V/231*10+.5)/10
50 PRINT"{DOWN}VOLUME="V"GALS"
   :PRINT"WEIGHT OF THE LIQUID
   ="WE"LBS"
60 PRINT"TOTAL WT (CONTAINER &
   LIQUID)="WE+CW"LBS"
```

In this program, the density (variable D) of the liquid and the container weight (CW) are defined in line 10. We've assumed that the liquid is water and that the container weighs 5.1 pounds. If the liquid in the container were something else, say gasoline, you'd need to substitute its density in line 10.

These same calculations can be adjusted for a cylinder by substituting the following two lines in the above program:

```
20 PRINT"{CLR}INPUT HEIGHT AND
   DIAMETER OF CONTAINER (IN
   {SPACE}INCHES)":INPUTH,DI
30 V=INT(↑*(DI/2)↑2*H*10+.5)/1
   0
```

In this variation, you input the height and diameter of the cylindrical container. Type line 30 carefully; the first up-arrow is underlined, which means you should hold down the SHIFT key to get the pi (π) character. The second up-arrow should be unshifted (↑).

Connecting A Printer

I own two microcomputers: a Commodore 64 and a DEC Professional 350. I would like to use my DEC LA50 printer with both systems, but don't know how to connect it to the Commodore. It's a serial printer with an RS-232 port. I expect I will need to disconnect and reconnect the printer each time I swap computers, unless you know of a method such that the printer remains connected to both computers.

Kathleen Dahly

To connect a non-Commodore printer to a 64 you need an interface, one that can translate Commodore ASCII characters to true ASCII. (ASCII is the standard way of sending characters and other information between computers and peripherals.) Commodore computers use a variation of ASCII; if you were to send Commodore characters to a standard printer, the uppercase and lowercase letters would be switched, lIKE tHIS.

At the very least, the interface will handle the task of converting Commodore ASCII to true ASCII. Many popular interfaces also offer a variety of graphics and listing modes.

Your best bet is a printer interface that has an RS-232 plug on one end (for the printer) and a six-pin plug for the Commodore serial port on the other end. If you don't own a disk drive, the six-pin plug would fit into your 64's serial port. If you do own a drive, you would plug the interface cable into the serial port on the back of the disk drive. Some interfaces have an additional wire that draws power from the cassette port.

A second option is to buy an interface that plugs into the 64's user port (otherwise known as the RS-232 port). There are a couple of problems with this type of interface, however. Some commercial programs expect printers to be connected to the serial port. With such a program, you couldn't use your printer when the interface was plugged into the user port. Also, it's more difficult to send information to the RS-232 port than it is to print or list to the serial port. On the VIC and 64, opening communications to the RS-232 port clears all variables—which means you have to open the RS-232 channel before you do anything else. In addition, you have to tell the computer how fast you want to send characters (the baud rate) and you may have to do your own translation to true ASCII. Finally, modems fit into the user port; if you had a printer interface attached there, you couldn't use a printer and a modem at the same time.

If your printer has only one RS-232 port, you're correct about having to switch printer cables when you move to the other computer, unless you have a switchbox. We called a local Radio Shack store; they have a Printer Selecter Switch (catalog #26-1498, $119.95) that would allow you to connect two computers to a single printer. It's likely that a similar switch would be available from other sources as well.

Additions To Sequential Files

Lately I have been working with sequential files on my 64. I haven't been able to find any information on how to add data to the end of a file. Is it possible to append to a file?

Steven Tuck

If you're using tape, the only way to add to a sequential file is to read the entire file into memory, make any necessary changes, and then write a new file to tape.

Disk users have some other options. String data may be read from a sequential

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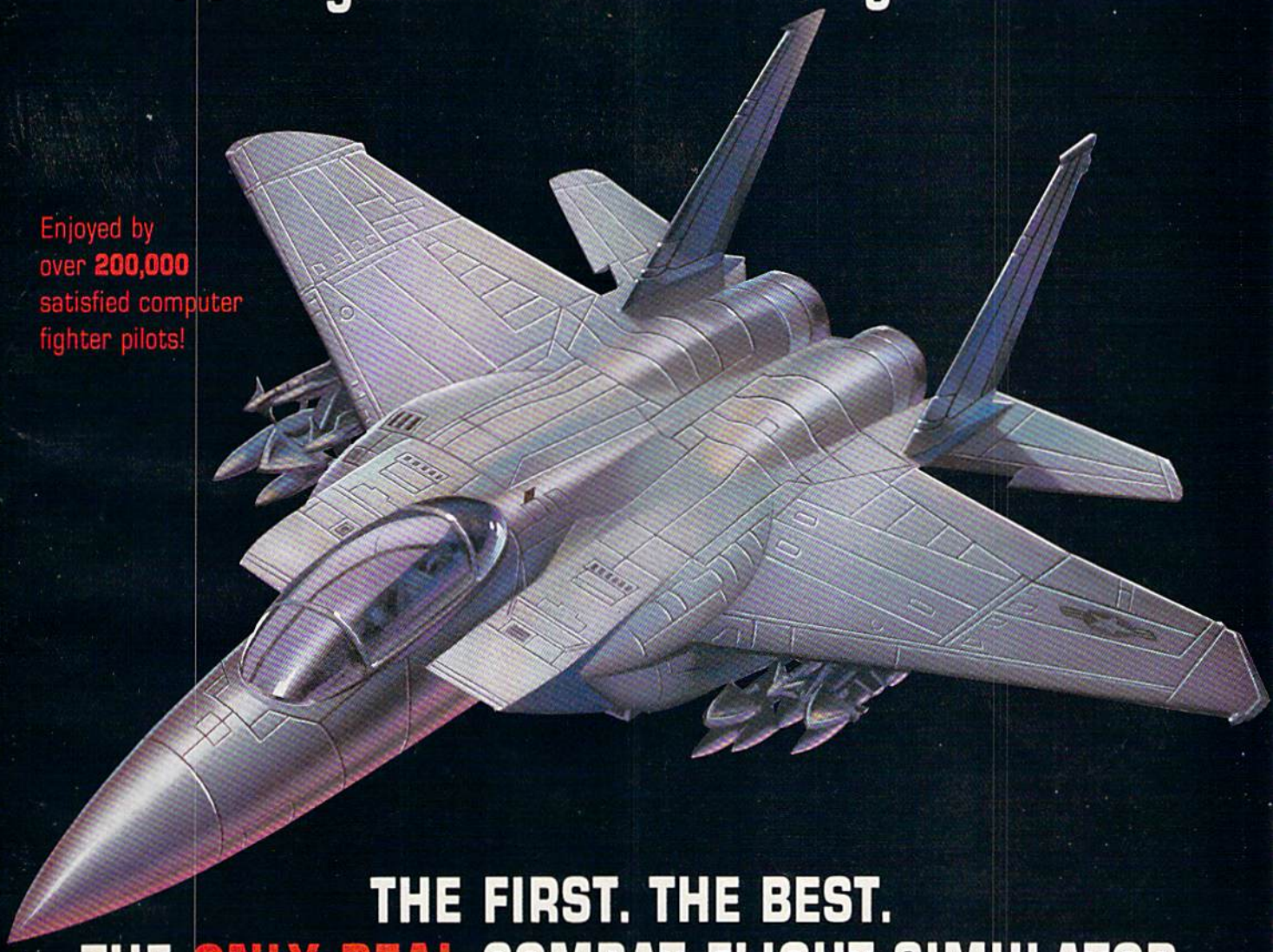

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disk file as follows (note that you have to DIMension the array A$ if the file contains more than ten items):

```
10 OPEN 1,8,2,"filename,S,R"
20 C=C+1
30 INPUT#1, A$(C)
40 IF (64 AND ST)=0 THEN 20
50 CLOSE 1
```

The syntax for the 128 is similar:

```
10 DOPEN#1,"filename"
20 C=C+1
30 INPUT#1, A$(C)
40 IF (64 AND ST)=0 THEN 20
50 DCLOSE#1
```

Once the file is in memory, the data may be changed or revised as desired. Complete the operation by writing the file back onto the disk.

```
10 OPEN 1,8,2,"filename,S,W"
20 FOR X=1TOC
30 PRINT#1, A$(X)
40 NEXT
50 CLOSE 1
```

Again, 128 users may use DOPEN and DCLOSE.

The 128's BASIC 7.0 includes an APPEND command for adding data to a sequential file. Everything printed to that file is appended to the end of the file, tacked on after the last entry. Use this line to open the file for writing:

```
APPEND#1,"filename"
```

Other Commodore computers can append to a file as well. Open the file using this line:

```
OPEN 1,8,2,"filename,S,A"
```

An A (for Append) is substituted where the W (for Write) would normally appear. Keep in mind that the data is just pasted onto the end of the file and that the file to which you are appending must already exist on the disk. You can't create a brand new file with this line. And, unfortunately, if you need to change or delete data, you must first read the file into an array in memory, make the correction, and write it back to disk.

There's one more command you might find helpful. If you have two sequential files on a disk, you can combine them with the DOS copy command. Use this line:

```
OPEN 15,8,15,"C0:newfile=0:firstfile,
  secondfile"
```

The two files will be combined (in the same order as they're listed) and copied to a new filename on the disk. The two original files will remain on the disk.

Memory Management

I'm writing a bulletin board program. I knew it was big, but I didn't think I would run out of memory. The program loads fine, but gives an OUT OF MEMORY error in the line holding all the DIM statements. I checked free memory with FRE and it returned the number 130, which is pretty low. Is there a way to retrieve more memory—renumbering, crunching, or something like that? The program is almost done, but I'm stuck until I can get more memory.

Scott McLaughlin

When you create an array with DIM, your computer sets aside some memory for exclusive use by the array. So if the OUT OF MEMORY error happens on the line containing the DIM commands, it means there isn't enough memory available for the arrays you want to use.

If you're using numeric arrays and they hold whole numbers in the range −32768 to 32767, you can save a lot of memory by switching to integer arrays. Floating point arrays need five bytes per element, while integer arrays need only two bytes for each variable. So DIM A(100), an array of 101 floating point numbers numbered 0–100, would take up approximately 505 bytes. But DIM A%(100) would need only about 202 bytes, a savings of more than 300 bytes.

You could also reduce the size of the arrays. Could you get by with an array of 4000 elements instead of 5000? If you cut back, the arrays won't need as much memory.

If you can't use integers or smaller arrays—or don't want to—you'll have to crunch the program. Here are a few suggestions that may help:

- *Eliminate all REMarks. The REM token uses one byte, and every character and space in the message uses a byte.*
- *Remove all unnecessary spaces. IF A = 5 THEN 500 might be more readable than IFA=5THEN500, but the extra spaces eat up memory.*
- *Where you can, combine more than one command on a line. Every line in a BASIC program requires five bytes for overhead (two for the line link, two for the line number, and a zero to mark the end of a line). If you eliminate a line, you save five bytes.*
- *Renumbering sometimes helps. Line numbers up to 63999 are allowed, and the number at the beginning of a line always takes up two bytes. But when a line contains something like GOTO 21000, the five characters "21000" take up one byte each. If you renumbered, the line might change to, say, GOTO 511 and you would save a couple of bytes.*
- *If you have a machine language routine that's POKEd into memory from DATA statements, you can save a lot of memory by creating an object file, a machine language program that you load directly from disk instead of POKEing it into memory. Consider the line DATA 155,201, which would need five bytes for the line and the links, one for the DATA token, six bytes for the ASCII numbers and one for the comma, a total of 13, just for two numbers to be POKEd into memory.*

A Partial Reset

I've installed a reset switch on my 64 and I'm wondering why, with some commercial games, it doesn't perform the normal reset. It just starts the game over and doesn't give me the usual cold start message.

D.J. Sadowski, Jr.

When you turn on a 64, it goes through a startup sequence which sets up some important memory locations. Among other things, your computer checks for an autostart cartridge. If the letters "CBM80" are in locations 32772–32776, the 64 allows the program in the cartridge to take over. The two bytes in 32768–32769 point to the beginning of the machine language program which will begin running, and 32770–32771 are the warm start vector (triggered by pressing RESTORE).

Pressing the reset button you've built causes the 64 to go through the standard startup sequence, and if there's an autostart cartridge in place, the program in the cartridge will begin running.

Some disk-based programs load the characters "CBM80" into locations 32772–32776, to make the computer think a cartridge is installed. If you reset the 64 with such a program in place, it finds something that looks like a cartridge and transfers control to the program.

---

64 Cartridges On The 128

I recently purchased a 128 and would like to know how I can run the Simons' BASIC cartridge if the computer starts in 128 mode. Could I harm the cartridge by starting in 128 mode? Any advice will be greatly appreciated.

M.C. Carney

The 128, like the 64, checks for the presence of a cartridge when it's turned on. One sequence of characters signals a cartridge for the 64 (see the previous letter), another sequence marks a 128 cartridge.

Simons' BASIC runs on the 64, so if you plug it into the 128 and turn on the system, your computer will automatically go into 64 mode and run the program. You don't need to follow any special instructions, just insert the cartridge and flip the power switch. The 128 is able to recognize autostart cartridges for the 64. If you have other cartridge-based programs that don't automatically start, you'll have to either type GO64 or turn on the computer with the Commodore key held down.

Learning New Commands

Can you explain the INSTR, USR, PUDEF, SYS, and WAIT commands?

Scott Baum

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The INSTR function looks for a particular substring of characters contained in another string. For instance, A=INSTR (I$,"DOG"), looks for the word DOG within string variable I$, and sets the numeric variable A to DOG's position. If I$ holds the characters "WALK THE DOG", the above line would set A to 10, since the D in DOG is the tenth character in I$. If I$ did not contain the substring "DOG", A would be set to 0. This command is useful for analyzing a user's input or for searching through large amounts of information. This function is available in BASIC 3.5 (Plus/4 and 16) and 7.0 (128), but not in BASIC 2.0 (VIC and 64).

*Both SYS and USR (implemented on all Commodore BASICs) tell the computer to begin executing a program written in machine language (ML). SYS is to machine language what RUN is to BASIC. It's always followed by a number that corresponds to the starting address of the ML routine (**SYS 64738**, for example). Although USR allows you to pass an input value to the routine and lets the routine return a result, SYS is generally easier to use.*

PUDEF (not available on the VIC or 64) changes the characters which are used for formatting PRINT USING and PRINT# USING statements. By default, the filler character for padding out short numbers is a space, the separator between numbers is a comma, the decimal point is a period, and the currency symbol is set to a dollar sign. The keyword PUDEF is followed by a four-character string containing the new values for each of these formatting characters. Note that the default symbols are still used in the formatting string in a PRINT USING statement. If you changed the dollar sign to a lira symbol (£) with PUDEF, you would still put a dollar sign in the formatting statement after PRINT USING. When the result was printed, the lira symbol would be substituted.

*The WAIT statement repeatedly tests one memory location until a certain condition is satisfied. On the VIC and 64, **WAIT 198,15** causes the computer to pause until a key is pressed. The first number is a memory address, the second is a bit mask which is ANDed with the value of the memory location. It determines which bits will be tested. A bit mask of 15 clears the top four bits, and tests only bits 0–3. As soon as any one of those four bits changes from 0 to 1,the program will continue. If a third (optional) parameter is added, it is exclusive-ORed with the value in memory before the bitwise AND is performed. This has the effect of reversing the polarity of certain bits. Instead of waiting for a bit to change from 0 to 1, it waits for a 1 bit to change to a 0.*

Of these commands, you rarely (if ever) find USR and WAIT in a program because they have very specialized uses.

Adding Memory Changes The VIC

I started working on a program for a VIC with no memory expansion and later decided it would need the 8K expander. My father told me I would have to rewrite the program because memory locations are different. Is there some way I can avoid rewriting the whole program?

Aaron Feeney

The additional 8K causes three sections of VIC memory to change.

The memory location where BASIC programs start moves from 4096 to 4608. This shouldn't affect most BASIC programs. If you're working with machine language, it would be a good idea to check the pointer at $2B–2C (decimal 43–44) to find out where BASIC starts. PEEKing this pointer can tell you whether or not memory has been added.

The two other changes may cause some problems in a BASIC program. Screen memory moves from 7680 (unexpanded VIC) to 4096 when you add 8K or more. In addition, color memory moves from 38400 (unexpanded) to 37888. You'll have to change all lines that POKE to screen or color memory. POKE 7682 would become POKE 4098, for example.

One way to avoid making a lot of changes is to define a variable for the start of screen memory and another for the start of color memory. At the beginning of a program for the unexpanded VIC, put SM=7680:CM=38400. Then, within the program use these variables for POKEs to the screen: POKE SM+5,1: POKE CM+5,4, for example. To modify the program for an expanded VIC, you would then change only that one line at the beginning of the program to SM=4096: CM=37888.

Multitasking?

I'd like to know how to write a routine which operates simultaneously with the execution of the BASIC program. For example, I have a game where the helicopter sound keeps on going even after the game has finished and the READY prompt has appeared.

Hamit Ranu

Here's a short routine for the Commodore 64 that does exactly what you're talking about. Note that the whirring helicopter sound continues even after the program ends and the READY prompt reappears. You can LIST the program, change it and use BASIC as you normally would. To change the pitch of the whir, POKE different values into location 54273. To change its speed, POKE new values into location 54286.

```
10 FOR J=54272 TO 54296:POKE J
   ,0:NEXT:ADR=49152
20 DATA 120,169,13,141,20,3,16
   9,192,141,21,3
30 DATA 88,96,173,27,212,141,2
   2,212,76,49,234,256
40 READ BYT:IF BYT<>256 THEN P
   OKE ADR,BYT:ADR=ADR+1:GOTO
   [SPACE]40
50 POKE 54286,200:POKE 54287,0
   :POKE 54273,10
60 POKE 54277,15:POKE 54278,24
   0:POKE 54276,129
70 POKE 54290,16:POKE 54295,24
   1:POKE 54296,15+32
80 SYS49152
```

This example works by wedging a short machine language routine into the computer's hardware interrupt routine that normally works "in the background" while other tasks are in progress. The main duties of the interrupt routine are to read the keyboard and update the computer's internal timers. By changing the vector that points to this routine, we can make the computer perform our short ML routine before proceeding with its normal tasks. As a result, the computer plays the helicopter sound automatically, changing it as many as 60 times every second, without slowing other tasks significantly.

Though it seems like the computer is doing two things at once (making a helicopter sound while operating BASIC), its microprocessor can actually do only one thing at a time. By alternating very rapidly (60 times per second) between one task and another, it seems to perform both simultaneously, even though it is interrupting (hence the term interrupt) the execution of BASIC each time it performs its housekeeping chores.

Since the 64 isn't designed for multitasking, it's necessary to use tricks like this to achieve the illusion that two things are happening at once. Such tricks aren't necessary on a true multitasking system like the Amiga (or a mainframe computer) although much the same process occurs. By switching back and forth between several programs, the Amiga can give the illusion of running all of them at once, even though it too has only one microprocessor. Of course, the Amiga was designed for multitasking from the ground up, and has a much faster microprocessor than the 64, as well as custom support chips that relieve the burden on the main processor.

The 64's SID chip also has the inherent ability to create sound continuously, without any expenditure of processing time. If you can still hear the sounds from the previous program, press RUN/STOP–RESTORE, then type the following lines. Be sure to press RETURN at the end of each line.

```
FOR J=54272 TO 54296:POKE J,0:NEXT
POKE 54273,10:POKE 54277,15
POKE 54278,240:POKE 54276,33
POKE 54296,15
```

These commands create a continuous sound with voice 1, the first of the 64's three tone generators. We've set voice 1's Attack/Decay/Sustain/Release (ADSR) envelope to make a continuous tone rather than fade out within a certain time period.

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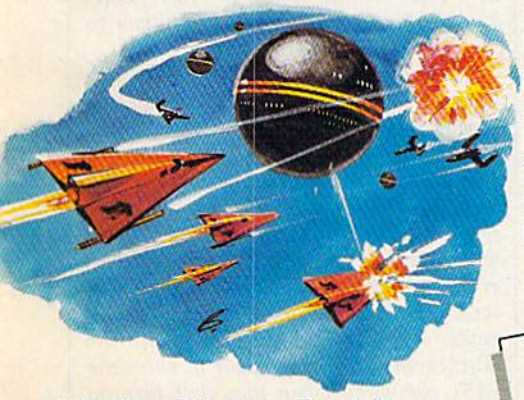

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The sound continues until you do something to terminate it. Strictly speaking, this is a function of the SID chip, not an example of multitasking.

To terminate the sound, press RUN/STOP–RESTORE. On some 64s you can still hear a faint sound in the background (this is caused by "crosstalk" or electronic leakage in the sound circuits). RUN/STOP– RESTORE (or typing SYS 64738) turns down the SID chip's volume, but doesn't affect other SID settings. So the tone generator still keeps working. To prove this, type POKE 54296, 15 to turn the volume back up. The sound comes back, loud and clear. The proper way to turn off a sound is to ungate the tone generator by setting the gate bit of its voice control register to 0. In this case you can ungate the voice by typing POKE 54276, 32.

A Scrolling Map

I'm trying to program a map that is larger than the screen. I'd like to be able to scroll the screen around the map if that's possible.

Colt Rymer

The program below (for the 64 only) uses the joystick to scroll through a large screen 80 columns wide and 50 rows high—twice as wide and twice as high as the normal screen. This requires 4000 memory locations, so the map fits nicely into memory starting at 49152. Publishing an actual map would require many DATA statements, so we'll leave it up to you to create the large map by POKEing screen codes to locations 49152–53151 (remember, every eightieth byte is the beginning of a new row). The following line could be used to clear the map:

```
FOR A=49152 TO 53151:POKE A,32:
NEXT
```

Lines 80–120 contain the data for the machine language routine that updates the screen. Line 30 is the line that reads the data and POKEs it into memory.

To use the routine, SYS 828 followed by a comma, the left column number (0–40), another comma, and the top row (0–25). For example, SYS828,5,12 would display columns 5–44 and rows 12–36.

```
10 POKE646,1:POKE53281,1:PRINT
   "{CLR}":POKE53281,0:X=0:Y=0
   :FORA=0TO10
20 READX(A),Y(A):NEXT:DATA 0,0
   ,0,-1,0,1,0,0,-1,0,-1,-1,-1
   ,1,0,0,1,0,1,-1,1,1
30 FORA=828TO914:READB:Q=Q+B:P
   OKEA,B:NEXT:IFQ<>7873THENPR
   INT"{CLR}DATA ERROR":STOP
40 SYS828,X,Y
50 J=15-(PEEK(56321)AND15):TX=
   X+X(J):TY=Y+Y(J)
60 IFTX<0ORTX>40ORTY<0ORTY>25T
   HEN50
70 X=TX:Y=TY:GOTO40
80 DATA 32,155,183,138,24,105,
   0,133,4,169,192,105,0,133,5
   ,32,155,183,224
90 DATA 0,240,16,165,4,24,105,
   80,133,4,165,5,105,0,133,5,
   202,208,240
100 DATA 169,0,133,2,169,4,133
   ,3,162,24,160,39,177,4,145,
   2,136,16,249
110 DATA 165,2,24,105,40,133,2
   ,165,3,105,0,133,3,165,4,24
   ,105,80,133
120 DATA 4,165,5,105,0,133,5,2
   02,16,218,96
```

Plus/4 Joystick Reader

Have you heard anymore about the Plus/4 Programmer's Reference Guide and if it is available? Also, I would like to know how you read the Plus/4's joysticks in machine language.

Bob Harrison

We have recently received the Programmer's Reference Guide for the Commodore Plus/4, *published by Scott, Foresman and Company. It contains a wealth of information for Plus/4 and Commodore 16 programmers. Chapter six of this book has an in-depth explanation of how to read the joysticks from ML. Here's a brief summary.*

The single location $FF08 can read both joysticks. To read joystick one, you first store the value $FA into $FF08. Store an $FD to read joystick two.

Once a value has been stored in $FF08, the corresponding joystick value can be read from the same location. The following ML program reads the value of joystick one then, using a number output routine ($A45F), prints this value on the screen. After you have entered this routine, exit the monitor and type SYS 828. The value of joystick one is printed on the screen.

To read joystick two, change the number $FA to $FD in the first line of the ML code.

```
033C LDA  #$FA
033E STA  $FF08
0341 LDA  $FF08
0344 TAX
0345 LDA  #$00
0347 JSR  $A45F
034A LDA  #$0D
034C JSR  $FFD2
034F JMP  $033C
```

Merge, FAST, And Windows For 128

I have a few questions about the 128. First, is there a short utility to merge or append two programs on the 128? Second, the FAST command gives the 128 a speed of 2 MHz, but in 40 columns it blanks the screen. Can you double the speed without the screen blank?

Finally, the line **FOR I=4TO23: POKE 781,I: SYS59903: NEXT** would erase the bottom screen on my 64 and leave the first four lines intact. This was great for preserving column titles. Is there a similar line for the 128?

James Thompson

Yes, no, and yes. There are at least three ways to append one BASIC program to another on the 128. But when you append, the second program must have higher line numbers than the first program, so it's not as flexible as a true merge utility. An easy way to merge two 128 programs was described in the recent March Hints & Tips column. You first create an ASCII program listing and then have the computer enter the lines into memory from the file. See the March 1986 issue for details.

FAST mode leaves the 80-column screen alone, but blanks the 40-column screen to the border color. It's not possible to restore the 40-column screen while the 128 is running at double speed, although you can still PRINT to the screen, which is helpful if you need to track certain variable values while you're in FAST mode. You won't see what's printed until you go back to SLOW mode, of course.

If you're doing a lot of FAST calculations in 40 columns, you can change the border color occasionally to remind the user that the computer is still working. It's also a good idea to insert a TRAP statement and then start off the error-handling routine with the SLOW command. Otherwise, you won't necessarily know when an error has happened, because of the blank screen. The 128 always starts out in SLOW mode, so readers who regularly use the 80-column screen will want to enter the FAST command when they first turn on the computer. You'll notice a big improvement in the speed of program listings and all calculations will double in speed.

Finally, there are a couple of ways to clear part of the screen on the 128. If you position the cursor somewhere on the screen and press the ESC key (don't hold it down) and then the commercial-at (@) key, every screen location past the cursor is cleared. The ESCape character is CHR$(27), so within a program you would place the cursor in the appropriate location and print ESC-@ as follows: ***CHAR1,0,3,CHR$(27)+"@"****. If you're using column headings, another option is to use the WINDOW command to partition off part of the screen. All printed characters will remain within the window. If you add a comma and a 1 after the top and bottom coordinates, the newly created window will be cleared and everything outside the window will remain intact.*

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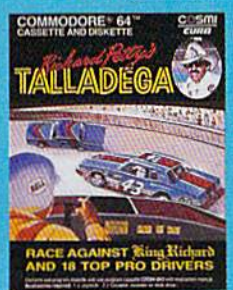

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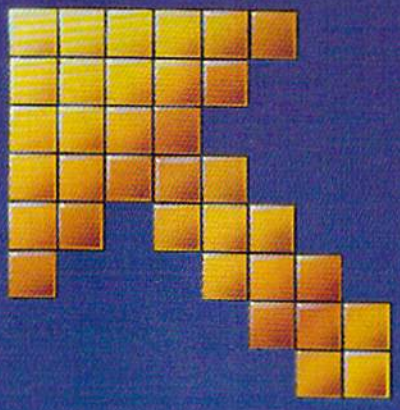


This entirely new operating system for the 64—similar in look and feel to the Macintosh environment—promises to greatly extend the 64's usefulness.

THE QUIET REVOLUTION

Lee Noel, Jr., Assistant Editor

The headlong rush to personal computers based on Motorola's powerful 68000 microprocessor has created revolutionary new machines such as the ST, the Apple Macintosh, and the Amiga. These new micros come close to being desktop mainframes. Great speed, flashy graphics, and the promise of superlative software give these computers tremendous advantages over their established eight-bit rivals.

But what of the millions of happy 64 owners? Software for the machine is abundant, and much of it is excellent. Is there any real reason to abandon this wealth of computing power?

Clearly, many people don't think so, and the 64 continues to thrive. Commodore attempted to stop production of the machine several times in 1985, only to be forced back to the assembly lines by public demand. Loyalty to the computer is further borne out by good sales of the Commodore 128, the only computer offering upgraded capabilities and full compatibility with the 64.

It's even possible to question whether the 64's technology is really outdated. After all, not every mainframe is a Cray supercomputer, nor should it be. Technology, like every type of power, should be applied at a level appropriate to its use.

However, the Amiga, ST, and Macintosh offer more than power and flexibility. They all contain a similar user interface that's easy to understand and to use. Pull-down menus, command bars, icons (graphic symbols), and a mouse-driven cursor are all similar among the three 68000-based computers.

Even people who fear and distrust computers readily adapt to the logical pictorial environment pioneered by the Macintosh and now used by the Amiga and ST.

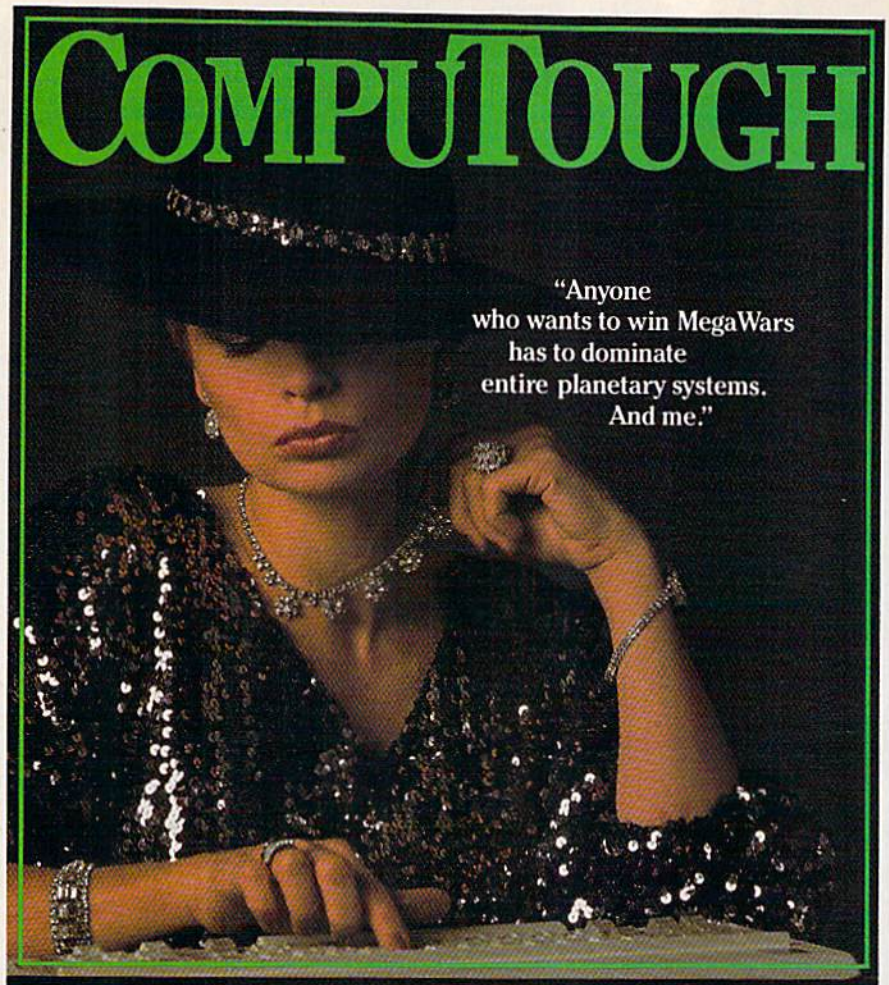
Happily for 64 owners, that type of environment will shortly be available for their machine. While the new technology has roared into the headlines, a quiet software revolution has been taking place. Berkeley Softworks, a Berkeley, California, software house, has developed *GEOS*, an entirely new operating system for the 64.

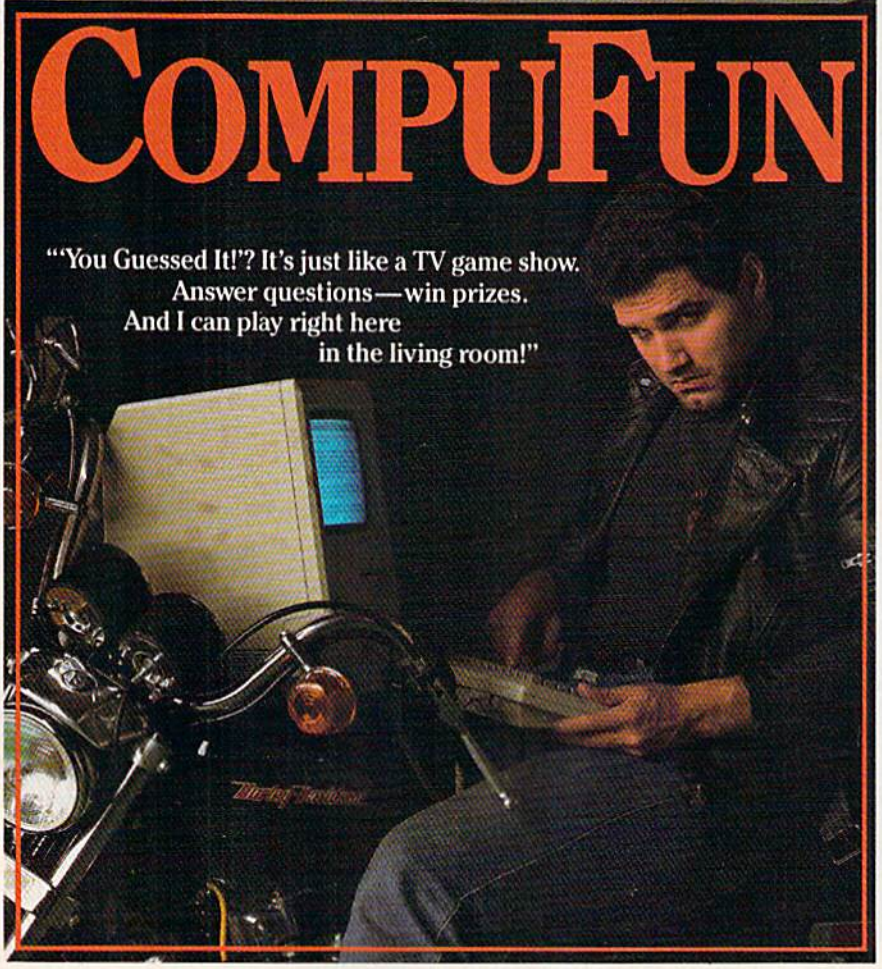
No longer are icons, windows, and pull-down menus reserved for the new computers. *GEOS*, which stands for Graphic Environment Operating System, implements all these features on the 64. At the same time, *GEOS* reprograms the 1541 disk drive, making it five to seven times faster and fully capable of playing a central part in this high-speed system. The overall effect is a complete transformation. The 64 doesn't quite turn into a Macintosh, but it's closer to that computer than to an unmodified 64. In addition, applications similar to the graphics programs and the word processors available for the Macintosh are a part of the *GEOS* system.

Although at this writing *GEOS* isn't quite finished, it will be by the time you read this. The version we've been working with, and from which the photos accompanying this article were taken, is a near-final test edition. Although a few aspects of *GEOS* still remain to be fully implemented, it's probably safe to say that the new operating system and its initial applications have the potential to be among the most important programs written for the 64 since the computer's built-in operating system was created.

Not surprisingly, the motivating force behind *GEOS*, Brian Dougherty, president of Berkeley Softworks, had at one time hoped to write the original operating system for the 64. In 1982, Dougherty, then a vice president at Imagic, was enthusiastic about the soon-to-be-released 64, and was negotiating with Commodore to write a disk-based operating system for it.

But those were heady days for the videogame industry, and it was difficult for Imagic to shift its focus away from its highly successful games to an untried computer system. Additionally, Commodore wasn't sure there was going be much of a market for disk drives for the 64. Programs in ROM (Read Only Memory)





seemed more likely to dominate, so Dougherty had to put his plans on a back burner.

Not too long afterwards, the videogame industry began a spectacular collapse. Dougherty left Imagic in September 1983, and started his own company, Berkeley Softworks. Hard economic realities dictated other projects then, but the idea for a new operating system continued to simmer, and the 64's 1541 disk drive became extremely popular.

Finally, after an inspiring visit to the hurly-burly of the 1985 Summer Consumer Electronic Show, Dougherty decided to return to the fray. The operating system was shifted to the forefront, and was in good shape by November. About the same time, old friend Clive Smith, vice president of corporate planning and development for Commodore, called. Dougherty sent Smith a copy of the evolving *GEOS* project. Duly impressed, Commodore offered encouragement and a measure of support. At Winter CES in 1986, *GEOS* generated considerable and well-deserved interest. (See "The Winter Consumer Electronics Show" article in April's GAZETTE.)

But background and history are only a minor part of the *GEOS* story. What is it, exactly, and what can it do for the 64?

The *GEOS* software consists of a number of small satellite programs and a core of four major ones, all supplied on a single disk. The first of these, and the cornerstone on which the *GEOS* structure rests, is Berkeley's new operating system for the 64 and 1541. As previously mentioned, loading *GEOS* turns the 1541 into something of a speed-demon. About 25 seconds after booting *GEOS*, approximately 34K of programs have been processed through the 1541. All subsequent disk operations in the *GEOS* environment take place at the same accelerated rate, including non-*GEOS* applications loaded through the *deskTop*. For example, we loaded a version of *SpeedScript* through *GEOS* in only 4 seconds instead of the usual 21 seconds.

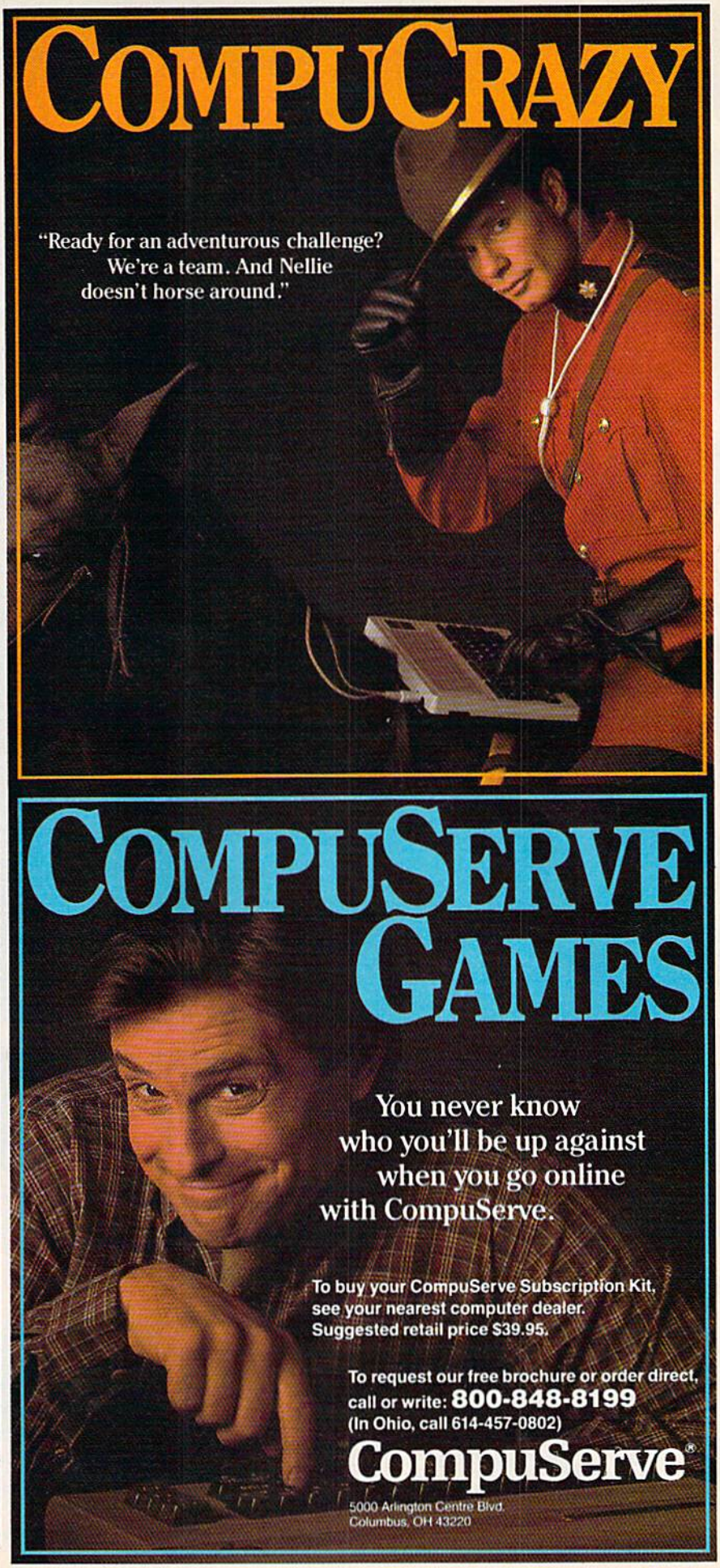
Once *GEOS* is installed, the 64 user is in unusual, but not unfamiliar territory. Instead of a barren

screen into which BASIC commands are typed, you see a graphic display representing the top of a desk. Since all *GEOS* screens operate in the 64's high-resolution mode, the desk graphic is highly detailed. This is particularly noticeable in the display of standard text, since it's in 80-column format, a significant improvement over the normal 64. This is close to being the optimum size of text for the 64: It's perfectly readable on an ordinary TV. Appropriately enough, this display is known as the *GEOS deskTop*. It's the second major program in the system, and it ties all the others together.

The GEOS deskTop: *The dark blue Notepad represents files and programs with clear, hi-res icons.*

Its largest element is the *deskTop* Notepad. Analogous to a large pad of paper, the Notepad shows icons—distinctive pictures—that indicate the type and number of files on the disk presently being used. If there are more files than will conveniently fit on one page, *GEOS* automatically prepares more pages.

To see these other pages, a joystick is used to move the screen pointer to the dog-eared corner of the notepad. Just clicking the fire button while the pointer is in this location will cycle through all available pages. Most features of *GEOS* are accessed in this straightforward way: Joystick moves pointer to



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'Twas split by Quad and hidden still — an amulet to seek thy will —
The pieces lost must thee amass

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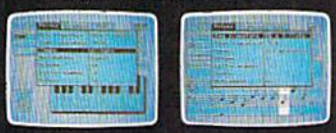

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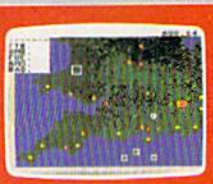


BATTLE OF BRITAIN

TEXT ADVENTURE

THE HELM
Have you the cunning, power and knowledge to wrest the troubled helm from the dark ones evil grasp?

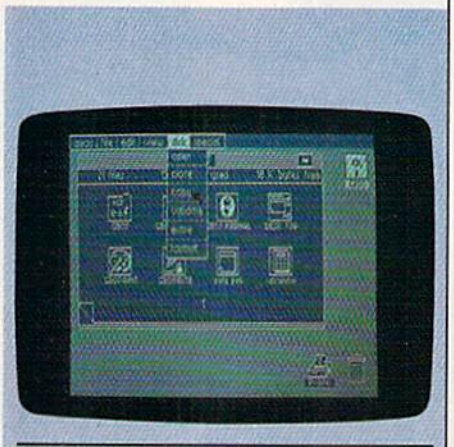
3D ACTION ADVENTURE

RASPUTIN
You must destroy the Jewel of the Seven Planets which is the power source of the spirit of Rasputin

STRATEGY WARGAMES

BATTLE FOR MIDWAY

symbol, then one or two clicks of the fire button activate the necessary function. There are no special codes or syntax sequences to remember. Both the Amiga and ST have a similar desktop environment, but their screen pointers are controlled by mouse, not joystick. Since Commodore is only now introducing a mouse for the 64, Berkeley has concentrated on the joystick. Special programming in *GEOS* compensates for some of the joystick's inherent shortcomings, and actually renders it superior to the mouse for certain purposes. However, Berkeley does plan to add a mouse driver, a program for receiving input from a mouse, to *GEOS* in the near future.



The copy feature has been selected by pulling the disk options menu down from the Command Bar.

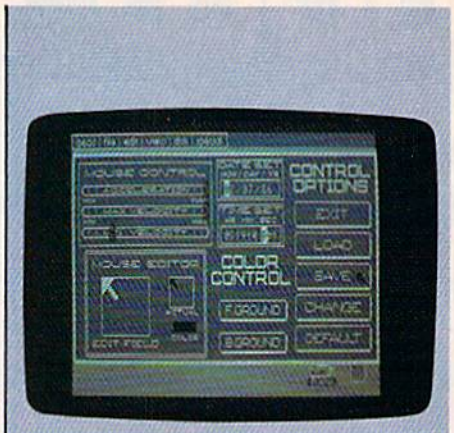
Once you're on the correct page of the notepad, manipulating files is as easy and instinctive as if they were really lying on a desk top. A single click of the fire button will activate a file, turning its icon dark. A second click following closely will load the file, or with a little more delay, will produce a ghost version of the icon. The ghost can be picked up and dragged around by the pointer, enabling the file to be moved, copied to another disk, thrown into the trash, or printed. Certain old-style 64 files can also be manipulated through the *deskTop*.

Also on the *GEOS* desk display, at its very top, is the Command Bar. In exactly the same way that file icons are activated, the various options in the Command Bar can be selected with the joystick fire button. As soon as one of these options is picked, a menu pops down, giving further subchoices in that category. Some of these pull-down menus contain functions that are duplicates of those that can be performed with just icons. Other functions are unique and must be accessed through the Command Bar and pull-down menus.

The system operates very swiftly and smoothly, and even offers some improvements over the Macintosh environment. The Mac's menus pop back up into the command bar the moment the mouse button is released, so even a brief lapse in attention means a lost menu. *GEOS* menus are stable once activated, disappearing only when a selection has been made or the pointer moves outside the menu boundaries. *GEOS* also dispenses with a particularly aggravating aspect of some other systems. These present only a single page of file icons. When a large number of files and icons are in use, the page must be resized to accommodate them. These elastic pages are quite impressive graphically, but it can be awfully hard to find files on them. *GEOS'* method of using as many pages as needed is not only more convenient, it's much truer to the idea of a real desktop. After all, few of us have notebooks made out of just one sheet of rubberized, highly expandable paper.

To further extend computing power, the *GEOS deskTop* is also capable of manipulating entire disks and a two-drive network.

The other programs on the *GEOS* disk not only operate in the same graphics-oriented manner as the *deskTop*, but also have to be accessed from it. The two remaining major programs are *geoPaint* and *geoWrite*, special applications that take advantage of the newly established *GEOS* environment. But before looking at these excellent art and word-processing programs, it's worth mentioning a number of the smaller programs on the disk, since they are convenient helpmates—



"The Preference Manager": With time, date, colors, and joystick response set to the user's taste, the new adjustments are about to be saved to disk.

accessible not only from the *deskTop*, but also from *geoPaint* and *geoWrite*.

Foremost among these accessories is the "Preference Manager." Activated either by opening its icon on the *deskTop* or by making a menu choice in another application, this program provides a control panel for the *GEOS* user. Again, with just the joystick and pointer, screen graphics are altered. As the

The "Calculator": A very useful accessory, available not only on the deskTop, *but also in* geoPaint *and* geoWrite.

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display is changed, corresponding changes are being made in some of *GEOS'* characteristics. Here, it's possible to set the time and date. This should be done at the start of every session with *GEOS*, because chronological information is part of the data stored with every file you create. Once you've seen the convenience of dated files, you'll wonder how you ever got along without them. Other changes that can be made from the "Preference Manager" include adjusting background and text colors, redesigning the shape of the screen pointer, and resetting joystick responsiveness to suit your personal tastes. Once set, your preferences can be saved to the *GEOS* disk, a permanent part of the system until you decide to modify them again. In this way, each *GEOS* system will become a personalized extension of the user.

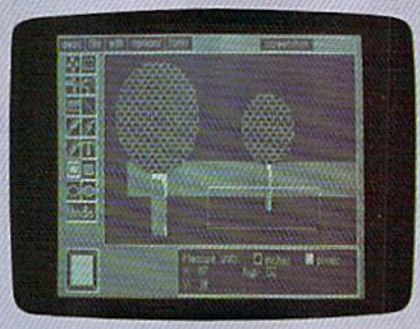
Other support programs include "Calculator," which can be operated by joystick or from the keyboard, and the multipaged "Notepad" in which fleeting thoughts can be set down and rapidly stored to disk. Naturally, there's "Alarm Clock," which you can set to remind you when you've spent too much time in the inviting *GEOS* environment. "Text Album" and "Photo Album" let you transfer chunks of *geoWrite* text into *geoPaint* designs, and vice versa.

About half of the other small programs are printer drivers enabling you to print out your *geoPaint* and *geoWrite* creations on just about any popular printer. The remainder are text fonts used to put different styles of type into documents and designs.

GEOS is, at present, supplied on just one disk and requires no hardware. A well-thought-out manual completes the package. Initial sales are to be by mail order, but dealer sales will come at a later point.

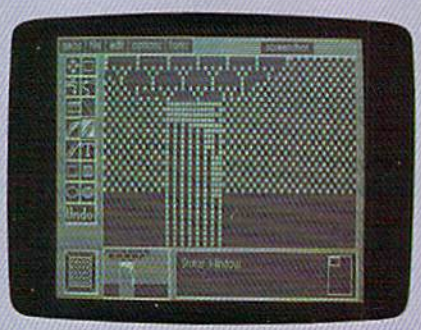
The disk is copy-protected, but Berkeley's protection allows the elements of *GEOS* to be copied onto other disks. This method permits backups for safety, and also enables you to put only essential programs onto given disks, thus freeing up storage space and creating disks customized for particular projects.

As you've probably realized by now, in addition to a powerful, high-speed operating system for the 64, the *GEOS* disk's two major application programs give you complete desktop publishing capability. Both *geoPaint* and *geoWrite* bear strong resemblance to some of the design and word-processing programs available for the Macintosh.



The geoPaint *drawing environment. Tool icons are at the left of the working area. The tool being used to draw the white rectangle displays precise measurements at the bottom of the screen.*

Also like the Macintosh, the quality of *GEOS* output is a function of printer resolution, rather than the fineness of the screen display. As a consequence, *GEOS* generally displays a window that shows only a small portion of the final document, which will actually be printed with a resolution of 80 dots per inch, impossible to achieve in any 64 screen graphic. Eventually, Berkeley will provide a driver program for laser printing. At that point, output will approach typeset quality, a real quantum leap for the 64.



geoPaint's *pixel edit option enables the artist to magnify any section of a design for precise detail work. Note the small status window (lower right) which indicates the working area's position in the document.*

Both *geoPaint* and *geoWrite* are full-featured programs, offering—in combination—capabilities never before available on the 64. Exploring either of them in detail would take a small book. Paradoxically, they're so well-designed that using them requires virtually no documentation. However, a brief look at some of their many features will provide a tantalizing insight into the power of *GEOS*.

The design program, *geoPaint*, has many of the features that have become standard in 64 art applications. The abilities to automatically draw lines, make outlined and solid circles and rectangles, and paint numerous patterns with different types of brush—including an airbrush-like effect—are supported. So, too, are cut, copy, and paste features for easily moving around chunks of design work. There's also a magnified mode that permits pixel-by-pixel, close-up editing of design details. Naturally, undo, erase, and fill options haven't been left out. All tools are selected by pointer from a strip of icons at the side of a display window. As usual, file-handling and other refinements are available from the Command Bar.

What's really special, though, is the overall orientation toward producing a printed document. In *geoPaint*, an on-screen measuring tool allows accurate sizing in either pixels or inches. This latter option is essential for keeping control of printed artwork. Another tool enables you to move the display window quickly to any point in a design, while a smaller window monitors the movement relative to the entire document. *MacPaint*, a similar design program for the Macintosh, handles documents in much the same way. As an informal comparison between *GEOS* on the 64 and *MacPaint* on the Macintosh, a

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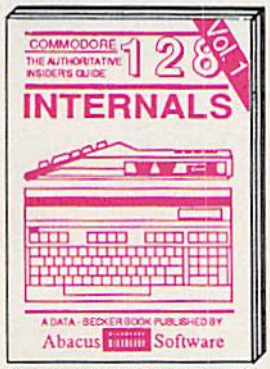

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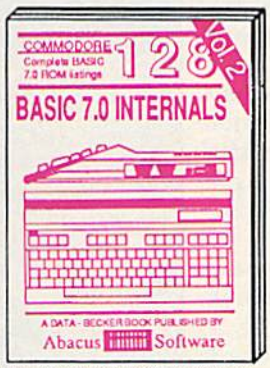

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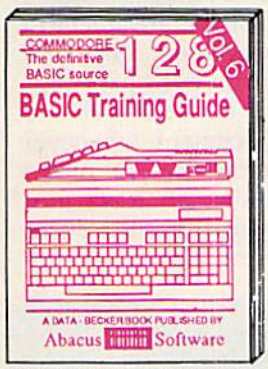

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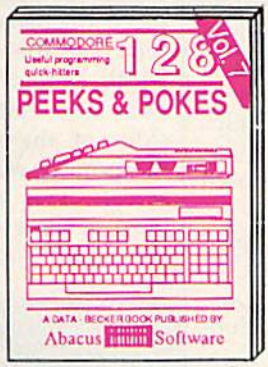

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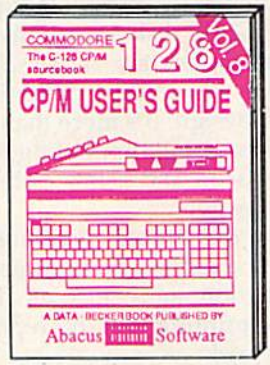

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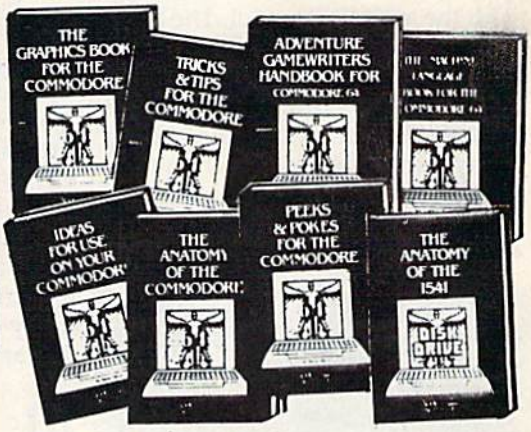

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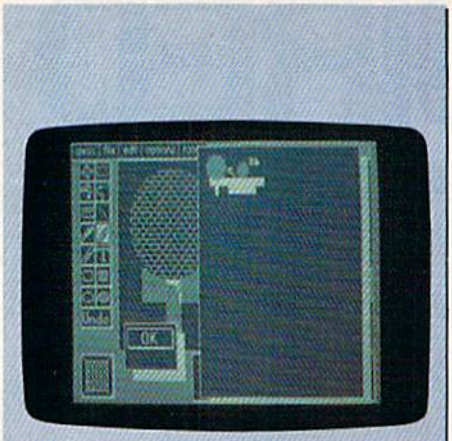
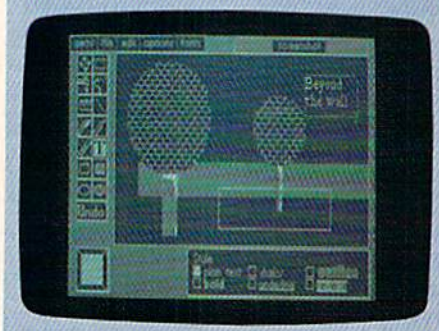


The entire document is displayed on the right half of the screen. The design in the working area appears as a small shape in the top left corner of the document display.

full document from each was scanned by moving the display window across the entire design with the appropriate tool. The Macintosh system took about 50 seconds; *GEOS*, about 70. That's a pretty respectable performance measured against a 68000-based computer, especially when you consider that output from the systems is virtually identical in size and appearance.



A title is added to the design with the highly effective text tool.

Also helpful is an option that allows you to look at a condensed version of the entire document. Data compression is used to facilitate the storage and retrieval of graphics information, so a full page can be displayed in about 20 seconds.

Another exceptional feature of *geoPaint* is its method of handling text. When text is placed in a design, it is entered into an elastic-bordered text box defined by the artist, who simply types the desired message on the 64's keyboard. Word-wrap takes place automatically within the box—it's like having a tiny word processor available at any point in a design. Even after all intended text is typed into a given box, resizing of the box is possible. A couple of clicks on the fire button, and the same text appears in a completely different block. Again, word-wrap is automatic, so there are no problems with words broken apart arbitrarily. The advantages for setting up columns of text should be obvious.

Some of the text fonts supplied on the *GEOS* disk are creative and unusual; others are classics. All of them can add an extra dimension to graphic design. It's more than helpful to have a full typesetting service only an icon and a few pull-down menus away.

On the whole, *geoPaint* provides an excellent environment for the creation and—just as importantly—printing out of reproducible artwork.

No less impressive is *geoWrite*, the system's word processor. As always, by simple manipulation of on-screen graphics, *GEOS* performs magic.

For example, the writer can set tabs and margins, and actually see where they are. All the *geoPaint* text fonts are available, too. Bold, italic, underlined, and outlined type can appear simultaneously, and in different sizes.

Two display modes are supported. The half-width mode operates as you might expect—every word that's typed remains visible on the screen. This is probably the way to enter text most efficiently. On the other hand, because the document will print a full 80 columns wide, the screen image does not accurately depict what the finished product will look like. As a result, the full-width mode is provided. Once an author finishes a piece, the usual procedure will be to reformat the document into full-width. In this display, the page flips back and forth between the two sides of the document whenever the pointer reaches the side of the screen. This allows an exact preview of the eventual printed document, and it offers the opportunity

geoWrite *offers a wide choice of different sizes and styles of text. Note the margins and tab set on the ruler at the top of the screen. This is half-width mode.*

The accessory "Notepad" is available at any time.

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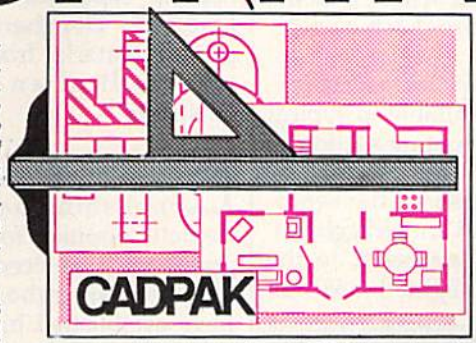

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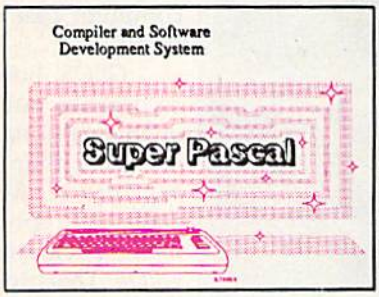

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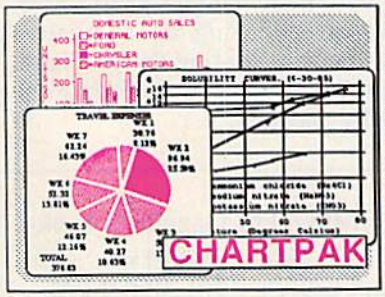

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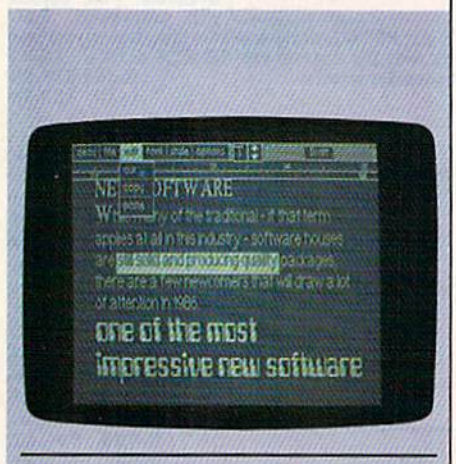
to make any final changes.

Text is entered into either kind of display from a cursor that can be positioned simply by moving the pointer to the desired location and clicking the joystick fire button. The text itself is then typed in directly from the keyboard, which also offers access to features such as deletion and tabbing.

Excellent graphics-based manipulations are available in typical *GEOS* style. Any existing section of writing may be highlighted by inserting the text cursor at the beginning of the material and dragging it, with fire button depressed, to the end. All the highlighted text can



The highlighted section of text is about to be cut from the document with one of the edit functions available from geoWrite's *Command Bar.*

then be cut, copied, deleted, pasted, or replaced in a few simple steps.

Since a document in *geoWrite* may consist of many pages, options at the top of the screen enable the writer to flip through the pages one-by-one, home in on a particular page, or get to the start or end of text rapidly. All necessary file operations are also found in the command bar at the top of the display.

Additionally, *geoWrite* allows the writer to further enhance the appearance of the printed document by adjusting line spacing and setting page breaks wherever they're wanted.

geoWrite is a sophisticated and powerful partner for *geoPaint*. Working together, and using the previously mentioned albums to transfer material, they are capable of creating the same high-quality material that the Macintosh has been producing for some time. *GEOS* fonts are, in fact, public-domain typefaces created for the Mac, says Dougherty. As a result, printed material from the two systems will often be indistinguishable.

Even without *GEOS*, desktop publishing has become extremely popular for the 64. Programs such as Brøderbund's *Print Shop* and Springboard's *Newsroom* have established high positions in the applications software charts. The *GEOS* disk offers professional publishing capability at a remarkably low cost, and on the same computer that millions are already using.

GEOS, however, is not limited to desktop publishing. The system is an open one. Software developers other than Berkeley can easily tap into it. Activision and Bank Street are reportedly converting existing programs to interface with *GEOS*. This process was designed to be an easy one, and Berkeley and Commodore hope it will attract many more third-party developers to the system.

For those interested in writing new software, *GEOS* offers opportunities for both hackers and professional programmers. The 22K of the new operating system includes the high-speed disk code, and fully supports the graphics-oriented user interface. By utilizing a series of jump tables—maps giving entry addresses for accessing important *GEOS* features—programmers can easily write software with all the speed and ease-of-use of *GEOS* itself. Berkeley expects to release a programmer's reference guide containing the tables and other technical information in June of this year. Every effort is being made to encourage others to write for the system. Berkeley and Commodore hope *GEOS* will catch on in a big way, establishing a uniform, standardized operating system for the 64.

Also on the horizon, and of great importance for *GEOS*, is the expected announcement of significant RAM expansion for the 64. If this does become available, many *GEOS*-based applications could be resident in memory at any given time. Switching from one to another would be virtually instantaneous, thus increasing both the scope and flexibility of programs for the 64. The RAM expansion is supposed to be coming from Commodore, who is also expected to begin offering some kind of concrete support for the fledgling *GEOS* system. News on both fronts may have been announced by the time you read this.

Meanwhile, Berkeley and Dougherty plan to enhance *GEOS* continuously, and will keep registered owners of the system notified of details. Already in the works for *geoPaint* are pattern-editing and full-color capabilities. (The system currently operates mostly in two colors, due to the strong emphasis on producing black and white printed output.) There is also talk of someday putting part of the system on cartridge, but the bulk will stay on disk, where it can readily be refined and improved.

GEOS doesn't offer merely new life for the 64; it provides a means for you to acquire advanced computing capability at low cost. Consequently, the question of upgrading may be put off indefinitely for many people. With *GEOS*, Berkeley is blazing an alternative trail that, considering the 64's loyal following, is a pathway likely to be heavily traveled.

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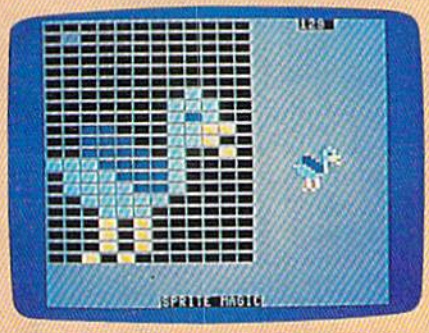

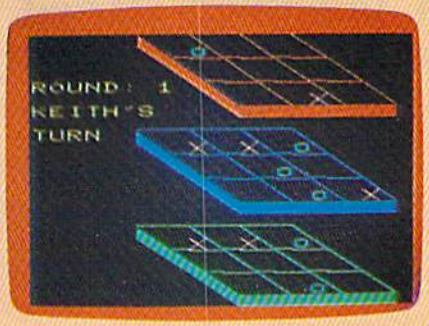

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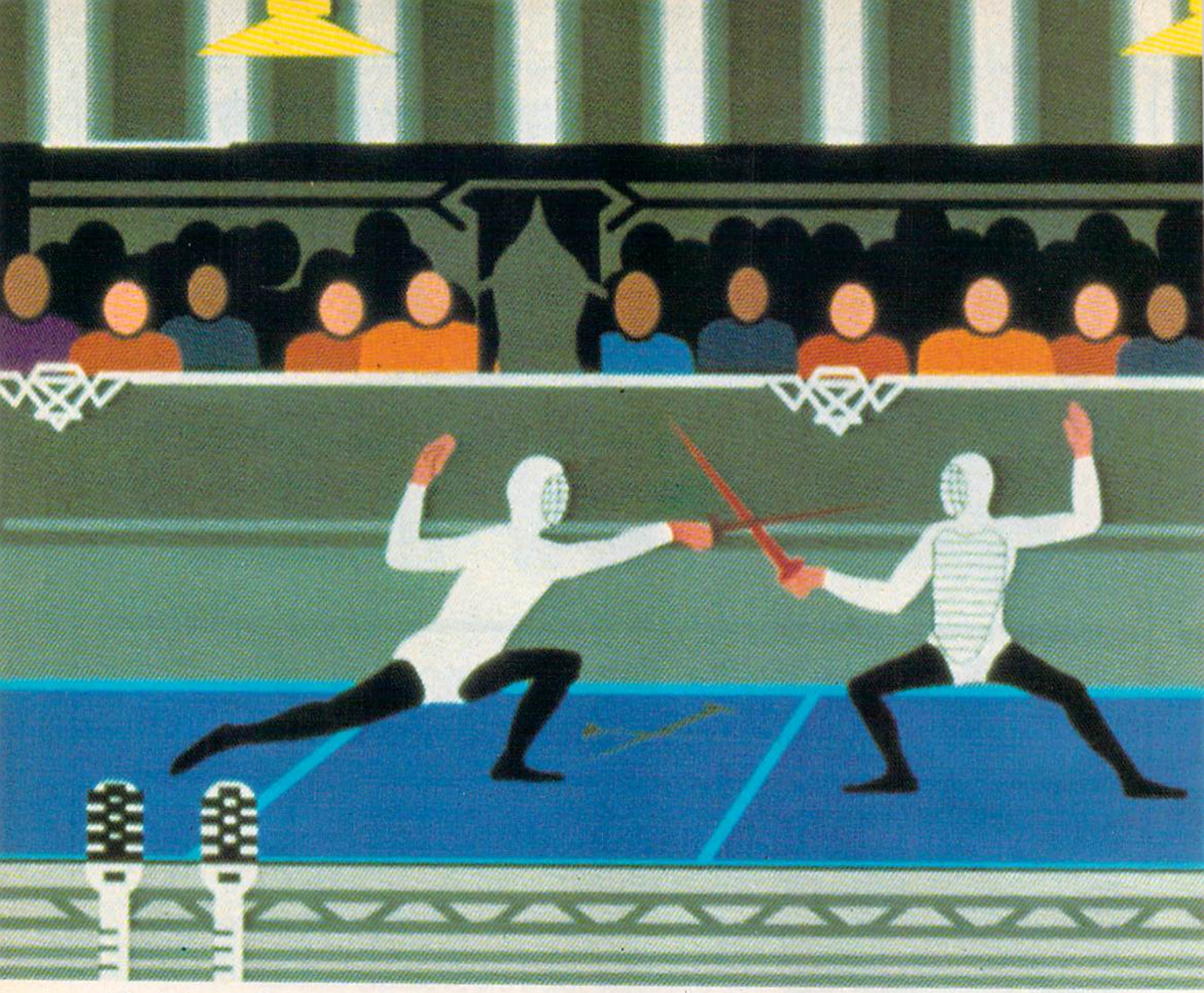
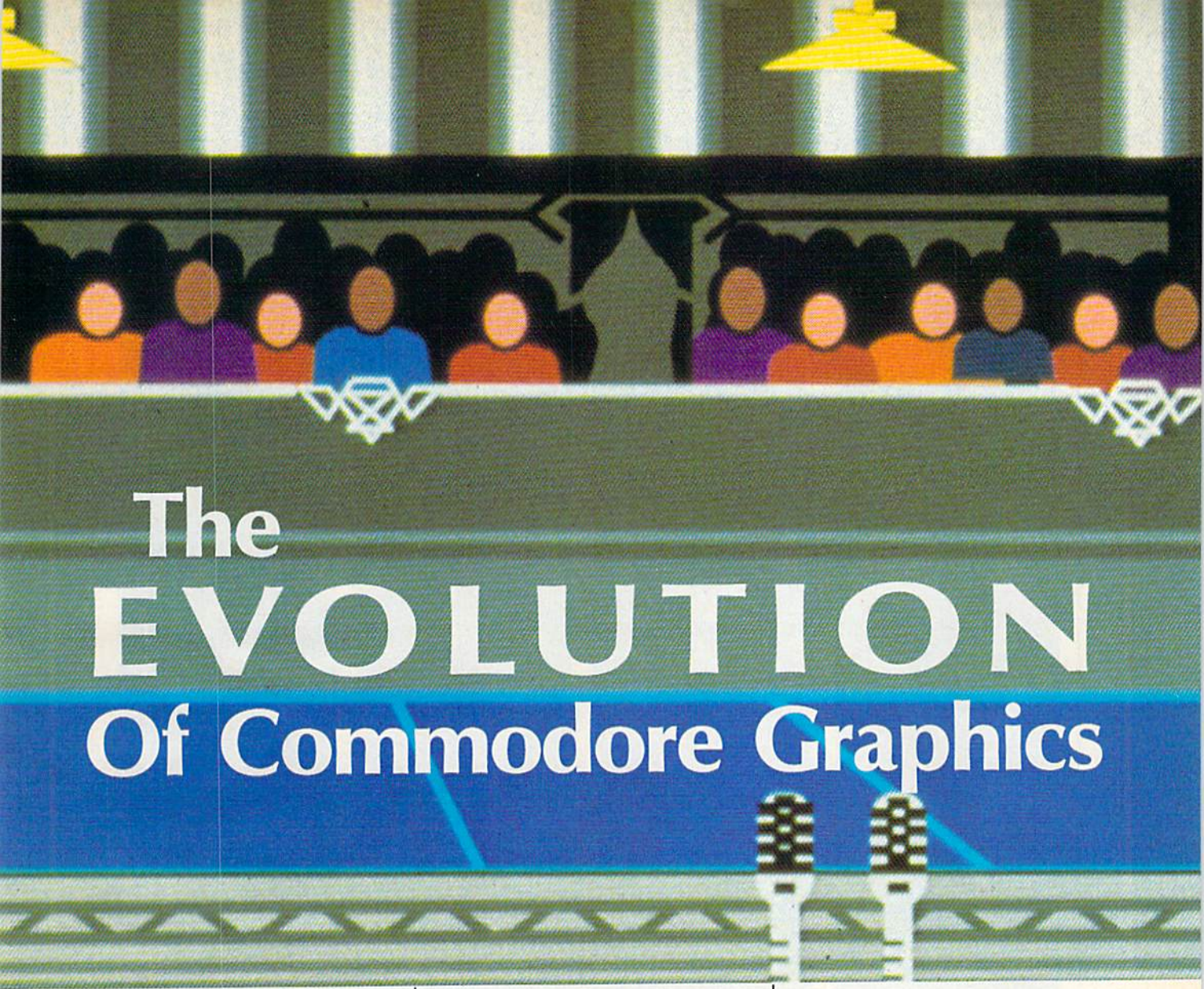


A few designers—like those behind Epyx Software's Summer Games II*—have broken new ground in Commodore graphics.*

Kathy Yakal, Assistant Features Editor

Think back for a minute to the first program you ever saw on a Commodore 64. Chances are it was a game, if you've had a 64 for more than a couple of years. And chances are its graphics were either crude or nonexistent. In early 1984, publishers started delivering software that contained some rather startling graphics. Here's why.



The EVOLUTION Of Commodore Graphics

In the first year or so of the Commodore 64's life, hundreds of software programs were developed, very few of which showed any particularly impressive visual effects. But don't blame the programmers. The success of the 64 in those days hinged on how much software got out quickly. No software, low hardware sales. Happily, it took only a few months before a multitude of programs were available, some good and some bad, but *available.* As the price of the machine dropped and more publishers produced titles, hundreds of thousands of people bought the 64.

The survivors of the software shakeout that began in 1984 and continued into 1985 found themselves with a different kind of problem. It was no longer necessary to rush products out so people would feel safe buying the machine, because about three million had already done so. But consumer sophistication had grown. Home computer owners were demanding better software: database programs with greater filing and search capabilities; word processors that had simple command structures, but more power and flexibility; educational software that held a child's attention, yet actually taught something; and richer entertainment experiences. Better games required not only more complex design concepts, but also better *graphics.*

Consumer demand was but one factor that triggered the next step in the evolution of Commodore graphics. Several forces collided in early 1984, resulting in games in which superb color graphics surprised and pleased their players. That seemingly sudden change was evolutionary, not revolutionary, say many of the people involved, and its impetus goes beyond the fact that program designers had simply spent more time with the machine.

In any endeavor, the more you practice, the better you get. Though that's not the sole reason for the improvement in Commodore 64 graphics—maybe not even the most important one—it's certainly the most obvious. Bruce Carver, president and founder of Access Software, attributes much of his company's present-day success to a steadily increasing knowledge of the machine.

"It's been an evolution of technology," says Carver. "Someone does a game, and someone else looks at it and says, *I can do it better.*"

Carver, a mechanical engineer, bought a Commodore 64 early in 1982, and started programming as a

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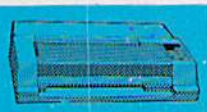

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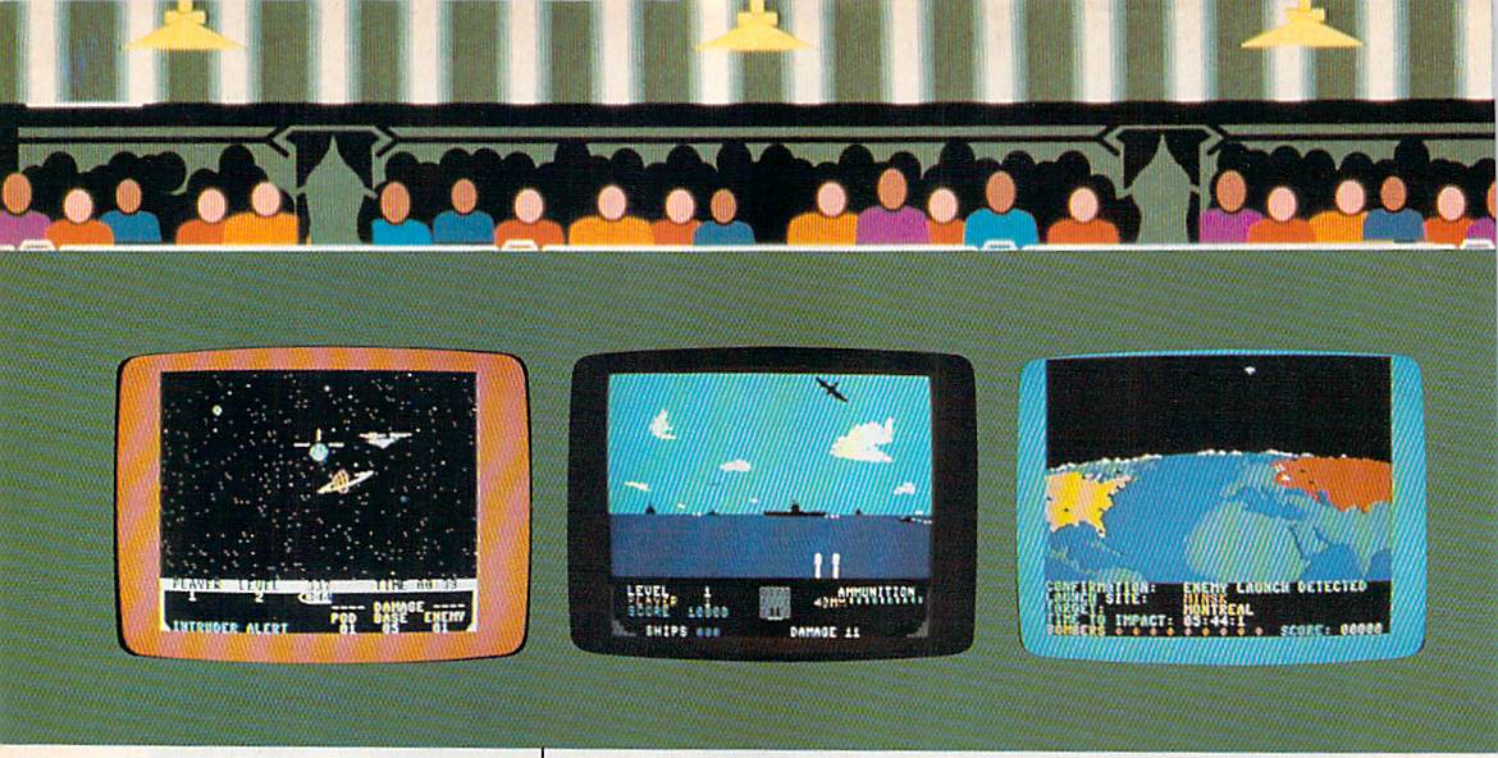
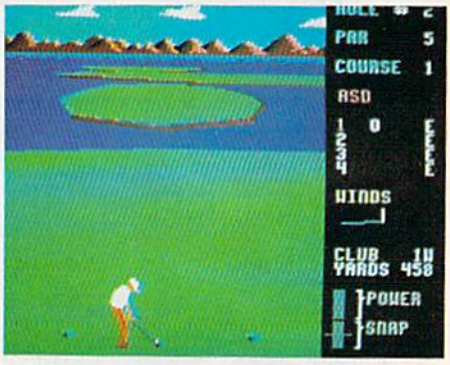


Access Software president Bruce Carver learned a little more about programming graphics on the Commodore 64 on each new project. Here, you can see that progression in these scenes from Neutral Zone, Beachhead, *and* Raid Over Moscow.



Leader Board *is Carver's latest program, and his best graphically.*

hobby. In those days, little documentation was available beyond the user manual, so designing a program was a learning process that involved a lot of trial and error.

Carver's first commercial attempt, *Sprite Master* (a simple sprite editor), launched his company and encouraged him to push his programming skills further. It was followed by a succession of popular games, including *Neutral Zone* and *Beachhead*, each a little better graphically than the previous one. His most recent game, *Leader Board*, contains some of the best visual effects his company has produced. Carver credits three years of practice and two programming tools for the lifelike graphics and animation in this golf simulation. (See review elsewhere in this issue.)

The first tool, *rotoscoping*, is a technique similar to one used in the movie industry. In previous Access games where animation was necessary, it was created in the same way animators draw cartoons. Each frame in succession is drawn just slightly different from the preceding one, so that when the sequence is run very fast, it looks like the characters are actually moving.

Rotoscoping involves using a video camera to film a sequence (in *Leader Board*, it was a golfer taking a swing). The sequence is then put up on a monitor and run through slowly, a single frame at a time. A series of frames is then chosen from shots that are close enough together so that the sequence looks fluid when run, and you don't miss the frames in-between.

Finding that balance is difficult, says Carver, because not only do you not want to use too few, but also you don't want to waste memory by using too many.

The next step is to rewind the tape and start from the beginning of the sequence, bringing up each individual image and shooting it with a camera to produce slides. Each slide is projected on a glass plate with a grid on it, and then it's traced. Using *Sprite Master*, Carver translates that information into a sprite shape. Then it's just a matter of determining the timing rate.

The second tool employed in developing *Leader Board* was *simulation equations*, a way of translating 3-D perspective information into two-dimensional screen information. (This technique is used often in designing flight simulators.) Though neither of these techniques is new, they're good examples of the types of things that program designers are doing to push the Commodore 64 to its technological limits while there is still demand for new software. "Value-wise, I still think it's the most beneficial machine, dollar for dollar, on the market today, although the Atari ST and Amiga are giving it a run," says Carver. "I think it's being pushed by a lot of programmers as hard as it can be pushed."

To further understand why Commodore 64 graphics improved so rapidly, you have to go back to the late 1970s at the Atari Corporation. Atari was selling millions of videogame systems, and it employed some of the best designers in the business to develop new game cartridges for a demanding market. Once home computers became available and affordable in the early 1980s, interest in the dedicated game machines began to wane.

Craig Nelson, now director of

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Epyx has enjoyed enormous success with Winter Games *and* Summer Games II, *thanks, in part, to the programs' superb color graphics.*

product development at Epyx, was one of those Atari game designers who watched the old give way to the new. Like many of his coworkers, he moved over to the Atari 800 in the early 80s. "The money used to be in VCS (Video Computer System) games, and that's where most of the talent was concentrated," he says. "So if you want to look back at the old days, there are a lot of reasons why Commodore graphics weren't up to par. One is, simply, not many of the pros were working on them."

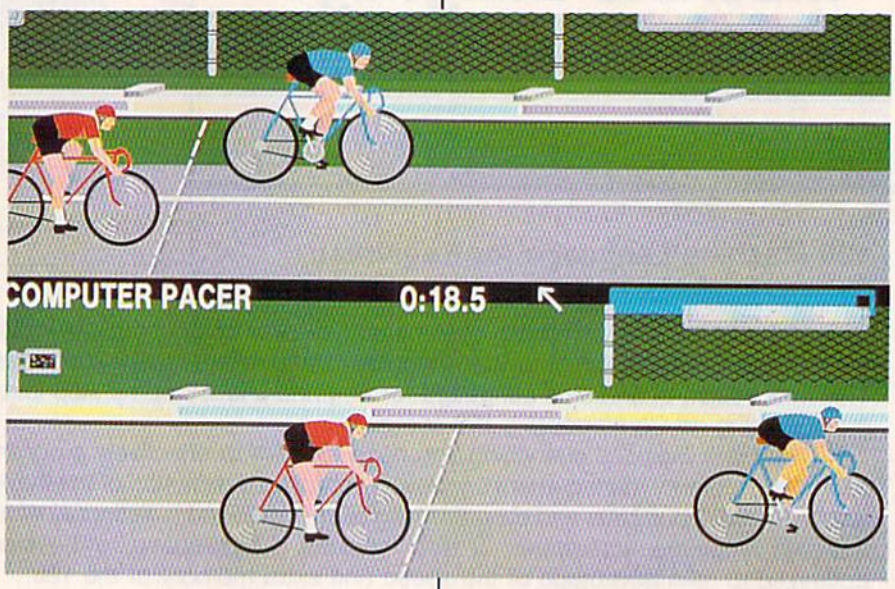
Which leads to another point. Many games designed initially for the Atari 800, taking advantage of the 800's sound and graphics capabilities, were then translated into a Commodore 64 format. Naturally, in comparing the two versions, Atari usually excelled. The best Commodore 64 games had to be designed on the machine itself, and that just wasn't being done very often. The period starting in late 1983, with a steadily increasing installed base of 64s, saw more and more developers take an interest in original design on the 64.

In that same period, software development teams started to form. Much of the earliest Commodore 64 software was done by one individual, a Herculean task. It's almost impossible for one person to have the multiple talents necessary to create a good game. The process of writing a game involves coming up with an original, entertaining concept, having the skill to bring it to fruition through good, efficient programming, and also being a fairly respectable artist.

Of course, the team approach has its problems. Anytime you try to get a group of people together to do a project—defining goals and deadlines, assigning individual tasks, meeting along the way to check progress, and completing the project satisfactorily and on schedule—it can be a headache. Add to that the pressures on everyone in the home computer industry, and you can see why so many tried and failed.

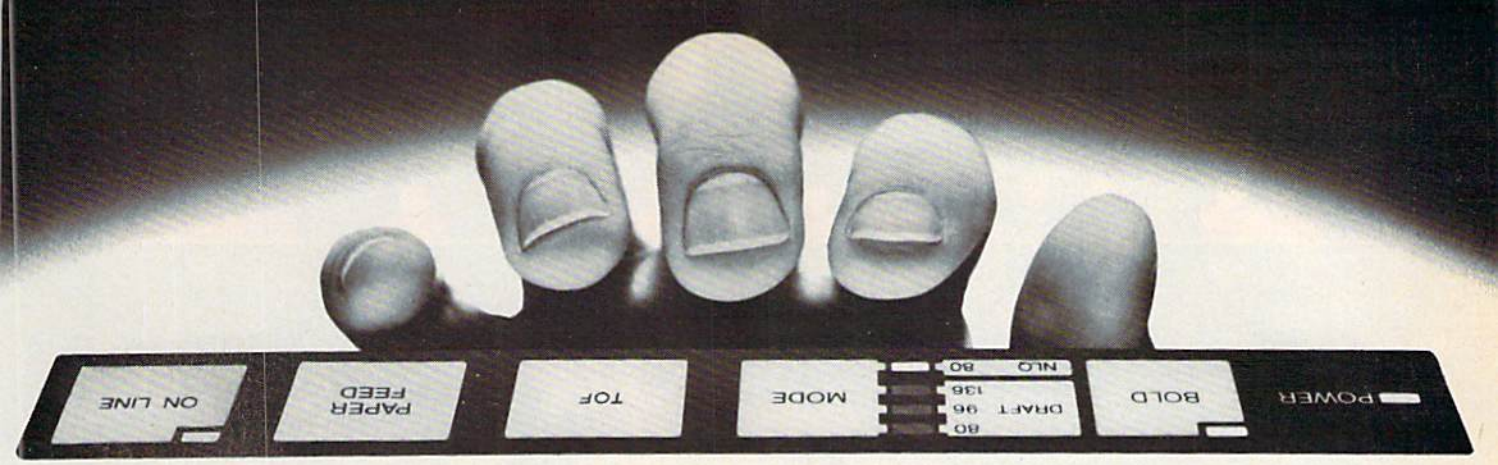
But some have succeeded. Nelson credits the emergence of better Commodore graphics in great part to the presence of trained artists on those teams. "Programmers can program, but they can't necessarily draw," he says. "And artists can draw, but they can't necessarily program."

Input by artists was key, according to Nelson, partly due to the dearth of graphics tools available to programmers. "Some of the graphics modes on the 64 are really strange, and they have no analogs to the Atari or Apple, like the ability to change color of the character basis across the screen. That gave us a lot of color capability that had not been exploited. The Koala Pad [a digitizing tablet] was the first good art tool that exploited the nice bitmap graphics mode."



Nelson acknowledges the demand by game players for better graphics as some motivation, but feels he and his staff create a lot of their own pressures. "We do it to ourselves," he says. "It's a horrible situation. We come out with something like *Summer Games*, and then we have to do something even better.

"There's a need, because of the general state of graphics, to do the



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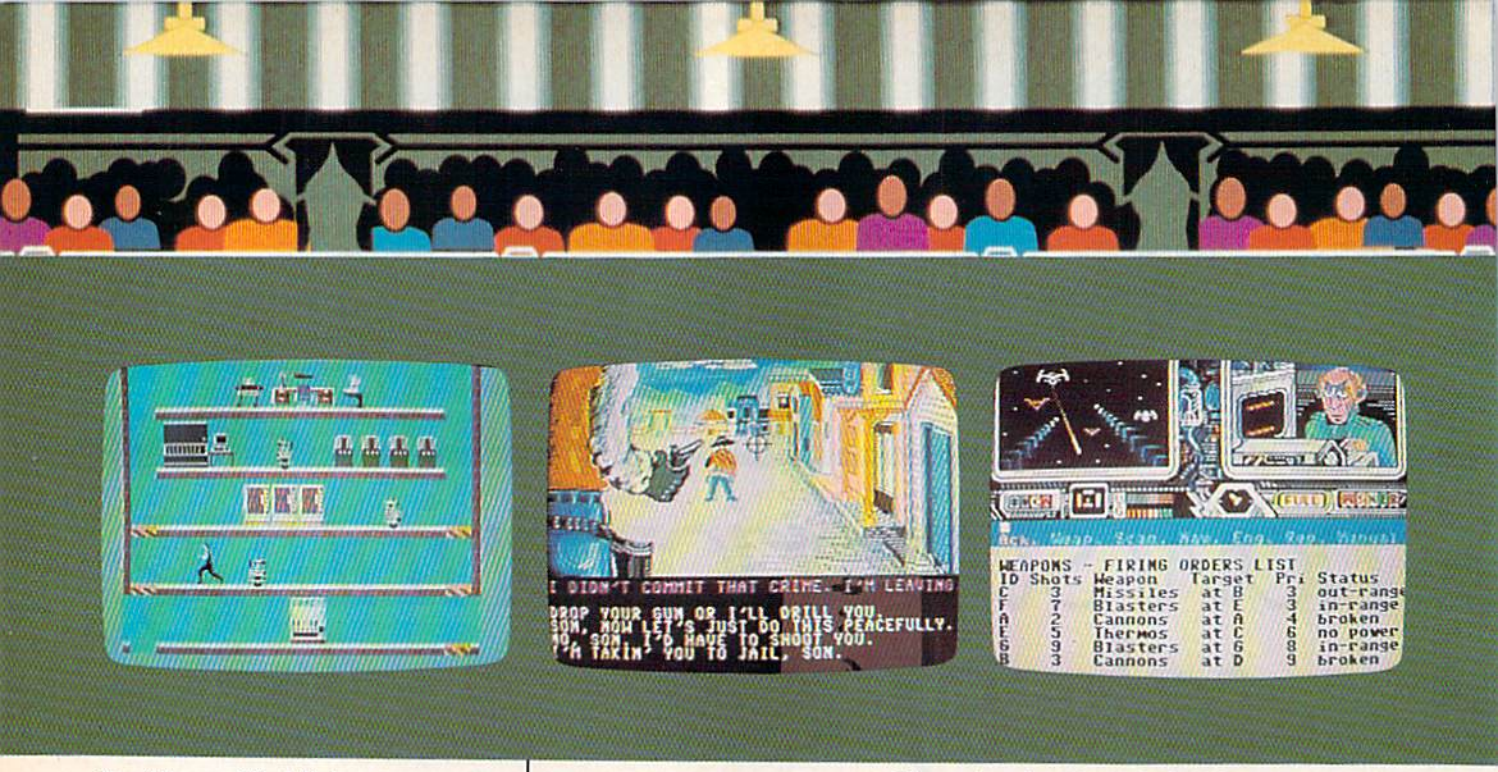

Epyx' Impossible Mission *was designed by Dennis Caswell, one of those rare people who has all the skills necessary to create and design an outstanding game.*

The co-founders of Accolade Software believe that exceptional color graphics are key to the success of a computer game. These scenes from Law of the West *and* Psi-5 Trading Company *illustrate that belief.*

really hard work. Before, it was sufficient to throw up a background screen and have a few sprites moving around. Now, you have to do complicated software interrupt routines to reuse sprites and do fancy programming things to get objects moving around."

That's the history of any given machine. You work your very hardest to get the most out of it. And Nelson thinks we're getting close with the Commodore 64.

"We very clearly have limitations that are insurmountable." he says. "We can't go much farther with Apple because of its slow processor. Commodore has the same processor, but has some graphics help that Apple doesn't have. We've pretty much used all of that up now. There are a few little niche areas that haven't really been exploited all the way, but we're finding it more and more difficult to come up with technical innovation."

Digitizing is one technical innovation that could have some effect on Commodore 64 games, but Nelson and his co-workers have yet to use it in an actual game. "We just haven't found the place where it's appropriate in a game yet," he says. "With the new machines (the Commodore Amiga and Atari ST), you can afford to throw memory away. With the 64, we're scraping for everything we can get, and we just can't afford to blow away the kind of memory that digitizing implied. While it's an interesting thing, it's not appropriate yet."

All of these elements—top designers moving over to the Commodore 64 and doing original programming, input from artists, greater familiarity with the machines, and better graphics tools—have triggered the evolution of Commodore 64 graphics from what we saw in 1983 to what we see today in 1986. Al Miller, a cofounder of Activision and, more recently, Accolade Software, thinks demand from the public and competition from other companies have been the most important driving forces.

Miller started designing 2K games for Atari VCS cartridges in 1977. Then he moved to 8K. His first game for Accolade, *Law of the West*, came in at 256K. That's 32 times bigger, but it wasn't 32 times more complex, he says. The extra memory was allocated for graphics and music.

"I really don't think that designers are learning that much more about the machines," says Miller. "It *was* the case in the VCS market because we were primarily employing tricks to get advanced graphics out of the cruder machines. Computers that are available now are pretty straightforward in descriptions of how to generate sound and graphics."

Today's best game designers have proven quite successful in stretching the limits of Commodore 64 graphics over a period of three years. But the learning curve posed for the next generation of game designers may be a bit tougher.

What state-of-the-art home entertainment will be like five or ten years down the road is almost impossible to predict. Laser technology is shaking up the information storage and retrieval industry these days with the advent of equipment like CD-ROMs, and it's likely to have some effect on the kinds of games we'll see in the future. In the meantime, image-rich games on the Commodore 64 are the best they've ever been.

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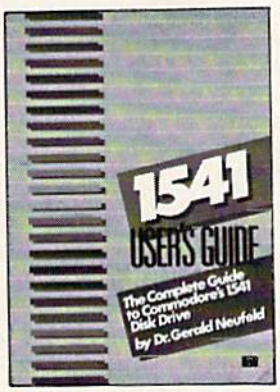

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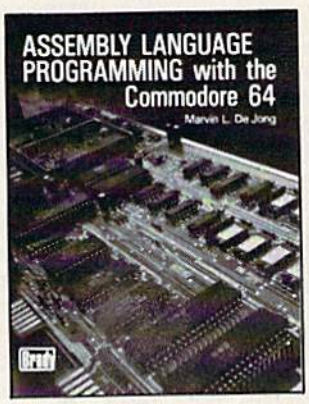

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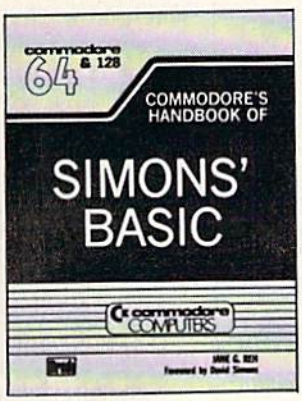

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The Bard's Tale

To His Most August Majesty, Emperor Huracor IV:
Most Exalted One,

It is as we had feared. The threads of a few terror-swollen reports can now be woven into a single cloth: The city of Skara Brae lies under a grim, malignant cloud; and the town—once the brightest jewel of your realm—is in the hands of the loathesome Mangar. How Mangar came here, I do not know. But I have been into the city, and his wizardry and evil are everywhere present. Decay and darkness are the order of the day, and death stalks the streets in a thousand different guises. There are, however, yet a few stout hearts within the walls.

It is with them that our hope lies. For it pleases Mangar to maintain a semblance of normal life in the town. This may be his conceit, or it may be that he needs commerce and the skills of these good people to sustain him in some manner. Regardless of his reasoning in this matter, it shall be his undoing.

Here is my plan:

A good number of taverns and temples remain open. In addition to the places of entertainment and worship, two outfitters have survived, and the venerable Adventurer's Guild remains untouched.

I met in these places with some of the valiant souls whose heartfelt desire it is to overthrow Mangar. They are not great men of arms or wizardry. Many such were taken by Mangar or fled at his coming. But by stealth and cunning, we may be able to creep unnoticed through the city, growing ever stronger in force and knowledge, until at last we confront and destroy the vile usurper.

As we had conjectured, Skara Brae cannot be taken by a great force of warriors. There is power here to resist the might of all our armies. Even in daylight the streets are patrolled by the Undead. Mangar has summoned them to join his hordes of men and monsters and sundry evil wizards. At night, the situation worsens—they say there are dragons, ogres, and fierce things that were never alive. Fighting will be inevitable and, against opponents such as these, would be doomed to failure without the utmost care in planning and strategy.

One essential element: Well-hidden within Skara Brae, a single stalwart Review Board refuses to submit to Mangar. The high folk from the ten classes will increase our powers if we can but find them and satisfy their noble standards. I know, too, that weapons and devices of sublime power still remain in the city. Many of them, I fear, have been secreted in the mazes and dungeons of the old town—never the safest places to venture, and now doubly dangerous. In the darkness of those cold chambers, perhaps the small magic of my songs will bring us some slight strength.

Still, there is no alternative. Shortly, I will return to the Adventurer's Guild—there to join my five companions and go into the streets and alleyways to pry at the chinks in Mangar's armor. Wish us well, and if we do not return, at least let our suffering pave the way for those who will follow.

I have the joy to remain...
Your obedient servant,
Tranhoff,
Imperial Bard

You won't find the emperor—or Tranhoff—but everything else—and more—is in *The Bard's Tale*, a wondrous new adventure game from Electronic Arts. Two seemingly normal 5 1/4" disks can now transform your 64 into the world of Mangar and the blighted city, Skara Brae.

In its general approach, *The Bard's Tale* is like any number of role-playing fantasy games. A band of intrepid adventurers fights its way through foes both magical and mundane. Eventually, some elusive, mystic goal is achieved. Cannons fire, music swells, and everybody goes home happy.

The excellence of *The Bard's Tale* stems not from its departure from this basic idea, but rather from its depth of concept and brilliance of execution. The program apparently represents over 400K of machine language, and it certainly looks like every bit has been put to good use.

The game is a graphics adventure rather than one based on text and a parser. All player options are presented in the form of smoothly scrolling menus that appear in a special message window. Simultaneously, another window displays graphics. These may be of monsters, buildings, or members of your party. Many of them are cleverly animated, and most are works of art.

Your reactions to what you see in the display are transmitted through the keyboard, either in single keypresses or brief codes. Movement is also controlled through the keyboard.

Beyond simple mechanics, the game unfolds to reveal level upon level of thought and challenge. Overall strategy is much as indicated in Tranhoff's letter: Find the Review Board, then learn and grow stronger, and eventually topple Mangar himself.

Tranhoff is not the bard supplied on the character disk, but you could create him. An option exists for creating all or any of the members of your band. Attributes are assigned randomly, but you can repeat this stage until you're satisfied with the strengths of a character. You must be careful with the newly born; they are terribly vulnerable in the streets and dungeons of Skara Brae. Some have valuable characteristics not available to those already on the disk. Nurturing new characters may become an important element of strategy at the higher levels of play.

Another fascinating area of gameplay is the use of magic. *The Bard's Tale* offers an array of 85 powerful spells and a complex system of ranking spellcasters. As magic users rise through the various levels and evolve into different classes, more of the spells become available to them. Optimizing spell use and employing it effectively in combat is intriguing and—eventually—rewarding. Any Bards in your party possess songs of magic, but no initial knowledge of their purposes.

A few final points. Players must explore Skara Brae's dark places to progress satisfactorily. These are contained on the second disk, the Dungeon Disk. Clues to find the first of them are packaged with the game. After that, you're on your own. Good luck with your searching, and don't come to depend too much on your equipment or party members. Be prepared to reclaim earlier incarnations from disk. For this reason, it's a good idea to play with two character disks, backing up any party member whose powers increase dramatically.

Working out a method of dealing with character disks is an area that may

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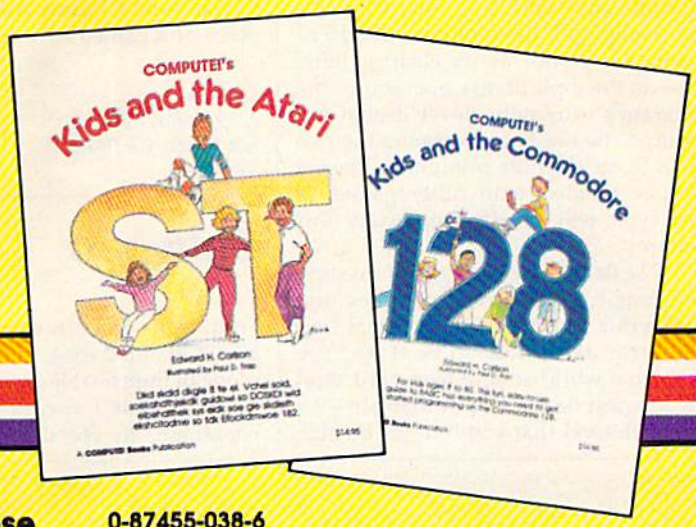

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be somewhat confusing. There's nothing wrong with the program, the documentation is not at its clearest here. Also on the topic of disk operations, the program's extremely clever design has reduced the need for swapping the two disks to an absolute minimum. Players who've tangled with other games of this type will greatly appreciate this feature.

The Bard's Tale is a story of mystery and magic. It tells of a complex and wonderful world where monsters lurk and great deeds wait to be done. You enter that world at your own peril. And the greatest danger is not Mangar—it's the likelihood that you'll never be able to tear yourself away from this masterpiece of a game.

—*Lee Noel, Jr.*

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Ballyhoo

From up in the bleachers, the circus is all glitter and daring, a magical kaleidoscope of improbable images. But watching the circus I always want to sneak backstage, to see the performers between acts and explore the shadowy world lurking beneath all the glitz. At last I've found the opportunity with *Ballyhoo*, Infocom's richly evocative, often exasperating, and very clever new text adventure.

The game begins as the circus performance ends. You are prowling around behind the big top, trying on stray masks and peering into the prop tent, when you overhear a conversation between the circus boss and a detective about the mysterious disappearance of the circus boss's daughter. Neither the boss nor the detective sounds terribly concerned or competent, so you valiantly resolve to find her on your own. Thus begins your foray into the seamy underworld of the circus.

Once you become immersed in the game, though, you may discover that your mission to find the abducted girl becomes secondary to exploring the bizarre and chimerical world around you. Sympathetic as you are to the girl's plight, you can hardly pass up the opportunity to walk a tightrope, watch an impromptu clown act, play with the exotic animals, or be hypnotized by Rimshaw the Incomparable. And often in pursuing these seemingly pointless diversions you can pick up some clues to the mystery.

But *Ballyhoo*, true to the Infocom tradition, is not for the impatient. Clues are hidden under layers of red herrings; some maneuvers have to be repeated two or three times before they'll work, while others are stubbornly refused; and each of the circus folk, from the tiny midget to the 827-pound Tina, is evasive when not downright cantankerous. Even the seasoned Infocom player is well-advised to draw a map, take copious notes, and leave no gorilla suit unturned.

While the game can frustrate—don't expect to complete it in a day—it can also charm. Great care was taken to evoke the atmosphere of the circus: You hear a calliope in the distance, you smell the musty elephant tent nearby, you feel the rough canvas of the tent as you sneak behind the big top. Many of the scenarios and props are added solely for their humor. And often the responses to your commands are whimsical or ironic.

The parsing in *Ballyhoo* is surprisingly flexible. You can, for instance, make commands such as "Take the apple. Polish it. Put it in the box." or "Drop all except the mask and the cheese morsel." You can also ask questions of specific characters, or use invaluable Infocom commands such as VERBOSE (for a thorough description of each location) and OOPS (which allows you to retype only the word you typed incorrectly in the last sentence).

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the packaging of *Ballyhoo* is splendid. The game comes with a circus ticket (or *Annie Oakley*, in circus lingo), a balloon, and a superbly illustrated circus program (or *bible*). Included in the booklet are a brief history of circuses, a colorful description of each of the key *Ballyhoo* characters, and a glossary of circus jargon (so that you too can toss around terms like *Annie Oakley, bible, lotlice,* etc.). There are also several pages of clearly written instructions, explanations, and tips. But don't be misled: The mysteries of *Ballyhoo* are not easily unraveled. Or, as the program has wryly told me more than once, "You'll have to do that yourself."

—Joan Rouleau

Infocom, Inc.
55 Wheeler St.
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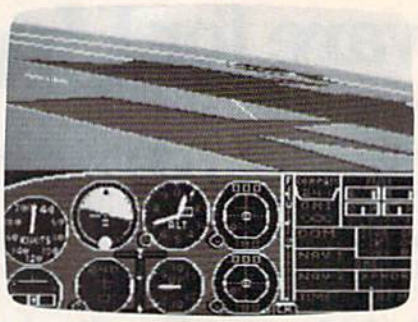
Jet

For flight simulation fans, there's more fun on the horizon. *Jet*, subLOGIC's latest addition to an ever-growing family of flight software, is an upscale, friendlier version of *Flight Simulator*. There are several points which draw an interesting comparison of the two.



First, *Jet* is easier to fly—especially for novices. All you have to do to get airborne is throttle up with the + key, and pull back on the joystick. You have the opportunity to look back and see the airstrips disappear more quickly and at a sharper angle than with *Flight Simulator II*. You can select a land-based craft or take off from a carrier at sea. When flying the land-based craft, you pilot an F-16, a ship modeled after its versatile and powerful namesake. If the carrier-based option is selected, an F-18 is used. The carrier-based takeoff requires more tries to master. Generally, though, getting in the air is not difficult.

Jet offers some features for arcade fans. Designer Bruce Artwick has filled in the details from the outline of the "WWI Ace" scenario presented in *Flight Simulator II*. Complete with dogfights, *Jet* provides computer-controlled radar tracking, heat-seeking missiles, and enemy aircraft that maneuver with apparent intelligence. Take some target practice in the Target Strike Game, in which there are air-to-ground missiles, machine guns, and smart bombs. The enemy is land-based, and seeks you out relentlessly, turning your screen to a streaming flash of red and yellow should it make contact. Three-dimensional graphics allow clear views of the enemy. (But fire *before* you see the whites of their eyes.) If it appears that you're in danger of losing your plane, don't worry: *Jet* includes a cockpit ejection system. You can always bail out and parachute to safety.

A featured bonus with *Jet* is its compatibility with any of the *Flight Simulator* Scenery Disks. You can fly it to New York, San Francisco, Albuquerque, or Los Angeles, or anywhere in the charted world of flight simulators.

Getting started might typically go like this: Take *JET* out of the hanger and taxi out a bit to the runways. Press C to get a view from the control tower, and then turn the craft until it faces the tower. Hit the thrusters and take off right by the tower—not something you'd want to try in real aviation. What you see is a great computer program doing what it does best—and letting you have some fun.

—David Florance

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(Scenery Disks, $19.95 each)

Battle of Antietam

Having grown up near several major Civil War battlefields, I developed an early interest in this special period of American history. Being able to explore the woods and fields of so many legendary exploits made the events of the Civil War more real and personal than the history I was taught in school.

So when I saw the package for *Battle of Antietam*, a recent release for the Commodore 64 from Strategic Simulations, it was only a question of how many minutes it would take before I had the game up and running.

I began by playing the basic game, suitable for beginners, before moving up to the more difficult and demanding intermediate and advanced levels. To begin each game, the forces are marshalled in their historical positions, where they stood at sunrise on September 17, 1862. The Union force consists

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of over 67,000 troops, while the Confederacy has only about 35,000—close to half the size of the Union army. (Lee had mistakenly divided his force, sending half to seize the Federal garrison at Harper's Ferry.) Although the North is overwhelmingly superior in numbers, the South can overcome seemingly hopeless odds, thanks to errors made by the Union command, which the program simulates rather effectively, and by careful, tactical planning.

Each turn, consisting of several phases of action as you command your forces against the computer or a human opponent, advances the clock one hour. Many options are available, and much is to be considered as you command your troops. Should you press the attack? Or maybe it would be best to allow the men a chance to catch their breath as fresh troops are brought up from the rear. Is now the right time to launch a counter-attack?

The simulation is quite involved. I was surprised to discover that as I commanded my forces through the battle hours of 6 a.m. to 5 p.m., I used as much (or more) time as the actual battle: Each time I played a complete battle, I spent at least 12 hours. Fortunately, a save option is included, and available often during the game. The computer is a formidable opponent, and will prepare you quite well for an encounter with a human opponent.

The Battle of Antietam is a must for anyone with even a mild interest in the Civil War. The simulation is easier to understand than many others of its kind. Included in the manual—which offers a thorough treatment of the battle—are organizational charts for both sides, and the complete order of battle. A colorful plastic laminated topographical map of the battlefield is included, and you'll find yourself referring to it often as you plan your strategy, looking to take advantage of the roads for troop movements and the hills for positioning your artillery. At the end of the game, occupation of several key road intersections is worth bonus points, and you'll be using the map to locate these crossroads, then dispatching your troops to seize control or defend them.

Many factors, including rate of fatigue, resupply, disruption of troops, and so on, are used to determine the outcome of a clash. And each encounter is resolved down to the man. You'll sense a feeling of overwhelming despair as the casuality rate climbs higher by the hour. Occasionally you'll feel yourself reeling from a report that a division lost somewhere in the smoke and noise of the battle has lost over a hundred men in a brief moment. You may even receive reports of entire companies being eliminated.

The value of SSI's *Battle of Antietam* may ultimately be that you'll decide to visit the library or even the battlefield to learn more about this battle's significance in one of the most important periods of American history. In that light, it's more than just another game.

—George Miller

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Leader Board: The Pro Golf Simulator

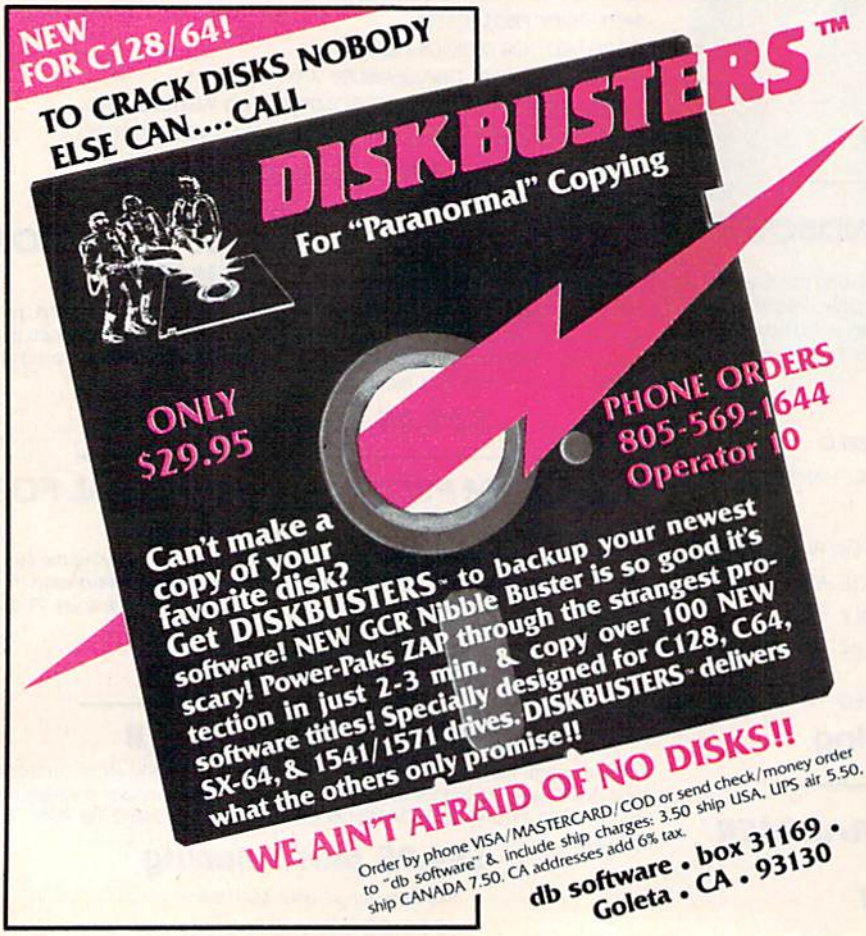
Golf can be a game of simple beauty, played on quiet mornings when the dew is still thick on the greens. Or it can be one of the most frustrating experiences, where clubs fly farther than the ball.

Leader Board, from Access Software, makers of the popular *Beach-Head* and *Beach-Head II*, can duplicate either definition of golf quite nicely. This golfing simulation for the Commodore 64 will either make you grin as you sink that 45-foot putt, or make you howl with anger as you slice a dozen balls into the water beside the fairway. This is a compliment, a high compliment, on the game's realism. It's so much like the real game that you're tempted to play from an electric golf cart.

Three levels of play—novice, amateur, and professional—and four different 18-hole courses make *Leader Board* a game you can stick with instead of discarding after a couple of afternoons. A driving range is also available—use it before you begin serious play, if only to sharpen your shooting skills.

Plug a joystick into port 2, load the game, and you're ready to start. Up to a foursome can play *Leader Board* (each player takes his or her turn with the joystick). Enter players' names, choose the course, the number of holes you'll play (up to the entire 72), and the game begins.

Leader Board puts every decision and move in your lap, from selecting the right club to hitting the ball at the right moment. Using the joystick, you decide in which direction to hit, then swing away. Depending on the difficulty level, you may have to take the wind into consideration. A combination of pressing the fire button, holding it, then



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pressing again controls your backswing and wrist snap, sending the ball flying. You can swing as hard or soft as you want, even hook (make the ball curve left) or slice (make it curve right) around those doglegs. Once on the green, where you can use your putter, you have to read the break, or how the ball will curve, as well as the slope. Again, you control the amount of power you put into the swing. If you're on target, you'll hear a comforting *thunk* as the ball lands in the cup.

All this makes *Leader Board* a game worth playing. What makes it worth remembering, and playing again and again, is its graphics. This game is simply amazing—there's no other word for it. With no disk access, the screen changes from scene to scene, showing your present perspective of the pin. Hit the ball into the water and a small splash appears. Your golfer's swing (each player's character wears different colored shirts and pants—only male figures for some reason) is something you have to watch to appreciate. It's so smooth that you could use it to improve your real game. And when the ball leaves the tee, the golfer lifts his head to follow the ball!

Shadows beneath the flying ball, balls which bounce as they land on the fairway or green, and even balls which hit the flag. Sound effects add to *Leader Board*, letting you hear the *thock* as the club meets the ball and the splash as the ball hits water.

Score is kept as in real-time golf. Color-coded birdies, eagles, bogies, and pars are put on the leader board shown at the end of each hole. You can see at a glance the present position of each player, even while you're playing a hole.

The only thing missing from *Leader Board* is sand traps. The only hazard is water, which is all over the place. Islands, peninsulas, and narrow necks of land are the only way to the green. One more thing I'd like to see in the game: You can't tell where the green actually starts since it's the same color (green) as the fairways.

(One interesting note about this game's copy protection: The disk itself is not copy protected, so you can easily make a backup copy. However, a piece of plastic with a very small resistor (often called a *dongle*), which comes with the program, must be inserted into the cassette port in order for *Leader Board* to work.)

Tee up a ball, ask your imaginary caddie for a club, and plant your feet firmly in the grass.

Swing and watch it fly. *Leader Board* is fun, a lot of fun, and as addicting as the real game. Best of all, there are no green fees.

—Gregg Keizer

Access Software, Inc.
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Votalker Speech Synthesizer

Over the years Votrax has built a reputation for producing high-quality speech synthesizers. One point in their favor is that they design their own speech chips; their engineers aren't limited to what's currently available. Votrax chips can be found in a variety of other companies' speech synthesizers, so even if you've never seen a Votrax-brand speech synthesizer, you've probably heard the sounds made by one of their speech chips.

Until recently, their products have been somewhat high-priced for the Commodore market. A year ago, I experimented briefly with a Votrax

synthesizer which, with the proper cable, would work with a Commodore 64, an Apple, an IBM, or several other computers. The suggested retail price was in the $300 range, more than what you would have paid for a 64 at that time. Votrax gave you Rolls-Royce quality at Rolls-Royce prices.

The recently released Votalker cartridge for the 64 is not only an excellent speech synthesizer, it also costs less than $100. It has the Votrax quality you'd expect, at an affordable price. To put it simply, the Votalker is a great value. It has the standard features found on other speech synthesizers—and more. It's compatible with both the 64 and the 128 (in 64 mode).

The Votalker fits into the expansion port and, like most cartridges, allocates 8K of memory for its own use. Programming speech is simple. Type SPEAK "HELLO. I AM A COMPUTER." and it pronounces the words inside quotation marks. It's good at recognizing our strange spelling conventions and translating them into properly spoken words. Once in a while it will make a mistake, which can be corrected by a creative misspelling. The word "don't" sounds too much like "dawnt," for example, so you have to type "doant" to get the proper pronunciation.

You can access the SPEAK command in both immediate and program modes. The Votalker takes words or phrases inside quotation marks, as well as numbers, string variables, and numeric variables. Arrays are also accepted. SPEAK is as flexible as the BASIC PRINT command.

Nine volume settings allow you to program a shout, a whisper, or something in-between. Four pitches can be employed to modify the tone, very important when you want to emphasize a certain word or phrase: Do *you* like anchovies? Do you *like* anchovies? Do you like *anchovies*?

The inflection of the Votrax voice, like most other speech synthesizers, is best described as a monotone with a slightly Scandinavian accent. But judicious variations of pitch and volume can make the voice sound much more natural. In addition, a knob on the side of the cartridge can be adjusted to affect the rate of speech. Youcanspeakfastlike aFederalExpressad, or. speak. very. slowly. The knob controls the overall speed; if you want slight pauses inside a sentence, you can insert various punctuation marks (a comma is a short pause, while a period provides a longer pause).

Many speech synthesizers don't make any provision for controlling the voice speed. They talk at one rate, period. If you have to listen to more than a paragraph or two, the words start to drag. According to a Votrax representative, most blind people can understand extremely fast speech, faster than a sighted person could follow, possibly because blind persons aren't distracted by visual cues. So reading through (or listening to) a long document can be vastly speeded up with a simple turn of the Votalker's rate knob. Those of us who can see a computer screen might consider a speech synthesizer a novelty (Listen, Mom, the computer can talk!). But a computer that can't talk is pretty useless to a blind person. And a typical slow-talking speech synthesizer takes too long to read through even a short story. The adjustable rate is a valuable feature of the Votalker, especially for sight-impaired computer users.

There are several other options available. You can choose to have shifted characters ignored (if you're in uppercase-graphics mode) or pronounced (if you're in upper/lowercase mode). In some cases, you might want punctuation marks to be spoken—the word "comma" instead of a short pause. Turning on *verbatim* mode gives you this choice. In *character* mode, every word is spelled out. You won't hear the word "hello," you'll hear the letters H-E-L-L-O. This can be very useful when you're double-checking a program you typed in from a magazine. These options can be joined with *echo* mode, where everything printed to the screen is also spoken by the Votalker.

The Votalker speech chip is phoneme-based rather than word-based (for example, the word "hat" is made up of three phonemes: an H sound, a short A, and a final T), so an infinite number of words can be spoken. Some word-based speech synthesizers have a limited number of words—usually around 200—that can be pronounced; if you ask for an alien word, they'll ignore it. Because it pronounces individual sounds, the Votalker is more flexible than some other speech synthesizers.

As a bonus, Votrax includes a disk containing *Trivia Talker I*, a trivia Q and A program written in BASIC. (An upgraded version, *Trivia Talker II*, which offers clearer sound, is available separately for $39.95.) It vividly illustrates one of the many applications for speech in a computer program. Questions don't just print to the screen, they're also spoken. Shades of *Jeopardy.* You can personalize the questions with the Editor program. You might write a question that asks "What is the most embarrassing thing that ever happened to Uncle Greg," followed by four answers. You could create a range of

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games: silly quizzes for a social gathering to serious educational programs (a history or spelling game for schoolchildren, say).

There are a few deficiencies which, while not major, should be mentioned. The trivia game runs too slow, probably because it's written in BASIC. After answering a question, you must wait for the score to be updated and the new question to be printed. It's sluggish—but it's free, so why complain? The documentation covers the necessary points for programming the Votalker in BASIC, but barely hints at what's necessary to write machine language programs that can speak. Some coverage of memory usage would have been nice.

These quibbles don't detract from the overall quality of the Votalker. This speech synthesizer does more than most others. The price is reasonable. And, if you're looking for some ready-made software, the trivia game is fun.

—Todd Heimarck

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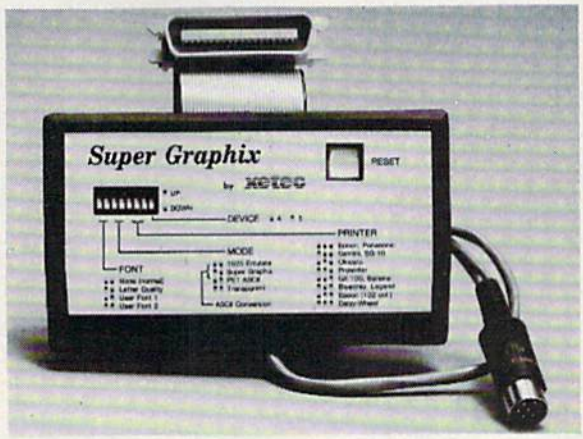

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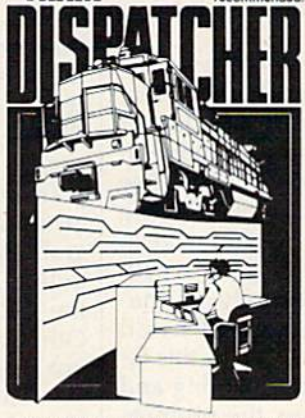

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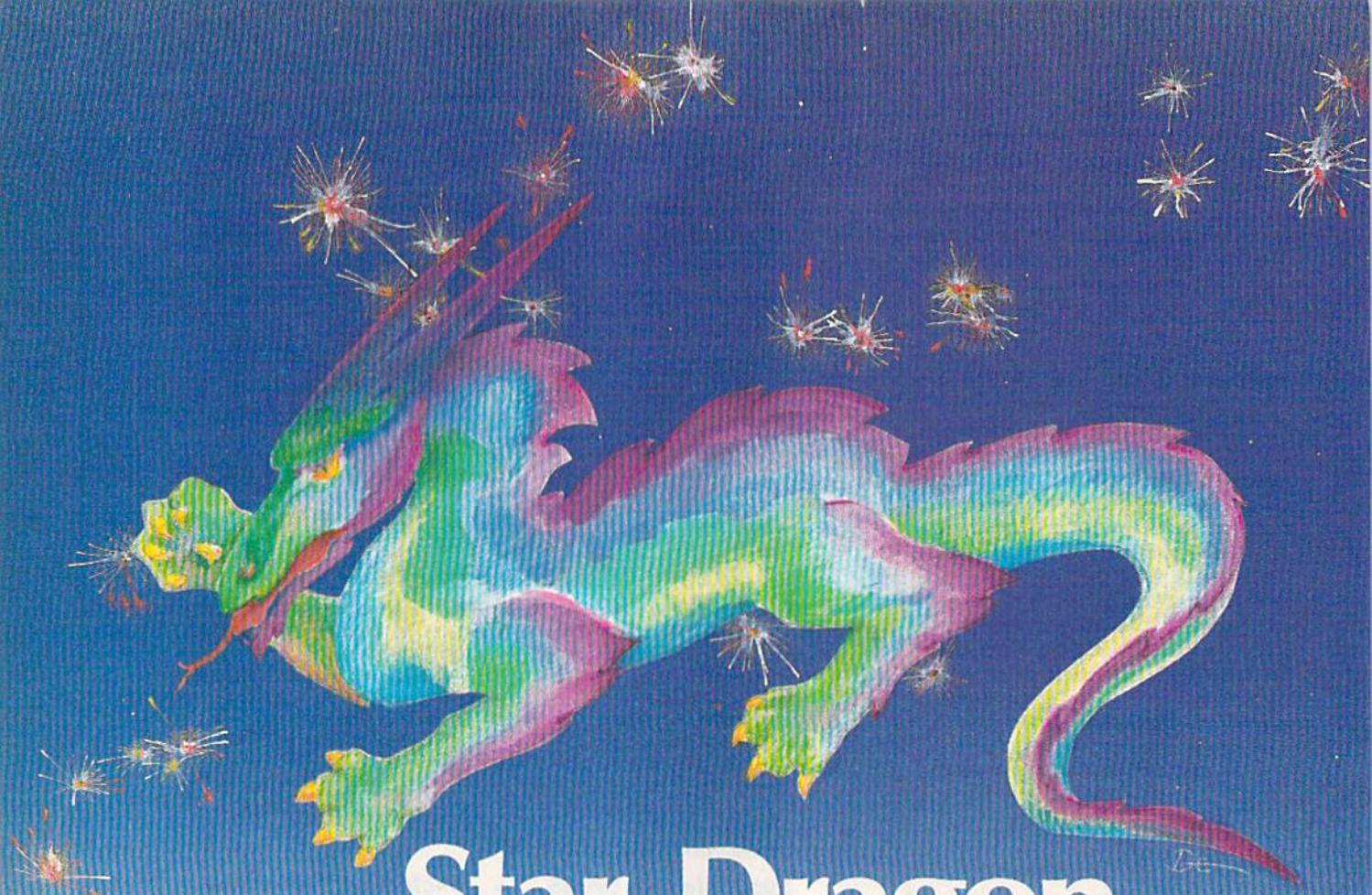

Star Dragon

Sean D. Wagle

And you thought the 64 could display only eight sprites. This short machine language game puts 16 on the screen. Or does it?

Sprites, those movable object blocks you create through a series of POKEs, are one of the most dazzling game elements available for the Commodore 64. You can create sprites of any shape, color them, move them, make them collide, even hide one behind another. But you can't have more than eight on the screen at any one time.

But with a bit of fancy dancing in machine language (ML), you can make it *seem* that there are more than eight sprites. "Star Dragon," an arcade-style game for the 64, uses a short machine language routine which temporarily moves all eight sprites to another location on the screen. *Temporarily* is the key word here, for the ML routine, listed as Program 1, "16," moves the sprites for only 1/60 second, then returns them to their original positions. As you'll see later, it's easy to use this 16-sprite feature in your own games.

Head First

You need to type in and save two programs to play Star Dragon. First, enter Program 1—a BASIC loader which puts the 16-sprite routine in memory—and save it to disk. (See instructions below if you're using tape.) Use *16* as its filename. Next, enter Program 2, the game itself. Since it's written entirely in machine language, you'll need "MLX," found elsewhere in this issue, to type it in. After loading and running MLX, answer the prompts for the starting and ending addresses with:

Starting Address: C0F0
Ending Address: C79F

Use MLX to type in the Star Dragon data from Program 2 and save it to disk as STAR.

It's a two-step process to run Star Dragon. First LOAD"16",8, then type RUN and press RETURN. You'll be prompted to enter a starting address. Enter 49152. After a moment, 16 sprites will appear on the screen. *While they're on the screen,* type LOAD"STAR",8,1, then press RETURN. Finally, when the message READY appears on the screen, enter SYS 49392, press RETURN, and the game begins. If that seems too complicated, use Program 3 to perform all these steps automatically. (When using Program 3, you must omit the {CLR} in line 100 of Program 1, as well as the PRINT"{CLR}": in line 290. Otherwise, the boot program will not work properly.)

The procedure is a bit different if you're using tape. It's necessary to load the data for Program 2 before starting the 16-sprite ML routine because the sprite routine's raster interrupts will disrupt tape loading. The easiest solution is to create a modified version of

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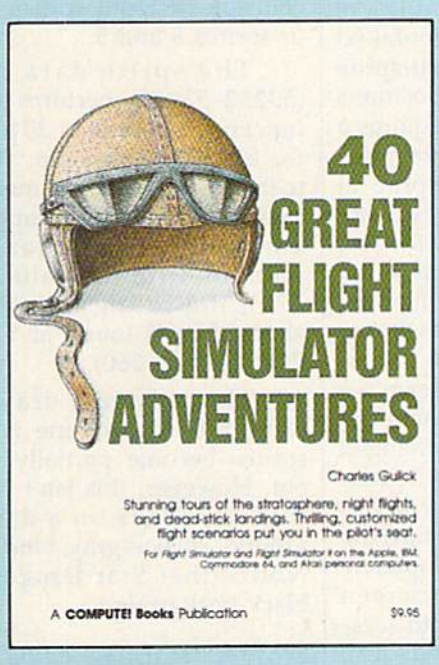

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Program 1. When typing in that program, replace lines 100 and 290 with those shown below:

```
100 PRINT"{CLR}":IF SA=0 THEN
    {SPACE}SA=49152:LOAD"STA
    R",1,1
290 POKE53178,255:POKE53179,25
    5:POKE53281,0:SYS 49392
```

Then use MLX to type in Program 2. When you've entered all the data, save it immediately following the modified Program 1 on tape. Now, to run Star Dragon you need only load and run the modified Program 1.

The trail of star-like sprites, the Star Dragon, slithers and slides across the screen. The Dragon Gun at the bottom of the screen is your only defense.

Move the gun back and forth across the screen by pressing the + key to move left and the − key to move right. Hitting the CTRL key fires the gun. (A fourth key, SHIFT-LOCK, pauses the game for those times when your fingers tire.)

The object of the game is simple: Hit the dragon's head. If you hit anywhere else on the dragon, the shots just ricochet. Unfortunately, these bouncing bullets destroy your gun as well as the dragon. Don't let the dragon touch the gun, either—its poisonous barbs will ruin your weapon. You have three guns at hand. Lose all three and the game's over.

Scoring is straightforward. The first and second dragons of each level are worth 20 points when eradicated. The third is worth 60 points. Star Dragon has ten levels, with a total of 30 dragons.

16 Candles, 16 Sprites

The key to Star Dragon is what appears to be 16 sprites. Actually, there aren't more than eight on the screen at any one time, but since each group of eight is shifting every 1/60 second, a speed much too fast for our eyes to follow, it seems like there are 16. It's something like a movie, which displays 24 still frames a second. Each individual frame doesn't move, but put them together at that speed and the illusion *is* movement.

The machine language routine listed as Program 1 wedges itself into a new raster interrupt address. It's entirely relocatable, and advanced programmers may want to use it in their own games. Just include lines 100–240 and 300–410 from Program 1 in your program, and you'll have 16 sprites to work with instead of 8.

The routine in Program 1 moves the sprite registers from their normal locations to addresses 53170–53247. Take a look at the table below for the new register locations if you're programming with 16 sprites. You POKE values to these new locations just as you do for locations 53248–53294 when using the normal eight sprites—with a few exceptions.

One major difference is in the locations that control horizontal (x) position. In the normal eight-sprite system, visible horizontal positions range from 24–344. This requires a nine-bit value for a horizontal position—eight bits for each sprite in the even-numbered locations 53248–53262, plus a bit for the highest bit of each sprite's position in location 53264. Those familiar with programming sprites know that this causes a problem whenever a sprite crosses the "seam"—the point on the screen where the horizontal position value changed from 255 to 256. The 16-sprite routine avoids this problem by dividing the x-position by two. Thus, the sprite now disappears completely off the right edge of the screen when the value POKEd into locations 53184–53199 exceeds 172 (half the old value of 344).

Another difference is that the collision registers (53180–53183) contain only the value for those collisions occurring at the moment the register location is checked, instead of maintaining a value until read as is the case for the normal collision registers. Note that collisions between sprites 0–7 and sprites 8–15 cannot be detected. For example, if sprites 1, 5, 8, and 14 are all in the same position, then the collision between sprites 1 and 5 can be detected, as can the collision between sprites 8 and 14. However, there is no provision for recognizing the collision between sprites 1 and 14 or sprites 8 and 5.

The sprite data pointers (53232–53247) perform the same function as locations 2040–2047 in the eight-sprite system: They point to the 64-byte block of memory that defines the sprite's shape. For example, Program 1 loads these pointers with the value 11 (line 270), indicating that the sprite shape data is found at 11 * 64 = 704 (see line 260).

The only real drawback to using this ML routine is that the sprites become partially transparent. However, this isn't noticeable if the sprite is on a dark background, such as gray, blue, or black. Notice that Star Dragon uses a black background.

See program listings on page 101.

Sprite Registers For 16-Sprite Routine

Location Hex	Location Decimal	Function
CFB2	53170	Sprites 0–7 multicolor off/on bits
CFB3	53171	Sprites 8–15 multicolor off/on bits
CFB4	53172	Sprites 0–7 x expansion bits
CFB5	53173	Sprites 8–15 x expansion bits
CFB6	53174	Sprites 0–7 y expansion bits
CFB7	53175	Sprites 8–15 y expansion bits
CFB8	53176	Sprites 0–7 sprite display priority
CFB9	53177	Sprites 8–15 sprite display priority
CFBA	53178	Bits to activate sprites 0–7
CFBB	53179	Bits to activate sprites 8–15
CFBC	53180	Collisions between sprites 0–7
CFBD	53181	Collisions between sprites 8–15
CFBE	53182	Sprites 0–7 collision with background
CFBF	53183	Sprites 8–15 collision with background
CFC0–CFCF	53184–53199	Sprites 0–15 x (horizontal) position
CFD0–CFDF	53200–53215	Sprites 0–15 y (vertical) position
CFE0–CFEF	53216–53231	Sprites 0–15 color registers
CFF0–CFFF	53232–53247	Sprites 0–15 data pointers

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Predictor

John Krutch

How do your wits match up against your computer's? You might be in for a surprise. A challenging machine language game for the 64, Plus/4, 16, and VIC-20.

Children sometimes play a game called "Matching Pennies." The rules go like this: The first player covers a penny with his or her hand. The second player has to guess which side of the coin the first player picked, and place a penny showing heads or tails. If the two coins match, the second player guessed correctly and keeps both. If the pennies are different, the first player wins both coins.

The key to guessing correctly is to find a pattern in the first person's choices. To win as the first player, you should either pick heads or tails randomly or look for a pattern in the second player's guesses.

"Predictor" is a variation on matching pennies. The play is simple—there are only two possible moves. Just choose to go left or right—the computer will predict each move based on its assessment of your previous moves. The first one to reach 100 is the winner. Your job is to try to randomize your choices enough so that the computer makes the wrong predictions. Although you might think your computer is easy to beat, you're likely to be surprised.

The computer always plays the part of the guesser; that is, it tries to match your choice of left or right. If it made this prediction randomly, you'd give Predictor a 50/50 chance of being correct. But Predictor doesn't play to tie, it plays to win. By analyzing your past moves for patterns, it should have better than a 50 percent chance of being correct. You could call it a primitive form of artificial intelligence.

Behavior Patterns

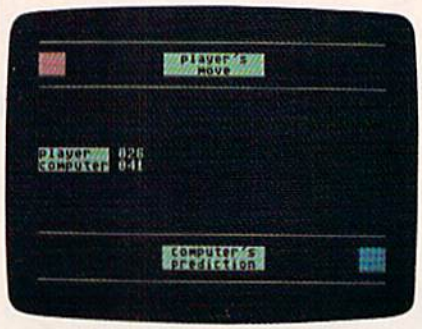
"Predictor" saves the choices you make, as well as the response (left or right) you give after any particular pattern of moves. The response you most likely chose in previous similar situations is the one that will be predicted for your move when that pattern reoccurs. (You can test this for yourself by entering any repeating pattern of moves; the program will very quickly notice the pattern and predict your response.)

Predictor gets smarter after the first dozen or so moves, as the computer becomes aware of your choice patterns. If you play a fast game by making random choices as fast as you can, you probably won't do very well—it's difficult to truly randomize your pattern of choices like this. The best way to beat Predictor is to proceed slowly, thinking out your moves and attempting to deceive the program.

But there's a catch. If you find yourself falling into a certain series of moves, you might recognize your own pattern. But breaking out of one pattern could easily put you into a new (just as recognizable) pattern.

Getting Started

There are three versions—separate programs—of Predictor: one version for the 64, one for the Plus/4 and Commodore 16, and one for the VIC (with disk only). After typing in the program, save a copy. To play, load and run the program. When it's through loading, there will be a screen message informing you to type a command to activate the game (for the 64, SYS 49152; for the Plus/4 and 16, SYS 15560; and for the VIC, LOAD "PREDICT.OBJ" ,8,1 and then SYS 6892). *(Note to VIC users: When typing in the program, be sure to have a disk in the drive. The program creates a separate machine language program that can be loaded and run with the commands above, because the VIC's memory is too small to store all the data necessary for the program.)*



The computer has a significant lead in this match, although it has just missed guessing this player's move.

When you first begin the program, you see two corridors, one near the top of the screen, the other near the bottom. Your moves are recorded in the upper area; the lower one displays the computer's prediction of your move.

You can make one of two moves: left or right. To move left, press the left-arrow key—the far left key on the top row. To move right, press the DELete key— the far right key on the top row. (Note: Plus/4 and 16 users should use the ESCape and DELete keys for moving.) A square appears on the left or right side of the screen when you make a choice. At the same time, a square appears in the computer's corridor to show its prediction. If the computer matches your move, a noise sounds and a point is awarded to the computer on the scoreboard at the left center of the screen. If the computer guesses wrong, a pleasant musical tone sounds, and your score will be incremented by 1. The first to reach 100 points wins, after which you're prompted (Y/N) to play again. You'll find your computer a canny opponent and a good prognosticator.

See program listings on page 104.

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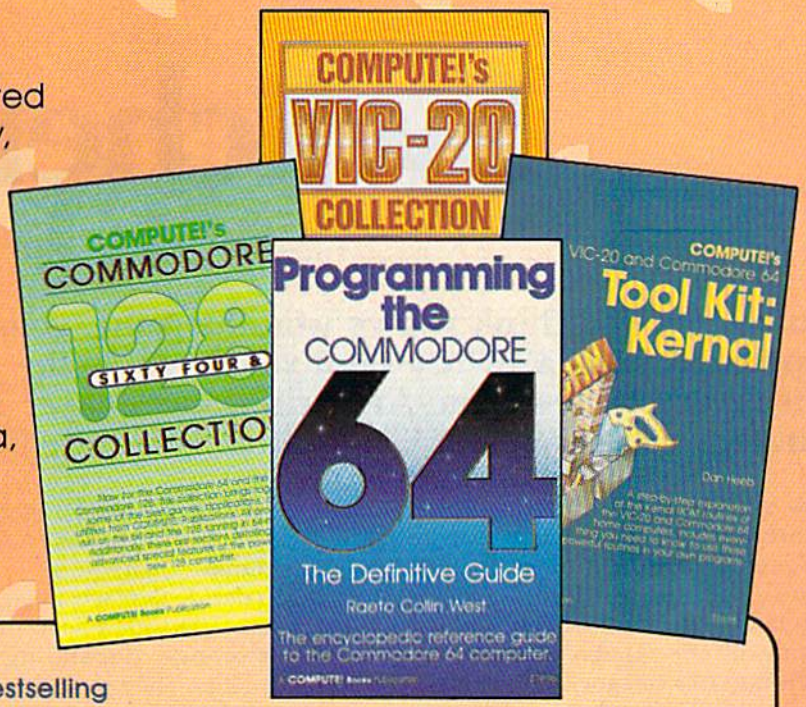

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Switcheroo

Kevin Mykytyn and Mark Tuttle

Just when you think you've won the game, your opponent pulls a switch—and you've got to devise a whole new plan. An exciting two-player strategy game for the 64. A joystick is required.

We're all familiar with games where players take turns placing pieces on a board or grid until there's a winner. Tic-tac-toe is probably the most widely known game of this kind. "Switcheroo" falls into this category, but it adds a few unique twists that make it quite challenging.

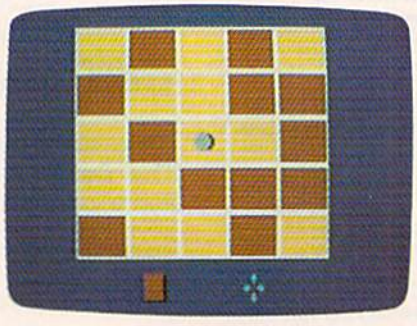
The object of Switcheroo is simple. You must get five of your pieces in a row—horizontally, vertically, or diagonally—while blocking your opponent's attempts to do the same. That sounds easy, but getting it done is a serious exercise in strategy. At any point in the game, a player may shift the pieces of one row or column by one space, effectively changing the complexion of the game.

Place Or Switch?

After typing in the program, save a copy. To play, load the game and type RUN. You're first asked if you wish to use one or two joysticks. Press the 1 or 2 key. If you're using just one joystick, make sure it's plugged into port 2.

Now the game begins. Player 1 controls the yellow pieces, while player 2 controls the orange ones. The screen displays a 25-square (5 × 5) grid with a circle in the center. Below the grid are two icons (symbols), a square and a four-directional arrow. Move your joystick left, to the square icon, if you want to place a square on the board. Move the joystick right, to the arrows icon, if you'd rather shift the pieces of a row or column.

If you decide to place, push the joystick left. The square icon turns yellow or orange, depending on whose turn it is. Then push the fire button to activate the circle icon. A tone sounds and the circle begins blinking. With the joystick, move the circle to the square where you wish to move a piece. Press the fire button again to put it in that position.



Both players have placed all their pieces. The only way to win now is with some fancy shifting.

If you wish to shift a row or column, first push the joystick right. The arrows icon turns yellow or orange. Press the fire button to activate the circle, then move to a square in the column or row you wish to shift. Press the fire button again. Finally, push the joystick up, down, left, or right—in the direction you want the row or column to shift. Each piece is moved one space in the direction you choose. Note that the last piece in a row or column wraps around to the first position. For example, if a row consists of orange, orange, yellow, orange, and yellow (OOYOY), a shift to the right will cause the row to be yellow, orange, orange, yellow, and orange (YOOYO). None of the pieces outside that row or column is affected.

If an illegal move is attempted (trying to place a piece on an occupied square, for example), the circle is returned to the center square of the grid and you must start your turn over. This feature can come in handy, however. If you decide you want to shift instead of place, you can make an illegal move and start your turn over.

How To Win

As you become more experienced at Switcheroo, you'll develop some winning tactics. These hints should help beginners. At the start of a game, placing is generally more valuable than shifting. After all, the goal is to position five in a row, and you can't win the game unless you've placed at least five pieces on the board. Also, if you shift a lot while your opponent places, you'll end up owning a distinct minority of the pieces.

Defensive play usually pays off. If you can block your opponent by placing (rather than shifting), so much the better. As the board fills up, shifting becomes more important. It's rare that a game will be won by placing. Usually, the victor will force a position where a shift wins the game.

See program listing on page 103.

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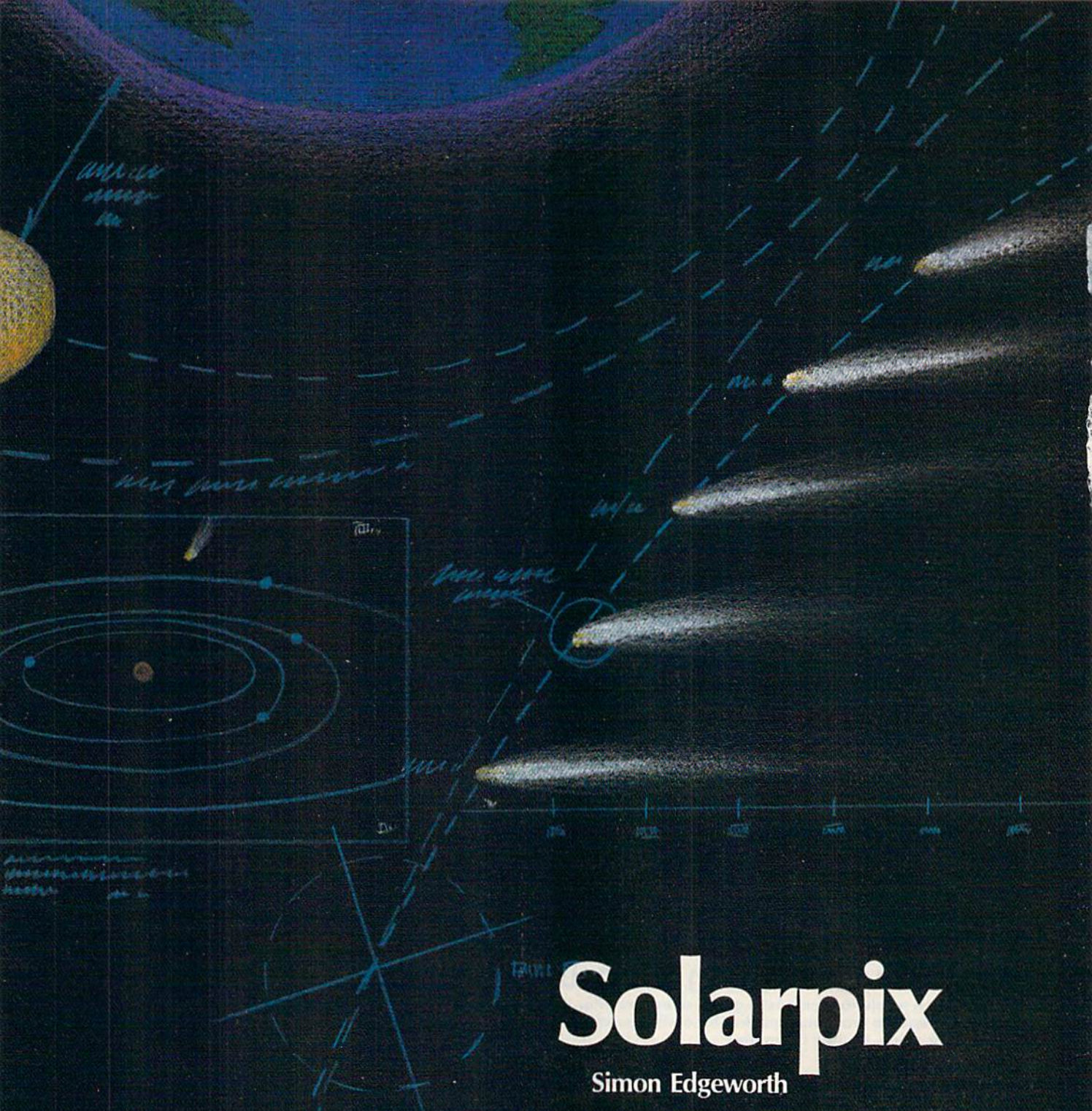

Solarpix

Simon Edgeworth

Set the solar system in motion with this series of astronomical simulations for the 64. You can also trace the orbits of Halley's and other comets, and look through a file of fascinating facts about our solar system.

Whether you're new to stargazing or a veteran astronomer, this easy-to-use demonstration of the planets and comets is fun to watch. The program is divided into four parts: Sun and Planets, which simulates the movement of the planets around the sun; Sun, Earth and Moon, which shows how the phases of the moon are created by its orbit; Comets, which shows the path of Halley's and other comets; and Facts, which lists the key properties of each planet and the sun and moon.

Type in "Solarpix" using the "Automatic Proofreader," published regularly in the GAZETTE, then type RUN. In the first part, Sun and Planets, you can watch the orbits of up to five planets at once. The sun is stationary at the center of the screen. Select the innermost and outermost planets you'd like to see, and a year from 1 to 2000. Press G to set them in motion, + to increase the speed, − to reduce the speed, and S to stop. Elapsed time is displayed in years on the right side of the screen.

Lunar Lore

The second menu selection, "Sun, Earth, and Moon," shows how the moon's orbit around the earth causes its different phases. The earth is shown orbiting the sun, while the moon orbits the earth. The distance between the earth and the moon has been magnified by 30 to make it visible. In the top right corner of the screen, the current appearance of the moon is illustrated. The elapsed time in days is displayed to the right. You can control the display using the G, S, +, and − keys as in the first part.

The moon takes 27.3 days to orbit the earth. However, it's 29.6 days from one full moon to the next. If you watch the display carefully, you can see why this is—the moon actually has to complete slightly more than one orbit around the earth to reach the same position relative to the sun.

Because the moon's orbit is slightly tilted, the moon, earth, and sun are normally never exactly aligned. On the rare occasions when they are, an eclipse occurs. If this happens at full moon, we see a lunar eclipse. If it happens at new moon, we see a solar eclipse.

Comets

The third menu selection shows what the orbits of comets look like. Planets and comets move in elliptical orbits, which look like flattened circles. The extent to which the circle is flattened is called its eccentricity, ranging from zero (circular) up to almost one. The eccentricities of the major planets range from Venus (almost zero) to Pluto (.25). A comet with an eccentricity of one or more would leave the solar system.

Enter a value between zero and .96 and press RETURN. Here are the names and eccentricities of some comets: Faye (.56), Finlay (.70), Enke (.85). To see a simulation of the orbit of Halley's Comet, enter .96R. The R stands for reverse, because Halley's Comet orbits in the opposite direction of the planets.

Notice that the speed of a planet or comet varies as it moves around its orbit. It moves slowest when it's furthest from the sun, and fastest when it's closest to the sun.

Facts And Figures

The last part of Solarpix provides some interesting facts about the solar system. From the menu, you can select a planet, the sun, or the moon, and view all the facts about it; or you can select a characteristic, such as mass or temperature, and compare the values for all the nine planets plus the sun and the moon. Because the distances from the planets to the sun are so hard to visualize, I've added "Drive Time," which shows the amount of time it would take to drive from a given planet to the sun while traveling at 55 miles per hour. For the moon, the drive time is given for travel from the moon to the earth.

Masses are given in units equivalent to the weight of the earth because the values in tons are too large to comprehend (the earth weighs about 6,588,000,000,000,000,000,000 tons). Densities are compared with water (notice that Saturn is less dense than water). Temperatures are average surface temperatures. Moons are listed in order of distance from their planet, starting with the closest. Moons listed as "X" have not yet been named.

For the amateur astronomer, here are a few technical details. In Solarpix, all orbits are assumed to be on the same plane. For Pluto, however, true elliptical motion is simulated. The planet screen is oriented with Pluto's aphelion on the right, and the positions of the planets are calculated from their actual positions on October 27, 1984. All of the graphics screens show views from ecliptic north.

If you have any questions about Solarpix, you may write to the author at: P.O. Box 26, West Upton, MA 01587. Please enclose a self-addressed stamped envelope.

See program listing on page 108.

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Faster Variables

Robert L. Raymond

As numeric variables are defined, their names and values are stored in memory just after the end of the BASIC program (except on the 128, where variables are kept in a separate section of memory). BASIC methodically puts together a list of all variables that have been used so far. When a new variable occurs in a program, its label and value are added to the end of the list.

Whenever a BASIC program needs to use a variable for any purpose, it must find that variable on the list. Starting at the beginning of the list, BASIC moves forward through memory until it finds the variable it's looking for. Since the list is built as the program runs, the variables defined first are first on the list.

These first few variables are always the fastest to be executed in a BASIC program. If you define a variable early in the program, it's near the beginning of the variable list, and BASIC will find it quickly when it's needed later in the program.

The following two programs illustrate this principle:

```
10 A=0:B=0:C=0:D=0:E=0:F=0:G=0
   :H=0:I=0
20 J=0:K=0:L=0:M=0:N=0:O=0:P=0
   :Q=0:R=0
30 S=0:T=0:U=0:V=0:W=0:X=0:Y=0
   :Z=0
40 TI$="000000"
50 FORX=1TO1000
60 Y=Y+Z
70 NEXTX
80 A1=TI:PRINTA1;"JIFFIES",A1/
   60;"SECONDS"
```

Note line 40, where the reserved time-keeping variable TIME$ (abbreviated as TI$) is set to zero. The related variable TI is checked in line 80. This is a standard way of timing the speed of a section of a program; set the clock to zero immediately before the routine, and then when the routine has finished, PRINT the value in the jiffy clock. (A "jiffy" is 1/60 second.) If the program added the two numbers only once, the times would be too small to measure. By performing the addition 1000 times, we're able to get a good average time.

This first program takes about seven seconds to run on the 64—VIC times will be somewhat faster, Plus/4 and 16 a little slower. A 128 in SLOW mode will be slower than other Commodore computers, while in FAST mode it will be faster than all of them.

Now change lines 50–70:

```
50 FORA=1TO1000
60 B=B+C
70 NEXTA
```

The program now runs in less than four seconds on the 64 (other computers will vary slightly, as above).

The two programs are almost exactly the same. What makes the second program faster? The three variables in the loop are defined early in the program. They're the first three on the variable list. In the first example, the variables X, Y, and Z were 24th through 26th on the list. If you perform more tests, you'll find that the alphabetical order makes no difference. So if X, Y, and Z are defined first, they'll be the fastest variables. You could also try other mathematical operations in line 60—multiplication, division, and so on—to find out how much faster the early variables are.

The lesson for programmers is clear: Your programs will run faster if you arrange to put heavily used variables near the beginning of the list of variables in memory. This can be accomplished by putting "unnecessary" initialization statements for those variables near the start of the program. In some cases, saving a few microseconds won't make a noticeable difference in program execution. But the next time you have to sort a list of 500 items, the time saved could be significant.

Here's another idea for speeding up a program: Try the two programs above without the index variable after NEXT. That is, change line 70 to a NEXT with no variable following. You'll discover that programs run faster when you omit the variable after NEXT.

Faster Functions

Luis Fernando Carballo

In mathematics, a function is a procedure that takes one or more numbers as input and returns another number as its output. Squaring a number is one example—insert the number 12 and the square-a-number function returns the answer 144 (12 times itself).

There are at least two ways to square a number and, as we'll see below, one is significantly faster. First type in this short program and run it:

```
10 TI$="000000"
20 FORJ=1TO1000
30 A=53*53
40 NEXT
50 A1=TI:PRINTA1;"JIFFIES",A1/
   60;"SECONDS"
```

It's a fairly straightforward program which multiplies 53 by itself 1000 times. A 64 takes seven to eight seconds to finish the calculations. Now change line 30, so the program looks like this:

```
10 TI$="000000"
20 FORJ=1TO1000
30 A=53↑2
40 NEXT
50 A1=TI:PRINTA1;"JIFFIES",A1/
   60;"SECONDS"
```

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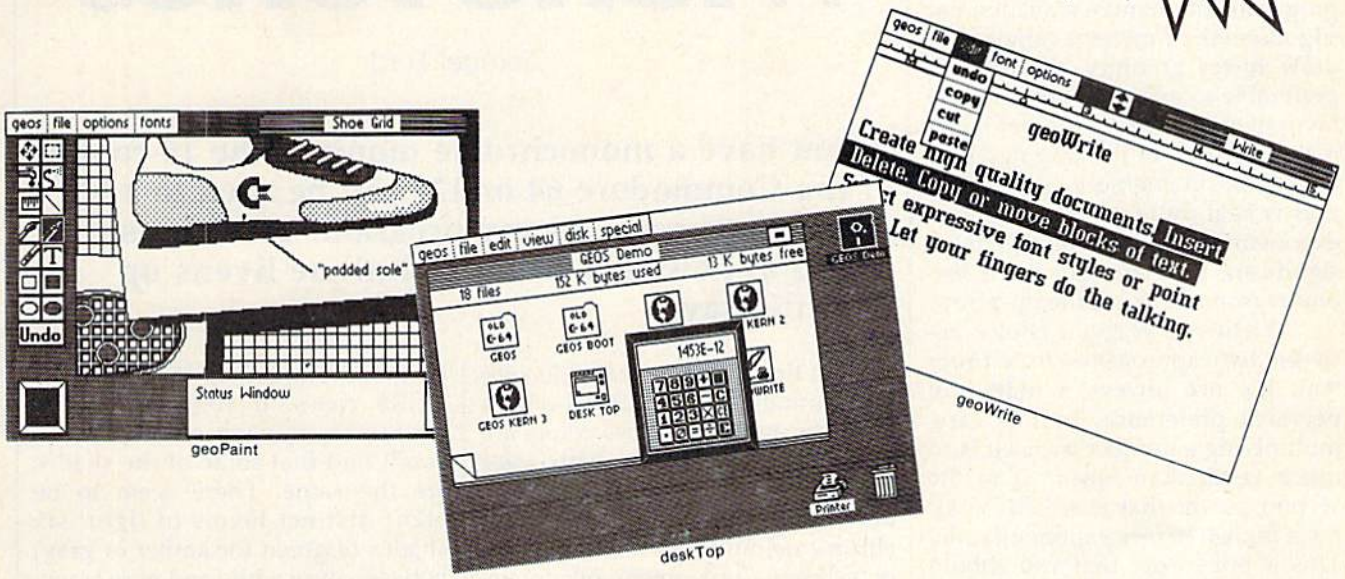

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This program performs the same calculation, but uses the up-arrow (exponentiation) operator. One thousand times through the loop, figuring out 53 squared, takes a Commodore 64 nearly 55 seconds, about seven times longer than the other program. Squaring a number is common in a variety of programs that handle statistics, use trigonometric functions (angles), or draw hi-res graphics. Clearly, it's preferable to avoid the up-arrow in favor of multiplying. Another factor is that because of the way numbers are stored in memory, multiplication is slightly more accurate than exponentiation. It's not usually a significant problem, but it's a second reason not to use the up-arrow.

When you've got a choice between two approaches to a problem, it's not always a matter of personal preference. In this case, multiplying a number by itself is so much faster than raising it to the second power that it would be almost foolish to pick exponentiation. This is not to say that you should never use the up-arrow; raising a number to the 1/3 power is the best way to find a cube root, for example. But if you need to square a number, you'll save time if you simply multiply the number by itself.

You can speed up the above programs even more if you insert variables into line 30. Try defining a variable B=53 in line 5 and then change 30 to A=B*B or A=B↑2. The programs will run a little faster because BASIC doesn't have to figure out that the characters "5" and "3" add up to the value 53. When B is predefined, BASIC can look up the value in variable B and act directly on that number.

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MonoTones

Samuel Ford

If you have a monochrome monitor, the 16 colors of the Commodore 64 or 128 can be used to add visual excitement to any program. You'll be surprised at how this clever technique livens up your display.

Each of the 16 colors available with a Commodore 64 or 128 is only a keypress away. But these colors are of value only to those with color monitors. Those of us with black and white televisions or monochrome monitors see no reds, blues, or yellows—just greens or ambers or grays. We don't get hues, we get shades.

It seems that Commodore's designers did not arrange the colors in any particular order—at least none that I can recognize. As an example, type in this two-line program and notice how the shades appear to be scattered. (Commodore 128 users should add a BANK 15: statement at the beginning of line 10.)

```
10 POKE 53280,0:POKE 53281,0
20 FOR A=0 TO 15:POKE 1024+A,
   160:POKE 55296+A,A:NEXT
```

This is the Commodore-assigned order of colors. There doesn't appear to be any significance to the order. But, if you look closely, you'll see that they can be rearranged, placed in order of intensity. Let's try that. Here are a couple of DATA statements that define what we'll call the "green scale."

```
100 REM ** DATA FOR COLOR POKES
    **
101 DATA 0,6,9,11,2,8,4,14,12,10,5,3,15,7,
    13,1
110 REM ** DATA FOR CHR$ COLORS
    **
111 DATA 144,31,149,151,28,129,156,
    154,152,150,30,159,155,158,153,5
```

The data in line 101 are the 16 colors arranged in order of intensity. The data in 111 are the 16 colors in the same order, but given as CHR$ codes. If you print a few characters in each of the colors, you'll find that some of the shades are the same. There seem to be eight distinct levels of light: six shades of green (or amber or gray) between pure white and pure black.

Now for the surprise: Type in the program that accompanies this article. You'll see an effect that's impossible on a color monitor. (Again, Commodore 128 owners should add the statement BANK 15: at the beginning of line 10.)

What the program does is print a short message in a box at the center of the screen, each time in a different color. But, since the colors are arranged in the "green-scale" order, the message appears to give off a smoothly pulsating glow. You could do the same kind of thing with the box itself, perhaps cycling colors opposite the message.

There are some fascinating possibilities with the application of this technique. For example: Using the data for the "green-scale" given as POKE codes, you could design a sprite that slowly flickers onto the screen, or have two sprites that collide, flash brightly, then fade. Since, when using the multicolor mode, all colors of a certain bit pair change color when the appropriate color register is altered, you might make a hi-res picture with flickering candles and shimmering fires. There are lots of possibilities that can give your monochrome monitor a whole new look.

See program listing on page 102.

Quick Key

James Nakakihara

This handy Commodore 64 utility can dramatically reduce the time required to type in BASIC programs, including those from the GAZETTE. It adds automatic line numbering, single key entry of any BASIC keyword, and even a numeric keypad.

Do you ever get tired of all the typing required to enter a BASIC program? If so, "Quick Key" may provide welcome relief. By pressing an alphabetic key along with either SHIFT or the Commodore key, you can have an entire BASIC keyword printed for you in just one keystroke. No more typing all five characters for PRINT; just type SHIFT-A. It's as easy as using ?, but has the added advantage of being compatible with the GAZETTE's "Automatic Proofreader" program. If you'd prefer some combination other than SHIFT-A for PRINT, that's no problem. Quick Key makes it easy to change the key definitions to suit your personal needs.

But what if you need to type one of the special graphics characters produced by using the SHIFT and Commodore keys? Quick Key is designed to avoid that sort of conflict. Since you almost always type the graphics characters as part of PRINT statements—and since you rarely type BASIC keywords within PRINT statements—the single-stroke keyword entry feature is disabled while typing within quotes. For example, if you activate Quick Key and type SHIFT-A, quote (SHIFT-2), SHIFT-Z, you should see:

```
PRINT"♦
```

The SHIFT-A outside quotes produces the keyword PRINT, but the SHIFT-Z within quotes produces the normal graphics character for that key combination.

Quick Key also provides for automatic line numbering and includes an added special feature to simplify the process of entering DATA statements. And a numeric keypad is provided for speedy numerical data entry.

Typing It In

Since Quick Key is written entirely in machine language, it must be entered with the "MLX" machine language entry program published regularly in GAZETTE. Be sure you have read and understood the directions for using MLX before you begin to enter the data for Quick Key. When you run MLX, you will be asked for the starting and ending addresses of the Quick Key data. The correct values are:

Starting address: C000
Ending address: C2B4

Now you can begin entering the Quick Key data. When you're finished, be sure to save at least one copy.

When you're ready to use the new commands, load the Quick Key routine with LOAD "QUICK KEY",8,1 for disk, or LOAD "QUICK KEY",1,1 for tape. (In place of QUICK KEY, substitute whatever name you used when you saved the program from MLX.) After the load is complete, type NEW and press RETURN before you attempt any other BASIC operations. (This is necessary to reset important BASIC memory locations and prevent an OUT OF MEMORY error message.) To activate the new features, type SYS 49152 and press RETURN. You won't notice any immediate changes, but now anytime you correctly enter a Quick Key command, you'll get the message QUICK KEY OK!. Use the Quick Key commands as you would any other BASIC command in direct mode. However, the new commands *cannot* be used within a program.

Using The New Commands

Quick Key adds the following new commands. Notice that each must be preceded by a + sign:

+AUTO *increment D.* Activates automatic line numbering. After you type in the first program line, the line numbers for all succeeding lines will be provided automatically. Each new line number is the sum of the previous line number plus the specified *increment* value. The optional parameter *D*, if used, will cause the BASIC keyword DATA to be printed following the line number. This is useful when entering a long series of DATA statements. When used in conjunction with the numeric keypad, this feature can save you a lot of time if you have many numeric DATA lines to enter.

For example, to have Quick Key increment by 10, just type:

```
+AUTO 10
```

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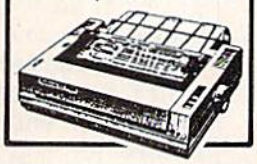

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Then type the first program line and press RETURN. Quick Key will provide the next line number—the first line number plus 10—followed by a space. If you want the keyword DATA to follow the line number, use:

+AUTO 10 D

To skip a range of lines, use either SHIFT–RETURN or the cursor keys to get to an empty line, then type the line with the next desired line number. Automatic line numbering will resume with the next line following the new line you just entered. For example, if you're using an increment of 10 and have just typed line 590, but want the next line to be 1000 rather than 600, you should press SHIFT–RETURN when the 600 is provided and type in the desired line 1000. Automatic line numbering will then resume with line 1010.

To cancel automatic line numbering, use either SHIFT–RETURN or the cursor keys to get to an empty line, then enter +AUTO (without parameters) and press RETURN. (SHIFT–RETURN appears to act like a regular RETURN, but any data on the line will not be acted upon or entered by the computer.)

+KEYC *letter, token.* Redefines a Commodore key combination to print a particular BASIC keyword. The table below shows the standard keyword definitions for all Commodore-letter key combinations. This command lets you change any of these to whatever other keyword you prefer. The *letter* parameter should be one of the alphabetic characters *A–Z*, and *token* should be the code number corresponding to the desired BASIC keyword, also found in the table at the end of this article. (The keyword code, or token, is the one-byte value that BASIC uses internally to represent a keyword.)

For example, to program the Commodore-Z key combination to print POKE, type

+KEYC Z,151

and press RETURN.

+KEYS *letter, token.* Redefines a SHIFT-letter key combination to print a chosen BASIC keyword. The parameters are the same as for the +KEYC command. For example, if you'd prefer to have SHIFT-P produce PRINT, then enter the following:

+KEYS P,153

To cancel the one-stroke keyword entry feature, enter +KEY alone and press RETURN. This does not destroy the key definitions, but simply sets or clears a flag. To reenable easy keyword entry, again type +KEY with no parameters, then press RETURN. Thus, the +KEY command functions as a *toggle*, switching the keyword entry feature off if it was previously on, or on if it was previously off.

+NUM. Activates the numeric keypad feature. The keypad is set up as shown in the accompanying figure. Most keys that are not part of the numeric keypad are disabled to prevent typing mistakes. However, the comma, period, colon, minus sign, INST/DEL, RETURN, and SHIFT keys remain active, as do all cursor control keys. The D key also remains active so that it can be used with the easy keyword entry feature (SHIFT-D prints DATA). To exit the numeric keypad and reactivate the full keyboard, press the RUN/STOP key.

Numeric Keypad Configuration

			T	Y	U
RUN/STOP	D	F	G	H	J
	C	V	B	N	M
			7	8	9
become: EXIT	D	0	4	5	6
	DEL	,	1	2	3

One word of caution: If you're using the numeric keypad, be careful to avoid the keyboard lockup bug (discussed in "Gazette Feedback," September 1985) which plagues many older 64s. With the keypad active, there is no apparent escape method short of turning off the computer. Exercise extreme caution when deleting characters at the bottom of the screen, especially after a scroll.

+OFF. Disables Quick Key and restores the normal BASIC vectors. As a safeguard, always turn Quick Key off before running any programs. When you need Quick Key again, just enter SYS 49152 to reactivate it.

It's also possible to permanently modify Quick Key's default values for the keyword function. If there's some key definition that you particularly dislike, this will save you from having to use +KEYC or +KEYS to change it every time you use Quick Key. First, load and activate Quick Key, then use +KEYC and +KEYS to set up the keyword definitions you prefer. Save a copy of the modified version by entering this line, followed by RETURN:

POKE 43,0:POKE 44,192:POKE 45,181 :POKE 46,194:SAVE"*filename*",8

Tape users should change the ,8 in the SAVE command to ,1. Be sure to use some different name for this version; keep your original copy as a backup. After the save is complete, you'll need to turn your 64 off and back on to reset important BASIC pointers.

See program listing on page 107.

BASIC Keyword Tokens

Default assignments:

Key	SHIFT	Token	Commodore	Token
A	PRINT	153	AND	175
B	RND	187	REM	143
C	CLOSE	160	CHR$	199
D	DATA	131	DIM	134
E	END	128	DEF	150
F	FOR	129	ASC	198
G	GOTO	137	GOSUB	141
H	GET	161	RUN	138
I	IF	139	INPUT	133
J	INT	181	INPUT#	132
K	RESTORE	140	LET	136
L	LIST	155	LOAD	147
M	MID$	202	LEN	195
N	NEXT	130	NEW	162
O	OPEN	159	OR	176
P	POKE	151	PEEK	194
Q	ON	145	PRINT#	152
R	READ	135	RETURN	142
S	SPC(	166	SAVE	148
T	THEN	167	TO	164
U	SYS	158	STEP	169
V	VAL	197	VERIFY	149
W	RIGHT$	201	LEFT$	200
X	TAB(	163	SIN	191
Y	LOG	188	COS	190
Z	CMD	157	CLR	156

Not used but also available:

Keyword	Token	Keyword	Token
ABS	182	ATN	193
CONT	154	EXP	189
FN	165	FRE	184
NOT	168	POS	185
SGN	180	SQR	186
STOP	144	STR$	196
TAN	192	USR	183
WAIT	146		

news & products

RAM Expansion For 128

Commodore has introduced two RAM expansion modules for the Commodore 128 that provide an additional 128K or 512K of memory for data or program storage. The Commodore 1700, with 128K of additional memory, and the Commodore 1750, with an extra 512K, each plug into the 128's expansion port, similar to an application or game cartridge.

The 128's BASIC 7.0 contains keywords, such as FETCH, STASH, and SWAP, that let programmers have easy access to the expansion memory. In CP/M mode, the 128's operating system lets the expansion modules serve as RAMdisks, or scratch disks, for temporary storage of user files. With a RAMdisk, the CP/M user is able to load and save files at up to one megabyte per second.

The Commodore 1700 sells for $199, and the Commodore 1750 for $299. Each module comes with a diagnostic test and demo disk.

Commodore Business Machines, Computer Systems Division, 1200 Wilson Dr., West Chester, PA 19380.

Circle Reader Service Number 236.

64 And 128 Mouse

A two-button mouse controller for the 64 and 128 computers is now available from Commodore. The mouse, priced at $49, plugs into one of the joystick ports. You control the direction of the cursor on the screen by moving the mouse across any flat surface. The two buttons let the user control a variety of features depending on the software used.

Commodore Business Machines, Computer Systems Division, 1200 Wilson Dr., West Chester, PA 19380.

Circle Reader Service Number 237.

Historical Fiction For The 128

You escape bomb-threatened London through a mysterious door and find yourself on a magical journey that takes you from the Siberian tundra to a tropical island, from deep underground to the depths of outer space. Finally, you arrive in the New Mexico desert minutes before the world's first atomic explosion, code-named Trinity. This is Infocom's *Trinity*, a new puzzle-oriented all-text adventure game for the Commodore 128 that combines fiction with history.

Suggested retail price is $39.95.

Infocom, Inc., 125 CambridgePark Dr., Cambridge, MA 02140.

Circle Reader Service Number 238.

Commodore 64/128 Assembler And Editor

The *Rebel Assembler/Editor*, from Nu-Age Software, is a machine language assembler and full-screen editor with versions for the 64 and 128, both on the same disk. The source editor allows full use of all resident BASIC commands. The company states that the program will assemble a 45K source file into a 7K machine language program in 16 seconds. *Rebel* is RAM-based, with options to assemble to memory, disk, screen, or printer. Labels are supported and the symbol table can be printed after assembly. Source files can be linked.

The 128 version in 80 columns provides an onscreen command summary and split-screen editing. The 64 version features renumbering, page flipping, and hexadecimal and ASCII conversions.

Suggested retail price is $29.95.

Nu-Age Software, 2311 28th St. N., St. Petersburg, FL 33713.

Circle Reader Service Number 239.

Video Images

Digital Vision has announced software that lets its Computereyes video acquisition system for the Commodore 64 work with the popular *Newsroom* newsletter-printing program from Springboard Software. Computereyes is a slow-scan device that plugs into the I/O port and connects to any standard video source to provide black and white images. The complete package includes a disk, owner's manual, interface module, and a one-year warranty.

The *Newsroom Compatibility Software* allows users to create their own images with Computereyes and use them with *Newsroom* to compose and print newspapers, newsletters, and announcements.

Computereyes is priced at $129.95. A complete system, including Computereyes and a video camera, is available for $349.95. *Newsroom Compatibility Software* costs $15. The *Newsroom* program is purchased separately ($49.95) from Springboard Software, 7808 Creekridge Circle, Minneapolis, MN 55435.

Digital Vision, Inc., 14 Oak St., Ste. 2, Needham, MA 02192.

Circle Reader Service Number 240.

Dvorak Keyboard Programs

Prelco has released new products for the Commodore 64 and 128 which are based on the Dvorak keyboard layout. *DV Switcher* is a ROM kernal kit that allows you to run *PaperClip, SpeedScript, Multiplan, Superbase,* and other programs using the Dvorak keyboard. The kit includes a modified ROM kernal, a switch to select the new ROM or the Qwerty ROM, and key covers with both markings. The new ROM changes your keyboard from the standard Qwerty layout to the faster Dvorak layout.

The $39.95 price does not include the hardware installation, which must be carried out by an electronic technician (installation voids remaining Commodore warranty).

DV Typer is a Dvorak typing tutor and keyboard conversion program for

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the Commodore 64 and 128. The 128 version includes autoboot of *DV Typer* and use of the *Paper Clip 128* word processor with Dvorak. *DV Typer* retails for $36.95.

Prelco, 14202 Galy St., Tustin, CA 92680.

Circle Reader Service Number 241.

128 Database Software

Bouncing Dog Software has released its first product for the Commodore 128, *Data Master 128*. This program allows you to develop multivolume data sets of up to 26,000 records, search the files using a wildcard, create mailing labels, and generate reports. Help screens may be activated from anywhere within the program without losing the data with which you're working.

Data Master 128 is priced at $29.95.

Bouncing Dog Software, P.O. Box 6753, Minneapolis, MN 55406.

Circle Reader Service Number 242.

Telecommunications Software

Electrosharp Telecommunications has released a new telecommunications software package for the Commodore 64. The program uses menus and help screens; supports ASCII, XMODEM, and Punter protocols; has a 34K capture buffer; converts BASIC listings into runnable programs and Commodore ASCII to regular ASCII (and vice versa); has full-screen editing and 40/80 columns; includes auto-dial features; works at 300 and 1200 bits per second; and the keyboard can be customized.

The package is sent free of charge to anyone who sends a self-addressed, stamped disk mailer. If satisfied, users are asked to remit $25, which entitles them to all future upgrades, technical assistance with telecommunications problems, and a telecommunications guide ($5 postage and handling). Unsatisfied users are requested to erase the disk.

Electrosharp Telecommunications, P.O. Box 2831, Orcutt, CA 93455.

Circle Reader Service Number 243.

New From SourceView

SourceView Software has released several new programs for the Commodore 64 and 128. *Math Pop Quiz* for the Commodore 64 uses graphics, color, and sound to teach addition, subtraction, multiplication, and division to children at various levels of ability.

PC Home Checkbook for the 64 lets you keep record of checkbook transactions, including deposits, checks written, automatic teller activity, and bank charges. It is designed for home use and provides a statement for any time span you specify. For the Commodore 64.

PCSecure for the Commodore 128 is a datafile encryption program which uses a key-driven code to protect your files from unauthorized users. It is written in machine language.

Suggested retail price for *Math Pop Quiz* is $19.95, $39.95 for *PC Home Checkbook*, and $49.50 for *PCSecure*.

SourceView Software International, 835 Castro St., Martinez, CA 94553.

Circle Reader Service Number 244.

Computer-Assisted Writing

Woodbury has added two new titles to the Playwriter Series for the Commodore 64. *Castles & Creatures*, for grades five and six, and *Mystery!*, for grades seven to twelve, help youngsters develop their writing skills and create a book. Each package includes a word-processing disk, special computer paper, a hardcover binding, and colored stickers for illustrating the book.

Retail price for the package is $39.95, and $9.95 for refill packs.

Woodbury Software, 127 White Oak Ln., CN 1001, Old Bridge, NJ 08857.

Circle Reader Service Number 245.

Math And Spelling Helpers

Eduware Services has released Commodore 64 versions of two of its educational software series. *Algebra 1*, 2, and 3 programs help students with first-year high school algebra by using definitions, explanations of algebra rules, sample problems, and practice problems.

Spelling & Reading Primer helps children from ages four to eight learn to read by watching pictures with words on the screen and playing a matching game. In the spelling part of the program, youngsters can receive coaching on how to spell words or practice without help.

Algebra 1, *Algebra 2*, *Algebra 3*, and *Spelling & Reading Primer* have suggested retail prices of $39.95 each.

EduWare Services, Inc., 185 Berry St., San Francisco, CA 94107.

Circle Reader Service Number 246.

64 Word Processor/Database

Software Resource Group has begun shipping *Brown Bag Software*, an integrated word processor and database manager for the Commodore 64. (An Apple II version is on the flip side of the disk.)

The program lets you easily incorporate information from your databases into letters, reports, and other documents. Up to 20 of these merges can be done within any one document. Editing features of the word processor include global search and replace, headers, trailers, footers, and deletion by character, word, line, and paragraph. The database manager lets you create your own templates or use the ones provided.

The suggested retail price is $59.95.

Software Resource Group, Inc., 15100 El Camino Grande, Saratoga, CA 95070.

Circle Reader Service Number 247.

Equation-Solving On The 64

Balance! is an interactive program that teaches students about solving equations. By working with graphically displayed linear equations on a balance beam, students can literally see the equation-solving process, and better understand it.

The program is aimed at beginning algebra students, advanced students who want to review the basics, and parents and teachers looking for more effective ways of teaching basic math concepts.

Developed by the New York Institute of Technology, the program strives to teach what an equation is and how it works, how and why an algorithm functions, and other aspects of working with equations.

Balance! is available for $49.

HRM Software, 175 Tompkins Ave., Pleasantville, NY 10570.

Circle Reader Service Number 248.

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64 AutoBoot Maker

Rene Suarez

Here's a Commodore 64 boot-making program with a twist: It's compatible with most commercial accelerators for the 1541 disk drive.

Unlike most other computers, the Commodore 64 does not automatically *boot* (load and run) programs from disk. After loading a program, you must type either a RUN or SYS command to start it up. However, you've probably used commercial software that automatically loads and runs when you enter a statement such as LOAD"BOOT",8,1. Wouldn't it be nice to run your own programs this way?

Such programs are said to *autoboot* because everything is automatic after you enter the LOAD command. In effect, they pull themselves up by their own bootstraps; hence the term. Since autoboots require less typing, they're ideal for frequently used programs or programs intended for people who aren't familiar with the computer. The only catch is that autoboots can be very tricky to write. And though there are programs that construct them for you, the resulting package may not be compatible with the popular accelerator programs for the 1541 disk drive.

"64 Autoboot Maker" gives you the best of both worlds—an autoboot that works with most accelerated drives and normal drives, too. (Unfortunately, it won't work with the "TurboDisk" accelerator published in the July 1985 issue of the GAZETTE.) You can make an autoboot for any BASIC or machine language program, and even disable the RUN/STOP and RESTORE keys if you like.

Preparing An Autoboot

Type in 64 Autoboot Maker and save a copy, then run it. First it asks for the name of the target program (the one you want the autoboot to load and run). Since Autoboot Maker looks for the program on disk, insert the correct disk in the drive when you enter the filename. Next, enter a name for the autoboot. Of course, this name should be different from the original filename. For example, if the target program is named LASER, you could call the autoboot LASER/BOOT.

At this point, you must enter the memory address where the program begins. If the target program is BASIC, press RETURN without entering a number (BASIC programs always start in the same place). If the target program is machine language, enter the memory address where it normally begins. The address may be entered in decimal or hexadecimal (a hex number must begin with the $ symbol).

Finally, you have the option of making the autoboot disable the RUN/STOP and RESTORE keys. (Warning: With these keys disabled, you may not be able to break out of the autobooted program without turning off the computer.) Enter Y if you want them disabled and N if you don't. Once this is done, the disk drive spins for a short time and the status of the drive appears on the screen.

To test the newly created autoboot package, simply type LOAD"*filename*",8,1 and press RETURN. Replace *filename* with the name of your autoboot, and don't forget the ,1 after the 8. The target program automatically loads and runs. (If it doesn't, one reason may be that it loads into the same memory area as the autoboot itself—locations $02A7–0303.)

Note that you must repeat the procedure to create the same autoboot file on another disk.

See program listing on page 100.

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Jaffer Siddiqui

Here's an easy way to include up to eight help screens with your BASIC and machine language programs. For the 64 and 128. A disk drive is required.

Many powerful programs include a lot of commands and options. In some cases, it's difficult or impossible to remember them all. And paging through a magazine article or manual for the documentation can be awkward and inconvenient. "Help Screens" offers an elegant solution. By following a few simple steps, you can create up to eight help screens for a program.

Begin by typing in and saving a copy of the program. Although most of the program is written in machine language, you can save, load, and run the program as if it were BASIC. The machine language is stored in the form of DATA statements. Program 1 is for the 64; Program 2 is for the 128.

When you type RUN, the machine language routines are POKEd into memory and the screen is cleared. When the flashing cursor returns, you're ready to begin creating your help screens.

Press the CLR key to erase the screen, then type in the information you want displayed on the first help screen. (*Do not* press RETURN while you're working on this screen. If this key is pressed, a SYNTAX ERROR will result, and your screen will be destroyed.) Use the cursor keys to move the cursor to any position on the screen. Use the cursor keys to move around the screen. Be careful to avoid scrolling the top line off of the screen.

When you've finished the help screen, press CTRL-F (press F while holding down the CTRL key). If you're using the 128 version, press the ENTER key on the numeric keypad. Help Screens then stores the page in memory. The 64 version flashes the border color to signal that the page has been saved. The 128 version changes the border color. After a help screen is saved, you can clear the screen and design the next one.

Up to eight screens can be created following these steps. After the eighth one is finished, a new program—HELP.EXE—is created on your disk, and your help screens are saved into a file called HS. You may find that you need less than eight help screens. In the 64 version, just press CONTROL-D after completing your last screen. In the 128 version, press SHIFT-ENTER.

It's a good idea to save your help screens on the same disk as the program they'll be used to support. For example, if you've created help screens for a program named "File-a-way," insert the disk that contains "File-a-way" and run "Help Screens". The "HELP.EXE" and "HS" files will then be on the same disk.

In Action

To use Help Screens, Commodore 64 users should enter **LOAD "HELPER.EXE",8,1**. Commodore 128 users should enter **BLOAD "HELPER.EXE"** then type **SYS 5632**.

Help Screens works with all BASIC programs and most machine language programs. Always load Help Screens (HELPER.EXE) first. After HELPER.EXE is loaded, it loads the HS file which contains your help screens. Enter NEW, then load the program for which you created the help screens. Your help screens are now available—and only a keypress away. If you're using a 64, press CTRL-H. If you're using a 128, press HELP. Page one (the first one created) is displayed when you first access the help screens. Commodore 64 users can flip through the pages by pressing CTRL-cursor right to page forward, or CTRL-cursor up. In the 128 version, use the up and down arrow keys to page through the help screens. To exit the help screens, press CTRL-DEL (64 version), In the 128 version, press the HELP key again. When you return to the help screens, you'll see the most recently viewed screen.

Running certain machine language programs—or pressing RUN/STOP-RESTORE—will prevent Help Screens from operating. If this happens, type SYS 679 (64 version) or SYS 5728 (128 version) to re-activate Help Screens.

See program listings on page 106.

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SpeedScript-80 For The 128

Todd Heimarck, Assistant Editor

Now 128 owners with an 80-column monitor can run the popular *SpeedScript* word processor for the Commodore 64. Very little typing is required because the program patches into an existing copy of *SpeedScript* version 3.0 or higher.

Without a doubt, the *SpeedScript* word processor is the most popular program ever published by COMPUTE! Publications. Version 1, including both a VIC and a 64 program, was printed in the January 1984 issue of COMPUTE!'s GAZETTE. The upgraded and improved version 2.0, with a help screen and custom characters, was included on the inaugural GAZETTE DISK in May of the same year. Version 2.1 can be found in *COMPUTE!'s Second Book of Commodore 64*.

Version 3.0 (with separate programs for 64, VIC, Apple, and Atari) appeared over several months in our sister magazine COMPUTE! in the spring of 1985. The machine language source code for 3.1 was published separately in the *SpeedScript* books for Commodore, Atari, and Apple. Version 3.2 was included as a bonus on the January 1986 COMPUTE! DISK. Individual disks containing *SpeedScript* 2.0, 3.0, 3.1, and 3.2 are still available.

SpeedScript For The 128

The ideal 128 version would take full advantage of the machine's features: 40- or 80-column output, access to the numeric keypad and other keys (perhaps an alternate character set toggled by the ALT key), and two large text areas of about 60K each.

As you may have guessed, this is not the full-featured 128 version. That's the bad news. The good news is that, if you already have a copy of *SpeedScript* for the 64, version 3.0 or higher (from the March 1985 COMPUTE!, the *SpeedScript* book, or the January 1986 COMPUTE! DISK), you have to type in only a few hundred characters to upgrade to a full 80 columns. Compare that to the roughly 7–8K you'd have to enter for a brand-new program.

"SpeedScript-80" patches into the main program to provide an 80-column screen display. It must be run on a 128—in 64 mode—because it takes advantage of the 128's 80-column chip (yes, the 80-column screen can be accessed in 64 mode). It won't run on standard 64s because they lack the 80-column chip.

Installing SpeedScript-80

You'll need to begin with a working version of *SpeedScript* 3. If you're not sure which version you own, look at the top (command) line. If there's no number, you have version 1 or 2. If it says 3.0, 3.1, or 3.2, you have the correct version.

First, go into 64 mode by typing GO 64. Load and run "MLX," the machine language entry program published elsewhere in this issue, and type in the following programs (save them as five separate files):

Patch 1
Starting Address: 289E
Ending Address: 2935

Patch 2
Starting Address: 2A4E
Ending Address: 2A5D

Patch 3
Starting Address: 315D
Ending Address: 31A4

Patch 4
Starting Address: 3445
Ending Address: 346C

Patch 5
Starting Address: C000
Ending Address: C137

After saving these five programs to disk, go back into 128 mode—turn your computer off and then on. Enter the machine language monitor with the command MONITOR (or press f8). Insert the disk containing *SpeedScript* into your drive and type the following monitor load command, substituting the appropriate filename for SPEEDSCRIPT:

```
L "SPEEDSCRIPT",8,02801
```

SpeedScript will be loaded into the 128's memory at address $02801. Normally, *SpeedScript* loads at $0801, but that part of memory is not available for use by programs in 128 mode. Now load the first four patches:

```
L "PATCH1",8
L "PATCH2",8
L "PATCH3",8
L "PATCH4",8
```

The 80-column patches are inserted into the program and you can now save the results:

```
S "TEMP",8,02801,04009
```

This is only a temporary file, which you can scratch when you've finished creating SpeedScript-80. You're almost there. Now type X (to eXit to BASIC) and enter GO 64. From 64 mode, type the following lines:

```
LOAD "PATCH5",8,1
NEW
```

```
LOAD "TEMP",8
SYS 49152
```

Insert the disk on which you want to save SpeedScript-80 before entering SAVE "SPEEDSCRIPT80",8. This file is the new 80-column version of *SpeedScript*; the patches are no longer needed.

How To Run It

You have to follow specific instructions to load and run SpeedScript-80:

1. Turn on your 128 in 128 mode.

2. Type GO 64, press RETURN, then answer Y to the ARE YOU SURE? question. The computer will switch to 64 mode.

3. From 64 mode, LOAD "SPEEDSCRIPT80",8 and RUN.

4. Switch the display from 40 to 80 columns.

If you hold down the Commodore key to go straight into 64 mode when you turn on the machine, SpeedScript-80 won't work correctly. Starting out in 128 mode forces the computer to initialize the 80-column chip. Among other things, the character set is loaded into 80-column memory.

How It Works

A Commodore 128 in 64 mode is not a perfect Commodore 64. It has some extra capabilities, like access to the 80-column chip.

The 8563 chip in the 128 provides the 80-column screen in 128 mode and has two handles in 64 mode: You can PEEK and POKE locations $D600 and $D601. Address $D600 controls which internal 8563 register is PEEKed or POKEd, while $D601 contains the value read from or written to the register.

The 8563 80-column chip has its own 16K of dedicated memory, and you can reach it only through the two memory locations at $D600–$D601. Between the two control locations and the 16K of memory, though, are 36 internal 8563 chip registers. To POKE the value 1 (we'll use the A character) to the first memory location for the 80-column screen (address $0000 in the 8563's 16K bank), you have to perform the following POKEs:

1. Store $12 in $D600. Register 18 ($12) holds the high byte of the address where we'll POKE.

2. Store a 0 in $D601, which is sent to register 18 ($12), as we set up in step 1.

3. Store $13 in $D600. Register 19 ($13) holds the low byte of the address where we'll POKE (note that for the 8563 chip the high byte comes before the low byte, just the opposite of a typical 8502 machine language address).

4. Store a 0 in $D601. Now, registers $12–$13 point to location $0000. This is not $0000 in the 128's memory map; it's a location in the 8563's private memory.

5. Store $1F in $D600. Register 31 ($1F) will hold the character to be POKEd to screen memory.

6. Finally, store a 1, the screen code of the letter we're putting in the top left corner, in $D601. From register 31, it will be transferred to the 80-column screen memory address in registers $12–$13.

For machine language programmers who want to try this, there's one more thing to keep in mind. After storing the register number in $D600, you have to wait for the high bit ($80) of $D600 to be set before storing a value in $D601. This can be done with the BIT instruction followed by a BPL. When the high bit is turned on, you can store the appropriate value in $D601.

Screen memory for the 80-column screen starts at $0000, and it takes six POKEs to get a character there. *SpeedScript* is built to deal with a screen size of 40 x 25 characters, and a lot of time goes to updating the screen. Theoretically, the 80-column screen should take more time.

FAST-64 Mode

You can make the 128 work twice as fast as usual in 128 mode by typing FAST. The 40-column screen is disabled, but the computer's speed doubles from 1 MHz (1,000,000 instruction cycles per second) to 2 MHz (2,000,000 instruction cycles per second).

Within 64 mode, you can access the FAST mode by sacrificing the 40-column screen. Since we're POKEing the 80-column chip, this isn't a problem. The 8563 has twice as much screen memory, so it should take twice as long to update the display. But if the computer works twice as fast, the disadvantage is cancelled out. Twice as much screen memory slows things down, and twice the speed returns things to normal.

From BASIC, you can go into FAST mode by typing POKE 53296,1. To go back to normal, POKE 53296,0. This works in both 64 mode and 128 mode (to be safe, issue a BANK 15 command before you use this POKE on the 128). Of course, BASIC 7.0 has the FAST command, so the POKE isn't really necessary in 128 mode.

Slight Changes To The Command Set

Three commands are no longer available when you run SpeedScript-80: CTRL-L (change letter color), CTRL-B (change background color), and CTRL-X (exchange two transposed characters). An RGB monitor is required to see 80 columns in color. And the routine to fill attribute memory (which is something like color memory, but it also controls flashing and underlining) would have required an additional patch. The CTRL-X option was deleted because a small section of memory was needed for one of the new 80-column subroutines.

In addition, because there is more information on the screen, the disk directory command (CTRL-$) lists the filenames in two columns. This means you can see up to 50 file names on a single screen. Unfortunately, the way the screen wraps around puts half the number of blocks per file on the right-hand edge of the screen. To fix this would have required another patch, which would have taken away one more *SpeedScript* command. Also, the characters have to be POKEd to 80-column memory, so there's no easy way to scroll the screen when you have more than 50 files on a disk. If you attempt to display a long directory, the extra characters go past screen memory into attribute memory. Again, writing a screen scroll routine would have meant another patch.

Apart from these four changes, all *SpeedScript* commands remain the same. Documents created in 40-column *SpeedScript* can be loaded, edited, and saved with SpeedScript-80. And the printing and formatting commands are unchanged.

See program listings on page 101.

A Guide To Commodore User Groups

Part 2

Joan Rouleau

The second half of the user group guide includes states N–W and countries outside the U.S. The U.S. groups are listed by state in order of ascending zip code.

When writing to a user group for information, remember to include a self-addressed envelope with postage that is appropriate for the country to which you're writing.

NEBRASKA

Pathfinder Commodore User Group, P.O. Box 683, Fremont, NE 68025

Pathfinders 64, 2133 Clarmar St., Fremont, NE 68025

Greater Omaha Commodore User Group, 2932 Leawood Dr., Omaha, NE 68123

Rivercity Commodore Club, 4007 N 101st, Omaha, NE 68134

Lincoln Commodore User's Group, P.O. Box 30665, Lincoln, NE 68503

Lincoln Commodore Users Group, P.O. Box 30655, Lincoln, NE 68503, attn: Secretary

Mid-Nebraska Users of Commodore (MUC), 3220 W. 13, Apt. 9, Grand Island, NE 68802

The Alliance Commodore Computer Club, 726 W. 16th St., Alliance NE 69301

Platte Valley Commodore Users Group (PVCUG), Box #283, Minatare, NE 69356

NEVADA

S.O.G. Commodore User Group, c/o IC Electronics, 4011 W. Charleston Blvd., Las Vegas, NV 89102

Silver State Computer Users Group, P.O. Box 81075, Las Vegas, NV 89180
89406

C.A.T.F.U.N., P.O. Box 2155, Fallon, NV 89406

Plus/4 Software Exchange User Group, 493 Hot Springs Rd. #3, Carson City, NV 89701

NEW HAMPSHIRE

Commodore Help And Information Network (CHAIN Gang), Jim Anderson, P.O. Box 428, Belmont, NH 03220

Monadnock Users Group (MUG) for Commodore Owners, 135 Liberty Ln., Keene, NH 03431

Developers of Interesting Software for the Commodore 64/128 (DISC), 34 Naves Rd., Hampton, NH 03842

64 Users, P.O. Box 878, Rochester, NH 03867-0009

NEW JERSEY

Commodore 64 Users Group of America, 114 Lake Ave., Clifton, NJ 07011

Commodore-IBM-Apple Users Group, 5 Peach Tree Dr., Montville, NJ 07045

Tri-County 64-User Group, 22 Jackson Village, Rutherford, NJ 07070

Commodore Link Users Group, 308 Palisade Ave., Union City, NJ 07087

Commodore Crew User Group (CCUG), 304 Born St., Secaucus, NJ 07094

Commodore Software Exchange, Box 281, Pompton Plains, NJ 07444

Info-64 c/o Video Dynamics, Ltd., 16 W. Ridgewood Ave., Ridgewood, NJ 07450

Commodore User Group of Hillsdale (CUGOH), 22 Palm St., Hillsdale, NJ 07642

Commodore 64 Beginners Group, 680 Leigh Terrace, Westwood, NJ 07675

L & L Commodore 64 User Group, One Longstreet Rd., Manalapan, NJ 07726

NJ Commodore 64/Computer Users Group, 11 Cheerful Pl., Highlands, NJ 07732

Commodore User Group of Matawan New Jersey, 112 Old Bridge Rd., Matawan, NJ 07747

Jersey Shore Commodore Users Group Inc., P.O. Box 441, Navesink, NJ 07752

Morris Area Commodore User Group, 12 Farview Ave., Randolph, NJ 07869

South Jersey Commodore Users Group, P.O. Box 4205, Cherry Hill, NJ 08034

Rancocas Valley Commodore Users Group, P.O. Box 505, Mt. Laurel, NJ 08054

RCA Commodore Users Group (RCACUG), 432 Hemlock Ln., Mt. Holly, NJ 08060

Cumberland County Commodore Users Group, 1976 N. East Ave., Vineland, NJ 08360

Bordentown Area Commodore Users Group, P.O. Box 381, Bordentown, NJ 08505

Plasma Physics Lab User Group, Princeton University, P.O. Box 451, Princeton, NJ 08544

Commodore Computer Collection Club, 72 Pine Dr., Roosevelt, NJ 08555

Southern Ocean County's User Group (SOCUG), 54 Shining Way, Toms River, NJ 08753

Southern Ocean County's User Group (SOCUG), 54 Shining Way, Toms River, NJ 08753

C-64 East Brunswick Users' Group (CEBUG), 346 Ryders Ln., East Brunswick, NJ 08816

Commodore E. Brunswick Users Group (CEBUG), 9 Kings Rd., E. Brunswick, NJ 08816

Somerset Users Group, 49 Marcy St., Somerset, NJ 08873

NEW MEXICO

Plus/4 Orphanage, P.O. Box 9201, Albuquerque, NM 87119

New Mexico Commodore User's Group, P.O. Box 37127, Albuquerque, NM 87176

The Northern New Mexico Commodore Users Group, 2725 Camino Cimarron, Santa Fe, NM 87501

Taos Area Commodore User's Group, P.O. Box 5089, Taos, NM 87571

Aviation and Computer Enthusiasts (ACE), 1220 Birch Dr., Las Cruces, NM 88001

The Southern New Mexico Commodore User's Group, P.O. Box 4437, Uni. Park Brch, Las Cruces, NM 88001

Commodore Users Group of Roswell (CUGOR), 304 E. Country Club Rd., Roswell, NM 88201

NEW YORK

New York City VIC-20/C-64 User Group (Citigroup), 436 E. 69th St., New York, NY 10021

Kids' Computer News User Group, St. Hilda's and St. Hugh's schools, 619 W. 114th St., New York NY 10025

New York Commodore Interest User Group (NYCIG), 380 Riverside Dr. 7Q, New York, NY 10025

HCHS C-64 User Group, 71 E. 94th St., New York, NY 10128

Metropolitan Life Insurance Users Group, P.O. Box 618, New York, NY 10159

Commodore Computer Game Masters of the Bronx & C.A.T. Productions, 4526 Monticello Ave., Bronx, NY 10466

Bronx-64 Users Group, P.O. Box 47 Cornell Station, Bronx, NY 10473

Folklife Terminal Club, Box 555-R, Co-op City Station, Bronx, NY 10475

Computer Literacy and Programming (CLAP), 7 Tuttle Dr., Ossining, NY 10562

ESUG, 52 Underhill Rd., Ossining, NY 10562

Frisco's Users Group, 41 Sunset Dr., Ossining, NY 10562

Commodore User Group of Westchester, P.O. Box 1280, White Plains, NY 10602

Highland Falls Commodore Users Group, 8 Knox Rd., Highland Falls, NY 10928

Commodore 64 User Group of Orange County, Box 238, RD 1, New Hampton, NY 10958

Rockland County CPU (C-64 Professional Users) Group, 98 West Central Ave., Spring Valley, NY 10977

Commodore SIG, Computer Club of Rockland, P.O. Box 233, Tallman, NY 10982

Great Neck Commodore User Group, 30 Grace Ave., Great Neck, NY 11021

Long Island VIC Enthusiasts, 17 Picadilly Rd., Great Neck, NY 11023

Brooklyn Commodore User's Group, 1735 E. 13th St., Apt.7N, Brooklyn, NY 11229-1950

Academy of Aeronautics C-64 Users Group, Aircraft Technology Dept., Academy of Aeronautics, La Guardia Airport, Flushing, NY 11371 (membership limited to those attending academy)

Commodore Crazy, 123-07 85 Ave., Kew Gardens, NY 11415

D-BUG, 78-23 91st Ave., Woodhaven, NY 11421

Commodore Users Group of Greater New York, 190-25 Woodhull Ave., Hollis, NY 11423

Sea-Glen Commodore User's Group (SGCUG) For Kids Only, 67 Todd Dr. North, Glen Head, NY 11545

Bay Shore Users Group, Mowbray St. Cafe, 82 W. Main St., Bay Shore, NY 11706

Micro-Hut Users Group, 62 E. Main St., Bay Shore, NY 11706

B.N.Y. Commodore User Group, 71 Head of Neck Rd., Bellport, NY 11713

Brentwood-Bayshore VIC/64 User Group, Pub. Lib. 2nd Ave. & 4th St., Brentwood, NY 11717

Bay Shore/Brightwaters Commodore 64 Users Group, c/o Bay Shore/Brightwaters Public Library, 5 South Country Rd., Brightwaters, NY 11718

LIVICS Commodore User Group, 20 Spyglass Ln., East Setauket, NY 11733

MI-64, 4 Essex Place, Jericho, NY 11753

Associated Commodore Enthusiasts (ACE), 94 Mallard Rd., Levittown, NY 11756

VIC-20 Commodore 64 User Group, P.O. Box 280, Lindenhurst, NY 11757

Club 64, 174 Maple Ave., Patchogue, NY 11772

Riverhead Commodore Club, 1069 Ostnander Ave., Riverhead, NY 11901

Mohawk Valley Commodore User Group, P.O. Box 343, Tribes Hill, NY 12177

Schenectady Commodore Users Group, #7 Center St., Rear, Scotia, NY 12302

Hudson Valley Commodore Club, P.O. Box 2190, Kingston, NY 12401

CMI Commodore Club/Computer Metropolis, 243 Main St., New Paltz, NY 12561

Orange County Commodore Users Group (OCCUG), P.O.Box 515, Vails Gate, NY 12584

Tri-State Commodore User Group (TSCUG), P.O. Box 705, Port Jervis, NY 12771

Adirondack C-64 Users Group, P.O. Box 99, Blue Mountain Lake, NY 12812

Plattsburgh Commodore Users Group, 61 E. Main St., Morrisonville, NY 12962

Canastota Users of Commodore Computers (CUCCO), 220 Lamb Ave., Canastota, NY 13032

Central New York Commodore Users Group, 8037 Morgan Rd., Liverpool, NY 13088

64 Club, P.O. Box 2394, Liverpool, NY 13089

Oswego Commodore User Group, 611 Culkin Hall, State University College, Oswego, NY 13126

The Commodore Computer Club of Syracuse, P.O. Box 2232, Syracuse, NY 13220

Utica Commodore User Group, 1801 Storrs Ave., Utica, NY 13501

Commodore Users Group of Massena (COMA), Star Tech Systems, 69 Main St., Massena, NY 13662

Northern New York Commodore Home User Group (NORNY-CHUG), P.O. Box 226, Norwood, NY 13668

North Country Commodore Club, 1607 Ford St., Ogdensburg, NY 13669

Chenango County Commodore Helpers & Users Group (CC-CHUG), P.O. Box 487, Norwich, NY 13815

64 Southtowns User Group, 504 Sommerville Rd., Tonawanda, NY 14150

Commodore Buffalo User Group (COMBUG), 199 Dale Dr., Tonawanda, NY 14150

North Buffalo Commodore Users' Group, 309 Commonwealth Ave., Buffalo, NY 14216

The Niagara Falls Commodore Club, 2405 Willow Ave., Niagara Falls, NY 14305

The Rainbow International C-64 Users' Group, 947 Harrison Ave., Niagara Falls, NY 14305

Geneva Commodore Users Group, 84 Pleasant St., Geneva, NY 14456

Commodore & VIC Enthusiasts (CAVE), P.O. Box 10, Holcomb, NY 14469

Commodore Users Group of Rochester (CUGOR), P.O. Box 23463, Rochester, NY 14692

Finger Lakes Area Komputer Experts (FLAKES), 86 West Lake Rd., Hammondsport, NY 14840

Commodore Computer Users Group of Ithaca, 202 Bridge St., Ithaca, NY 14850

NORTH CAROLINA

Triad C-64 Users Group, P.O. Box 10833, Greensboro, NC 27404

Carolina Commodore Computer Club, P.O. Box 2664, Raleigh, NC 27602-2664

Commodore Research Triangle User Group, 2213 Wininger Dr., Raleigh, NC 27603

Raleigh Area Commodore Enthusiasts, President, 904 Davidson St., Raleigh, NC 27609-5547

Carolina Amiga Club, 808 Colleton Rd., Raleigh, NC 27610

VIC-20/C-64 User Group, Rt. 3, Box 351, Lincolnton, NC 28092

Salisbury Compute, Rt. 1, Box 349B, Salisbury, NC 28144

Cleveland/Gaston Commodore User's Group (CGCUG), Rt. 2, Box 234-C, Shelby, NC 28150

Commodore Users Group of Fayetteville (CUGOF), P.O. Box 41601, Fayetteville, NC 28309

Wilmington Commodore Users Group, 2104 Wisteria Dr., Wilmington, NC 28401

Wilmington C-128 Users Group, 409 R.L. Honeycutt Dr., Wilmington, NC 28403

Down East Commodore Users Group, 117 Keith Dr., Havelock, NC 28532

Greater Onslow Commodore User's Group, 127B Henderson Dr., Jacksonville, NC 28540

Unifour Commodore Users Group, P.O. Box 9324, Hickory, NC 28603-9324

Commodore 64 User Group, P.O. Box 1635, Banner Elk, NC 28604

Asheville-Buncombe User Group (A-BUG), P.O. Box 15578, Asheville, NC 28813

NORTH DAKOTA

Central Dakota Commodore Club, Bob MacLeod, 102 East Capitol Ave., Bismarck, ND 58501

OHIO

Central Ohio Commodore Users Group, P.O. Box 28229, Columbus, OH 43228-0229

Commodore Club of Central Ohio (CCCO), P.O. Box 292392, Columbus, OH 43229

Marion Ohio Commodore User Group (MOCUG), 775 Wolfinger Rd., Marion, OH 43302

Bowling Green State University User Group, 519 Ridge #18, Bowling Green, OH 43402

South Toledo Commodore Computer Club, P.O. Box 6086, Toledo, OH 43614

Commodore Computer Club of Toledo (CCCT), P.O. Box 8909, Toledo, OH 43623

Commodore Hammondsville Users Group of Ohio (CHUGO), P.O. Box 7, S.R. 213, 6M642, Hammondsville, OH 43930

Basic Bits User Group, 5564 Wallace Blvd., N. Ridgeville, OH 44039

Northeast Ohio Commodore User Group, P.O. Box 718, Mentor, OH 44061-0015

Commodore Preference Users Connection (CPU Connection), P.O. Box 42032, Brook Park, OH 44142

Akron Area Commodore User Group, Rm. B-201, 80 W. Bowery, Akron, OH 44308

Youngstown C-64 User's Group, 209 N. Pearl, Columbiana, OH 44408

C-128 Users Group, 416 Shields Rd., Youngstown, OH 44512

Akron Area Commodore Users Group, 4140 Eastlynn Ave. NW, Massillon, OH 44646

Commodore Users Group, 702 Park Ave. NW, New Philadelphia, OH 44663

Akron Area Commodore Club (AACC), 1443 Wendy St.#88, Canton, OH 44709

Ford and Commodore Together (FACT), P.O. Box 8495, Canton, OH 44711

C.A.M. Area Users Group, 334 Fairview SE, North Canton, OH 44720

Mid-Ohio Commodore User's Club, 21 Highland Dr., Butler, OH 44822

Galion Commodore User Group, 980 Bucyrus Rd., Galion, OH 44833

Commodore Erie Bay Users Group (CEBUG), P.O. Box 1461, Sandusky, OH 44870

Cincinnati Commodore Computer Club, Box 450, Owensville, OH 45160

The Cincinnati Commodore Computer Connection, 816 Beecher St., Cincinnati, OH 45206

UCOM-64, 340 Tangeman University Center, Mail location 136, University of Cincinnati, Cincinnati, OH 45221

Southwestern Ohio Commodore Users Group (SWOCUG), P.O. Box 46644, Cincinnati, OH 45246

WESTCOM 64 Commodore 64 Users Group of Western Cincinnati, 3859 Chatwood Ct., Cincinnati, OH 45248

Chillicothe Commodore User Group (CCUG), 9 Ash Rd., Chillicothe, OH 45601

OKLAHOMA

Commodore Users, P.O. Box 1055, Guthrie, OK 73044-1055

Greater Oklahoma Commodore Club, 1401 N. Rockwell, Oklahoma City, OK 73127

Greater Oklahoma Commodore Club, P.O. Box 96751, Oklahoma City, OK 73143

Commodore Users of Bartlesville, 1704 S. Osage, Bartlesville, OK 74003

Tulsa Area Commodore Users Group, 7804 N. 117th E. Ave., Owasso, OK 74055

Stillwater Commodore Users Group, 3124 N. Lincoln, Stillwater, OK 74075

Muskogee Commodore Users Group, 309 S. Meigs, Fort Gibson, OK 74434

Osage/Kay Commodore User's Group (OKCOM), 300 Woodbury Rd., Ponca City, OK 74601

OREGON

Amateur Radio Group, P.O. Box 626, Molalla, OR 97038

Mount Hood Community College Commodore Users Group, 2340 Harlow Ave., Troutdale, OR 97060

Astoria Commodore User Group, Rt. 3, Box 75, Astoria, OR 97103

Commodore Beaverton User Group, 2001 NE Hyde, Hillsboro, OR 97124

Commodore Owners Resource Exchange (CORE) (For 64/128), P.O. Box 17580, Portland, OR 97217

Salem C-64 Users Group, 3795 Saxon Dr. S., Salem, OR 97302

Albany-Corvallis Users Group, 800 South 19th, Philomath, OR 97370

Yamhill County Commodore Users Group, 9273 Gopher Valley Rd., Sheridan, OR 97378

Lane County Commodore User's Group, P.O. Box 11316, Eugene, OR 97440

Pacific Northwest Commodore User Group, P.O. Box 2310, Roseburg, OR 97470

Springfield Commodore User's Group, 5324 B St., Springfield, OR 97478

United States Commodore Users Group, P.O. Box 2310, Roseburg, OR 97470

Caveman Commodore Computer Club (CCCC), 5863 Lower River Rd., Grants Pass, OR 97526

Klamath Commodore 64 User Group, P.O. Box 7654, Klamath Falls, OR 97602

PENNSYLVANIA

Beaver County Area Commodore User's Group (BCACUG), Secretary, 112 Spruce Dr., Monaca, PA 15061

A-K 64 User Group, 1762 Fairmont St., New Kensington, PA 15068

South Pittsburgh Commodore Group, 2407 Pa Ave., West Mifflin, PA 15122

United Users Incorporated ATTN:Commodore Division, 1931 Rockledge St., Pittsburgh, PA 15212

Greater Pittsburgh Commodore User Group, 1560 Orchard View Dr., Pittsburgh, PA 15220

Pittsburgh Commodore Group, 2015 Garrick Dr., Pittsburgh, PA 15235

Bettis Commodore Users Group, 592 Arbor Ln., Pittsburgh, PA 15236

Foundation for the Advancement of Computer Technology (FACT), Microcomputer Division, 1255 Brinkerton Rd., Greensburg, PA 15601

United States Commodore Users Group, 1255 Brinkerton Rd., Greensburg, PA 15601

Westmoreland Computer Users Club (Commodore Section), P.O. Box 3051, Greensburg, PA 15601

Butler Commodore 64 User Group, P.O. Box 2408, Butler, PA 16001

Castle Commodores Computer Club, R.D. #1, Box 210A, Edinburg, PA 16116

North Coast Commodore Users Group Erie, P.O. Box 6117, Erie, PA 16512-6117

B.A.S.I.C., 515 E. 26th Ave., Altoona, PA 16601-4036

Cen.P.U.G. for Commodore, RD #1, RC #17, Howard, PA 16841

Capitol Area Commodore Club, P.O. Box 333, Lemoyne, PA 17043
Blue Juniata Commodore Users-Group, 107 Washington Ave., Lewistown, PA 17044
Central Area Bulletin Board Systems (CABBS) User Group, 4205 Ridgeview Rd., Harrisburg, PA 17112
White Rose Commodore Users Group, 160 Linden Ave., Red Lion, PA 17356
Southern York County Commodore Users Group, 233 W. Forrest Ave., Shrewsbury, PA 17361
CUBBS Commodore Users Group, 500 Diller Ave., New Holland, PA 17557
West Branch Commodore Users Group, P.O. Box 995, Williamsport, PA 17703
Cen.P.U.G. for Commodore, Box 102, Salona, PA 17767
ABC Chips, Lehigh Valley Medical Center, 3159 Middletown Rd., Bethlehem, PA 18017
Lehigh Valley Commodore User Group, 2228 Baker Dr., Allentown, PA 18102
Wyoming Valley Commodore Users Group, 94 Second Ave., Kingston, PA 18704
Ingersol Rand Commodore Computer Users Group (IRCCUG), 402 S. Keystone Ave., Sayre, PA 18840
Ewing Commodore Users Group (Trenton NJ), 528 Sugartree Rd., Holland, PA 18966
Environmental Protection Agency (EPA) Commodore Users Group, 1712 Aidenn Lair Rd., Dresher, PA 19025 *(Note: Open to all federal government employees and their families.)*
Fort Washington 64, 20-A Lumber Jack Circle, Horsham, PA 19044
Lowerbucks User Group, 252 Makefield Rd., Morrisville, PA 67, 19067
SUB-64 User's Group, P.O. Box 54208, Philadelphia, PA 19105
Naval Air Development Center Commodore User Club, 912 Fraser Rd., Erdenheim, PA 19118
Main Line Commodore Users Group (MLCUG), 1046 General Allen Ln., West Chester, PA 19382
Worldwide Commodore User Groups—Norristown Chapter, 110 Miami Ave., Norristown, PA 19403
Worldwide Commodore Users Group (International Headquarters), P.O. Box 337, Blue Bell, PA 19422
COMPSTARS, 3770 Worthington, Collegeville, PA 19426
Upper Buxmont C64 Users, 1206 Cowpath Rd., Hatfield, PA 19440
P.C.U.C., C. Rhoads, 1338 Lynn Dr., Pottstown, PA 19464
Worldwide Commodore User Groups—Pottstown/Boyertown Area Chapter, R.D. #1, Washington Rd., Bechtelsville, PA 19505
Reading Commodore Users Group, 1020 Pear St., Reading, PA 19601
Commodore Users of Berks (CUB), 2455 McKinley Ave., West Lawn, PA 19609

RHODE ISLAND

Newport Computer Club (RI), P.O. Box 1439, Newport, RI 02840-0997
Burrillville Commodore Users Group, 28 Cherry Farm Rd., Harrisville, RI 02859
Narragansett Commodore Users Group, EPA Environmental Research Lab, South Ferry Rd., Narragansett, RI 02882
Commodore Connection, P.O. Box 929, Woonsocket, RI 02895-0929
R.I. Commodore Users Group (RICUG), 4 Mowry Ave., Johnston, RI 02919

SOUTH CAROLINA

Commodore Kids of America, Rt. 8, Box 280, Sumter, SC 29150
Commodore Computer Club of Columbia, P.O. Box 2775, Cayce/W. Columbia, SC 29171
Spartanburg Commodore Users Group (SPARCUG), P.O. Box 319, Spartanburg, SC 29304
Charleston Computer Society, P.O. Box 5264, N. Charleston, SC 29406
B.I.B.S., SPO 786, Charleston, SC 29424
The Executive Touch (ET), 522 Broadway, Myrtle Beach, SC 29577
COUCH, 100 Oak Park Dr., Mauldin, SC 29662
Rock Hill Commodore User Group (RHCUG), 565 Scaleybark Circle, Rock Hill, SC 29730
Beaufort Technical College User Group, Center For Staff And Curriculum Development, P.O. Box 1288, Beaufort, SC 29902

SOUTH DAKOTA

Sioux Falls User Group, 4200 S. Louise, Suite 304, Sioux Falls, SD 57106
VIC-64 User Club, 608 W. 5th, Pierre, SD 57501
Port 64 User Group, 929 Lemmon St., Rapid City, SD 57701

TENNESSEE

Dungeons and Dragons User's Group, Rt. 1, Box 28A, Cumberland City, Erin, TN 37050
Clarksville Commodore Users Group, P.O. Box 403, St. Bethleham, TN 37155
Springfield Commodore Computer Club, Rt. 1, Box 166, Springfield, TN 37172
Commodore Association of the Southeast (CASE), P.O. Box 110386, Nashville, TN 37211
Nashville Commodore User Group, P.O. Box 121282, Nashville, TN 37212
Commodore Computer Club, P.O. Box 96, Estill Springs, TN 37330
Fort Washington 64, 213 Holly Ave., S. Pittsburg, TN 37380
Choo Choo 64, 505 Valley Bridge Dr., Chattanooga, TN 37415
Tri-Cities Commodore Club, Vickie Davis, c/o Computer Corner, 114 Springbrook Dr., Johnson City, TN 37601
Greeneville Computer Home Users Group, Rt. 8, Box 138-T, Greeneville, TN 37743
Metro Knoxville Commodore User Club, 7405 Oxmoor Rd., Rt. #20, Knoxville, TN 37931
Memphis Commodore Users Club, Dwight Campbell, P.O. Box 34095, Bartlett, TN 38134-0095
Memphis Commodore Users Club, P.O. Box 34095, Memphis, TN 38134-0095
Raleigh-Bartlett Hackers CUB, James Patrick, 3457 Gatewood Dr., Memphis, TN 38134
Old Hickory Commodore Users Group, 25 Coats Cove, Jackson, TN 38305

TEXAS

Commodore Users Club, P.O. Box 110867, Carrollton, TX 75011
Irving Commodore Users Club, P.O. Box 165034, Irving, TX 75016
Sherman Commodore Users Group (SCUG), 827 W. Sears, Denison, TX 75020
Society of Computer Owners and P.E.T. Enthusiasts (SCOPE), P.O. Box 3095, Richardson, TX 75083
The Users, 209 Altavista, Rockwall, TX 75087
FED 64 Computer Club, 1100 Commerce St., Dallas, TX 75242
Longview Users Group, P.O. Box 9284, Longview, TX 75608
Mid-Cities Commodore Club, P.O. Box 1578, Bedford, TX 76021
BiStone Users Club, P.O. Box 386, Mexia, TX 76667
Heart of Texas Commodore Home User Group (HOT CHUG), 2100 N. New Rd., Waco, TX 76710
Commodore Houston User Group (CHUG), P.O. Box 612, Tomball, TX 77375
The Woodlands Commodore Users Group, 3 Splitrock Rd., The Woodlands, TX 77380
Meadows User Group (MUG), 11923 Scottsdale, Meadows, TX 77477
Our Gang, 201 Stanford, Lake Jackson, TX 77566
Commodore Brazos Users Group (C-BUG), P.O. Box 9622, College Station, TX 77840
Crossroads Commodore Users' Group, 417 Irma Dr., Victoria, TX 77901
Business Interface Languages Limited (BILL), P.O. Box 592, Adkins, TX 78101
Interface Computer Club, 7532 Triple Oaks, San Antonio, TX 78263
Commodore Users of San Antonio, P.O. Box 380732, San Antonio, TX 78280
Corpus Christi Commodores, P.O. Box 6541, Corpus Christi, TX 78411
Commodore User Group of Austin, P.O. Box 49138, Austin, TX 78765
Top of Texas Commodore (TOTCOM), Box 2851, Pampa, TX 79066-2851
Tri-State Commodore Users Group, P.O. Box 8971, Amarillo, TX 79114-8971
Commodore Users of Texas (CUT), 5509 Harvard, Lubbock, TX 79416
Abilene Cursor Control, P.O. Box 6261, Abilene, TX 79608
Commodore Users Group of Ward County, 2902 W. 4th St., Monahans, TX 79756
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Arrays In The Next Dimension

Michael S. Tomczyk

Let's pick up where we left off last month, with our discussion of arrays. In BASIC programming, an *array* is an efficient way to handle a large number of items. An array is a group of items usually arranged as a table of numbers and words. Each item has its own code name and location in the table.

Arrays are sometimes considered an advanced concept and excluded from many BASIC handbooks. This is unfortunate because arrays are not that difficult to understand and they're extremely useful and important programming tools. So let's continue our discussion.

If you think of DATA as a *list* of information, then arrays are *groups* of information. It helps if you think of an array as a *group*, even if the array contains only one item. You can also think of an array as an arrangement of boxes or containers, or as a table of rows and columns. Each box has a name like G(1), and it may be empty or contain one item of information, as in this *one-dimensional array:*

G(1)	G(2)	G(3)	G(4)	G(5)
100	150	200	250	300

There's one row of five boxes, or columns, in this array, numbered G(1) to G(5). The first box, G(1), contains the number 100, G(2) contains the number 150, and so on. Here's a program you could use to fill up the boxes with the numbers shown, and display them. Type it in and RUN it:

```
10 DATA 100,150,200,250,300
20 FOR X=1 TO 5:READ G(X):NEXT
30 FOR X=1 TO 5:PRINT SPC(1)"G"
   X;:NEXT
40 PRINT:FOR X=1 TO 5:PRINT G(X);
   :NEXT
```

You can also have *two-dimensional arrays* which you might visualize as rows and columns of boxes like this:

	1	2	3	4	5
1	G(1,1)	G(1,2)	G(1,3)	G(1,4)	G(1,5)
	100	150	200	250	300
2	G(2,1)	G(2,2)	G(2,3)	G(2,4)	G(2,5)
	−100	−150	−200	−250	−300

This program sets up the table (type NEW, then enter and RUN this example):

```
10 DATA 100,150,200,250,300,-100,-150,
   -200,-250,-300
15 DIM G(2,5)
20 FOR X=1 TO 5:READ G(1,X):NEXT
30 FOR X=1 TO 5:PRINT SPC(1)"G1"X;
   :NEXT:PRINT
40 FOR X=1 TO 5:PRINT G(1,X);
   :NEXT:PRINT
50 FOR X=1 TO 5:READ G(2,X):NEXT
60 FOR X=1 TO 5:PRINT SPC(1)"G2"
   X;:NEXT:PRINT
70 FOR X=1 TO 5:PRINT G(2,X);
   :NEXT:PRINT
```

First, we put all ten numbers in a DATA list, and then DIMension an array two columns deep by five rows wide, and READ and PRINT the first five numbers as G(1,1), G(1,2), G(1,3), G(1,4), and G(1,5). Then we READ and PRINT the second five numbers as G(2,1), G(2,2), G(2,3), G(2,4), and G(2,5).

The SPC(1) statement inserts one space in front of the G numbers so the positions line up. The PRINT statement at the end of lines 30, 40, 60, and 70 is needed because of the semicolon in the earlier PRINT statement in those lines.

Each item in an array can be moved to another location, redefined, changed, used in a calculation, or displayed individually, in subsets or in tables. For example, try adding these two lines to the previous program:

```
80 PRINT:PRINT G(1,1)"MULTIPLIED
   BY"G(2,1)"IS"G(1,1)*G(2,1)
90 G(1,1)=17:PRINT G(1,1)*G(2,1)
```

Line 80 shows how you can multiply numbers in an array using their row and column numbers. Line 50 redefines G(1,1) as 17 and multiplies it by G(2,1). Note that the computer PRINTs only the result of the calculation.

Array Notation

Let's try some simple exercises so we can get used to working with array notation, which is very similar to working with numeric and string variables (covered in recent months in this column). A *numeric* array contains numbers only. The name of the array is usually a letter of the alphabet like A, B, X, or N. The notation for one item from the array looks like this: A(3). The A is the name of the array, and the (3) represents item number 3. Try this example:

```
10 FOR X=1 TO 10:A(X)=X:PRINT
   A(X):NEXT
```

This line uses a FOR-NEXT loop to count from 1 to 10—on each loop, the number from 1 to 10 is inserted where the X's are. On the first loop, A(X)=X becomes A(1)=1 which means position A(1) in the array is defined as the number 1. Next, the computer PRINTs A(X), which is A(1) the first time through the loop—which is the number 1. The NEXT statement tells the computer to go back and redefine X as 2, then 3, and on up to 10. So A(1) equals one, A(6) equals 6, A(10) equals 10.

A *string* array contains string information like words, phrases, sentences, graphics symbols, and so on. The name of the array looks like a string variable because it uses a dollar sign, like this: N$(4). The N$ is the name of the string array, and the (4) represents item number 4 in the array. Type NEW and press RETURN, then try this example:

```
10 PRINT CHR$(147)
20 FOR X=1 TO 10:PRINT"ENTER
   WORD OR PHRASE NUMBER"X:IN
   PUT N$(X):NEXT
30 PRINT CHR$(147):FOR X=1 TO 10:
   PRINT"YOUR WORDS ARE:
   N$("X")"N$(X):NEXT
```

Line 10 clears the screen. Line 20 uses a FOR-NEXT loop like the previous example. The numbers from 1 to 10 are inserted wherever you see an X, so "WORD NUMBER" X becomes WORD NUMBER 1, then 2, 3, and so on. The INPUT statement makes the computer display a question mark and wait until you type in a word or phrase (or even a number), then defines what you typed as an item in the string array. The first item you type becomes N$(1), the second item becomes N$(2), and so on.

Line 30 clears the screen and uses another FOR-NEXT loop to cycle through the ten words and display them next to their string array names. Notice we went outside quotation marks to display the first X—because X is a variable and variables are always displayed outside quotes. We also displayed the second N$(X) completely outside quotes.

Putting Information Into Arrays

If you know how to define a variable (like A=14:PRINT A), then you know how to define the elements in an array—with a few variations.

First, you can use a FOR-NEXT loop to put a series of consecutive numbers into an array, like this:

```
10 DIM Q(25):FOR X=1 TO 25:Q(X)=X:
   PRINT Q(X):NEXT
```

You can use the equal sign to define specific array elements, like this:

```
10 M$(1)="ZORICK":M$(2)=
   "HEDRICK"
20 PRINT M$(1)" IS "M$(2)" IN
   DISGUISE."
```

You can define an array by using DATA statements, like this (note in line 10 how we put a comma in a DATA list—enclose it in quotes):

```
10 DATA ALAS,POOR,YORICK,",",I,
   KNEW ,HIM,WELL
100 FOR Q=1 TO 8:READ Y$(Q):NEXT
200 FOR Q=1 TO 8: PRINT Y$(Q);
   SPC(1);:NEXT:PRINT
```

You can let the user INPUT array elements, like this:

```
10 PRINT CHR$(147)"TYPE 10 LOAN
   AMOUNTS & PRESS RETURN"
20 FOR A=1 TO 10:INPUT N(A):NEXT
30 PRINT CHR$(147):FOR B=1 TO
   10:PRINT"$"N(B)"TIMES 9%
   EQUALS"N(B)*.09:NEXT
```

You can also let the user define the size of the array (which is L):

```
10 PRINT CHR$(147)"TYPE THE
   NUMBER OF NAMES YOU WILL
   ENTER":INPUT L
20 DIM N$(L):PRINT CHR$(147)
30 FOR X=1 TO L:PRINT"ENTER
   NAME NUMBER"X;:INPUT
   N$(X):NEXT
40 PRINT CHR$(147)"THE NAMES ARE
   ":FOR D=1 TO X:PRINT N$(X):NEXT
```

Using The DIM Statement

So far, most of our arrays have included ten or fewer items—but you may have noticed that in cases where the array had more than 11 items, and when we set up a two-dimensional array, we used the DIM (DIMension) statement.

Your computer automatically sets up an array with the name you give it—such as A(X) or N$(X)—when the array has 11 or fewer items, but if you want to put more than 11 items (numbered 0–10) in your array, you *must* use the DIM statement to tell the computer how much space in memory to reserve for the array. The DIM statement tells the computer to make room for an array. Type NEW, then try this example:

```
10 DIM S(12):DIM M$(12)
20 DATA JANUARY,FEBRUARY
   ,MARCH,APRIL,MAY,JUNE,JULY,
   AUGUST
30 DATA SEPTEMBER,OCTOBER,
   NOVEMBER,DECEMBER
40 FOR X=1 TO 12:READ M$(X):PRINT
   "ENTER SALES FOR "M$(X):INPUT
   S(X):NEXT
50 FOR X=1 TO 12:SALES=
   SALES+S(X) :NEXT
60 PRINT:PRINT"TOTAL SALES FOR
   THE YEAR WERE $"SALES
70 PRINT:PRINT"AVERAGE MONTH-
   LY SALES FOR THE YEAR WERE
   $"SALES/12
```

Line 10 begins by DIMensioning two arrays. The first is a numeric array named S which will contain 12 numbers. The second is a string array called M$ which will contain 12 words. Remember, you need to use the DIM statement when you have more than 11 items in your array.

Lines 20 and 30 contain a DATA list with the names of the 12 months. Line 40 uses a FOR-NEXT loop to READ the names of the months from the DATA list into the M$ array. On the first cycle, the computer READs JANUARY from the DATA list and defines it as M$(1) in the M$ array. Then the computer PRINTs the message in quotation marks. The INPUT statement displays a question mark and waits for one number to be typed in, which is defined as S(1) in the S array. Finally, the NEXT statement tells the computer to go back and repeat the process—M$(2) and S(2), M$(3) and S(3)—until it reaches 12, which is the upper limit of the loop. At this point, the 12 months are safely tucked away in the M$ array and the 12 sales numbers are stored in the S array.

Line 50 adds the sales figures for each month, stored in the S(X) array, and stores the total in the variable called SALES.

Line 60 begins with a PRINT statement which merely displays a blank line on the screen (used for positioning and spacing). Then we PRINT the message shown inside quotation marks, followed by the variable SALES.

Line 70 is similar to line 60, except here we divide the total SALES by 12 to get the average sales per month.

REM: *You can use a full word like SALES as a variable name to help you keep track of what's going on in your program, but the computer sees only the first two letters, so SALES is interpreted by the computer as SA. You may get unexpected problems that are difficult to figure out if your program has two or more variables with the same first two letters. For example, you should not use both SATURDAY and SALES in the same program because the computer sees both words as the same variable SA. An additional problem to avoid when using long variable names is accidentally including a BASIC keyword within the name. For example, the variable name SAND contains the BASIC keyword AND, which is not allowed—an error message will result.*

There are many more nuances involved in using arrays. Next month, we'll explore this topic further and look at one of the best applications for arrays.

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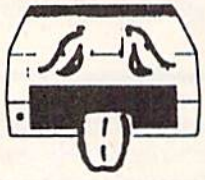

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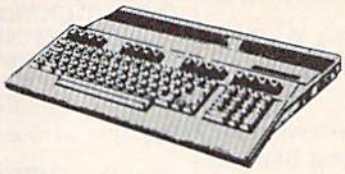

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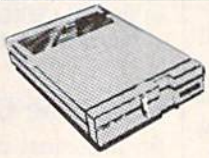

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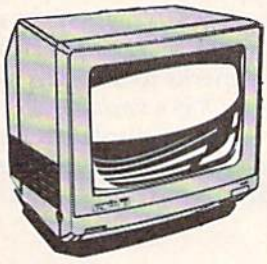

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simple answers to common questions

Tom R. Halfhill, Staff Editor

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by Commodore users. If you have a question you'd like to see answered here, send it to this column, c/o* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

Q. I own a Commodore 128 and would like to know how to access the Z80 chip through BASIC without using the CP/M software supplied with the system.

A. We've seen a novelty program that POKEs a short Z80 machine language program into memory, enables the Z80, runs the program, and returns to 128 mode. But without CP/M, you can't print to the screen or to a printer, you can't input from the keyboard, you can't access any peripherals. All you can do is move numbers in memory.

So there's no practical way to access the Z80 chip from 128 mode—but you really wouldn't want to, anyway. A central processing unit is pretty useless without an operating system, and the Z80's operating system is CP/M (Control Program for Microcomputers). Without an operating system, a chip is like an automobile engine without a transmission or steering mechanism. If you want to access the Z80, there are several good languages, including BASIC, available on disk for CP/M.

Q. The rationale behind the need for separate ID numbers on disks escapes me. I believe it to be true, but don't understand why. The bottom line of explanations given me is that if you change disks and both have the same ID, the drive thinks it has the same disk. But what is the drive comparing IDs against? I never save using an ID.

A. Actually, there seems to be a division of opinion on this, even among the Commodore users at COMPUTE! Publications. Some people swear they've had disks ruined because of identical ID numbers, while others say they use the same ID number on every disk and have yet to lose a file.

In theory, at least, here's how identical ID numbers could cause a problem. When you first format a disk, the NEW command requires a diskname and ID number:

BASIC 2.0:
```
OPEN 15,8,15,"NEW0:diskname,id"
 :CLOSE 15
```

BASIC 7.0:
```
HEADER"diskname",id
```

Diskname can be any legal Commodore filename up to 16 characters long, and *id* any two numbers, letters, or characters. The NEW command can be abbreviated to a single N. Examples:

```
OPEN 15,8,15,"N0:BASICPROGS,T8"
 :CLOSE 15
HEADER "BASICPROGS",IT8
```

This would assign the diskname *BASICPROGS* and the ID number *T8* to the disk. (Important: Use this command only on a blank or scratch disk, because it irretrievably erases any existing information on the disk.) During the formatting process, the ID is written to every sector on the disk.

Commodore disk drives use the ID numbers to determine when a different disk has been inserted into the drive. You've never had to specify an ID number when saving a file because the drive checks it for you.

It's important for the drive to know when a different disk has been inserted because it must always keep track of available space on the current disk. When you save a program or write to a file, the drive has to know where the empty space is on the disk. Otherwise, it might overwrite existing data. Every disk contains a map, called a block availability map (BAM), which tells the drive which space is free and which space is occupied. The drive reads this map into memory—memory within the disk drive itself, not the computer. The drive refers to the map when new data is to be saved. Each time you add or delete information on the disk, the drive updates the map and writes it to the disk.

If you swap two disks that happen to have the same ID number, the drive may not be aware that you've inserted a different disk. It might continue to use the map from disk 1 when writing to disk 2. As a result, some existing information on disk 2 may be overwritten or scrambled. If each disk has a different ID number, this shouldn't happen. To be safe, you can issue the Initialize command (**OPEN 15,8,15, "I0":CLOSE15**) to force the drive to read the BAM.

In actual practice, most Commodore users say they rarely, if ever, experience disk problems which could be attributed to duplicate ID numbers.

Q. Is it possible to connect Commodore 64 and VIC-20 compatible joysticks to a Commodore Plus/4 or 16? If so, what connections would I have to make?

A. Yes, it's possible, but you'd have to rewire the joystick and find the correct plug connector to fit the Plus/4's and 16's joystick ports. This wouldn't be a difficult job for a technician or electronics hobbyist, but finding the right plug probably won't be easy.

We seem to remember seeing advertisements in European computer magazines for converter plugs that let you use a regular joystick with a Plus/4 or 16, but can't recall who made them. Perhaps some of our European readers could suggest a source.

Thanks For The Memory

Todd Heimarck
Assistant Editor

We welcome Todd Heimarck as the new "Horizons" columnist. Todd is the GAZETTE*'s Assistant Editor. Charles Brannon, author of the column since October 1983, is writing a new column, "AmigaView," which debuted in the May issue of our sister magazine,* COMPUTE!. *—Ed.*

Computer memory is like money. No matter how much you have, you can find a way to spend it.

Four years ago, I bought my first personal computer, a VIC-20 with an 8K expander and a Datassette. This system was replaced first by a 64 and 1541, then by a 128 and 1571. The price of each computer, not counting peripherals or software, was in the $250–300 range and yet each offered three times more usable memory for BASIC programs, from 12K (expanded VIC) to 39K (64) to 120K (128).

Although each new machine included new hardware and software features, my primary reason for upgrading was the extra memory. The more memory you have, the more powerful your programs.

When I've told friends that I plan to buy the 512K expander for the 128 as soon as it's available, their first question is usually, "Why would you want that much memory?"

Here are a few ideas. The 512K could hold 64 hi-res screens at 8,000 bytes each, so you could design 64 frames of full-screen animation. Or you could save 8192 sprite shapes there—1024 shapes for each of the eight sprites. By changing shapes twice a second, you could produce an eight-minute cartoon.

More serious applications could include up to 512 help screens. Or a single-swap disk backup program. A 1571 disk holds 340K, all of which could be copied to the expansion memory and then transferred to a new disk. A word processor could put roughly 50,000 words in the expander for a spelling checker. And CP/M recognizes the extra memory as disk M:—you can copy your favorite commands to the memory pack, for almost instantaneous execution.

A Few Quirks Of The 128 And 1571

Two months ago, "Gazette Feedback" included a short program for setting up custom characters on the 128. The beginning of the program performs a GRAPHIC1 followed by GRAPHIC0. The intention is not to set up a hi-res screen, but to move the start of BASIC memory up by 9K, to reserve a portion of memory for the character set.

I recently used this technique to create some custom characters. Then, needing a sprite shape, I typed the SPRDEF command to enable the built-in sprite editor.

Upon returning to BASIC, the screen was completely blank and the keyboard seemed to be disabled. The 128 wasn't completely locked up; pressing RUN–STOP/RESTORE put things right again. A little experimentation in the machine language monitor revealed the problem. Apparently, the sprite editor clears the entire hi-res graphics area (where the custom characters were located). You can test this by drawing a simple shape on the hi-res screen and then going into the sprite editor. When you quit, try looking at the hi-res screen.

The next is a quirk of the 1571. If you go directly into 64 mode by holding down the Commodore key when you turn on the 128, the 1571 will work as if it were a single-sided 1541. You can convert it to a 1571 by entering **OPEN15,8,15, "U0>M1": CLOSE15**. To force it into 1541 mode, which might be necessary with some commercial software, use **"U0>M0"** instead. Files aren't written to the second side until the first side is full, so it often doesn't matter whether the 1571 is in mode 0 or mode 1.

Now, imagine that you're working on a program in 64 mode and the disk drive is acting like a 1541. The disk has been formatted with two sides, but it's mostly empty, so it makes no difference that the 1571 is accessing only one side. After scratching several files, you validate the disk with **OPEN 15,8, 15: PRINT#15, "V0"** (the same as the COLLECT command in 128 mode). This isn't really necessary, but it shouldn't do any damage. Validating makes the disk drive read through the directory and protect any disk sector currently being used by a file, so existing files won't be overwritten by new files. After scratching several programs, I'll often validate the disk, to be safe.

Here's the problem: Validating while the disk drive is in 1541 mode turns a double-sided disk into a single-sided disk. Sending the "U0>M1" command won't let you regain the second side. A flag in byte 3 of track 18, sector 0 identifies double-sided disks. Since the validate command writes a new Block Allocation Map (BAM) on that same sector, it must write the single/double flag at the same time. In other words, in 1541 mode, it acts just like you'd expect a 1541 to act.

If this situation should happen to you, here's a program to turn your disk back into a double-sider:

```
10 OPEN15,8,15:OPEN2,8,2,"#"
20 PRINT#15,"U1";2;0;18;0
30 PRINT#15,"B-P";2;3
40 PRINT#2,CHR$(128);
50 PRINT#15,"U2";2;0;18;0
60 CLOSE2:PRINT#15,"I0":CLOSE15
```

Pay close attention to the punctuation—the commas and semicolons should be typed just as they're listed.

computing for families

My Favorite Robots

Fred D'Ignazio
Associate Editor

I'm writing a book inspired by The Learning Company's bestselling game *Robot Odyssey*. The book is set nearly 30 years in the future in the year 2014, and is titled *Escape From Robotropolis* (Blue Jay Books, Fall 1986). It's the story of teenager Homer Pierce's journey through an underground city inhabited by robot "Guardians" from another planet.

Writing this book has helped me speculate about how computers and robots might evolve over the next 30 years. One great danger I see is that they could become so easy to use that no one except the experts will need to understand how they work. As a result, we'll be placing major and minor decisions affecting our lives in the hands of "smart machines" which we do not understand. One way in helping to avoid this fate is to begin to acquire a basic understanding of how these machines work by building computer and robot kits.

Kits

A decade ago, during the early days of personal computing, there used to be a variety of computer kits on the market. But now, in the late 1980s, there is little demand for starter kits with 4K of memory when you can buy a 16K Radio Shack Color Computer for under $70, already assembled. And far more powerful computers (like the 64 and 128) are not much more expensive.

There are plenty of robot kits on the market, mostly marketed as "construction set" toys for kids. But the problem with most of them is that they have no computer interface, no motors, and no sensors—three essential features of any real robot.

However, if you look hard enough, real computer-robot kits can be found. One of the best places to start is Capsela. The Capsela kits have four virtues: They're easy to find (they're carried in Toys 'R Us stores nationwide), easy to assemble, versatile (allowing you to build many different kinds of machines), and inexpensive, costing as little as $12 for a starter kit (with no motors or computers) and ranging up to the computerized, motorized Capsela 2000 ($85) and Capsela 5000 ($120).

The parts in a Capsela kit are large and "friendly" looking, which makes them especially attractive as a beginner kit for a young child or a technophobic adult. Their varied and fantastic shapes are guaranteed to inspire any child's creativity and imagination. And, at the high end, the Capsela 5000 lets you program your robots on a handheld, wireless remote unit from up to 20 feet. Your robot can have up to 17 functions and your program can have up to 94 commands.

Capsela is a wise choice because it features a family of machines all built from similar parts. This gives you a wider choice of kits and robots, and enables you to become familiar with all the parts the first time you build a kit. As a result, all succeeding kits become much easier to assemble.

Once you and your children have built a couple of Capsela robots, you'll be ready to tackle the Movit family of robots from OWI. Like Capsela, the Movits come in all shapes and sizes and are inexpensive (as little as $25). Unfortunately, the Movit pieces are much smaller and less easy to manipulate, so they're better suited for older children (ages eight and up). And the Movit kits are not as available as the Capsela kits. (You can order them by direct mail and from popular hobbyist and computer stores and catalogs, including Heath/Zenith and Fordham Radio.)

At the top of the Movit line is the WAO (Wise Argent Orb) for $100. You can assemble WAO from its 100 parts in two to three hours—with no soldering. Once it is assembled you can program WAO with up to 27 commands on its onboard computer/keyboard or on a 64 or 128 using the WAO's RS-232 port (and a $40 computer interface). WAO has a pen mechanism which can be programmed to draw Logo-like graphics, including circles, stars, spirals, and letters.

After you've adopted and assembled an entire family of Movits, you'll be looking for a new challenge. My recommendation is a Fischertechnik robotic computing kit for the VIC-20, 64, or 128. The kit is relatively expensive ($200), but the price includes a power supply and computer interface.

A Fischertechnik kit is a low-cost way for an older child (ten and up) or a school group to learn about the basics of computers and robotics. With the help of the excellent, clearly written manual you can build ten different robotic devices, including a plotter, a machine tool, a sorting system, an automated Towers of Hanoi puzzle, a solar tracker, a robotic traffic light, and a teachable assembly-line robot. The kit's parts are as finely made as industrial parts for a factory, yet they are relatively large, "friendly," and easy to manipulate.

If you're looking for a local Capsela dealer, call Jill Cooper of Play-Jour Inc. at 212-243-5200. For more information about the Movits, talk to June Morioka at 213-638-4732. To find the Fischertechnik dealer closest to you, call Fischer America at 201-227-9283.

machine language for beginners

Richard Mansfield
Senior Editor

Last month we explored how easy it is to add and subtract numbers in machine language. Let's finish off this tour of arithmetic by looking at multiplication, division, and arithmetic involving multi-byte numbers.

Multiplication is especially easy if one of your numbers is a *power* of two (two multiplied by itself any number of times: 2, 4, 8, 16, 32, etc.). In these cases, you merely use the ASL instruction the appropriate number of times.

ASL shifts left all eight bits in a byte so that the number two (00000010) becomes (00000100) the number four. Thus, ASL multiplies whatever's in the accumulator by two. To multiply by four, you would ASL:ASL twice. Here's how to multiply 5 × 16:

```
5 LDA #5
10 ASL:ASL:ASL:ASL
```

This leaves the result, 80, in the accumulator.

To multiply by numbers which aren't powers of two, you can store the result in a temporary storage location and combine multiplication with addition to get the result. To multiply 5 × 3, we'll need to resort to this method since neither five nor three is a power of two:

```
10 LDA #5
20 STA TEMP
30 ASL; MULTIPLY 5 X 2
40 CLC
50 ADC TEMP; ADD THE RESULT, 10,
   TO THE 5 IN TEMP
60 STA TEMP
70 RTS
100 .BYTE TEMP 0; THE TOTAL WILL
    APPEAR HERE
```

Multiplication involving larger numbers, numbers which fit into two-byte units, requires some additional programming. Essentially, we will be using the ASL technique and, through a combination of ASL multiplication and any necessary addition, we can multiply any number. Here's how to multiply 258 × 10:

```
100 LDA NUMBER:STA TEMP; PRE-
    SERVE THE ORIGINAL NUMBER
    (258)
110 LDA NUMBER+1:STA TEMP+1
120 ASL NUMBER; MULTIPLY LOW
    BYTE BY 2
130 ROL NUMBER+1; ROLL ANY
    CARRY INTO HIGH BYTE
140 ASL NUMBER; DO IT AGAIN
150 ROL NUMBER+1
160 CLC
170 LDA TEMP; ADD ORIGINAL
    NUMBER
180 ADC NUMBER
190 STA NUMBER
200 LDA TEMP+1
210 ADC NUMBER+1
220 STA NUMBER+1; NOW WE'VE
    GOT 257 X 5 IN NUMBER
230 ASL NUMBER; SO WE JUST
    MULTIPLY BY 2
240 ROL NUMBER+1
250;
260 NUMBER .BYTE 2 1; THE RESULT
    WILL APPEAR HERE
270 TEMP .BYTE 0 0
```

Single-byte division follows the same rules as single-byte multiplication, except you substitute LSR (Logical Shift Right) for ASL. So to divide 80 by 4, you would:

```
5 LDA #80
10 LSR:LSR
```

The result, 20, would be left in the accumulator.

Finally, to add or subtract multi-byte numbers, we loop through a chain of bytes holding our numbers and letting the carry flag take any overflow as we travel from less to more significant bytes. Let's say that we need to add 65539 + 16777222. Two bytes together can hold a number up to 65535, so 65539 will require three bytes and will look like this:

```
.BYTE 3 0 1
```

because the least significant byte is on the left (representing 1's), then the byte representing 256's, and finally the most significant byte (representing 65536's). So, .BYTE 0 0 2 would be the equivalent of 131072. 16777222 needs four bytes and looks like this:

```
.BYTE 6 0 0 1
```

When we finish adding them together, the result will appear in the four bytes labeled LNUMBER below.

```
100 LOWER = $FB; FIRST SET UP
    POINTERS TO OUR BYTE CHAINS
110 UPPER = $FD
120 LDA #<LNUMBER; PUT ADDRESS
    OF LOWER CHAIN INTO POINTER
130 STA LOWER
140 LDA #>LNUMBER
150 STA LOWER+1
160 LDA #<UNUMBER:STA UPPER:
    LDA #>UNUMBER:STA UPPER+1;
    UPPER CHAIN
170;
180 LDX #4; THE NUMBER OF BYTES
    IN OUR CHAIN
190 LDY #0
200 CLC
210 LOOP LDA (LOWER),Y
220 ADC (UPPER),Y
230 STA (LOWER),Y
240 INY
250 DEX
260 BNE LOOP:RTS
270;
280 LNUMBER .BYTE 3 0 1 0; 65539
    (RESULT IN THESE FOUR BYTES)
290 UNUMBER .BYTE 6 0 0 1; +
    16777222
```

The result, 9 0 1 1, when translated into decimal, is 16842761.

ASSISTANT TECHNICAL EDITOR

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FontMaker

John Cawley III

Now you can easily design and print out your own characters. Up to nine custom character sets can be handled with this two-program package for the 64. A Commodore 1525, MPS-801, MPS-803, or compatible printer is required.

One benefit that owners of dot-matrix printers have over owners of daisywheel printers is that they can design and print their own character fonts (type styles). The programs accompanying this article, "FontMaker" and "FontPrinter," offer this ability and make it easy for the user. FontMaker lets you design your own character sets, and FontPrinter allows you to print text files—including specially-prepared *SpeedScript* documents—on a Commodore 1525, 801, or 803 printer. Note that the Commodore 1526 and MPS-802 printers are *not* compatible with the other Commodore models; FontPrinter (Program 2) will not work with a 1526 or 802.

Creating Fonts

FontMaker is written entirely in BASIC and may be typed in and saved as usual. If you use a tape drive instead of a disk, then a number of small modifications are required. First, delete lines 550 and 640–660, plus the OPEN 15,8,15 statement in line 120. Then change the 8 in lines 560 and 610 to a 1, and change line 630 to read simply GOTO 330. For easiest use, you should store all fonts you design on a separate tape from the one you use for FontMaker and FontPrinter.

To use Fontmaker, simply load it and type RUN. On the screen you'll see a square in which you can design characters. Below the design area is a full set of characters from which you select one to edit. To the right is a list of options. Begin by selecting a font to edit. Fontmaker provides for nine different custom font sets, numbered 1–9. Font 0 is reserved for your printer's normal character set, so that's always available as well. FontMaker always begins with font 1 selected; press f6 to change to another font.

FontMaker provides several different methods of selecting which character in the font you wish to design. You can use the cursor keys to move to the character you wish to edit. The character at the current cursor position in the character set display appears in black instead of light blue like the others. Press RETURN to select that character for editing; it will turn white to indicate that it's been selected. Or just type the key corresponding to the character you wish to edit. In this case, the color of character in the display will not change; instead, you'll see a message under the design area telling you which character is being edited.

If you type a nonprintable *control* character—one with a character code between 0 and 31 or between 128 and 159—you'll receive the message *invalid character*. You cannot edit these characters. If FontPrinter receives a control character from a text file, it does not attempt to locate its shape (control characters aren't printable, so they don't have shapes); it just sends the character code value straight to the printer. Thus, you can still use any special printer control characters that fall within this range.

There's one additional method for selecting which character you wish to edit. Press f5 and you'll be prompted for a character to edit. You can either type a single character and press RETURN, or you can type a slash followed by a character code number. For example, if you type /65, you'll be able to edit the *a* character. As before, however, characters 0–31 and 128–159 cannot be edited.

Once you've selected a character, the cursor appears in the design area. If the character you selected has been previously defined, its existing definition will be displayed in the design area, with a cursor in the upper left corner. If the specified character has not previously been defined, the design area will be blank, and the cursor will appear as a dark line on the left border of the design area. Actually, a random pattern may appear for some undefined characters because of leftover values in the area of memory used to store the font sets. If you wish to

initialize the storage area to ensure that all characters start out undefined, enter the following line in direct mode *before* running FontMaker:

```
FOR X=31488 TO 40703: POKE X,0:
  NEXT
```

Be patient; this initialization will take about 35 seconds.

For a previously undefined character, your first step should be to specify the width for your character design. The standard size for characters on the 1525 and related printers is six dots wide by seven dots high. Most character definitions actually use only the first five vertical columns, with the sixth (rightmost) column left blank for spacing between characters. Fontmaker offers greater flexibility by allowing you to define each character individually to be any width between zero and eight dots. This is useful, for example, in making the letters *i* and *t* thinner and the letters *m* and *w* wider. Character height is fixed at seven dots; this is an unchangeable physical feature of the printer, which forms characters using a vertical stack of seven wire "hammers" in its printhead.

Of course, you need not make your character design a full seven dots high—you might want to reserve the bottom two rows for descenders for lowercase letters like g, p, q, and y. Press f3 to add a column of pixels (short for *picture elements*, the technical term for screen or printer dots), or f4 to remove a column. Columns are always added left to right, and deleted right to left. Remember to add a blank column on the right side of your design; otherwise, the characters will run together when printed.

The only caution with varying letter width is that the printer still assumes that each character is only six dots wide. That is, the printer assumes that a line consists of 80 six-dot characters (for a total of 480 dots). If you use too many seven- or eight-dot-wide characters, there is the possibility that the line will overflow and run over onto the next line. For a few wide characters, this isn't likely to happen, but if you have several, you should temporarily redefine the margins on your word processor, or include a few characters of zero width on that line in order to fool the printer.

You can use the normal cursor control keys to move about the design area. The cursor wraps around at all design area boundaries. Pressing CLR/HOME returns the cursor to the upper left corner; SHIFT–CLR/HOME clears the design area, turning all pixels off (the defined width remains unchanged). To turn on a dot, press f1 (or any key other than space, RETURN, SHIFT–RETURN, and the other function keys). An asterisk will appear to indicate that the pixel is on and the cursor will move one position to the right, wrapping around at the right edge of the design area. To clear (turn off) a dot that was previously on, press f2 or the space bar. The asterisk will disappear and the cursor will move one position to the right.

When you've finished designing a character, press RETURN to save the new version of the character into the currently selected font. The design area will clear and the cursor will return to the character set. The character pattern on the screen will not change. Remember, FontMaker is for designing custom *printer* characters, not custom *screen* characters. If you wish to cancel a design without saving any changes you may have made, press SHIFT–RETURN. This also clears the design area and returns the cursor to the character set display, but without affecting the previous definition for the character you were editing.

You can also use the f5 and f6 keys while designing a character. While the cursor is in the design area, f5 changes the character position at which the design will be stored without affecting the character pattern currently being edited. This allows you to copy designs between character positions within a font, and can be a useful shortcut. For example, you can define and store a design for the *h* character, then select *h* again, turn off the extra dots at the top, then press f5, the N key, and RETURN to store a design for *n* without having to redraw it from scratch.

You can change font sets without affecting the character being edited by pressing f6. This allows you to copy characters between font sets. For example, you could copy the definition of the *A* character from font 1 to font 4 by selecting the *A* character in font 1, pressing f6 and then 4 to switch to font 4, then pressing RETURN to store the definition in the *A* character position in that font 4. (You would then remain in font 4 until you switched to another font.) You can even use the f5 and f6 keys together to copy one character in one font to a different character in a different font.

After you've designed all the characters you want, you must save the font sets to tape or disk for FontPrinter to use. Press f8 to save a font set; you'll be prompted for a filename. Fontmaker also allows you to reload previously created font sets for additions or further editing. Pressing f7 activates the load feature. Keep in mind that f7 and f8 always load and save all nine fonts in the set—FontMaker does not provide for selective loading or saving of individual fonts.

There are a couple of other cautions. If you press f7 or f8 accidentally, you can undo your mistake by pressing RETURN alone. However, f5 and f6 both require that some value be entered. If you press one of these accidentally, you can negate the effect of the mistake by simply entering the value of the currently selected character or font. If the program should stop because of an error, just clear the screen and run the program again—the font will be intact. However, if an error occurs during a save, you must type GOTO 620, then press RUN/STOP, type RUN, and press RETURN. The font set in the process of being saved should still be intact.

One final note: You don't have to design a shape for every character in every font—all the printer's normal characters still remain available for your use—but you must design a new shape for every character you actually use in every font you use. For example, suppose you want to use font 6 as italics and you design an italic shape for every uppercase letter in that font except *L*. When you try to print *HELLO* using font 6, all that will appear at the printer is *HEO*. This caution also applies to the space and shifted-space characters (codes 32 and 160, respectively). These two are easy to overlook because they don't appear in the character set display on the FontMaker screen.

Because FontPrinter assumes

zero width for all undefined characters, all the words you print in the custom fonts will run together if you don't have space defined. How do you define a space? Select the space character by pressing the space bar, or by pressing f5 and entering the code for space, /32. Use f3 to open up the desired number of empty columns for the space, then press RETURN to store the definition.

Printing Fonts

Program 2, FontPrinter, is written entirely in machine language. To type it in, you must use the "MLX" machine language editor program, found elsewhere in this issue. After loading and running MLX, respond to the prompts with:

Starting address: 0801
Ending address: 09C8

After entering all the data, be sure to save at least one copy. To load FontPrinter, type LOAD *"filename"*,8 and press RETURN. If you're using tape, change the ,8 to ,1. After the file entered with MLX is loaded, tape users should enter the following line:

```
POKE2136,1:POKE2176,1:POKE2178,1
```

and press RETURN. Then resave this modified version of FontPrinter to use with your Datassette instead of the original version entered with MLX.

When FontPrinter has finished loading, type RUN. You'll be asked for the filename of a font set. This will be one of the font sets you designed and saved using FontMaker. Enter your choice and press RETURN, then wait while the selected font is loaded into memory. When you see the prompt *Source:*, reply with the name of the previously created text file you wish to print.

FontPrinter requires that the text in files it prints be stored as Commodore ASCII characters. Thus a special step is necessary if you want to print files generated using COMPUTE!'s *SpeedScript* word processor (and several others, including *WordPro* and *Paperclip*). These word processors store the text as screen codes rather than as Commodore character codes. To create an ASCII-format *SpeedScript* file for use with FontPrinter, follow these instructions: After entering or loading the desired text using *SpeedScript*, press SHIFT-CTRL-P. When you're prompted for screen, disk, or printer, enter D for disk and respond with a filename. This version of the text file can now be printed with FontPrinter. Note that *SpeedScript* will not print text files to cassette, so you'll have to use some alternate method to create an ASCII file on tape (such as the programs below).

Once FontPrinter has been given the name of the text file, it will begin printing in font 0, the printer's normal character set. FontPrinter interprets a CHR$(0) in your text as a signal to change fonts. The character sent immediately after the CHR$(0) must be a number between 0 and 9 (character codes 48–57). FontPrinter will then change to the previously defined font indicated. For example, if font 2 of your character set is italics and you'd like to print a word in italics, you would redefine a character to be treated as CHR$(0) somewhere in your document. Just before you type the phrase to be italicized, you would type a CHR$(0) followed by a character 2. Then type the phrase, and FontPrinter will italicize it. To switch from italics to another font, type a CHR$(0) followed by the number of the desired font—for example, CHR$(0) followed by 0 to return to the printer's normal font.

You can change fonts in *SpeedScript* using a definable printkey. For example, type CTRL-£ (the British pound character £ is just to the left of the CLR/HOME key), then respond to the *Press format key:* message by pressing the 0 key, followed by an equal sign (=) and a 0. This will appear on the screen as a reverse-video 0, followed by =0. After this, CTRL-£ 0 will be treated as CHR$(0). To switch to font 2, you would include in your text CTRL-£ 0 followed by 2. Remember that, once you switch to a font, all text will be printed in that font until you switch to a different font.

If you don't have a copy of *SpeedScript* or some other word processor that can store text as character codes, a simple program such as the following will allow you to create an ASCII file directly on disk or tape (although not with the ease of a word processor, since there is no provision for editing the text you enter):

```
10 PRINT CHR$(14)"FILENAME";
20 INPUT F$:OPEN 1,8,6,F$+",S,W"
30 GET A$:IF A$="" THEN 30
40 IF A$="@" THEN PRINT#1:CLOSE
   1:END
50 IF A$="£" THEN PRINT A$;:A$=
   CHR$(0)
60 PRINT A$;:PRINT#1,A$;:GOTO 30
```

Be careful not to omit the semicolon (;) at the end of each PRINT statement. For tape, change line 20 to:

```
20 INPUT F$:OPEN 1,1,1,F$
```

To use this program, simply type RUN and press RETURN. You'll be asked for a name for the text file. After you enter the name, the file is opened and anything you type from then on is written to the file on disk or tape as well as being displayed on the screen. To end entry and close the file, press the @ key. Since it's not normally possible to type a character equivalent to CHR$(0) from the keyboard, the £ key is programmed to send the CHR$(0) you need to change fonts (although it still appears on the screen as £). For example, to indicate a switch to font 4 you would simply type £ followed by 4.

See program listings on page 110.

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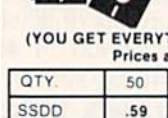

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COMPUTE!'s GAZETTE Author Guide

Here are some suggestions which serve to improve the speed and accuracy of publication for prospective authors. COMPUTE!'s GAZETTE is primarily interested in new and timely articles on the Commodore 128, 64, Plus/4, 16, and VIC-20. We are much more concerned with the content of an article than with its style, but articles should as be clear and well-explained as possible.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one model of computer, please state the model name. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing or computer paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name and the title of the article. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, CTRL, SHIFT), BASIC words (LIST, RND, GOTO), and the language BASIC. Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE!'s GAZETTE pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403) it will take from two to four weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE!'s GAZETTE does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact our Features Editor for details.

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the Commodore 128, 64, Plus/4, 16, and VIC-20. 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 frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed 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 then back on, erasing whatever was in memory. So be sure to *save a copy of your 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 the 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 reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote 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 + ↑	

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	

The Automatic Proofreader

Philip I. Nelson, Assistant Editor

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, 16, and VIC-20 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now 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 the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

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 after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *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. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. 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 (SYS 65341 for the 128, 64738 for the 64, 65526 for the Plus/4 and 16, and 64802 for the VIC). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that 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 New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

MLX Machine Language Editor For The Commodore 64

Ottis Cowper
Technical Editor

"MLX" is a labor-saving utility that will help you enter machine language program listings without error. MLX is required to enter all Commodore 64 machine language programs published in COMPUTE!'s GAZETTE. This version of MLX was first published in the January 1986 issue; it cannot be used to enter MLX programs published prior to that date, nor can earlier versions of MLX be used to enter the listings in this issue.

Type in and save a copy of MLX. You'll need it for all future machine language programs in COMPUTE!'s GAZETTE, as well as machine language (ML) programs in our companion magazine, COMPUTE!, and COMPUTE! books. When you're ready to enter an ML program, load and run MLX. It asks you for a starting and ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing. If you're unfamiliar with ML, 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 enter the starting and ending addresses, MLX offers the option of clearing the workspace. The data you enter with MLX is kept in a special reserved area of memory; clearing this workspace area fills the reserved area with zeros, which will make it easier to find where you left off typing if you enter the listing in several sessions. 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 there's no point in clearing the workspace, since the data you load in will fill the area with whatever values were in workspace memory at the time of the last Save.

At this point, MLX presents a menu of commands:

```
Enter data
Display data
Load data
Save file
Quit
```

Press the corresponding key to select a menu option. These commands are available only while the menu is displayed. You can get back to the menu from most options by pressing RETURN.

Entering A Listing

To begin entering data, press E. You'll be asked for the address at which you wish to begin. (If you pressed E by mistake, you can return to the command menu by pressing RETURN.) When you begin typing a listing, enter the starting address here. If you're typing in a long listing in several sessions, you should enter the address where you left off typing at the end of the previous session. In any case, make sure the address you enter corresponds to the address of a line in the MLX listing. Otherwise, you'll be unable to enter the data correctly.

After you enter the address, you'll see that address appear as a prompt with a nonblinking cursor. Now you're ready to enter data. To help prevent typing mistakes, only a few keys are active, so you may have to unlearn some habits. MLX listings consist of nine columns of two-digit numbers—eight bytes of data and a checksum. You *do not* type spaces between the columns; the new MLX automatically inserts these for you. Nor do you press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit. The only keys needed for data entry are 0–9 and A–F. Pressing most of the other keys produces a warning buzz.

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) 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, you can press CLR/HOME to quickly get to a line number prompt.

Beep Or Buzz?

After you type the last digit in a line, MLX calculates a checksum from the line number and the first eight columns of data, then compares it with the value in the ninth column. The formula (found in lines 370–390 of the MLX program) catches almost every conceivable typing error, including the transposition of numbers. If the values match, you'll hear a pleasant beep, the data is added to the workspace area, and the prompt for the next line of data appears (unless the line just entered was the last line of the listing—in which case you'll automatically advance to the Save option). But if MLX detects a typing error, you'll hear a low buzz and see an error message. Then MLX redisplays the line for editing.

To edit a line, move the cursor left and right using the cursor keys. (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. To make corrections in a mistyped line, 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. 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.

Other MLX Functions

The Display data option lets you review your work. When you select D, you'll be asked for a starting address. (As with the other menu options, pressing RETURN at this point takes you back to the command menu.) Make sure the address corresponds to a line from the listing. You can pause the scrolling display by pressing the space bar. (MLX finishes printing the current line before halting.) To resume scrolling, press the space bar again. The display continues to scroll until the ending address is reached, then the menu reappears. To break out of the display and return to the menu before the ending address is reached, press RETURN. A quick way to check your typing is to compare the reverse video checksums on the screen with the data in the rightmost column of the printed listing. If the values match, you can be sure the line is entered correctly.

The Save and Load menu options are straightforward. First, MLX asks for a filename. (Again, pressing RETURN at this prompt without entering anything returns you to the command menu.) Next, MLX asks you to press either T or D for tape or disk. If you notice the disk drive starting and stopping several times during a load or save,

don't panic; this behavior is normal because MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. For disk, the drive prefix 0: is automatically 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 remember to give each version saved a different name.) MLX saves the entire workspace area from the starting to 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 so you'll know where to resume entry when you reload.

MLX reports any errors detected during the save or load. (Tape users should bear in mind that the Commodore 64 is never able to detect errors when saving to tape.) MLX 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 originally specified. If you get one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct ending address.

The Quit menu option has the obvious effect—it stops MLX and enters BASIC at a READY prompt. Since the RUN/STOP key is disabled, Q 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 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 to see the results. The instructions for loading the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. (Such programs usually have 0801 as their MLX starting address.) Others must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. (On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000.) In any case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

By the time you finish typing in the data for a long ML program, you'll have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type in MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. (Incidentally, MLX is included every month on the GAZETTE DISK.) 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. Don't let a simple typing error in MLX cost you several nights of hard work.

MLX

For instructions on entering this listing, refer to "How To Type In COMPUTE!'s GAZETTE Programs" elsewhere in this issue.

```
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:Z
       4=254:Z5=255:Z6=256:Z7=
       127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
       :BS=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
       +23:POKE I,0:NEXT:POKE
       {SPACE}SD+24,15:POKE 78
       8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
       R$(8):POKE 53280,15:POK
       E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
       {2 SPACES}{8 @}
       {2 SPACES}"SPC(28)"
       {2 SPACES}{OFF}{BLU} ML
       X II {RED}{RVS}
       {2 SPACES}"SPC(28)"
       {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
       {3 SPACES}COMPUTE!'S MA
       CHINE LANGUAGE EDITOR
       {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
       RESS{4}";:GOSUB300:SA=A
       D:GOSUB1040:IF F THEN18
       0
GF 190 PRINT"{BLK}{2 SPACES}EN
       DING ADDRESS{4}";:GOSUB
       300:EA=AD:GOSUB1030:IF
       {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
       R WORKSPACE [Y/N]{4}";A
       $:IF LEFT$(A$,1)<>"Y"TH
       EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
       ING...";:FORI=BS TO BS+
       EA-SA+7:POKE I,0:NEXT:P
       RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
       {BLK}{RVS} MLX COMMAND
       {SPACE}MENU {DOWN}{4}":
       PRINT T$"{RVS}E{OFF}NTE
       R DATA"
ED 230 PRINT T$"{RVS}D{OFF}ISP
       LAY DATA":PRINT T$"
       {RVS}L{OFF}OAD DATA"
JS 240 PRINT T$"{RVS}S{OFF}AVE
        FILE":PRINT T$"{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$=
       MID$("EDLSQ",I,1)THEN A
       =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
       90,700,280:GOSUB1060:GO
       TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
       T"{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$:AD=0:INPUTIN$:IF
       LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
       =MID$(IN$,3):GOSUB320:A
       D=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:PRI
       NT MID$(H$,B+1,1);:RETU
       RN
RR 360 A=INT(AD/Z6):GOSUB350:A
       =AD-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
       {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
       {SPACE}":GOSUB400:IF IN
       $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
        THEN PRINT IN$:PRINT"
       {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
       =S$:FOR J=1 TO 2:IF F T
       HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
       24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
       $>"@"ANDA$<"G")THEN540
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 PRI
       NT B$:J=2:NEXT:I=24:NEX
       T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
       ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
       ((I=0)AND(J=1))THEN GOS
```

```
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE [43]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK[43]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME[43]";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: [43]";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      [43]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
KH 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF
      {SPACE}ST AND(I<>B)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
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
AX 950 POKE147,0:SYS 63562:IF
      {SPACE}ST<>64 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}[43]":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
      D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
      ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
      1050
HA 1040 IF(AD>511 AND AD<40960
      )OR(AD>49151 AND AD<53
      248)THEN GOSUB1080:F=0
      :RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
      {SPACE}INVALID ADDRESS
       {DOWN}{BLK}":F=1:RETU
      RN
AR 1060 POKE SD+5,31:POKE SD+6
      ,208:POKE SD,240:POKE
      {SPACE}SD+1,4:POKE SD+
      4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
      TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
      240:POKE SD,0:POKE SD+
      1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
      KE SD+4,0:POKE SD,0:PO
      KE SD+1,0:RETURN
```

Autoboot Maker

Article on page 75.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
FF 100 INPUT "NAME OF PROGRAM
      {SPACE}TO LOAD";PN$
RH 110 INPUT "NAME OF BOOT PRO
      GRAM";BN$
BE 120 INPUT "LOCATION TO JUMP
       AFTER LOAD";LOC$
XS 130 IF LOC$="" THEN BASIC=1
      :GOTO 160
CQ 140 IF LEFT$(LOC$,1)="$" TH
      EN GOSUB 760:GOTO 160
MG 150 LOC=VAL(LOC$)
PX 160 INPUT "KILL RUNSTOP/RES
      TORE (Y/N)";RN$
EK 170 RN$=LEFT$(RN$,1)
FE 180 IF NOT (RN$="Y" OR RN$=
      "N") THEN 160
FE 190 OPEN 15,8,15,"I"
BB 200 OPEN 8,8,8,"0:"+BN$+",P
      ,W"
KC 210 PRINT#8,CHR$(167)CHR$(0
      2);
XX 220 PRINT#8,CHR$(LEN(PN$));
XQ 230 PRINT#8,PN$;
KB 240 IF RN$="N" THEN 380
JX 250 FOR C=1 TO 17
BM 260 READ CODE
SK 270 PRINT#8,CHR$(CODE);
EE 280 NEXT C
SJ 290 DATA 120{9 SPACES}: REM
       SEI
KK 300 DATA 169,052{5 SPACES}:
       REM LDA #52
AK 310 DATA 141,020,003 : REM
      {SPACE}STA $0314
SK 320 DATA 169,134{5 SPACES}:
       REM LDA #134
PM 330 DATA 141,024,003 : REM
      {SPACE}STA $0318
QF 340 DATA 169,234{5 SPACES}:
       REM LDA #234
SG 350 DATA 141,025,003 : REM
      {SPACE}STA $0319
XQ 360 DATA 088{9 SPACES}: REM
       CLI
MS 370 GOTO 390
FK 380 FOR C=1 TO 17:READ CODE
      :NEXT C
BP 390 FOR C=1 TO 38
GC 400 READ CODE
PB 410 PRINT#8,CHR$(CODE);
MR 420 NEXT C
AH 430 DATA 169,002{5 SPACES}:
       REM LDA #2
RX 440 DATA 162,008{5 SPACES}:
       REM LDX #8
SR 450 DATA 160,255{5 SPACES}:
       REM LDY #255
BA 460 DATA 032,186,255 :REM J
      SR $FFBA
KD 470 DATA 173,167,002 :REM L
      DA $02A7
JE 480 DATA 162,168{5 SPACES}:
       REM LDX #$A8
EH 490 DATA 160,002{5 SPACES}:
       REM LDY #$02
DG 500 DATA 032,189,255 :REM J
      SR $FFBD
PB 510 DATA 169,000{5 SPACES}:
```

```
        REM LDA #$00
AH 520  DATA 032,213,255 :REM J
        SR $FFD5
MH 530  DATA 169,131{5 SPACES}:
        REM LDA #131
MX 540  DATA 141,002,003 :REM S
        TA $0302
XH 550  DATA 169,164{5 SPACES}:
        REM LDA #164
SP 560  DATA 141,003,003 :REM S
        TA $0303
MP 570  DATA 134,045{5 SPACES}:
        REM STX $2D
EG 580  DATA 132,046{5 SPACES}:
        REM STY $2E
AA 590  IF BASIC=1 THEN GOSUB 8
        60:GOTO 620
HD 600  L1=INT(LOC/256):L2=LOC-
        (L1*256)
CM 610  PRINT#8,CHR$(76)CHR$(L2
        )CHR$(L1);
RP 620  IF RN$="Y" THEN BU=58+L
        EN(PN$)+1
CR 630  IF RN$="N" THEN BU=41+L
        EN(PN$)+1
GE 640  IF BASIC=1 THEN BU=BU+1
        1
GR 650  BL=88-BU
KC 660  FOR C=1 TO BL+1:PRINT#8
        ,CHR$(0);:NEXT C
KP 670  PRINT#8,CHR$(139)CHR$(2
        27);
GH 680  B=679+LEN(PN$)+1
SD 690  L1=INT(B/256):L2=B-(L1*
        256)
CA 700  PRINT#8,CHR$(L2)CHR$(L1
        );
JP 710  CLOSE8
AS 720  GET#15,A$:S=ST
AJ 730  PRINT A$;
QE 740  IF S=0 THEN 720
KF 750  END
KP 760  L=LEN(LOC$)
ED 770  S=L-1
RK 780  FOR C=1 TO L
JR 790  I$=MID$(LOC$,C,1)
MD 800  IF I$<="9" THEN I$=STR$
        (VAL(I$))
MB 810  IF I$=>"A" THEN I$=STR$
        (ASC(I$)-55)
QQ 820  LOC=LOC+VAL(I$)*16↑S
FK 830  S=S-1
AH 840  NEXT C
SM 850  RETURN
JC 860  FOR C=1 TO 14
JA 870  READ CODE
RE 880  PRINT#8,CHR$(CODE);
EP 890  NEXT C
CK 900  DATA 169,000{5 SPACES}:
        REM LDA #$00
EA 910  DATA 133,122{5 SPACES}:
        REM STA $7A
EG 920  DATA 169,008{5 SPACES}:
        REM LDA #$08
RR 930  DATA 133,123{5 SPACES}:
        REM STA $78
KP 940  DATA 032,096,166 :REM J
        SR $A660
QG 950  DATA 076,174,167 :REM J
        MP $A7AE
SD 960  RETURN
```

SpeedScript-80

See instructions in article on page 77 before typing in.

Patch 1

```
289E:4C B6 08 8E 00 D6 D0 07 B0
28A6:48 A9 1F 8D 00 D6 68 2C 9A
28AE:00 D6 10 FB 8D 01 D6 60 F4
28B6:A9 00 A2 12 20 A1 08 E8 D1
28BE:A9 50 20 A1 08 AD 11 20 4F
28C6:85 FB AD 12 20 85 FC A2 63
28CE:01 A0 00 B1 FB 99 3C 03 A4
28D6:C8 29 7F C9 1F F0 13 C0 06
28DE:50 D0 F0 88 B1 FB 29 7F 81
28E6:C9 20 F0 05 88 D0 F5 A0 A6
28EE:4F C8 84 3B A0 00 B9 3C 12
28F6:03 20 A6 08 C8 C4 3B D0 C6
28FE:F5 18 98 65 FB 85 FB A5 4D
2906:FC 69 00 85 FC E0 01 D0 C7
290E:03 8C 10 20 20 28 09 E8 A5
2916:E0 19 F0 03 4C CF 08 A5 C4
291E:FB 8D 1B 20 A5 FC 8D 1C 8F
2926:20 60 C0 50 F0 08 A9 20 D8
292E:20 A6 08 C8 D0 F4 60 00 E2
```

Patch 2

```
2A4E:A9 00 A8 20 96 11 20 28 EF
2A56:09 A9 00 4C 96 11 00 00 57
```

Patch 3

```
315D:A9 FD 8D 30 D0 A9 08 20 26
3165:96 11 A9 20 A2 18 20 A1 E5
316D:08 A9 8F 20 A6 08 A0 08 D0
3175:A9 FF A2 1E 20 A1 08 88 03
317D:D0 FA 60 29 7F C9 20 90 99
3185:0F C9 40 90 08 E9 40 C9 25
318D:20 90 02 69 1F 20 A6 08 C9
3195:60 A2 12 20 A1 08 A9 00 95
319D:E8 4C A1 08 00 00 00 00 3C
```

Patch 4

```
3445:A9 FC 8D 30 D0 A9 00 4C EF
344D:96 11 20 CD BD A0 00 B9 50
3455:00 01 F0 06 20 A6 08 C8 F0
345D:D0 F5 60 30 20 A9 00 20 82
3465:96 11 A9 20 20 70 11 00 79
```

Patch 5

```
C000:A9 12 85 FB A9 1E 85 FC 19
C008:A0 00 B1 FB 29 7F F0 14 0D
C010:C9 20 B0 02 A9 2A C9 40 7E
C018:90 0A 38 E9 40 C9 20 90 04
C020:03 18 69 20 91 FB C8 D0 37
C028:E1 A6 FC E0 20 F0 05 E8 A9
C030:86 FC D0 D6 A0 00 84 FB C5
C038:A9 08 85 FC B1 FB C9 20 42
C040:F0 0F C8 D0 F7 A6 FC E8 61
C048:86 FC E0 15 D0 EE 4C 76 0B
C050:C0 84 02 84 FD A5 FC 85 E1
C058:FE A0 01 B1 FD C9 D2 D0 4A
C060:10 C8 B1 FD C9 FF D0 09 2B
C068:A9 11 91 FD 88 A9 80 91 92
C070:FD A4 02 4C 42 C0 A9 4F D6
C078:8D E3 14 A9 14 8D E4 14 8B
C080:A9 06 8D FA 14 A9 A6 8D DB
C088:FC 14 A9 08 8D FD 14 A9 79
C090:20 8D B4 16 8D 85 18 A9 D9
C098:45 8D B5 16 A9 14 8D B6 A7
C0A0:16 A9 5D 8D 86 18 A9 11 15
C0A8:8D 87 18 A9 A6 8D 7C 09 DD
C0B0:A9 08 8D 7D 09 A0 04 A9 0F
C0B8:78 99 8B 0E 99 0A 16 A9 F9
C0C0:58 99 9B 0E 99 1A 16 88 13
C0C8:A9 EA 99 8B 0E 99 0A 16 C6
C0D0:99 9B 0E 99 1A 16 88 10 AB
C0D8:F1 A9 4F 8D B8 1D 8D 06 DB
C0E0:1E A9 14 8D B9 1D 8D 07 9B
C0E8:1E A9 22 8D 8C 1B A9 16 3B
C0F0:8D 8D 1B A0 0B B9 1C C1 43
C0F8:99 24 16 88 10 F7 A0 08 45
C100:B9 28 C1 99 E5 14 88 10 DC
C108:F7 A9 EA 8D F9 14 8D FA 5E
C110:14 A9 28 8D FC 14 A9 09 7A
C118:8D FD 14 60 B9 45 20 F0 7E
C120:06 20 D2 FF C8 D0 F5 60 DE
C128:A9 36 85 01 98 18 69 43 0A
C130:A8 00 00 00 00 00 00 00 08
```

Star Dragon

Article on page 54.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: 16 Sprites

```
CD 100  INPUT"{CLR}{2 DOWN}STAR
        TING ADDRESS";SA
AR 110  IFSA>53020THENPRINT"INP
        UT AN ADDRESS LOWER THA
        N 53021":RUN
SH 120  PRINT"WAIT..."
SD 130  REM >> PUT DATA AT STAR
        TING ADDR <<
DH 140  FORT=0TO149:READV$
RA 150  L$=LEFT$(V$,1)
JD 160  IFASC(L$)>64THEN HN=ASC
        (L$)-55
MX 170  IFASC(L$)<65THEN HN=ASC
        (L$)-48
RA 180  R$=RIGHT$(V$,1)
PS 190  IFASC(R$)>64THEN LN=ASC
        (R$)-55
JP 200  IFASC(R$)<65THEN LN=ASC
        (R$)-48
CD 210  B=HN*16+LN:POKE SA+T,B:
        NEXT
BX 220  REM >> WEDGE PROGRAM IN
        TO RASTER <<
HH 230  POKE53265,27:POKE56333,
        127:POKE788,((SA/256)-I
        NT(SA/256))*256
RX 240  POKE789,SA/256:POKESA+1
        09,PEEK(648)+3:POKE5327
        4,129
XB 250  REM >>>>> DISPLAY 16 SP
        RITES <<<<<<
ED 260  FORT=53170TO53247:POKET
        ,0:NEXT:FORT=0TO63:POKE
        704+T,255:NEXT
DE 270  FORT=0TO15:POKE53232+T,
        11
GG 280  POKE53216+T,1+RND(0)*8:
        POKE53184+T,140-T*8:POK
        E53200+T,60+T*10:NEXT
CE 290  POKE53178,255:POKE53179
        ,255:POKE53281,0:PRINT"
        {CLR}":END
JS 300  REM >>>>> 16 SPRITES HE
        X DATA <<<<<
AF 310  DATA A5,FD,29,01,AA,49,
        01,A8,BD,B2,CF,8D,1C,D0
RM 320  DATA BD,B4,CF,8D,1D,D0,
        BD,B6,CF,8D,17,D0,BD,B8
EG 330  DATA CF,8D,1B,D0,BD,BA,
        CF,8D,15,D0,AD,1E,D0,99
PE 340  DATA BC,CF,AD,1F,D0,99,
        BE,CF,A9,01,8D,19,D0,A5
JF 350  DATA FD,29,01,0A,0A,0A,
        AA,A0,00,84,FE,A9,01,85
SQ 360  DATA FC,BD,C0,CF,0A,99,
        00,D0,90,06,A5,FC,05,FE
BH 370  DATA 85,FE,BD,D0,CF,99,
        01,D0,8A,84,FF,29,07,A8
BC 380  DATA BD,E0,CF,99,27,D0,
        BD,F0,CF,99,F8,07,A4,FF
KQ 390  DATA 18,26,FC,E8,C8,C8,
        C0,10,D0,CD,A5,FE,8D,10
XE 400  DATA D0,AD,1F,D0,E6,FD,
        A9,00,8D,12,D0,AD,0D,DC
```

```
BC 410 DATA 29,01,F0,03,4C,31,
       EA,4C,BC,FE
```

Program 2: Star Dragon—Main Program

See instructions in article on page 54 before typing in.

```
C0F0:4C 6A C7 A4 15 8C 01 D4 28
C0F8:F0 02 C6 15 4C 00 C2 60 E5
C100:00 18 00 00 18 00 00 18 62
C108:00 00 3C 00 1E 3C 78 0F F4
C110:3C F0 07 FF E0 03 E7 C0 72
C118:03 C3 E0 3F BD FC FF BD BD
C120:FF 3F C3 FC 03 E7 E0 03 38
C128:FF E0 07 3C F0 1E 3C 38 39
C130:1E 3C 38 00 18 00 00 18 B1
C138:00 00 18 00 00 00 00 00 BE
C140:00 00 00 00 00 00 00 00 C3
C148:00 00 30 00 00 78 00 00 B3
C150:FC 00 01 FE 00 03 FF 00 6E
C158:00 78 00 00 78 00 03 7B 3F
C160:00 07 7B 80 0F 7B C0 1F 24
C168:7B E0 3F FF F0 7F FF F8 48
C170:7C FC F8 79 FE 78 73 FF E8
C178:38 63 FF 18 00 00 00 00 72
C180:93 05 0D 0D 0D 0D 20 20 7E
C188:20 20 20 20 20 20 20 20 0C
C190:53 43 4F 52 45 3A 30 30 41
C198:30 30 20 4C 45 56 45 4C 63
C1A0:3A 42 0D 0D 9E 20 20 20 1A
C1A8:20 20 20 20 20 20 20 20 2C
C1B0:20 20 20 20 20 48 49 54 5B
C1B8:20 2B 0D 0D 20 20 20 20 6B
C1C0:20 20 20 20 20 20 54 4F DB
C1C8:20 50 4C 41 59 20 53 54 54
C1D0:41 52 44 52 41 47 4F 4E 4B
C1D8:00 40 80 C0 C0 30 0C 03 6A
C1E0:20 21 22 23 25 26 27 28 6B
C1E8:2A 2B 2C 2D 2F 30 31 32 73
C1F0:34 35 36 37 39 3A 3B 3C 7B
C1F8:3E 3F 40 41 43 44 45 46 83
C200:A2 00 A2 00 BD 00 CF F0 A9
C208:44 C9 01 F0 14 BC D0 CF 56
C210:88 88 98 9D D0 CF C9 04 46
C218:B0 05 A9 00 9D 00 CF F0 E9
C220:2C BC 40 CF BD C0 CF 85 06
C228:AE BD 20 CF 20 53 C2 9D E6
C230:40 CF A5 AE 9D C0 CF BC B5
C238:50 CF BD D0 CF 85 AE B1 4E
C240:30 CF 20 53 C2 9D 50 CF 08
C248:A5 AE 9D D0 CF E8 E0 0F FF
C250:D0 B2 60 30 0A 0A 84 02 7D
C258:65 02 90 02 E6 AE 60 0A FF
C260:85 02 98 E5 02 B0 02 C6 38
C268:AE 60 4C 13 C3 A2 00 BD 7E
C270:00 CF C9 01 D0 F4 A0 00 CE
C278:84 AE 84 B0 A9 FF 85 AF 8F
C280:85 B1 FE 70 CF BD 70 CF 42
C288:D0 13 A9 FC 9D 70 CF DE 6D
C290:10 CF BD 10 CF D0 06 20 B8
C298:DD C2 4C 13 C3 BD C0 CF DE
C2A0:C9 12 B0 08 A0 00 84 AE E2
C2A8:A0 7F 84 AF C9 9C 90 08 D3
C2B0:A0 80 84 AE A0 FF 84 AF DF
C2B8:BD D0 CF C9 30 B0 08 A0 DC
C2C0:00 84 B0 A0 7F 84 B1 C9 C2
C2C8:DA 90 08 A0 80 84 B0 A0 03
C2D0:FF 84 B1 C0 00 F0 3C 20 16
C2D8:DD C2 38 B0 36 BC 60 CF 45
C2E0:B9 00 CE 05 AE 25 AF 9D 74
C2E8:20 CF B9 01 CE 05 B0 25 CA
C2F0:B1 9D 30 CF B9 01 CE 05 2E
C2F8:B0 25 B1 9D 30 CF BD 10 7C
C300:CF F0 0F B9 02 CE 9D 10 BF
C308:CF BD 60 CF 18 69 04 9D FB
C310:60 CF 60 E8 E0 0F B0 03 FD
C318:4C 6F C2 60 4C F6 C3 A2 68
C320:00 BD 00 CC C9 00 F0 F4 09
C328:C9 02 90 05 A9 00 9D 00 FF
C330:CC BD 80 CB 85 AE BD C0 7D
C338:CB 85 AF A9 00 A8 91 AE 0C
C340:BD C0 CD 85 AD A5 AD F0 39
C348:54 A0 00 BD 40 CD C9 04 CE
C350:B0 01 C8 C9 9E 90 01 C8 28
C358:BD 80 CD C9 C8 90 01 C8 88
C360:C0 00 F0 08 A9 00 9D 00 6F
C368:CC 4C F6 C3 BD 40 CD 85 94
C370:AE BC C0 CC BD 40 CC 20 0C
C378:53 C2 9D C0 CC A5 AE 9D 12
C380:40 CD BD 80 CD 85 AE BC F9
C388:00 CD BD 80 CC 20 53 C2 93
C390:9D 00 CD A5 AE 9D 80 CD B5
C398:C6 AD 4C 45 C3 BD 80 CD B0
C3A0:4A 4A 4A 48 29 03 86 02 12
C3A8:A8 B9 D8 C1 85 AE 68 A8 8A
C3B0:B9 E0 C1 85 AF BD 40 CD A0
C3B8:18 65 AE 85 AE 90 02 E6 76
C3C0:AF BD 40 CD 18 65 AE 85 AD
C3C8:AE 90 02 E6 AF 29 F8 85 14
C3D0:AE BD 80 CD 29 07 A8 BD 80
C3D8:40 CD 29 03 AA BD DC C1 11
C3E0:11 AE 91 AE A6 02 18 98 BF
C3E8:65 AE 90 02 E6 AF 9D 80 B2
C3F0:CB A5 AF 9D C0 CB E8 E0 7F
C3F8:40 F0 03 4C 21 C3 60 AC 87
C400:CF CF A5 CB C9 28 D0 06 6D
C408:C0 0E 90 02 88 88 C9 2B CC
C410:D0 06 C0 A0 B0 02 C8 C8 8D
C418:8C CF CF AD 8D 02 C5 16 C6
C420:85 16 F0 07 C9 04 D0 03 83
C428:20 2C C4 60 A2 00 BD 00 FB
C430:CC D0 21 A9 06 9D C0 CD 09
C438:A9 00 9D 40 CC A9 FF 9D F8
C440:80 CC AD CF CF 38 E9 08 2B
C448:9D 40 CD A9 B0 9D 80 CD CF
C450:FE 00 CC 60 E8 E0 40 D0 15
C458:D5 60 A2 00 BD 00 CC F0 B1
C460:5B BD C0 CD C9 03 F0 54 8C
C468:BD 40 CD 85 B0 BD 80 CD 3E
C470:85 B1 86 02 A2 00 86 AF EB
C478:BD 00 CF C9 01 D0 43 BD 07
C480:C0 CF E9 0C C5 B0 B0 2D DB
C488:69 0C C5 B0 90 27 BD D0 FA
C490:CF E9 30 C5 B1 B0 1E 69 D4
C498:14 C5 B1 90 18 E4 AF D0 61
C4A0:26 A9 02 9D 00 CF A9 2A 7E
C4A8:85 15 86 AA A6 02 A9 F0 37
C4B0:9D 80 CD A6 AA E8 E0 0F 17
C4B8:D0 BE A6 02 E8 E0 40 D0 6B
C4C0:9B 60 E6 AF D0 EF 60 20 2F
C4C8:97 E0 A6 02 A9 03 9D C0 A0
C4D0:CD A5 8E 9D 40 CC A9 7F 5E
C4D8:9D 80 CC 4C BA C4 AD 0E 02
C4E0:CF C9 02 F0 03 4C 63 C5 E9
C4E8:AD CE CF E9 08 85 B0 AD FA
C4F0:DE CF E9 28 85 B1 A2 00 D5
C4F8:86 02 20 97 E0 A6 02 A5 0F
C500:8E 9D 40 CC A5 8F 9D 80 36
C508:CC A9 01 9D 00 CC A5 8D 6A
C510:29 03 9D C0 CD A5 B0 9D B4
C518:40 CD A5 B1 9D 80 CD E8 7A
C520:E0 40 D0 D4 A2 00 8E BA 80
C528:CF A2 80 8E BB CF A2 00 9F
C530:86 96 20 1F C3 A6 96 E8 69
C538:8E 01 D4 D0 F3 EE FD 9F E9
C540:AE FD 9F E0 03 90 16 EE 1A
C548:FF 9F A9 00 8D FD 9F AD 42
C550:FF 9F C9 0B F0 0A A9 22 D2
C558:85 B1 20 BD C5 4C 3A C6 8D
C560:4C 23 C7 AD BF CF 30 29 75
C568:AD BF CF 30 24 A2 00 BD 21
C570:C0 CF E9 05 CD CF CF B0 DB
C578:10 69 0B CD CF CF 90 09 8C
C580:BD D0 CF C9 D6 90 02 B0 63
C588:08 E8 E0 0F D0 E1 4C 22 28
C590:C6 A9 08 8D 01 D4 A2 00 64
C598:A0 00 C8 D0 FD EE 20 D0 57
C5A0:E8 D0 F5 8E 01 D4 EE FA B0
C5A8:9F AD FA 9F C9 03 B0 03 87
C5B0:4C 3A C6 8E BA CF 8E BB A0
C5B8:CF A9 58 85 B1 A9 15 8D E5
C5C0:18 D0 A9 1B 8D 11 D0 A2 68
C5C8:00 AD FD 9F 0A 18 69 30 2D
C5D0:8D 98 C1 AD FF 9F 38 69 B4
C5D8:3F 8D A1 C1 E9 10 C9 3A 15
C5E0:90 07 EE 96 C1 E9 0A B0 38
C5E8:F5 8D 97 C1 A2 00 BD 80 F2
C5F0:C1 20 D2 FF E8 E4 B1 D0 CE
C5F8:F5 85 A2 0A C5 A2 D0 FC 2D
C600:A5 B1 C9 58 F0 01 60 A5 7D
C608:CB C9 28 D0 FA 4C F0 C0 AB
C610:20 6D C2 AD FF 9F 85 B4 7A
C618:20 F3 C0 C6 B4 D0 F9 4C 60
C620:DE C4 20 FF C3 20 1F C3 F2
C628:20 5A C4 AD 8D 02 C9 01 D8
C630:D0 DE A9 00 8D 01 D4 4C 79
C638:2B C6 A9 20 85 B1 A9 00 8A
C640:85 B0 A8 AA 91 B0 C8 D0 2E
C648:FB E8 E6 B1 E0 20 D0 F4 24
C650:AA 9D 00 CF 9D 00 CC E8 07
C658:E0 BA D0 F5 AA 86 02 20 12
C660:97 E0 A5 8E A6 02 29 BF DE
C668:9D 00 CE E8 D0 EF A2 00 B8
C670:BD 02 CE 29 1F 9D 02 CE 0C
C678:E8 E8 E8 E8 D0 F2 A5 8F 8D
C680:4A 4A 69 20 85 AC A5 AC CB
C688:9D C0 CF A9 40 9D D0 CF 93
C690:86 02 20 97 E0 A6 02 A5 AA
C698:8F 29 07 69 02 9D E0 CF C7
C6A0:FE 00 CF A9 0D 9D F0 CF D2
C6A8:A9 F0 9D 70 CF E8 E0 0F F4
C6B0:D0 D4 A9 FF 8D BA CF 8D 95
C6B8:BB CF A9 0E 8D FF CF A2 DC
C6C0:00 A0 01 98 9D 10 CF E8 D5
C6C8:C8 E0 0F D0 F6 A9 E0 8D 8F
C6D0:DF CF A9 80 8D CF FF A9 D4
C6D8:3B 8D 11 D0 A9 1D 8D 18 8B
C6E0:D0 A9 01 8D EF CF A2 00 3E
C6E8:A9 10 9D 00 04 9D 00 05 9E
C6F0:9D 00 06 9D E8 06 E8 D0 E9
C6F8:F1 A9 0F 8D 18 D4 A9 0F 1B
C700:8D 05 D4 A9 F5 8D 06 D4 93
C708:A9 81 8D 04 D4 A2 00 A9 99
C710:30 9D 96 C1 E8 E0 04 D0 B1
C718:F6 AD FF 9F 0A 8D 20 D0 20
C720:4C 10 C6 A2 00 A9 93 20 CA
C728:D2 FF A9 1B 8D 11 D0 A9 04
C730:15 8D 18 D0 BD 52 C7 9D 22
C738:20 D9 9D 20 05 E8 E0 18 A9
C740:D0 F2 CA 86 A2 CA A5 A2 E4
C748:8D 21 D0 E4 A2 D0 F7 4C E3
C750:B9 C5 07 0F 0F 04 20 17 DF
C758:0F 12 0B 2C 20 04 12 01 4E
C760:07 0F 0E 13 0C 01 19 05 C5
C768:12 21 A2 00 A9 20 9D C0 67
C770:CB BD 00 C1 9D 40 03 E8 4E
C778:E0 80 D0 F0 A9 00 8D FA 25
C780:9F 8D FD 9F A9 01 8D FF 69
C788:9F A9 50 8D CF CF 8D 21 2F
C790:D0 8D 20 D0 4C 3A C6 00 D5
C798:00 00 00 00 EA EA EA EA EB
```

Program 3: Star Dragon Booter

```
EP 100 POKE 53280,2:POKE 53281
       ,0:PRINT"{CLR}{2 DOWN}"
       TAB(9)"{7 }{RVS} BOOTING
        DRAGON STAR {4 }":PRINT
KC 110 PRINT"LOAD "CHR$(34)"0:
       16"CHR$(34)",8":PRINT"
       {4 DOWN}RUN"
RQ 120 PRINT"{2 DOWN}
       {18 RIGHT}49152"
HG 130 PRINT"{3 DOWN}LOAD "CHR
       $(34)"0:STAR"CHR$(34)",
       8,1":PRINT"{4 DOWN}SYS
       {SPACE}49392"
FQ 140 PRINT"{21 UP}"
BP 150 FOR I=0 TO 4:POKE 631+I
       ,13:NEXT:POKE 198,5
```

MonoTones

Article on page 68.

```
RF 10 POKE53280,0:POKE53281,0:
      DIM C$(15):FORA=0TO15:RE
      ADB:C$(A)=CHR$(B):NEXT
AE 20 A$="THIS IS REALLY A GLO
```

```
      WING{DOWN}{19 LEFT}DEMON
      STRATION"
SH 30 A$="{HOME}{11 DOWN}
      {8 RIGHT}"+A$
AP 40 PRINT"{CLR}{BLU}
      {10 DOWN}"SPC(6)"U******
      **********************I"
CF 50 PRINTSPC(6)"-"SPC(26)"-"
      :PRINTSPC(6)"-"SPC(26)"-
      "
XB 60 PRINTSPC(6)"J**********
      **********K"
GG 70 FORA=1TO15:PRINTC$(A)A$:
      NEXT
FR 80 FORA=15TO1STEP-1:PRINTC$
      (A)A$:NEXT:GOTO70
KC 90 DATA 144,31,149,151,28,1
      29,156,154,152,150,30,15
      9,155,158,153,5
```

Switcheroo

Article on page 60.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
AX 10 FORA=54272TO54295:POKEA,
      0:NEXT:POKE54296,47:POKE
      54273,16:POKE54280,19
HP 20 POKE54277,24:POKE54284,2
      4:POKE54295,20:POKE54291
      ,25:POKE54287,5:GOSUB640
FA 30 GOTO280
CJ 40 JY=15-(PEEK(56320+PL*F2)
      AND15):FR=PEEK(56320+PL*
      F2)AND16:IFFR=0THENJY=0
MC 50 RETURN
JF 60 WAIT56320+PL*F2,16,0:RET
      URN
PB 70 POKE53288,C1:POKE53289,C
      2:RETURN
QD 80 TX=X*6-1:TY=Y*4-3:GOSUB2
      70:POKE646,C:PRINT"{RVS}
      "A$:RETURN
XQ 90 POKE54276,16:POKE54283,1
      6:POKE54276,17:POKE54283
      ,17
EF 100 FORA=1TO300:NEXT:POKE54
      276,0:POKE54283,0:RETUR
      N
DR 110 POKE54280,19:FORB=50TO1
      50STEP50:POKE54273,B:GO
      SUB90:NEXT:RETURN
BP 120 POKE54290,128:POKE54290
      ,129:FORA=100TO200:POKE
      54294,A:NEXT:RETURN
DB 130 QT=0:X=0:Q=1:FORA=1TO5:
      FORB=1TO5:X=X+AR(A,B):N
      EXT:IFX=35ORX=40THENGOS
      UB190
GF 140 X=0:NEXT:Q=2:FORA=1TO5:
      FORB=1TO5:X=X+AR(B,A):N
      EXT:IFX=35ORX=40THENGOS
      UB190
AJ 150 X=0:NEXT:Q=3:FORA=1TO5:
      B=A:X=X+AR(A,B):NEXT:IF
      X=35ORX=40THENGOSUB190
QS 160 X=0:Q=4:FORA=1TO5:B=6-A
      :X=X+AR(A,B):NEXT:IFX=3
      5ORX=40THENGOSUB190
PE 170 IFQTTHEN230
BB 180 RETURN
PD 190 QT=1:A$="{OFF}{DOWN}
      {2 RIGHT}{2 SPACES}
      {DOWN}{2 LEFT}
      {2 SPACES}":IFQ=1THENFO
      RZB=1TO5:X=A:Y=ZB:GOSUB
      80:NEXT:RETURN
QG 200 IFQ=2THENFORZB=1TO5:Y=A
      :X=ZB:GOSUB80:NEXT:RETU
      RN
KA 210 IFQ=3THENFORZA=1TO5:X=Z
      A:Y=ZA:GOSUB80:NEXT:RET
      URN
XQ 220 FORZA=1TO5:X=ZA:Y=6-ZA:
      GOSUB80:NEXT:RETURN
JC 230 POKE53269,0:GOSUB110:TY
      =23:TX=4:GOSUB270
AJ 240 PRINT"{RVS}{BLU} PRESS
      {SPACE}FIRE BUTTON TO P
      LAY AGAIN"
SH 250 IFPEEK(56320)<>111ANDPE
      EK(56321)<>239THEN250
DM 260 CLR:GOTO280
JE 270 POKE783,0:POKE781,TY:PO
      KE782,TX:SYS65520:RETUR
      N
GB 280 PRINT"{HOME}";:DIM CL(2
      5),AR(5,5):PC(0)=7:PC(1
      )=8:PL=1:F2=PEEK(828)
EA 290 MX(1)=0:MX(2)=0:MX(4)=-
      48:MX(8)=48:MY(1)=-32:M
      Y(2)=32:MY(4)=0:MY(8)=0
FR 300 FORA=1TO5:FORB=1TO5:AR(
      A,B)=14:NEXTB,A:OJ=0
CP 310 A$="O{4 Y}P{DOWN}
      {6 LEFT}{H}{4 SPACES}
      {N}{DOWN}{6 LEFT}{H}
      {4 SPACES}{N}{DOWN}
      {6 LEFT}L{4 P}@":B$="
      {3 UP}"
XH 320 FORI=0TO23:PRINT"{RVS}
      {BLU}{39 SPACES}":M=106
      3+(40*I)
EB 330 POKEM,160:POKEM+54272,6
      :NEXT:POKE2023,160:POKE
      56295,6
CQ 340 PRINT"{RVS}{39 SPACES}
      {HOME}{7}":POKE53281,1
GK 350 FORX=1TO5:PRINT"{RVS}"S
      PC(5)A$B$A$B$A$B$A$B$A$
      :NEXTX:FORI=1TO25:CL(I)
      =1:NEXT
QA 360 POKE53250,126:POKE53251
      ,228:POKE53252,223:POKE
      53253,228
GF 370 GOSUB130:POKE53248,173:
      POKE53249,129:POKE53269
      ,7
QF 380 PL=-(PL=0):POKE54273,16
      *2↑PL:POKE54280,19*2↑PL
CM 390 C1=PC(PL):C2=3:GOSUB70:
      FL=1:POKE53248,173:POKE
      53249,129
HX 400 POKE53264,0:GOSUB40:IFJ
      Y=4THENC1=PC(PL):C2=3:F
      L=1:GOSUB70
JS 410 IFJY=8THENC1=3:C2=PC(PL
      ):FL=2:GOSUB70
QQ 420 IFFR=16THEN400
CA 430 GOSUB90:GOSUB60:XP=173:
      YP=129
HE 440 POKE53249,0:POKE53264,(
      XPAND256)/256:POKE53248
      ,XPAND255:POKE53249,YP
JG 450 GOSUB40:T=XP+MX(JY):XP=
      XP-MX(JY)*(T>76ANDT<270
      ):T=YP+MY(JY)
RK 460 YP=YP-MY(JY)*(T>64ANDT<
      194):IFFR=16THEN440
XG 470 GOSUB90:C=PC(PL):GOSUB6
      0:X=INT((XP-26)/48):Y=I
      NT((YP-32)/32)
QG 480 IFFL=2THEN510
QP 490 IFAR(X,Y)<>14THENGOSUB1
      20:GOTO390
GG 500 OJ=0:AR(X,Y)=C:GOSUB80:
      GOTO370
JS 510 GOSUB60
KR 520 GOSUB40:IFFR=0THENGOSUB
      60:GOTO390
DP 530 IF(JY+OJ=3ANDX=OX)OR(JY
      +OJ=12ANDY=OY)THENGOSUB
      120:GOTO390
KR 540 ONJYGOTO550,560,520,570
      ,520,520,520,580:GOTO52
      0
AJ 550 T=AR(X,1):FORA=1TO4:AR(
      X,A)=AR(X,A+1):NEXT:AR(
      X,5)=T:GOTO590
SE 560 T=AR(X,5):FORA=5TO2STEP
      -1:AR(X,A)=AR(X,A-1):NE
      XT:AR(X,1)=T:GOTO590
GK 570 T=AR(1,Y):FORA=1TO4:AR(
      A,Y)=AR(A+1,Y):NEXT:AR(
      5,Y)=T:GOTO600
HJ 580 T=AR(5,Y):FORA=5TO2STEP
      -1:AR(A,Y)=AR(A-1,Y):NE
      XT:AR(1,Y)=T:GOTO600
HH 590 FORA=1TO5:Y=A:C=AR(X,A)
      :GOSUB80:NEXT:GOSUB610:
      GOTO370
KP 600 FORA=1TO5:X=A:C=AR(X,Y)
      :GOSUB80:NEXT:GOSUB610:
      GOTO370
GJ 610 OJ=JY:OX=X:OY=Y:RETURN
EF 620 FORA=14336TO14527:READB
      :POKEA,B:NEXT:POKE53276
      ,3:POKE53285,0
MX 630 POKE53287,15:FORA=224TO
      226:POKE1816+A,A:NEXT:R
      ETURN
MQ 640 POKE53281,1:POKE53280,6
      :PRINT"{CLR}";:A$="O{Y}
      P{DOWN}{3 LEFT}{H} {N}
      {DOWN}{3 LEFT}L{P}@":B$
      ="{2 UP}"
DC 650 FORI=0TO23:PRINT"{RVS}
      {BLU}{39 SPACES}":M=106
      3+(40*I)
GQ 660 POKEM,160:POKEM+54272,6
      :NEXT:POKE2023,160:POKE
      56295,6
RG 670 PRINT"{RVS}{39 SPACES}
      {HOME}"
MF 680 PRINT"{HOME}{4 DOWN}{7}
      ":FORI=1TO5:PRINTSPC(12
      );:FORZ=1TO5:PRINT"
      {RVS}"A$B$;:NEXT
AC 690 PRINT"{2 DOWN}":NEXT:PR
      INT"{HOME}{11 DOWN}"SPC
      (18)"{RVS}{YEL}"A$"
      {DOWN}{1}";:GOSUB90
XR 700 PRINTA$;:GOSUB90:PRINT"
      {11 UP}{YEL}"A$:GOSUB90
      :PRINTSPC(15)"{1}{RVS}"
      A$;
EB 710 GOSUB90:PRINT"{7 DOWN}
      {6 LEFT}{YEL}"A$;:GOSUB
      90:PRINT"{HOME}{8 DOWN}
      {RVS}{1}"SPC(24)A$
KQ 720 GOSUB90:PRINT"{3 DOWN}"
      SPC(15)"{YEL}{RVS}"A$;:
      GOSUB90:PRINT"{11 UP}
      {6 LEFT}{1}"A$;
MA 730 GOSUB90:PRINTSPC(6)"
      {DOWN}{YEL}"A$:GOSUB90:
      TX=25:TY=6:GOSUB270:FOR
      I=1TO5
XX 740 PRINT" {3 DOWN}{4 LEFT}
      ";:NEXT:GOSUB110:PRINT"
      {HOME}{2 DOWN}"SPC(10)"
      {RVS}{BLU}S W I T C H E
       R O O"
CF 750 GOSUB620:TY=21:TX=16:GO
      SUB270:PRINT"{BLU}1
      {RVS} OR {OFF}2{2 DOWN}
```

```
      {7 LEFT}{RVS}JOYSTICKS
      {HOME}"
XG 760 GETMT$:IFMT$<>"1"ANDMT$
      <>"2"THEN760
EA 770 POKE828,VAL(MT$)-1:RETU
      RN
XH 780 DATA 0,0,0,0,0,0,0,0,0,
      0,168,0,2,170,64,10,170
GB 790 DATA 144,10,170,144,42,
      170,164,42,170,164,42
HP 800 DATA 170,164,42,170,164
      ,42,170,164,10,170,144
XQ 810 DATA 10,170,144,2,170,6
      4,0,168,0,0,0,0,0,0,0
CP 820 DATA 0,0,0,0,0,0,0,0,0,
      0,170,170,160,170,170
PA 830 DATA 164,170,170,164,17
      0,170,164,170,170,164
CH 840 DATA 170,170,164,170,17
      0,164,170,170,164,170
MF 850 DATA 170,164,170,170,16
      4,170,170,164,170,170
ER 860 DATA 164,170,170,164,17
      0,170,164,170,170,164
SB 870 DATA 170,170,164,170,17
      0,164,170,170,164,170
GK 880 DATA 170,164,21,85,84,0
      ,0,0,0,0,32,0,0,112,0
XK 890 DATA 0,248,0,1,252,0,0,
      112,0,0,112,0,0,112,0
SC 900 DATA 16,0,64,48,0,96,12
      6,3,240,254,3,248,126
DX 910 DATA 3,240,48,0,96,16,0
      ,64,0,112,0,0,112,0,0
FS 920 DATA 112,0,1,252,0,0,24
      8,0,0,112,0,0,32,0,0
```

Predictor

Article on page 58.

Program 1: Predictor—64 Version

```
JD 10 PRINT"{CLR}{WHT}LOADING
      {SPACE}ML...":FORI=49152
      TO49956:READA:POKEI,A:X=
      X+A:NEXT
XD 20 IFX<>91612THENPRINT"ERRO
      R IN DATA.":STOP
EF 30 PRINT"{CLR}TYPE {RVS}SYS
      49152{OFF} TO ACTIVATE."
      :END
AX 40 DATA 76,221,192,127,128,
      127,128,127,128,127
EB 50 DATA 128,127,128,127,128
      ,127,128,127,128,0
KB 60 DATA 0,162,2,157,120,216
      ,157,160,216,202
KE 70 DATA 16,247,96,162,2,157
      ,157,216,157,197
KG 80 DATA 216,202,16,247,96,1
      62,2,157,248,218
XJ 90 DATA 157,32,219,202,16,2
      47,96,162,2,157
AP 100 DATA 29,219,157,69,219,
      202,16,247,96,169
CH 110 DATA 0,141,4,212,169,33
      ,141,4,212,96
MA 120 DATA 169,0,141,4,212,16
      9,129,141,4,212
EJ 130 DATA 96,162,2,24,189,19
      3,5,117,139,201
MP 140 DATA 58,144,2,233,10,15
      7,193,5,202,16
MP 150 DATA 239,173,193,5,201,
      49,240,1,96,24
HB 160 DATA 160,16,162,11,32,2
      40,255,169,239,160
QK 170 DATA 194,32,30,171,24,1
      60,16,162,12,32
CS 180 DATA 240,255,169,13,160
      ,195,32,30,171,165
KE 190 DATA 197,201,64,240,250
      ,201,25,240,12,201
KX 200 DATA 39,208,242,169,0,1
      41,145,2,133,198
FK 210 DATA 0,104,76,221,192,1
      62,2,24,189,233
PG 220 DATA 5,117,251,201,58,1
      44,2,233,10,157
DE 230 DATA 233,5,202,16,239,1
      73,233,5,201,49
KS 240 DATA 240,1,96,24,160,16
      ,162,11,32,240
MP 250 DATA 255,169,253,160,19
      4,32,30,171,76,134
DH 260 DATA 192,169,147,32,210
      ,255,169,14,32,210
PS 270 DATA 255,169,128,141,14
      5,2,169,0,141,32
AM 280 DATA 208,141,33,208,133
      ,251,133,252,133,139
FJ 290 DATA 133,140,169,1,133,
      253,133,141,169,5
SG 300 DATA 162,0,157,0,216,15
      7,0,217,157,0
QE 310 DATA 218,157,0,219,232,
      208,241,169,99,162
RK 320 DATA 40,157,79,4,157,20
      7,6,202,208,247
GH 330 DATA 169,100,162,40,157
      ,199,4,157,71,7
BC 340 DATA 202,208,247,169,0,
      32,21,192,32,33
KF 350 DATA 192,32,45,192,32,5
      7,192,169,160,162
ES 360 DATA 2,157,120,4,157,15
      7,4,157,248,6
MH 370 DATA 157,29,7,157,160,4
      ,157,197,4,157
BA 380 DATA 32,7,157,69,7,202,
      16,229,24,160
FA 390 DATA 14,162,3,32,240,25
      5,169,154,160,194
PH 400 DATA 32,30,171,24,160,1
      4,162,4,32,240
EH 410 DATA 255,169,169,160,19
      4,32,30,171,24,160
XC 420 DATA 14,162,19,32,240,2
      55,169,182,160,194
QQ 430 DATA 32,30,171,24,160,1
      4,162,20,32,240
FG 440 DATA 255,169,195,160,19
      4,32,30,171,24,160
GG 450 DATA 0,162,11,32,240,25
      5,169,209,160,194
GA 460 DATA 32,30,171,24,160,0
      ,162,12,32,240
PP 470 DATA 255,169,224,160,19
      4,32,30,171,162,25
RC 480 DATA 169,0,157,0,212,20
      2,208,250,169,15
XH 490 DATA 141,24,212,169,79,
      141,1,212,169,22
XP 500 DATA 141,5,212,174,19,1
      92,189,3,192,48
AJ 510 DATA 5,160,0,76,222,193
      ,160,1,165,197
RB 520 DATA 201,64,208,8,162,2
      55,142,20,192,76
SE 530 DATA 222,193,205,20,192
      ,240,237,201,0,240
FK 540 DATA 85,201,57,240,3,76
      ,222,193,141,20
PM 550 DATA 192,174,19,192,222
      ,3,192,14,19,192
AJ 560 DATA 173,19,192,41,15,1
      41,19,192,192,0
FJ 570 DATA 240,27,32,69,192,1
      69,0,32,33,192
FK 580 DATA 32,45,192,169,2,32
      ,21,192,169,6
CG 590 DATA 32,57,192,32,91,19
      2,76,207,193,32
QS 600 DATA 80,192,169,0,32,33
      ,192,32,57,192
CK 610 DATA 169,2,32,21,192,16
      9,6,32,45,192
MH 620 DATA 32,175,192,76,207,
      193,141,20,192,174
PF 630 DATA 19,192,254,3,192,1
      4,19,192,173,19
JH 640 DATA 192,41,15,73,1,141
      ,19,192,192,1
JK 650 DATA 240,27,32,69,192,1
      69,0,32,21,192
AF 660 DATA 32,57,192,169,2,32
      ,33,192,169,6
JE 670 DATA 32,45,192,32,91,19
      2,76,207,193,32
SP 680 DATA 80,192,169,0,32,21
      ,192,32,45,192
FK 690 DATA 169,2,32,33,192,16
      9,6,32,57,192
JB 700 DATA 32,175,192,76,207,
      193,18,30,32,160
JC 710 DATA 80,76,65,89,69,82,
      39,83,160,160
GS 720 DATA 0,160,160,160,160,
      77,79,86,69,160
EQ 730 DATA 160,160,160,0,160,
      67,79,77,80,85
RF 740 DATA 84,69,82,39,83,160
      ,0,160,80,82
HP 750 DATA 69,68,73,67,84,73,
      79,78,160,146
SQ 760 DATA 0,18,80,76,65,89,6
      9,82,160,160
MD 770 DATA 146,160,48,48,48,0
      ,18,67,79,77
QS 780 DATA 80,85,84,69,82,146
      ,32,48,48,48
HX 790 DATA 0,208,76,65,89,69,
      82,32,87,73
QX 800 DATA 78,83,45,45,0,195,
      79,77,80,85
AP 810 DATA 84,69,82,32,87,73,
      78,83,45,45
AD 820 DATA 0,193,78,79,84,72,
      69,82,32,71
XA 830 DATA 65,77,69,32,40,18,
      217,146,47,18
CM 840 DATA 206,146,41,63,0
```

Program 2: Predictor—Plus/4 and 16 Version

```
FA 10 PRINT"{CLR}LOADING ML...
      ":POKE56,60:POKE55,200:C
      LR:FORI=15560TO16380:REA
      DA
AX 20 POKEI,A:X=X+A:NEXT:IFX<>
      88190THENPRINT"ERROR IN
      {SPACE}DATA.":STOP
BJ 30 PRINT"{CLR}TYPE {RVS}SYS
      15560{OFF} TO ACTIVATE."
      :END
QB 40 DATA 76,207,61,127,128,1
      27,128,127,128,127
EB 50 DATA 128,127,128,127,128
      ,127,128,127,128,0
DC 60 DATA 0,162,2,157,120,8,1
      57,160,8,202
AQ 70 DATA 16,247,96,162,2,157
      ,157,8,157,197
AR 80 DATA 8,202,16,247,96,162
      ,2,157,248,10
FH 90 DATA 157,32,11,202,16,24
      7,96,162,2,157
QA 100 DATA 29,11,157,69,11,20
      2,16,247,96,169
AS 110 DATA 23,141,17,255,173,
      18,255,41,252,9
```

```
ES 120 DATA 3,141,18,255,169,2
       ,141,14,255,160
CK 130 DATA 64,162,255,202,208
       ,253,136,208,250,169
AH 140 DATA 16,141,17,255,96,1
       69,23,141,17,255
AP 150 DATA 173,18,255,41,252,
       9,2,141,18,255
SG 160 DATA 169,66,141,14,255,
       76,33,61,162,2
QM 170 DATA 24,189,193,13,117,
       159,201,58,144,2
GP 180 DATA 233,10,157,193,13,
       202,16,239,173,193
JA 190 DATA 13,201,49,240,1,96
       ,24,160,16,162
BP 200 DATA 11,32,240,255,169,
       199,160,63,32,136
PP 210 DATA 144,24,160,16,162,
       12,32,240,255,169
EH 220 DATA 229,160,63,32,136,
       144,173,246,7,201
CR 230 DATA 64,240,249,201,25,
       240,16,201,39,208
QS 240 DATA 241,169,0,141,71,5
       ,133,239,162,128
QR 250 DATA 108,0,3,104,76,207
       ,61,162,2,24
CJ 260 DATA 189,233,13,117,3,2
       01,58,144,2,233
XR 270 DATA 10,157,233,13,202,
       16,239,173,233,13
GM 280 DATA 201,49,240,1,96,24
       ,160,16,162,11
AD 290 DATA 32,240,255,169,213
       ,160,63,32,136,144
PK 300 DATA 76,115,61,169,147,
       32,210,255,169,14
PF 310 DATA 32,210,255,169,0,1
       41,71,5,141,21
JM 320 DATA 255,141,25,255,133
       ,3,133,4,133,159
RQ 330 DATA 133,160,169,1,133,
       5,133,161,169,5
RC 340 DATA 162,0,157,0,8,157,
       0,9,157,0
RB 350 DATA 10,157,0,11,232,20
       8,241,169,99,162
GP 360 DATA 40,157,79,12,157,2
       07,14,202,208,247
BR 370 DATA 169,100,162,40,157
       ,199,12,157,71,15
XJ 380 DATA 202,208,247,169,0,
       32,221,60,32,233
PB 390 DATA 60,32,245,60,32,1,
       61,169,160,162
PM 400 DATA 2,157,120,12,157,1
       57,12,157,248,14
XM 410 DATA 157,29,15,157,160,
       12,157,197,12,157
CA 420 DATA 32,15,157,69,15,20
       2,16,229,24,160
DD 430 DATA 14,162,3,32,240,25
       5,169,114,160,63
SM 440 DATA 32,136,144,24,160,
       14,162,4,32,240
RM 450 DATA 255,169,129,160,63
       ,32,136,144,24,160
DS 460 DATA 14,162,19,32,240,2
       55,169,142,160,63
EA 470 DATA 32,136,144,24,160,
       14,162,20,32,240
QK 480 DATA 255,169,155,160,63
       ,32,136,144,24,160
SF 490 DATA 0,162,11,32,240,25
       5,169,169,160,63
FA 500 DATA 32,136,144,24,160,
       0,162,12,32,240
RM 510 DATA 255,169,184,160,63
       ,32,136,144,174,219
HG 520 DATA 60,189,203,60,48,5
       ,160,0,76,181
CK 530 DATA 62,160,1,173,246,7
       ,201,64,208,8
BD 540 DATA 162,255,142,220,60
       ,76,181,62,205,220
DF 550 DATA 60,240,236,201,0,2
       40,85,201,52,240
FP 560 DATA 3,76,181,62,141,22
       0,60,174,219,60
JB 570 DATA 222,203,60,14,219,
       60,173,219,60,41
MJ 580 DATA 15,141,219,60,192,
       0,240,27,32,13
QK 590 DATA 61,169,0,32,233,60
       ,32,245,60,169
JB 600 DATA 2,32,221,60,169,6,
       32,1,61,32
JE 610 DATA 72,61,76,166,62,32
       ,49,61,169,0
KR 620 DATA 32,233,60,32,1,61,
       169,2,32,221
PD 630 DATA 60,169,6,32,245,60
       ,32,161,61,76
BR 640 DATA 166,62,141,220,60,
       174,219,60,254,203
MH 650 DATA 60,14,219,60,173,2
       19,60,41,15,73
FH 660 DATA 1,141,219,60,192,1
       ,240,27,32,13
FS 670 DATA 61,169,0,32,221,60
       ,32,1,61,169
RD 680 DATA 2,32,233,60,169,6,
       32,245,60,32
KM 690 DATA 72,61,76,166,62,32
       ,49,61,169,0
JR 700 DATA 32,221,60,32,245,6
       0,169,2,32,233
FJ 710 DATA 60,169,6,32,1,61,3
       2,161,61,76
MA 720 DATA 166,62,18,30,32,16
       0,80,76,65,89
MH 730 DATA 69,82,39,83,160,16
       0,0,160,160,160
RG 740 DATA 160,77,79,86,69,16
       0,160,160,160,0
BX 750 DATA 160,67,79,77,80,85
       ,84,69,82,39
QF 760 DATA 83,160,0,160,80,82
       ,69,68,73,67
QK 770 DATA 84,73,79,78,160,14
       6,0,18,80,76
JJ 780 DATA 65,89,69,82,160,16
       0,146,160,48,48
BP 790 DATA 48,0,18,67,79,77,8
       0,85,84,69
QS 800 DATA 82,146,32,48,48,48
       ,0,208,76,65
RS 810 DATA 89,69,82,32,87,73,
       78,83,45,45
MQ 820 DATA 0,195,79,77,80,85,
       84,69,82,32
FD 830 DATA 87,73,78,83,45,45,
       0,193,78,79
MF 840 DATA 84,72,69,82,32,71,
       65,77,69,32
HE 850 DATA 40,18,217,146,47,1
       8,206,146,41,63,0
```

Program 3: Program Generator for VIC Version

```
DS 10 PRINT"{CLR}{BLU}CREATING
      OBJECT FILE."
MX 20 HI=26:LO=236:OPEN2,8,2,"
      PREDICT.OBJ,P,W":PRINT#2
      ,CHR$(LO)CHR$(HI);
QP 30 FORI=6892TO7679:READA:X=
      X+A:PRINT#2,CHR$(A);:NEX
      T:CLOSE2
HD 40 IFX<>81314THENPRINT"ERRO
      R IN DATA.":STOP
AD 50 PRINT"{CLR}TYPE:":PRINT"
      {RVS}LOAD {RVS}"CHR$(34)
      "PREDICT.OBJ"CHR$(34)",8
      ,1{OFF}";
EP 60 PRINT"& {RVS}SYS6892
      {OFF} TO RUN.":NEW
CB 70 DATA 76,211,27,127,128,1
      27,128,127,128,127
FH 80 DATA 128,127,128,127,128
      ,127,128,127,128,0
AE 90 DATA 0,162,2,157,44,150,
      157,66,150,202
AS 100 DATA 16,247,96,162,2,15
       7,63,150,157,85
JH 110 DATA 150,202,16,247,96,
       162,2,157,162,151
KB 120 DATA 157,184,151,202,16
       ,247,96,162,2,157
XJ 130 DATA 181,151,157,203,15
       1,202,16,247,96,169
KA 140 DATA 225,141,12,144,162
       ,255,160,64,202,208
MJ 150 DATA 253,136,208,250,16
       9,0,141,10,144,141
SX 160 DATA 12,144,96,169,225,
       141,10,144,76,54
JB 170 DATA 27,162,2,24,189,22
       9,30,117,139,201
FA 180 DATA 58,144,2,233,10,15
       7,229,30,202,16
EG 190 DATA 239,173,229,30,201
       ,49,240,1,96,24
FF 200 DATA 160,0,162,14,32,24
       0,255,169,202,160
SX 210 DATA 29,32,30,203,24,16
       0,0,162,15,32
RA 220 DATA 240,255,169,232,16
       0,29,32,30,203,165
XQ 230 DATA 197,201,64,240,250
       ,201,11,240,12,201
GQ 240 DATA 28,208,242,169,0,1
       41,145,2,133,198
RS 250 DATA 0,104,76,211,27,16
       2,2,24,189,251
FE 260 DATA 30,117,251,201,58,
       144,2,233,10,157
OR 270 DATA 251.30.202.16.239,
       173,251,30,201,49
HK 280 DATA 240,1,96,24,160,0,
       162,14,32,240
BP 290 DATA 255,169,216,160,29
       ,32,30,203,76,124
BC 300 DATA 27,169,147,32,210,
       255,169,14,32,210
CD 310 DATA 255,169,128,141,14
       5,2,169,8,141,15
BH 320 DATA 144,169,0,133,251,
       133,252,133,139,133
XR 330 DATA 140,169,1,133,253,
       133,141,169,5,162
CF 340 DATA 0,157,0,150,157,0,
       151,232,208,247
MG 350 DATA 169,99,162,22,157,
       21,30,157,139,31
HJ 360 DATA 202,208,247,169,10
       0,162,22,157,87,30
HX 370 DATA 157,205,31,202,208
       ,247,169,0,32,1
EE 380 DATA 27,32,13,27,32,25,
       27,32,37,27
DX 390 DATA 169,160,162,2,157,
       44,30,157,63,30
QC 400 DATA 157,162,31,157,181
       ,31,157,66,30,157
AQ 410 DATA 85,30,157,184,31,1
       57,203,31,202,16
SF 420 DATA 229,24,160,5,162,2
       ,32,240,255,169
JK 430 DATA 117,160,29,32,30,2
       03,24,160,5,162
```

```
XM 440 DATA 3,32,240,255,169,1
       32,160,29,32,30
HQ 450 DATA 203,24,160,5,162,1
       9,32,240,255,169
DQ 460 DATA 145,160,29,32,30,2
       03,24,160,5,162
CH 470 DATA 20,32,240,255,169,
       158,160,29,32,30
BS 480 DATA 203,24,160,0,162,1
       0,32,240,255,169
XE 490 DATA 172,160,29,32,30,2
       03,24,160,0,162
JJ 500 DATA 11,32,240,255,169,
       187,160,29,32,30
RR 510 DATA 203,169,15,141,14,
       144,174,255,26,189
XD 520 DATA 239,26,48,5,160,0,
       76,185,28,160
XB 530 DATA 1,165,197,201,64,2
       08,8,162,255,142
EK 540 DATA 0,27,76,185,28,205
       ,0,27,240,237
EQ 550 DATA 201,7,240,85,201,8
       ,240,3,76,185
JF 560 DATA 28,141,0,27,174,25
       5,26,222,239,26
CX 570 DATA 14,255,26,173,255,
       26,41,15,141,255
FJ 580 DATA 26,192,0,240,27,32
       ,49,27,169,0
SQ 590 DATA 32,13,27,32,25,27,
       169,2,32,1
HJ 600 DATA 27,169,6,32,37,27,
       32,81,27,76
EX 610 DATA 170,28,32,73,27,16
       9,0,32,13,27
GC 620 DATA 32,37,27,169,2,32,
       1,27,169,6
SQ 630 DATA 32,25,27,32,165,27
       ,76,170,28,141
GH 640 DATA 0,27,174,255,26,25
       4,239,26,14,255
QB 650 DATA 26,173,255,26,41,1
       5,73,1,141,255
KS 660 DATA 26,192,1,240,27,32
       ,49,27,169,0
EB 670 DATA 32,1,27,32,37,27,1
       69,2,32,13
FM 680 DATA 27,169,6,32,25,27,
       32,81,27,76
AA 690 DATA 170,28,32,73,27,16
       9,0,32,1,27
DC 700 DATA 32,25,27,169,2,32,
       13,27,169,6
CH 710 DATA 32,37,27,32,165,27
       ,76,170,28,18
FG 720 DATA 30,160,160,80,76,6
       5,89,69,82,39
RD 730 DATA 83,160,160,0,160,1
       60,160,160,77,79
CE 740 DATA 86,69,160,160,160,
       160,0,160,67,79
BB 750 DATA 77,80,85,84,69,82,
       39,83,160,0
KX 760 DATA 160,80,82,69,68,73
       ,67,84,73,79
AD 770 DATA 78,160,146,0,18,80
       ,76,65,89,69
KP 780 DATA 82,160,160,146,160
       ,48,48,48,0,18
DQ 790 DATA 67,79,77,80,85,84,
       69,82,146,32
FG 800 DATA 48,48,48,0,208,76,
       65,89,69,82
HK 810 DATA 32,87,73,78,83,45,
       45,0,195,79
AJ 820 DATA 77,80,85,84,69,82,
       32,87,73,78
CH 830 DATA 83,45,45,0,193,78,
       79,84,72,69
DE 840 DATA 82,32,71,65,77,69,
       32,40,18,217
RR 850 DATA 146,47,18,206,146,
       41,63,0
```

Power BASIC: Help Screens

Article on page 76.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

Program 1: Help Screens—64 Version

```
DJ 10 FORS=679TO766:READA:POKE
      S,A:NEXT:FORS=820TO1016:
      READA:POKES,A:NEXT
ES 20 FORS=49152TO49397:READA:
      POKES,A:NEXT:PRINT"{CLR}
      {WHT}PROGRAM ACTIVATED"
KC 30 PRINT"CTRL/F{2 SPACES}SC
      REEN FINISHED":PRINT"CTR
      L/D{2 SPACES}DONE WITH S
      CREENS":SYS49152:NEW
RC 40 DATA 173,245,3,208,18,17
      3,20
QH 50 DATA 3,141,212,2,173,21,
      3
PR 60 DATA 141,213,2,238,245,3
      ,32
AX 70 DATA 223,3,160,2,169,214
      ,32
GM 80 DATA 160,3,88,169,131,14
      1,2
XJ 90 DATA 3,169,164,141,3,3,7
      6
FQ 100 DATA 116,164,76,0,0,173
       ,141
FH 110 DATA 2,201,4,208,246,16
       5,197
CE 120 DATA 201,29,208,240,160
       ,234,169
AP 130 DATA 49,32,160,3,88,169
       ,193
MJ 140 DATA 141,24,3,173,2,221
       ,9
EH 150 DATA 3,141,2,221,173,21
       ,208,72,76
HR 160 DATA 52,3,169,0,141,21,
       208,169,197
CP 170 DATA 141,0,221,173,32,2
       08,72
SX 180 DATA 173,134,2,32,205,3
       ,76
AA 190 DATA 79,3,24,32,168,3,3
       2
KM 200 DATA 193,3,76,89,3,56,7
       6
GP 210 DATA 76,3,238,32,208,16
       5,197
HF 220 DATA 201,64,208,247,238
       ,32,208
BF 230 DATA 173,141,2,201,4,20
       8,246
FR 240 DATA 165,197,201,2,240,
       217,201
QA 250 DATA 7,240,223,201,0,20
       8,232
MH 260 DATA 169,63,141,2,221,1
       69,199
JK 270 DATA 141,0,221,169,21,1
       41,24
KH 280 DATA 208,104,141,32,208
       ,104,141
RC 290 DATA 21,208,160,2,169,2
       14,32
AP 300 DATA 160,3,169,71,141,2
       4,3
CQ 310 DATA 76,211,2,120,141,2
       0,3
CQ 320 DATA 140,21,3,96,173,24
       6,3
AE 330 DATA 176,10,105,16,208,
       2,169
QD 340 DATA 128,141,246,3,96,2
       33,16
RH 350 DATA 201,128,176,246,16
       9,240,144
MA 360 DATA 242,173,24,208,41,
       15,13
HX 370 DATA 246,3,141,24,208,9
       6,162
BR 380 DATA 0,157,0,216,157,25
       5,216
HF 390 DATA 157,254,217,157,25
       3,218,232
MH 400 DATA 208,241,96,169,1,1
       62,8
RF 410 DATA 168,32,186,255,169
       ,2,162
XJ 420 DATA 247,160,3,32,189,2
       55,169
SX 430 DATA 0,76,213,255,0,128
       ,72,83
QB 440 DATA 169,17,160,192,32,
       201,192
QX 450 DATA 88,169,193,141,24,
       3,96
SS 460 DATA 76,49,234,173,141,
       2,201
XF 470 DATA 4,208,246,165,197,
       201,18
RR 480 DATA 240,71,201,21,208,
       236,32
JX 490 DATA 209,192,32,197,192
       ,88,169
RG 500 DATA 0,133,95,169,4,133
       ,96
MC 510 DATA 169,232,133,90,169
       ,7,133
HC 520 DATA 91,173,244,192,133
       ,88,173
GP 530 DATA 245,192,133,89,32,
       191,163
PF 540 DATA 238,32,208,162,0,3
       2,179
QG 550 DATA 238,232,208,250,20
       6,32,208
MS 560 DATA 173,231,192,201,8,
       240,10
HK 570 DATA 169,17,160,192,32,
       201,192
EG 580 DATA 76,14,192,32,197,1
       92,88
QS 590 DATA 169,167,141,2,3,13
       3,253
GE 600 DATA 169,2,141,3,3,133,
       254
QJ 610 DATA 32,222,192,169,10,
       162,232
QD 620 DATA 160,192,32,189,255
       ,162,250
EX 630 DATA 160,3,169,253,32,2
       16,255
CF 640 DATA 32,222,192,169,2,1
       62,242
PE 650 DATA 160,192,32,189,255
       ,169,0
MF 660 DATA 133,253,169,160,13
       3,254,165
HQ 670 DATA 1,41,254,133,1,169
       ,253
QE 680 DATA 162,255,160,191,32
       ,216,255
SD 690 DATA 169,71,141,24,3,16
```

```
      9,131
KR 700 DATA 141,2,3,169,164,14
      1,3
RP 710 DATA 3,165,1,9,1,133,1
MB 720 DATA 96,169,49,160,234,
      120,141
ED 730 DATA 20,3,140,21,3,96,1
      73
DF 740 DATA 245,192,24,105,4,1
      41,245
DP 750 DATA 192,238,231,192,96
      ,169,1
QJ 760 DATA 162,8,160,1,76,186
      ,255
SH 770 DATA 0,72,69,76,80,69,8
      2
CF 780 DATA 46,69,88,69,72,83,
      232,159
```

Program 2: Help Screens—128 Version

```
FE 10 PRINT "LOADING DATA"
AF 20 FOR I=3072 TO 3249:READ
      {SPACE}A:POKE I,A:NEXT
BG 30 FOR I=5632 TO 6045:READ
      {SPACE}A:POKE I,A:NEXT
JH 40 BSAVE "HELPER.EXE",P5632
      TO P6046
EM 50 PRINT "INSTALLING HELP S
      CREEN MAKER":SYS3072
KC 60 END
BR 3072 DATA173,60,3,141,33,12
      ,173,61
XD 3080 DATA3,141,34,12,169,28
      ,141,60
XD 3088 DATA3,169,12,141,61,3,
      169,192
KE 3096 DATA141,76,12,96,192,7
      6,240,3
KA 3104 DATA76,255,255,224,1,2
      40,79,224
BD 3112 DATA0,208,245,173,41,1
      0,164,236
QD 3120 DATA145,224,169,4,141,
      73,12,162
SF 3128 DATA0,120,173,6,213,9,
      3,141
BP 3136 DATA6,213,169,127,141,
      0,255,189
JG 3144 DATA0,4,157,0,192,232,
      208,247
XQ 3152 DATA238,73,12,238,76,1
      2,173,73
XE 3160 DATA12,201,8,208,234,1
      69,0,141
MD 3168 DATA0,255,173,6,213,41
      ,252,141
SK 3176 DATA6,213,88,238,32,20
      8,173,76
HR 3184 DATA12,201,224,240,1,9
      6,169,1
QM 3192 DATA162,0,32,104,255,1
      69,0,162
SH 3200 DATA8,168,32,186,255,1
      69,4,162
CM 3208 DATA174,160,12,32,189,
      255,169,0
JS 3216 DATA133,253,169,192,13
      3,254,169,253
XK 3224 DATA162,255,160,223,32
      ,216,255,120
QD 3232 DATA173,33,12,141,60,3
      ,173,34
GX 3240 DATA12,141,61,3,88,96,
      48,58
XQ 3248 DATA72,83
KH 5632 DATA169,0,141,0,255,17
      3,6,213
BJ 5640 DATA9,3,141,6,213,169,
      79,141
MJ 5648 DATA0,255,162,0,189,0,
      208,157
AC 5656 DATA0,224,232,208,247,
      238,22,22
QA 5664 DATA238,25,22,173,22,2
      2,201,224
JE 5672 DATA208,234,169,0,141,
      0,255,173
RR 5680 DATA6,213,41,252,141,6
      ,213,169
CJ 5688 DATA1,162,0,32,104,255
      ,169,1
CC 5696 DATA162,8,160,0,32,186
      ,255,169
MH 5704 DATA2,162,119,160,22,3
      2,189,255
XS 5712 DATA169,0,162,0,160,19
      2,32,213
EP 5720 DATA255,169,192,133,58
      ,32,129,175
MB 5728 DATA173,60,3,141,131,2
      2,173,61
PC 5736 DATA3,141,132,22,169,1
      26,141,60
FM 5744 DATA3,169,22,141,61,3,
      96,72
SM 5752 DATA83,8,0,216,0,240,2
      01,132
QX 5760 DATA240,3,76,255,255,1
      69,118,141
XH 5768 DATA60,3,120,173,24,3,
      72,169
EH 5776 DATA51,141,24,3,173,25
      ,3,72
RG 5784 DATA169,255,141,25,3,1
      65,216,72
GG 5792 DATA169,0,133,216,165,
      217,72,169
KB 5800 DATA4,133,217,173,44,1
      0,72,173
PR 5808 DATA121,22,141,44,10,1
      73,21,208
SX 5816 DATA72,169,0,141,21,20
      8,173,33
HF 5824 DATA208,72,169,0,141,3
      3,208,173
BR 5832 DATA2,221,9,3,141,2,22
      1,173
MX 5840 DATA0,221,72,41,252,9,
      0,141
HS 5848 DATA0,221,173,6,213,72
      ,41,63
HX 5856 DATA9,67,141,6,213,32,
      108,23
KG 5864 DATA88,165,212,201,88,
      208,250,165
AX 5872 DATA212,201,64,240,24,
      201,83,240
MQ 5880 DATA7,201,84,208,242,1
      69,240,44
XE 5888 DATA169,16,24,109,44,1
      0,41,127
MK 5896 DATA141,44,10,16,220,1
      65,212,201
KC 5904 DATA88,208,250,120,169
      ,22,141,7
EB 5912 DATA213,173,6,213,9,3,
      141,6
GR 5920 DATA213,169,112,141,0,
      255,160,0
PG 5928 DATA198,123,198,125,17
      7,124,145,122
FG 5936 DATA200,208,249,165,12
      3,201,216,208
HR 5944 DATA239,169,0,141,0,25
      5,141,7
QD 5952 DATA213,104,141,6,213,
      104,141,0
CP 5960 DATA221,104,141,33,208
      ,104,141,21
RP 5968 DATA208,173,44,10,141,
      121,22,104
CF 5976 DATA141,44,10,104,133,
      217,104,133
RA 5984 DATA216,104,141,25,3,1
      04,141,24
KG 5992 DATA3,76,108,22,169,11
      2,141,0
BM 6000 DATA255,169,22,141,7,2
      13,160,0
PA 6008 DATA177,122,145,124,16
      9,13,145,122
FR 6016 DATA200,208,245,230,12
      3,230,125,165
AC 6024 DATA123,201,220,208,23
      5,169,0,141
EX 6032 DATA0,255,141,7,213,17
      3,6,213
HG 6040 DATA41,252,141,6,213,9
      6
```

Quick Key

See instructions in article on page 69 before typing in.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
C000:78 AD 04 03 C9 BC F0 1F 1C
C008:A2 00 BD 04 03 9D B6 C2 91
C010:BD 8F 02 9D B8 C2 BD 70 2B
C018:C2 9D 8F 02 BD 72 C2 9D 4F
C020:04 03 E8 E0 02 D0 E3 58 03
C028:60 AD 7D C2 D0 17 A5 D4 24
C030:D0 10 AD 7C C2 F0 0B AE 3A
C038:8D 02 E0 01 F0 2C E0 02 29
C040:F0 28 6C B8 C2 A5 CB C9 6B
C048:3F F0 16 A2 00 DD 42 C2 51
C050:F0 07 E8 E0 18 D0 F6 F0 1A
C058:0D BD 59 C2 85 CB 4C 2E 49
C060:C0 A9 00 8D 7D C2 A9 40 10
C068:D0 F2 A9 C2 85 F5 A9 EB B3
C070:85 F6 A5 D7 C9 C1 90 41 5C
C078:C9 DB B0 3D 38 E9 C1 E0 8D
C080:02 D0 03 18 69 1A AA BD DF
C088:80 C2 38 E9 7F AA A0 FF 88
C090:CA F0 08 C8 B9 9E A0 10 DA
C098:FA 30 F5 C8 B9 9E A0 30 A8
C0A0:07 9D 78 02 E8 4C 9B C0 AC
C0A8:29 7F E8 9D 77 02 E8 86 B1
C0B0:C6 A9 9D 8D 77 02 4C 48 31
C0B8:EB 4C E0 EA A5 7A 8D BA FA
C0C0:C2 A5 7B 8D BB C2 A0 FF 7F
C0C8:84 7A A0 01 84 7B 20 73 15
C0D0:00 90 07 C9 2B F0 3E 4C D9
C0D8:EB C1 AE 7E C2 F0 33 20 DE
C0E0:F8 C1 20 0C C2 A9 C0 20 72
C0E8:67 B8 20 DD BD A2 00 E8 8F
C0F0:BD 00 01 9D 76 02 D0 F7 A0
C0F8:AD 7F C2 F0 0E A0 00 B9 45
C100:3C C2 F0 07 9D 76 02 C8 74
C108:E8 D0 F4 A9 20 9D 76 02 D3
C110:86 C6 4C EB C1 A0 00 A2 04
C118:00 8C BC C2 20 73 00 BD 0F
C120:2E C2 30 16 D1 7A D0 03 EF
C128:E8 D0 F1 EE BC C2 EE BC 0D
C130:C2 E8 BD 2E C2 10 FA E8 1F
C138:D0 E5 38 E9 80 D1 7A D0 54
C140:96 AE BC C2 BD 74 C2 8D 51
C148:BE C2 BD 75 C2 8D BF C2 79
C150:6C BE C2 A9 00 8D B5 C2 11
C158:20 73 00 F0 2E C9 53 F0 08
C160:05 A9 1A 8D B5 C2 20 73 59
C168:00 C9 5B B0 5B 38 E9 41 A5
C170:90 56 18 6D B5 C2 8D B4 34
C178:C2 20 73 00 A2 2C 20 F1 CB
```

```
C180:B7 8A AE B4 C2 9D 80 C2 F3
C188:4C E0 C1 AE 7C C2 D0 02 20
C190:A2 02 CA 8E 7C C2 4C E0 90
C198:C1 A9 01 8D 7D C2 D0 25 1E
C1A0:20 73 00 D0 04 A9 00 F0 D5
C1A8:19 B0 1D 20 F8 C1 A2 00 9E
C1B0:C9 44 D0 01 E8 8E 7F C2 97
C1B8:20 0C C2 A2 C0 20 D4 BB BD
C1C0:A9 01 8D 7E C2 4C E0 C1 BD
C1C8:4C EB C1 78 A2 00 BD B6 74
C1D0:C2 9D 04 03 BD B8 C2 9D C1
C1D8:8F 02 E8 E0 02 D0 EF 58 5B
C1E0:A2 FF E8 BD 1D C2 9D 00 DD
C1E8:02 D0 F7 AD BA C2 85 7A E1
C1F0:AD BB C2 85 7B 6C B6 C2 A8
C1F8:A2 01 9D 00 01 E8 20 73 21
C200:00 90 F7 A9 00 9D 00 01 BA
C208:20 79 00 60 A9 00 85 7A D4
C210:A9 01 85 7B 20 73 00 20 02
C218:F3 BC A0 C2 60 3F 22 51 9C
C220:55 49 43 4B 20 4B 45 59 D1
C228:20 4F 4B 21 22 00 4B 45 F9
C230:D9 4E 55 CD 41 55 54 CF 95
C238:4F 46 C6 00 20 44 41 54 B8
C240:41 00 16 19 1E 15 1A 1D 51
C248:22 1F 1C 27 24 2F 2D 12 E6
C250:07 02 3C 00 01 18 17 2C 24
C258:14 18 1B 20 23 0B 10 13 CB
C260:2F 38 3B 08 2F 2D 12 07 CC
C268:02 3C 00 01 40 2B 2C 00 15
C270:29 C0 BC C0 53 C1 99 C1 F4
C278:A0 C1 CB C1 01 00 00 00 5C
C280:99 BB A0 83 80 81 89 A1 CC
C288:8B B5 8C 9B CA 82 9F 97 C3
C290:91 87 A6 A7 9E C5 C9 A3 53
C298:BC 9D AF 8F C7 86 96 C6 1F
C2A0:8D 8A 85 84 88 93 C3 A2 45
C2A8:B0 C2 98 8E 94 A4 A9 95 53
C2B0:C8 BF BE 9C 00 00 00 00 2C
```

Solarpix

Article on page 64.

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

```
XA 10 POKE56,132:CLR
FG 20 POKE792,193:POKE648,132
RC 30 POKE56576,(PEEK(56576)AN
      D252)OR1
XR 40 POKE53280,3:POKE53281,3:
      DIMS(255),C(255),M$(9,17
      )
PA 50 BP=34808:V=53248:LC=4915
      2:EY=1984.82
CB 60 PP=2*↑:P$(0)="AC":P$(1)=
      "DE":SA=1.1
RA 70 PRINT"{CLR}{8 DOWN}{BLU}
      "SPC(14)"PLEASE WAIT"
CB 80 SP$=CHR$(32):X$=SP$+"Z=E
      XIT"
KC 90 RE$=CHR$(18):RX$=CHR$(14
      6)
XQ 100 T$(1)=RE$+"SUN & PLANET
       S"+RX$
FF 110 T$(2)=RE$+"SUN,EARTH &
       {SPACE}MOON"+RX$
RD 120 T$(3)=RE$+"COMETS"+RX$
PQ 130 T$(4)=RE$+"FACTS"+RX$
SH 140 FORJ=49152TO49240:READK
       :POKEJ,K:NEXT
AF 150 FORJ=34816TO35199:READK
       :POKEJ,K:NEXT
KK 160 FORJ=35520TO35775:POKEJ
       ,0:NEXT
PX 170 FORL=1TO10:READJ,K:POKE
       35584+J,K:NEXT
SJ 180 FORJ=0TO7:READK:POKEBP+
       J,K:NEXT
BH 190 FORJ=0TO7:READH(J):NEXT
BC 200 FORJ=0TO10:READF$(J),U$
       (J)
HQ 210 L=0:H=10:IFJ>4THENL=1:H
       =9
EB 220 FORK=LTOH:READZ(K,J):NE
       XT:NEXT
DQ 230 FORJ=1TO9:D(J)=Z(J,5)
BB 240 P(J)=Z(J,6):NEXT
XE 250 FORJ=0TO10:READN$(J)
DG 260 IFJ<4ORJ=10THEN280
HF 270 FORK=1TOZ(J,10):READM$(
       J,K):NEXT
CE 280 NEXT:FORJ=1TO9:READR:R(
       J)=R/360:NEXT
SJ 290 FORN=0TO255:M=N*2*↑/256
RJ 300 S(N)=SIN(M):C(N)=COS(M)
       :NEXT
RR 310 FORJ=32TO36:K=74-J
BA 320 POKE251,J:POKE252,2:POK
       E253,K
AK 330 POKE254,2:SYS49175:NEXT
MF 340 FORJ=0TO7:POKEV+39+J,H(
       J):NEXT
BH 350 POKEV+23,0:POKEV+29,0:P
       OKEV+16,128
QQ 360 GOSUB550:POKEV+39,7:POK
       EV+40,3
HK 370 POKEV+32,3:POKEV+33,3:P
       OKE646,6
EG 380 PRINT"{CLR}":SYSLC,4,14
KQ 390 PRINT"SOLARPIX":PRINT:P
       RINT
KC 400 FORJ=1TO4:PRINTTAB(8)J;
       T$(J):PRINT
GD 410 NEXT:PRINTTAB(9)"Q QUIT
       "
DR 420 GOSUB470:ONKGOTO630,101
       0,1280,1460
MB 430 IFK$<>"Q"THEN420
MM 440 POKE56576,PEEK(56576)OR
       3
MG 450 POKE648,4:POKE792,71:GO
       SUB550
KE 460 PRINT"{CLR}":POKE56,160
       :CLR:END
GE 470 POKE198,0
RR 480 GETK$:IFK$=""THEN480
HF 490 K=VAL(K$):RETURN
BM 500 SYSLC,18,31:PRINT"G=GO"
BC 510 PRINTTAB(31)"S=STOP"
PH 520 PRINTTAB(31)"+=FASTER"
ME 530 PRINTTAB(31)"-=SLOWER"
RS 540 PRINTTAB(30)X$:RETURN
PX 550 POKEV+21,0:FORJ=0TO15
JK 560 POKEV+J,0:NEXT:RETURN
DH 570 SYSLC,23,30:PRINTX$
GA 580 SYSLC,2,0:RETURN
FR 590 GETK$:IFK$="S"THENFL=1
PH 600 IFK$="G"THENFL=0
QJ 610 IFK$="-"THENM=M/2
XR 620 RETURN
JA 630 POKEV+32,11:POKEV+33,0:
       POKE646,7
KR 640 GOSUB550:PRINT"{CLR}"T$
       (1):GOSUB570
HG 650 PRINT"{7}PLEASE SELECT
       {SPACE}PLANETS (MAX5)"
FF 660 PRINT:FORJ=1TO9:PRINTJ;
       N$(J):NEXT
DG 670 PRINT:PRINT"INNER PLANE
       T?";
CX 680 GOSUB470:IFK$="Z"THEN36
       0
QF 690 L=K:IFL<1THEN680
EG 700 PRINTN$(L):PRINT"OUTER
       {SPACE}PLANET?";
RK 710 GOSUB470:IFK$="Z"THEN36
       0
DE 720 H=K:IFH<LORH>9ORH-L>4TH
       EN710
FR 730 PRINTN$(H):PRINT:X=1
MH 740 FORJ=1TOH-L+1:X=X+2↑J:N
       EXT
MK 750 FORJ=LTOH:F(J)=D(J)*90/
       D(H)
RR 760 E(J)=F(J)*SA:NEXT:M=P(L
       )/50:ML=M*9
SR 770 INPUT"STARTING YEAR (1-
       2000)";K$
FC 780 SY=VAL(K$):IFSY<1ORSY>2
       000THEN630
DJ 790 PRINT"{CLR}{YEL}"T$(1):
       K=1
AF 800 FORJ=LTOH:POKE646,H(K)
RF 810 PRINTTAB(31)N$(J):K=K+1
       :NEXT
DJ 820 POKE646,14:GOSUB500:SYS
       LC,7,31
AX 830 PRINT"EARTH":PRINTTAB(3
       1)"YEAR"
PE 840 E=.25:T=SY-EY:FL=1
RS 850 POKEV,130:POKEV+1,148:P
       OKEV+21,X
BH 860 FORJ=LTOH:A=T/P(J)+R(J)
BD 870 A=INT((A-INT(A))*256):I
       FJ=9THEN890
AD 880 X(J)=C(A):Y(J)=-S(A):GO
       TO910
MB 890 Z=1+E*C(A):X(J)=E+(E+C(
       A))/Z
FK 900 Y(J)=(E*E-1)*S(A)/Z
XE 910 X(J)=INT(131+X(J)*E(J))
MQ 920 Y(J)=INT(149+Y(J)*F(J))
       :NEXT
JC 930 K=1:FORJ=LTOH:POKEV+2*K
       ,X(J)
ER 940 POKEV+2*K+1,Y(J):K=K+1:
       NEXT
JB 950 T$=STR$(INT((T+EY)*10)/
       10)
BA 960 SYSLC,9,30:PRINTT$SP$SP
       $
CP 970 GOSUB590:IFK$="Z"THEN63
       0
QJ 980 IFFLTHEN970
HK 990 IFK$="+"ANDM<MLTHENM=M*
       2
RJ 1000 T=T+M:GOTO860
BQ 1010 POKEV+32,14:POKEV+33,0
       :POKE646,14
SM 1020 PRINT"{CLR}"T$(2):PRIN
       TTAB(31)"MOON"
AQ 1030 PRINTTAB(31)"PHASE":GO
       SUB500
BR 1040 SYSLC,24,1:PRINT"(EART
       H-MOON DISTANCE MAGNIF
       IED BY 30)";
CP 1050 SYSLC,7,31:PRINT"EARTH
       "
EQ 1060 PRINTTAB(31)"DAY"
GP 1070 E=84:D=E*SA:F=D*30/390
       :G=F/SA
BF 1080 M=0.3/365.25:T=0:H=13.
       3685
EB 1090 POKEV+39,14:POKEV+40,1
       2
SF 1100 POKEV+12,141:POKEV+13,
       147
HS 1110 POKEV+14,24:POKEV+15,8
       0
PS 1120 POKEV+21,195:FL=1
DG 1130 A=T-INT(T):B=T*H:B=B-I
       NT(B)
CQ 1140 C=INT(12*(B-A)+.5-7)
RX 1150 IFC<0THENC=C+12:GOTO11
       50
DG 1160 A=A*PP:B=B*PP
XB 1170 X=INT(142.5+COS(A)*D)
```

```
RH 1180 Y=INT(148.5-SIN(A)*E)
KJ 1190 W=INT(X+1+COS(B)*F)
GA 1200 Z=INT(Y+1-SIN(B)*G)
MD 1210 POKEV,X:POKEV+1,Y:POKE
        V+2,W
EP 1220 POKEV+3,Z:POKEBP+7,32+
        C
JR 1230 SYSLC,9,30:PRINTINT(T*
        365.25)
GR 1240 GOSUB590:IFK$="Z"THEN3
        60
QX 1250 IFFLTHEN1240
PB 1260 IFK$="+"ANDM<.006THENM
        =M*2
GJ 1270 T=T+M:GOTO1130
GD 1280 POKEV+32,5:POKEV+33,0:
        POKE646,5
CR 1290 GOSUB550:PRINT"{CLR}"R
        E$T$(3):GOSUB570
SB 1300 INPUT"ECCENTRICITY(0-0
        .96)";K$
HJ 1310 E=VAL(K$):IFK$="Z"THEN
        360
KB 1320 IFE<0ORE>.96ORLEN(K$)=
        0THEN1280
BE 1330 FL=1:IFRIGHT$(K$,1)="R
        "THENFL=-1
BS 1340 PRINT"{CLR}"RE$T$(3):G
        OSUB570
FF 1350 PRINT"ECCENTRICITY="E:
        SYSLC,2,27
JS 1360 IFETHENPRINT"ACCELERAT
        ING"
HC 1370 M=0.01:T=0:F=65*SA:G=6
        5*FL
QK 1380 POKEV,106:POKEV+1,148:
        POKEV+21,3
MG 1390 A=(T-INT(T))*PP:Z=1+E*
        COS(A)
RC 1400 X=E+(E+COS(A))/Z:Y=(E*
        E-1)*SIN(A)/Z
AG 1410 X=INT(107+X*F):Y=INT(1
        49+Y*G)
FD 1420 J=INT(A/↑):POKEV+2,X:P
        OKEV+3,Y
JQ 1430 IFE>0.1THENSYSLC,2,27:
        PRINTP$(J)
FX 1440 GETK$:IFK$="Z"THEN1280
XQ 1450 T=T+M:GOTO1390
XA 1460 POKEV+32,3:POKEV+33,6:
        POKE646,3
CD 1470 PRINT"{CLR}"RE$T$(4)"
        {SPACE}MENU":SYSLC,4,0
MS 1480 GOSUB570:SYSLC,4,0
JK 1490 PRINT" S SUN":PRINT" M
         MOON"
SJ 1500 FORJ=1TO9:PRINTJ;N$(J)
        :NEXT
FS 1510 SYSLC,4,0:FORJ=0TO10
BC 1520 PRINTTAB(20)CHR$(J+65)
        " "F$(J):NEXT
CR 1530 GOSUB470:IFK$="Z"THEN3
        60
QD 1540 IFK$="S"THENK=0:GOTO15
        90
GE 1550 IFK$="M"THENK=10:GOTO1
        590
EM 1560 IFK>0ANDK<10THEN1590
RS 1570 K=ASC(K$)-65:IFK<0ORK>
        10THEN1530
RG 1580 GOTO1720
FM 1590 POKEV+32,3:POKEV+33,11
        :POKE646,3
QG 1600 PRINT"{CLR}"RE$N$(K)RX
        $;
AG 1610 H=4:IFK=0ORK=10THENPRI
        NT:GOTO1630
SB 1620 H=10:PRINT" PLANET #"K
        "FROM SUN"
PE 1630 PRINT:FORJ=0TOH
HJ 1640 PRINTF$(J)TAB(18)Z(K,J
        )TAB(28)U$(J)
GR 1650 NEXT:IFK<10THEN1680
FS 1660 PRINT"DIST.FROM EARTH"
        TAB(19)"243000 MILES"
DH 1670 PRINTF$(9)TAB(19)"6 MO
        NTHS"
SE 1680 PRINT:IFK<4ORK=10THEN1
        770
CQ 1690 FORJ=1TOZ(K,10):C=INT(
        (J-1)/7)
PE 1700 L=13+J-C*7:SYSLC,L,C*1
        3
BD 1710 PRINTM$(K,J):NEXT:GOTO
        1770
MR 1720 POKEV+32,3:POKEV+33,11
        :POKE646,3
BK 1730 PRINT"{CLR}"RE$F$(K)RX
        $TAB(19)U$(K)
CP 1740 L=0:H=10:IFK>4THENL=1:
        H=9
AR 1750 SYSLC,5,0:FORJ=LTOH
KD 1760 PRINTN$(J)TAB(18)Z(J,K
        ):NEXT
RQ 1770 GOSUB570:GOSUB470:GOTO
        1460
XJ 1780 DATA 32,13,192,132,251
        ,32,13
HG 1790 DATA 192,166,251,76,24
        0,255,32
EM 1800 DATA 253,174,32,158,17
        3,32,170
AH 1810 DATA 177,96,162,6,6,25
        1,38
BA 1820 DATA 252,6,253,38,254,
        202,208
MH 1830 DATA 245,169,21,133,2,
        160,2
CC 1840 DATA 177,251,162,8,106
        ,38,255
ME 1850 DATA 202,208,250,192,1
        ,240,4
QX 1860 DATA 152,73,2,168,165,
        255,145
PK 1870 DATA 253,192,1,240,4,1
        52,73
PH 1880 DATA 2,168,136,16,223,
        162,3
QR 1890 DATA 230,251,230,253,2
        02,208,249
KS 1900 DATA 198,2,208,208,96
KS 1910 DATA 0,15,0,0,0,192,0,
        0,48
JG 1920 DATA 0,0,56,0,0,28,0,0
        ,28
FP 1930 DATA 0,0,14,0,0,14,0,0
        ,7
GC 1940 DATA 0,0,7,0,0,7,0,0,7
GF 1950 DATA 0,0,7,0,0,14,0,0,
        14
GR 1960 DATA 0,0,28,0,0,28,0,0
        ,56
JX 1970 DATA 0,0,48,0,0,192,0,
        15,0,0
QM 1980 DATA 0,15,0,0,7,192,0,
        3,240
GR 1990 DATA 0,1,248,0,1,252,0
        ,1,252
ER 2000 DATA 0,0,254,0,0,254,0
        ,0,255
BJ 2010 DATA 0,0,255,0,0,255,0
        ,0,255
MR 2020 DATA 0,0,255,0,0,254,0
        ,0,254
SG 2030 DATA 0,1,252,0,1,252,0
        ,1,248
KH 2040 DATA 0,3,240,0,7,192,0
        ,15,0,0
HH 2050 DATA 0,15,0,0,15,192,0
        ,15,240
RQ 2060 DATA 0,15,248,0,15,252
        ,0,15,252
GF 2070 DATA 0,15,254,0,15,254
        ,0,15,255
QB 2080 DATA 0,15,255,0,15,255
        ,0,15,255
SE 2090 DATA 0,15,255,0,15,254
        ,0,15,254
EF 2100 DATA 0,15,252,0,15,252
        ,0,15,248
SJ 2110 DATA 0,15,240,0,15,192
        ,0,15,0,0
BB 2120 DATA 0,15,0,0,31,192,0
        ,63,240
SX 2130 DATA 0,127,248,0,127,2
        52,0,127,252
MX 2140 DATA 0,255,254,0,255,2
        54,0,255,255
DD 2150 DATA 0,255,255,0,255,2
        55,0,255,255
QX 2160 DATA 0,255,255,0,255,2
        54,0,255,254
FK 2170 DATA 0,127,252,0,127,2
        52,0,127,248
XD 2180 DATA 0,63,240,0,31,192
        ,0,15,0,0
FR 2190 DATA 0,31,0,0,255,192,
        3,255,240
HA 2200 DATA 3,255,248,7,255,2
        52,7,255,252
HP 2210 DATA 15,255,254,15,255
        ,254,31,255,255
RP 2220 DATA 31,255,255,31,255
        ,255,31,255,255
HS 2230 DATA 31,255,255,15,255
        ,254,15,255,254
XE 2240 DATA 7,255,252,7,255,2
        52,3,255,248
CA 2250 DATA 3,255,240,0,255,1
        92,0,31,0,0
KQ 2260 DATA 0,255,0,3,255,192
        ,15,255,240
PB 2270 DATA 31,255,248,63,255
        ,252,63,255,252
XR 2280 DATA 127,255,254,127,2
        55,254,255,255,255
AF 2290 DATA 255,255,255,255,2
        55,255,255,255,255
CB 2300 DATA 255,255,255,127,2
        55,254,127,255,254
DG 2310 DATA 63,255,252,63,255
        ,252,31,255,248
RR 2320 DATA 15,255,240,3,255,
        192,0,255,0,0
CK 2330 DATA 0,112,3,248,6,248
        ,9,248,12,112
BR 2340 DATA 64,192,67,192
BR 2350 DATA 128,224,131,224,1
        34,224
SE 2360 DATA 46,45,45,45,45,45
        ,44,37
FR 2370 DATA 7,3,4,14,8,6,7,12
AK 2380 DATA DIAMETER,MILES
FH 2390 DATA 864000,3100,7700,
        7926
RC 2400 DATA 4200,88000,71000,
        32000
GA 2410 DATA 31000,1500,2160
GJ 2420 DATA MASS,(EARTH=1)
MK 2430 DATA 332830,0.055,0.81
        5,1
DP 2440 DATA 0.107,318,95.2,14
        .5
CM 2450 DATA 17.2,0.01,0.012
SA 2460 DATA DENSITY,(WATER=1)
SD 2470 DATA 1.4,5.4,5.2,5.5,3
        .9,1.3
BD 2480 DATA 0.7,1.2,1.7,1.4,3
        .4
EE 2490 DATA ROTATION PERIOD,E
        ARTHDAYS
QS 2500 DATA 25,58.9,243,1,1.0
        3,0.404
CE 2510 DATA 0.444,0.67,0.77,6
        .39,27.3
```

```
KK 2520 DATA TEMPERATURE,FAHRE
        NHEIT
AJ 2530 DATA 10000,620,900,72,
        -10,-240
BM 2540 DATA -300,-340,-370,-4
        00,-10
FE 2550 DATA DISTANCE FROM SUN
        ,MILL.MILES
SP 2560 DATA 36,67.2,92.9,142,
        483
BK 2570 DATA 887,1783,2795,367
        0
GK 2580 DATA LENGTH OF YEAR,EA
        RTHYEARS
EX 2590 DATA 0.241,0.615,1,1.8
        8,11.86
PR 2600 DATA 29.46,84,164,248
BK 2610 DATA ORBIT SPEED,MPH
XJ 2620 DATA 107000,78000,6600
        0,54000
QD 2630 DATA 29000,22000,15000
        ,12000,10000
XG 2640 DATA AXIS TILT,DEGREES
AJ 2650 DATA 0,179,23.5,25,3.1
FD 2660 DATA 26.7,97.9,28.8,0
XQ 2670 DATA DRIVETIME(55MPH),
        YEARS
JA 2680 DATA 75,139,193,295,10
        02
MM 2690 DATA 1840,3698,5797,76
        12
RS 2700 DATA MOONS,-
AK 2710 DATA 0,0,1,2,16,17,5,3
        ,1
XC 2720 DATA SUN,MERCURY,VENUS
        ,EARTH,MARS,PHOBOS,DEI
        MOS
DH 2730 DATA JUPITER,METIS,ADR
        ASTREA,AMALTHEA,THEBE,
        IO,EUROPA,GANYMEDE,CAL
        LISTO
JB 2740 DATA LEDA,HIMALIA,LYSI
        THEA,ELARA,ANANKE,CARM
        E,PASIPHAE,SINOPE
FR 2750 DATA SATURN,ATLAS,X,X,
        JANUS,EPIMETHEUS,MIMAS
        ,ENCELADUS,TETHYS,TELE
        STO
MA 2760 DATA CALYPSO,DIONE,X,R
        HEA,TITAN,HYPERION,IAP
        ETUS,PHOEBE
EK 2770 DATA URANUS,MIRANDA,AR
        IEL,UMBRIEL,TITANIA,OB
        ERON
JK 2780 DATA NEPTUNE,TRITON,NE
        REID,X,PLUTO,CHARON,MO
        ON
EH 2790 DATA 198,255,351,285,2
        49,180,204,227,173
```

BEFORE TYPING . . .

Before typing in programs, please refer to "How To Type In COMPUTE!'s GAZETTE Programs," which appears before the Program Listings.

FontMaker

See instructions in article on page 92 before typing in.

Program 1: FontMaker

```
BJ 100 IF XX=1 THEN 630
KX 110 POKE 56,123:CLR:XX=1:FT
       =1
CP 120 DIM T(29,2),R(7,7):OPEN
        15,8,15
GX 130 FOR X=0 TO 29:T(X,0)=33
       +X:NEXT
RM 140 FOR X=0 TO 25:T(X,1)=65
       +X:NEXT
JH 150 T(26,1)=31:T(27,1)=32:T
       (28,1)=0:T(29,1)=122
AR 160 FOR X=0 TO 29:T(X,2)=X+
       1:NEXT
KJ 170 HH$="{HOME}{21 DOWN}"
BE 180 GG$="{39 SPACES}"
PH 190 POKE 53280,6:PRINT CHR$
       (8)CHR$(14)"{CLR}{DOWN}
       {7}{7 SPACES}FONTMAKER
       {SPACE}FOR FONTPRINTER"
QE 200 GOSUB 1710:PRINT"{DOWN}
       {5 SPACES}12345678":PRI
       NT"{4 SPACES}{A}*******
       *{S}{6 SPACES}F1 PIXEL
       {SPACE}ON"
PC 210 PRINT"{3 SPACES}1-
       {8 SPACES}-{6 SPACES}F2
        PIXEL OFF"
PS 220 PRINT"{3 SPACES}2-
       {8 SPACES}-{6 SPACES}F3
        ADD COLUMN"
SE 230 PRINT"{3 SPACES}3-
       {8 SPACES}-{6 SPACES}F4
        DELETE COLUMN"
ME 240 PRINT"{3 SPACES}4-
       {8 SPACES}-"
AJ 250 PRINT"{3 SPACES}5-
       {8 SPACES}-{6 SPACES}F5
        KEYBOARD CHOICE"
SS 260 PRINT"{3 SPACES}6-
       {8 SPACES}-{6 SPACES}F6
        NEW FONT NUMBER"
KJ 270 PRINT"{3 SPACES}7-
       {8 SPACES}-{6 SPACES}F7
        LOAD A FONT SET"
DX 280 PRINT"{4 SPACES}{Z}****
       ****{X}{6 SPACES}F8 SAV
       E A FONT SET"
KE 290 PRINT"{2 DOWN}
       {4 SPACES}ABCDEFGHIJKLM
       NOPQRSTUVWXYZ[£]↑"
AS 300 PRINT"{4 SPACES}ABCDEFG
       HIJKLMNOPQRSTUVWXYZ?@
       {@}@"
KJ 310 PRINT"{4 SPACES}!"+CHR$
       (34)+"#$%&'()*+,-./0123
       456789:;<=>"
BD 320 X1=4:Y1=17
XD 330 POKE 55296+40*Y1+X1,0:G
       OSUB 1680
XK 340 GET A$:IF A$="" THEN 34
       0
EC 350 POKE 55296+40*Y1+X1,14
DQ 360 IF A$<>"{RIGHT}" THEN 3
       90
PX 370 IF X1>32 THEN X1=3
MX 380 X1=X1+1:GOTO 330
SC 390 IF A$<>"{LEFT}" THEN 42
       0
MF 400 IF X1<5 THEN X1=34
KR 410 X1=X1-1:GOTO 330
KE 420 IF A$<>"{DOWN}" THEN 45
       0
JB 430 IF Y1>18 THEN Y1=16
PD 440 Y1=Y1+1:GOTO 330
RA 450 IF A$<>"{UP}" THEN480
RS 460 IF Y1<18 THEN Y1=20
RG 470 Y1=Y1-1:GOTO 330
DX 480 IF A$<>"{F6}" THEN 520
AM 490 GOSUB 1680:PRINT"{WHT}S
       WITCH TO WHICH FONT?"
PE 500 GET B$:IF B$<"1" OR B$>
       "9" THEN 500
EE 510 FT=ASC(B$)-48:GOSUB 171
       0:GOTO 330
JC 520 IF A$<>"{F7}" THEN 570
EA 530 GOSUB 1680:PRINT"{WHT}L
       OAD FILE{BLK}";
DD 540 S$="":INPUT S$:S$=LEFT$
       (S$,16):IF S$="" THEN 3
       30
KF 550 OPEN 1,8,8,S$+",P,R":IN
       PUT#15,A,E$,B$,B$:CLOSE
        1:IF A THEN 640
BB 560 LOAD S$,8,1
DM 570 IF A$<>"{F8}" THEN 670
RD 580 GOSUB 1680:PRINT"{WHT}S
       AVE AS{BLK}";
DP 590 POKE 2,PEEK(45):POKE 3,
       PEEK(46):POKE 43,0:POKE
        44,123:POKE 45,0:POKE
       {SPACE}46,159
FQ 600 S$="":INPUT S$:S$=LEFT$
       (S$,16):IF S$="" THEN 6
       20
XS 610 SAVE S$,8
FS 620 POKE 43,1:POKE 44,8:POK
       E 45,PEEK(2):POKE 46,PE
       EK(3)
RH 630 INPUT#15,A,E$,B$,B$:IF
       {SPACE}A=0 THEN 330
CD 640 GOSUB 1690:PRINT"DISK E
       RROR:"A;E$
RC 650 GET A$:IF A$="" THEN 65
       0
PG 660 GOSUB 1690:GOTO 330
CR 670 IF A$<>"{F5}" THEN 780
DF 680 OPEN 3,3:CMD 3:GOSUB 16
       90
FP 690 PRINT"{WHT}CHOICE:
       {BLK}";:INPUT A$
ES 700 PRINT#3:CLOSE 3
MD 710 IF LEN(A$)=1 THEN A=ASC
       (A$):GOTO740
EH 720 IF LEFT$(A$,1)<>"/" THE
       N A=0:GOTO 740
KQ 730 A=VAL(RIGHT$(A$,LEN(A$)
       -1))
AA 740 X2=5:Y2=7:GOSUB 1600:IF
        SC=1 THEN 1420
QD 750 POKE 55296+40*Y1+X1,0
JE 760 GET A$:IF A$="" THEN 76
       0
CQ 770 GOSUB 1690:GOTO 350
FQ 780 IF A$=CHR$(13) THEN POK
       E 55296+40*Y1+X1,1:GOTO
        820
PQ 790 A=ASC(A$+CHR$(0)):GOSUB
        1600:IF SC=0 THEN 750
HA 800 GOSUB 1690:PRINT"{WHT}C
       HOICE:{BLK} "A$
PX 810 X2=5:Y2=7:GOTO 1420
DJ 820 X2=5:Y2=7:GOTO 1410
KM 830 PRINT LEFT$(HH$,Y2+1)TA
       B(X2)"{RVS}{7}";
QP 840 POKE 55296+40*Y2+X2,0
AC 850 GET A$:IF A$="" THEN 85
       0
GR 860 POKE 55296+40*Y2+X2,14
SS 870 IF A$<>"{RIGHT}" THEN 9
       10
AE 880 IF WD=0 THEN 850
GK 890 IF X2>3+WD THEN X2=5:GO
       TO 830
RB 900 X2=X2+1:PRINT"{RIGHT}";
       :GOTO 840
FM 910 IF A$<>"{LEFT}" THEN 94
       0
```

```
QR 920 IF X2<6THENX2=4+WD:GOTO
       830
AQ 930 X2=X2-1:PRINT"{LEFT}";:
       GOTO 840
BQ 940 IF A$<>"{DOWN}" THEN 97
       0
MP 950 IF Y2>12 THEN Y2=6:PRIN
       T"{7 UP}";
HK 960 Y2=Y2+1:PRINT"{DOWN}";:
       GOTO 840
QH 970 IF A$<>"{UP}" THEN1000
FB 980 IF Y2<8 THEN Y2=14:PRIN
       T"{7 DOWN}";
HE 990 Y2=Y2-1:PRINT"{UP}";:GO
       TO 840
FF 1000 IFA$=CHR$(13) THEN 157
       0
DE 1010 IF A$<>CHR$(141) THEN
       {SPACE}1040
JK 1020 GOSUB 1690:PRINT"{BLU}
       "LEFT$(HH$,8)TAB(5);
RC 1030 FOR K=0 TO 7:PRINT"
       {DOWN}{LEFT} {DOWN}
       {LEFT} {DOWN}{LEFT}
       {DOWN}{LEFT} {DOWN}
       {LEFT} {DOWN}{LEFT}
       {DOWN}{7 UP}";:NEXT:GO
       TO 330
RA 1040 IF A$<>"{CLR}" THEN 10
       80
KM 1050 PRINT LEFT$(HH$,8);
ES 1060 FOR I=0 TO 6:PRINT TAB
       (5)"{RVS}"LEFT$(GG$,WD
       )
DR 1070 FOR R=0 TO 7:R(R,I)=0:
       NEXT:NEXT:GOTO 830
KR 1080 IF A$<>"{HOME}" THEN 1
       110
CG 1090 IF WD THEN X2=5
PS 1100 Y2=7:GOTO 850
SH 1110 IF A$<>"{F2}" AND A$<>
       CHR$(32) THEN 1140
DE 1120 IF WD=0 THEN 850
DK 1130 PRINT" {LEFT}";:R(X2-5
       ,Y2-7)=0:GOTO 890
SB 1140 IF A$<>"{F3}" THEN 119
       0
KM 1150 IF WD<8 THEN WD=WD+1:R
       (WD-1,7)=128
FR 1160 FOR K=7 TO 13:POKE 553
       00+40*K+WD,14:NEXT
SR 1170 IF WD=1 THEN 890
MJ 1180 GOTO 830
SH 1190 IF A$<>"{F4}" THEN 124
       0
XP 1200 IF WD=0 THEN 830
HK 1210 FOR K=7 TO 13:POKE5530
       0+40*K+WD,6:NEXT
CF 1220 R(WD-1,7)=0:WD=WD-1:IF
        X2>WD+4 THEN X2=WD+4
HR 1230 GOTO 830
XX 1240 IF A$<>"{F6}" THEN 128
       0
BP 1250 GOSUB 1690:PRINT"{WHT}
       SWITCH TO WHICH FONT?"
JB 1260 GET B$:IF B$<"1" OR B$
       >"9" THEN 1260
DA 1270 FT=ASC(B$)-48:GOSUB 17
       10:GOSUB 1690:GOTO 830
GS 1280 IF A$<>"{F5}" THEN 138
       0
AS 1290 OPEN 3,3:CMD 3:GOSUB 1
       690
KR 1300 PRINT"{WHT}CHOICE:
       {BLK}";:INPUT A$
JJ 1310 PRINT#3:CLOSE 3
XK 1320 IF LEN(A$)=1 THEN A=AS
       C(A$):GOTO 1340
SK 1330 A=VAL(RIGHT$(A$,LEN(A$
       )-1))
KH 1340 GOSUB 1600:POKE 55296+
       40*Y2+X2,0
QP 1350 IF SC=1 THEN POKE 5529
       6+40*Y1+X1,14:GOTO 830
XC 1360 GET A$:IF A$="" THEN 1
       360
PA 1370 GOSUB 1690:PRINT LEFT$
       (HH$,Y2+1)TAB(X2)"
       {RVS}";:GOTO 870
JX 1380 IF A$="{F7}" OR A$="
       {F8}" THEN 830
PP 1390 IF WD=0 THEN 850
QR 1400 PRINT"*{LEFT}";:R(X2-5
       ,Y2-7)=2↑(Y2-7):GOTO 8
       90
GA 1410 TT=8*T(X1-4,Y1-17)+304
       64
GD 1420 SS=TT+FT*1024
FF 1430 IF A$=CHR$(13) THEN GO
       SUB 1690
PS 1440 PRINT"{HOME}{7 DOWN}
       {RVS}{73}"TAB(5);:R=0
SK 1450 RR=PEEK(SS+R):IF RR<12
       8 THEN 1520
HJ 1460 FOR I=0 TO 6:R(R,I)=RR
        AND 2↑I
AS 1470 IF R(R,I) THEN PRINT"*
       {DOWN}{LEFT}";:GOTO 14
       90
BF 1480 PRINT" {DOWN}{LEFT}";
AC 1490 NEXT:R(R,7)=128:PRINT"
       {RIGHT}{7 UP}";
AG 1500 R=R+1:IF R<8 THEN 1450
HM 1510 WD=R:GOTO 830
BH 1520 IF R=0 THEN X2=4
PM 1530 FOR RR=R TO 7:FOR I=0
       {SPACE}TO 6
SE 1540 R(RR,I)=0:PRINT"{BLU}
       {SPACE}{DOWN}{LEFT}";:
       NEXT
HB 1550 R(R,7)=0:PRINT"{RIGHT}
       {7 UP}";
RF 1560 NEXT:WD=R:GOTO 830
RS 1570 GOSUB 1690:SS=TT+FT*10
       24:PRINT"{HOME}
       {7 DOWN}{RVS}{BLU}"TAB
       (5);
MM 1580 FOR R=0 TO 7:K=0:FOR I
       =0 TO 7:K=K+R(R,I):NEX
       T
PA 1590 POKE SS+R,K:PRINT"
       {DOWN}{LEFT} {DOWN}
       {LEFT} {DOWN}{LEFT}
       {DOWN}{LEFT} {DOWN}
       {LEFT} {DOWN}{LEFT}
       {DOWN}{7 UP}";:NEXT:GO
       TO 330
JJ 1600 SC=1:IF A>255 THEN 167
       0
FS 1610 IF A=255 THEN TT=8*94+
       30464:RETURN
PQ 1620 IF A>127 THEN 1650
QX 1630 IF A<32 THEN 1670
RR 1640 TT=8*(A-32)+30464:RETU
       RN
QD 1650 IF A<160 THEN 1670
ME 1660 TT=8*(A AND 127 OR64)+
       30464:RETURN
BP 1670 GOSUB 1690:PRINT"{BLK}
       -INVALID CHARACTER":SC
       =0:RETURN
BR 1680 PRINT HH$GG$:GOTO 1700
GR 1690 PRINT "{OFF}"LEFT$(HH$
       ,16)GG$
PQ 1700 PRINT"{UP}{4 RIGHT}";:
       RETURN
SX 1710 PRINT"{HOME}{3 DOWN}"T
       AB(12)"{73}CURRENT FONT
       :"FT:RETURN
```

Program 2: FontPrinter

```
0801:0B 08 0A 00 9E 32 31 31 2B
0809:38 00 00 00 FF FF 93 0E 6A
0811:0D C6 4F 4E 54 D0 52 49 FB
0819:4E 54 45 52 0D 20 20 20 7C
0821:20 20 20 20 20 20 20 20 31
0829:20 20 20 20 20 20 20 20 39
0831:0D 0D 46 4F 4E 54 20 53 20
0839:45 54 3A 00 0D 53 4F 55 F1
0841:52 43 45 3A 00 A0 00 20 3A
0849:BB 08 20 C1 08 A2 00 A0 C4
0851:60 20 BD FF A9 05 A2 08 FF
0859:A0 00 20 BA FF A9 00 A2 B2
0861:C1 A0 09 20 D5 FF B0 35 E2
0869:A9 05 20 C3 FF A0 2E 20 CE
0871:BB 08 20 C1 08 A2 00 A0 EC
0879:60 20 BD FF A9 05 A2 08 28
0881:A0 05 20 BA FF 20 C0 FF D4
0889:B0 13 A9 00 20 BD FF A9 8D
0891:04 A2 04 A0 07 20 BA FF 05
0899:20 C0 FF 90 06 AA 68 68 07
08A1:4C 37 A4 20 D6 08 B9 00 86
08A9:60 D0 03 4C 1B 09 20 A8 29
08B1:FF C8 D0 F2 F0 ED 20 D2 8F
08B9:FF C8 B9 0F 08 D0 F7 60 F7
08C1:A0 FF C8 20 CF FF 99 00 EE
08C9:60 C9 0D D0 F5 C0 11 90 90
08D1:02 A0 10 98 60 20 B7 FF 89
08D9:F0 0D A9 04 20 C3 FF A9 D4
08E1:05 20 C3 FF 68 68 60 20 BA
08E9:AE FF A9 08 20 B4 FF A9 84
08F1:65 20 96 FF 20 A5 FF 99 C0
08F9:00 60 20 B7 FF D0 0A C8 C1
0901:D0 F2 F0 08 A9 00 99 00 57
0909:60 C8 D0 F8 20 AB FF A9 80
0911:04 20 B1 FF A9 67 20 93 22
0919:FF 60 C8 D0 03 20 D6 08 B7
0921:B9 00 60 38 E9 30 10 08 D7
0929:A9 0F 20 A8 FF 4C B2 08 01
0931:F0 F6 C9 0A B0 F2 A2 C1 AB
0939:8E 0D 08 0A 0A 18 69 05 FF
0941:8D 0E 08 A9 08 20 A8 FF 4B
0949:4C BC 09 A9 0F 20 A8 FF B6
0951:A9 0D 20 A8 FF A9 08 20 E0
0959:A8 FF 4C BC 09 20 D6 08 93
0961:B9 00 60 D0 03 4C 1B 09 F1
0969:C9 0D F0 DF C9 FF D0 04 B3
0971:A9 5E D0 19 30 0F C9 20 0D
0979:B0 06 20 A8 FF 4C BC 09 A7
0981:38 E9 20 10 08 C9 A0 90 68
0989:F1 29 7F 09 40 A2 00 8E 7A
0991:B1 09 0A 2E B1 09 0A 2E D6
0999:B1 09 0A 2E B1 09 18 6D 3A
09A1:0D 08 8D B0 09 AD B1 09 64
09A9:6D 0E 08 8D B1 09 BD FF FC
09B1:FF 10 08 20 A8 FF E8 E0 C2
09B9:08 90 F3 C8 D0 A2 F0 9D 8F
09C1:00 00 00 00 FF 00 FF 00 D3
```

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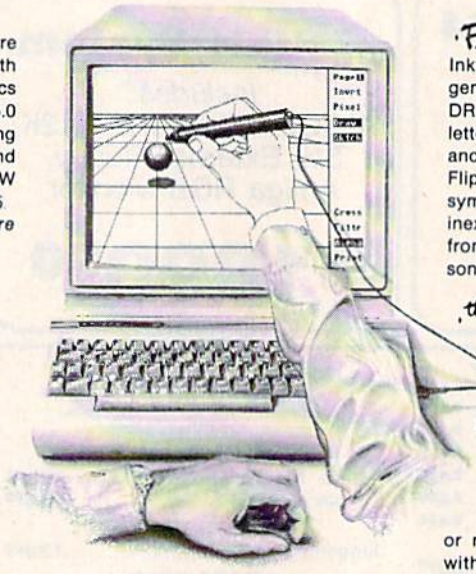

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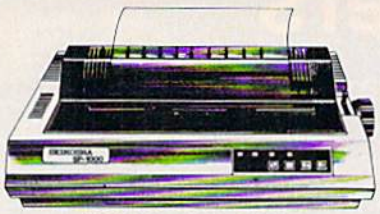

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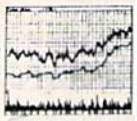

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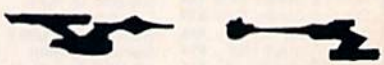

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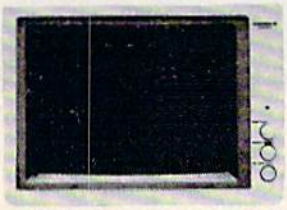

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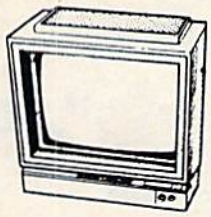

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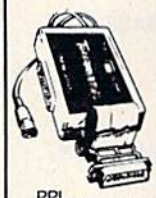

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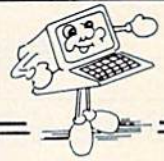

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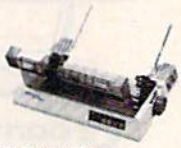

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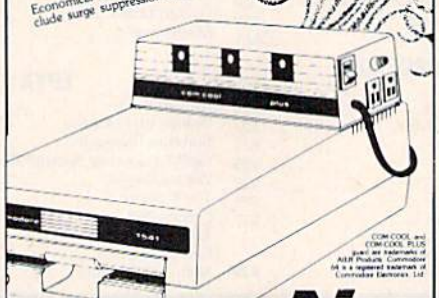

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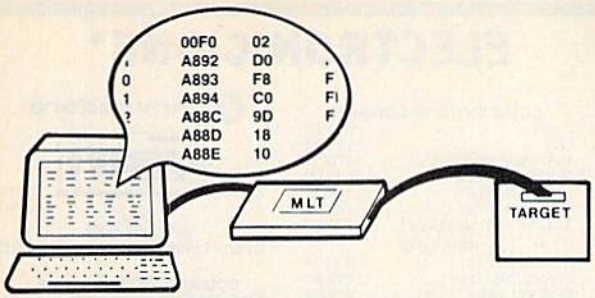

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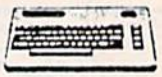

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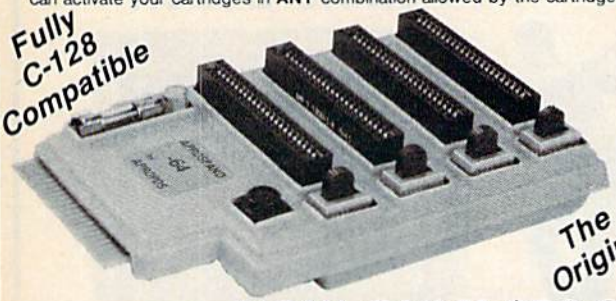

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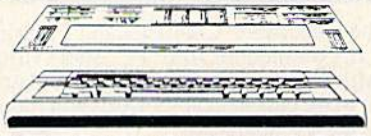

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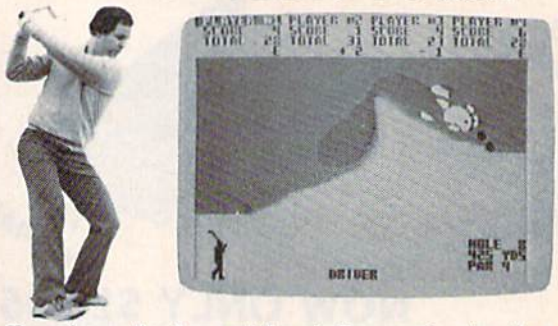

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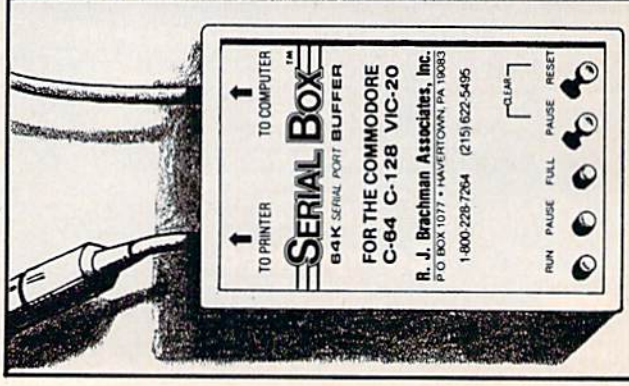

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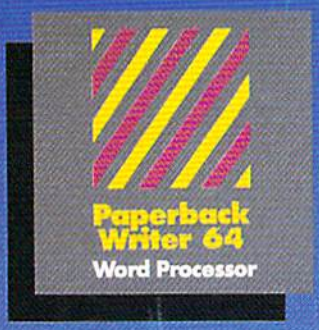

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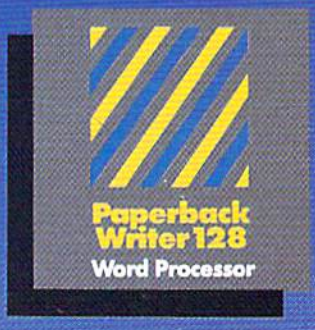

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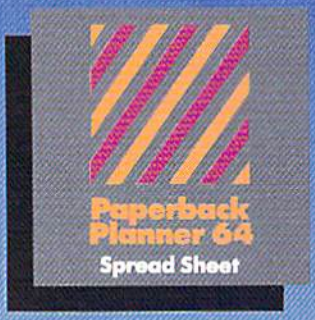

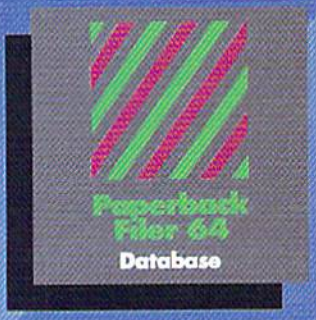

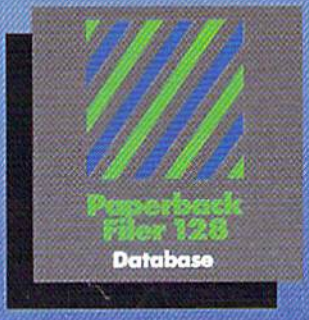

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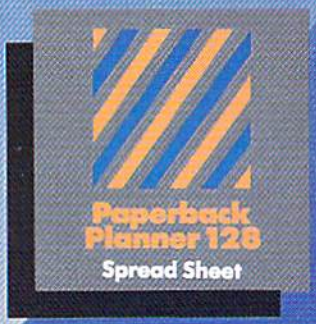

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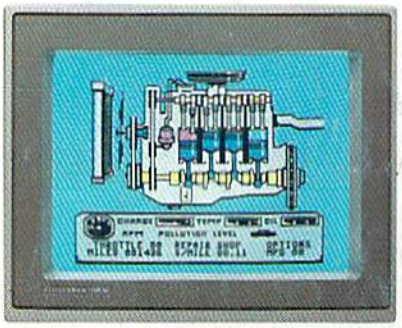

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