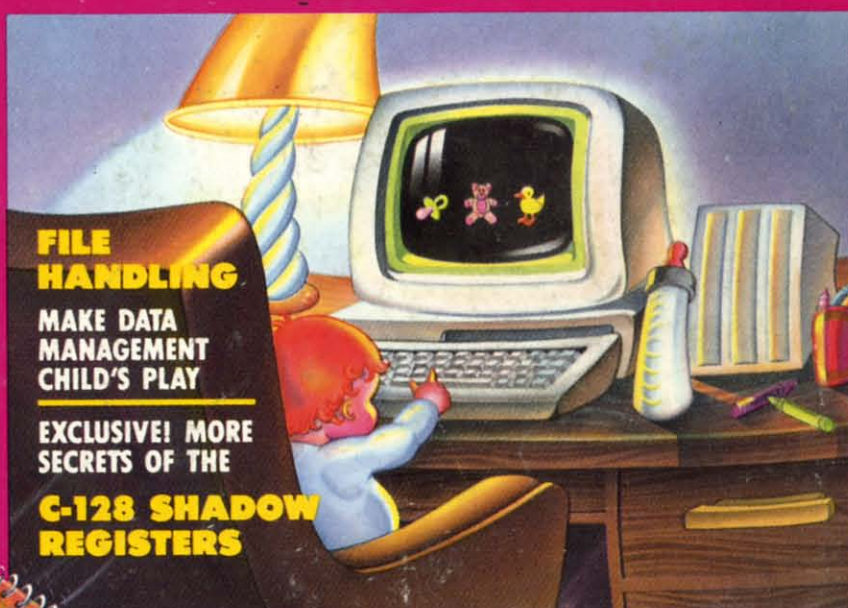


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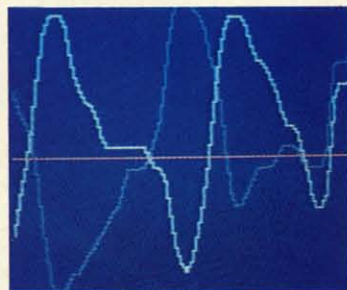


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VIEW FROM THE BRIDGE



nce again, *Ahoy!* has gone up against the toughest review board in the Commodore market—that of Benn Dunnington's *INFO Magazine*—and come out smelling like a rose! Certain other magazines came out smelling more like a substance found at the other end of a rose...but we'll let you read about that on page 97.

Right now, we're more interested in boasting about the premium offered with this month's *Ahoy! Disk*: all the software you need to get online with PlayNET and enjoy two free hours of the popular bulletin board system's games and other services! You can read more about what PlayNET has to offer in the ad on the facing page; and for details on ordering the December *Ahoy! Disk*, see page 87.

Finally, and best of all, let's crow about the contents of this issue of *Ahoy!*:

- While serious computer artists will have already purchased one of the excellent sketching programs for the 128, the recreational doodler may find his palate and pocketbook suited by *The Artist*. In addition to supporting a range of drawing features, the program is easily expanded to do even more. (Turn to page 34.)

- As if the filthy peasant rabble weren't revolting enough, they're now really revolting—and your armies must stop them in *Rebels and Lords*. (Turn to page 96.)

- We finally realized why we didn't get more letters praising *LazyBASIC* in our June '86 issue. The sloths who most appreciated this shorthand entry program were too lazy to write us! With that in mind, Michael Bennett comes back with *Lazy Source Code* in this issue. (Turn to page 88.)

- We won't say Tony Brantner's *Speedway* is exciting—but the burning rubber you smell may not be due to power of suggestion. It may come from grinding your sneaker heel against the imaginary brake on the floor! (Turn to page 78.)

- Continuing his one-man mission to add every feature to the C-64 that its designers left out, Buck Childress presents *The Editor*, providing 64 users with many of the screen editing features that the C-128 offers—and some that it doesn't. (Turn to page 56.)

- Rapidly becoming to *Ahoy!* games what Buck is to *Ahoy!* utilities, Cleveland Blakemore makes his monthly appearance with *Minotaur Maze*, placing the mythological beasts in their classic habitat. (Turn to page 52.)

- The next best thing to living in a Tom and Jerry cartoon, *Mouse in the House* enables you and a friend to play a classic game of cat and mouse. (Turn to page 55.)

- But besting rodents and felines will seem like cake compared to your mission to outbox the nine toughest members of the street gang that's taken over *Micro City*. (Turn to page 76.)

- Dale Rupert continues his series on 128 data management with an explanation of creating and using relative files. Even if you've never used them, this month's

Rupert Report will turn you into a *File Manipulator!* (Turn to page 20.)

- Mark Andrews continues delving into regions of the 128 where no writer has gone before, devoting this month's *Commodore Roots* to the "shadow registers" so useful for sprite programming, yet so mysteriously overlooked by the *C-128 Reference Guide*. (Turn to page 27.)

- In addition to a roster of the latest gridiron games for the Commodore, this month's *Entertainment Software Section* introduces a new semi-regular feature: *Under Construction*, designed to help users get the most out of the growing genre of screen editor-equipped recreations. Also included this month are reviews of *Macbeth*, *Elite*, *Ultimate Wizard*, and the *Arc of Yesod/Nodes of Yesod* dual disk. (Turn to page 41.)

- Morton Kevelson details a construction project of a more real world variety as he tells you how to *Build a Five Volt Peripheral Power Supply*. (Turn to page 92.)

- Cheryl Peterson recommends ways for beginning computerists to put St. Nick to best advantage with a *Cadet's Column* compendium of *Christmas Presents for You and Your Commodore*. (Turn to page 100.)

But you're holding the best \$2.75 stocking stuffer we know of—or so the reviews tell us. Next month's third anniversary issue will be packed fuller with surprises than Santa's sleigh. If you miss an occasional issue of *Ahoy!*, make sure that January '87 is not one of those issues!

—David Allikas



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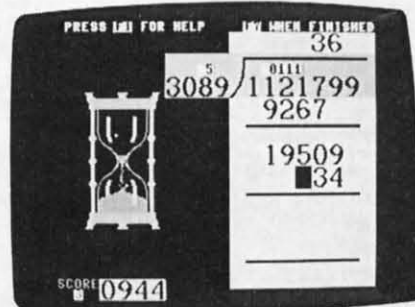
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AMIGA SPELL CHECKER

Containing a dictionary allowing recognition of over 80,000 words, the *Nancy* spelling checker for the Amiga (\$60.00) can flag misspellings passively (marking them for later review) or interactively (allowing for immediate correction). Up to four supplemental word lists and four automatic correction lists (for correcting previously misspelled words without user interaction) are possible, their size limited only by amount of available memory. The Amiga's voice is used to pronounce words not found in the dictionary or word lists.

The Computer Club (see address list, page 14).

BOOKS

New from Howard W. Sams:

The 656-page *Commodore 128 Reference Guide for Programmers* (\$19.95) covers BASIC, assembly language, 40- and 80-column text programming, graphics, and details of the operating system.

By *Ahoy!* columnist Mark Andrews and incorporating material previously covered in *Commodore Roots*, *Commodore 128 Assembly Language Programming* (\$15.95) concentrates on the 128 assembler with a focus on programming, uses for its special features, and details of its memory configuration.

Organized as a troubleshooting guide, *Computer Connection Mysteries Solved* (\$15.95) allows users to deal with a variety of system configurations. Theory and technical information is provided, but simple solutions are presented early.

The second edition of *Experiments in Artificial Intelligence for Microcomputers* (\$14.95), containing 75% more material and many new chapters, provides details on applying AI to practical activities. BASIC programs for the 64 are included.

Howard W. Sams & Co. (see address list, page 14).

A revised edition of *1001 Things to Do with Your Commodore 128* (\$12.45 paperback, \$18.95 hardbound) includes programs for sound and graphics, games, and financial, business, and educational applica-

SAMS

Commodore 128 Reference Guide for Programmers

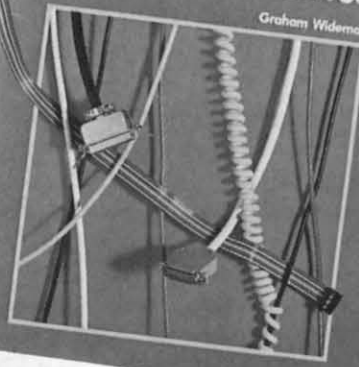
David L. Heiserman



SAMS

Computer Connection Mysteries Solved

Graham Wideman



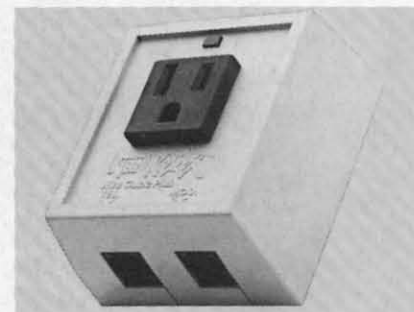
This month's manuals from Sams & Co.
READER SERVICE NO. 253

tions.

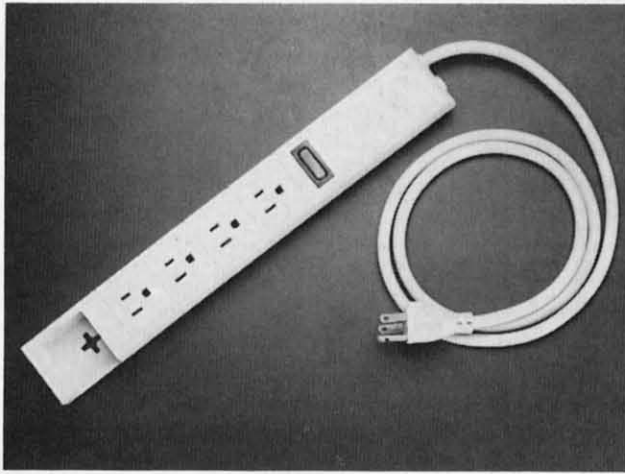
TAB Books Inc., 717-794-2191 (see address list, page 14).

SURGE PROTECTORS

MicroComputer Accessories' six-



Wire Cube Plus: modem protection.
READER SERVICE NO. 254



Designed to defend against damage and data loss caused by power surges, spikes, and noise interference, MCA's Surge Protector cuts power in under 1 nanosecond.
READER
SERVICE NO. 255

outlet Surge Protector (\$39.95) protects computer systems from damage and data loss caused by power surges, spikes, and noise interference. The unit's circuit breaker cuts power in less than 1 nanosecond; the reset button reactivates the system.

MicroComputer Accessories, Inc., 213-301-9400 (see address list, page 14).

Network's single-outlet Wire Cube Plus (\$39.95) defends against spikes and surges, and prevents disruption of modem operation by shunting harmful energy on modem lines to ground.

Network, 718-821-7555 (see address list, page 14).

CHARACTER GENERATOR

Intended for the professional video market, *Pro Video CGI* (\$199.95) works with the Amiga to create a character generation production tool supposedly comparable to dedicated systems costing thousands of dollars. The software provides various text styles, character shadow and edging, and 32K+ of text memory.

JDK Images, 612-854-7793 (see address list, page 14).

64, 128, AMIGA GAMES

Two C-64 games from Activision based on licensed characters, each \$34.95:

Those stars of toy store shelves and Saturday morning TV make it to the C-64 screen in *Transformers—Battle to Save the Earth*, requiring the player to help the Autobots thwart the Decepticons' scheme to destroy the world. Autobot characters include

Rodimus Prime, Kup, Cliffjumper, Hound, Hotrod, Pipes, and Bumblebee, each with his own particular strengths and attributes that must be matched to each battle.

Based on the Jim Henson-directed film and developed by Lucasfilm Games, *Labyrinth: The Computer Game* is an animated adventure that places you in the clutches of the evil Goblin King. He has promised you your freedom if you can escape his Labyrinth, a twisting maze of paths and passageways, within 13 hours. You'll encounter friends and foes along the way, including the Fireys, Ludo, Hoggle, and Sir Didymus, while visiting locations like the Bog of Eternal Stench, the Wise Man's Garden, and the Hall of Stone Faces.

Activision, Inc., 415-960-0410 (see address list, page 14).

The Amiga version of The Software Toolworks' *The Chessmaster 2000* (\$44.95), covered in last month's *Scuttlebutt* (page 10), will be distributed through Electronic Arts' Affiliated Labels program.

Electronic Arts, 415-571-7171 (see address list, page 14).

A text-based interactive novella, *The Adventure of the Vatican Cameos* (\$32.95) requires the player as Sherlock Holmes to navigate through over 60 locations in search of the solution to a mystery. The first player to find the correct solution will receive \$1000.

Ellicott Creek Software (see address list, page 14).

Bridge Baron (\$49.95) has been enhanced to include hints, computer scoring in rubber bridge fashion, au-

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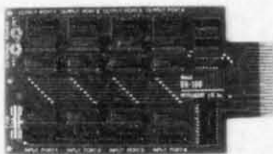
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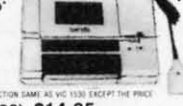
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tomatic play, strong or weak two-bids, and switching sides to replay deals.

Great Game Products, 301-365-3297 (see address list, page 14).

Bear Graphics Software has released three games that can be played via modem without additional software: *Trapdoor Checkers* (each player gets two trapdoors that can be sprung anytime), *Radical Chess* (if a player lands on the computer-selected radical square, it is exchanged for a piece from the discard), and *Seabattle* (similar to *Battleship*). Players can type messages to each other on a scrolling text bar during a game. For the 64; \$24.95 each.

Bear Graphics Software (see address list, page 14).

Also playable on two computers at separate locations via modem, *Battle Command* (\$20.00) offers a different playing field for each game and a variety of game options definable by the player.

Applied Computer Consultants, 612-827-2425 (see address list, page 14).

SubLOGIC's long and eagerly awaited *Flight Simulator II* (\$49.95) for the Amiga features 120 airports in New York, Chicago, Seattle, Los Angeles, and San Francisco. Players can fly in day, dusk, or night, and control such environmental factors as cloud layers, fog, winds, and turbulence. Also included are full instrumentation, with VOR, ILS, ADF, and DME avionics, multiple 3-D window

views with aspect ratio and zoom control, and multiple viewpoints including cockpit, tower, map, and spot-plane. Two or more players using separate machines can fly together via modem port connectors.

SubLOGIC, 217-359-8482; orders 800-637-4983 (see address list, page 14).

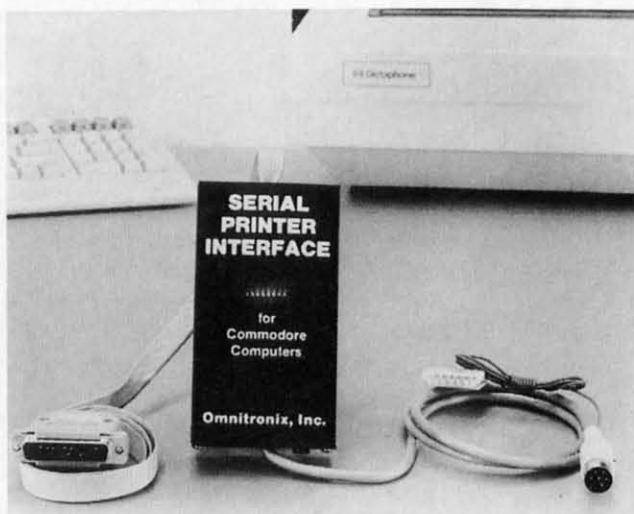
ASTROLOGY PROGRAM

Basing its calculations on true astrological principles, Dynacomp's *Mr. Astrologer* (\$29.95) enables C-64 users to prepare natal horoscopes, and answer questions about and chart previews for any future date up to the year 1990. The program will profile the positive and negative characteristics of any person born between 1920 and 1990.

A free software catalog is available on request from Dynacomp, 716-671-6160 (see address list, page 14).

SERIAL INTERFACE

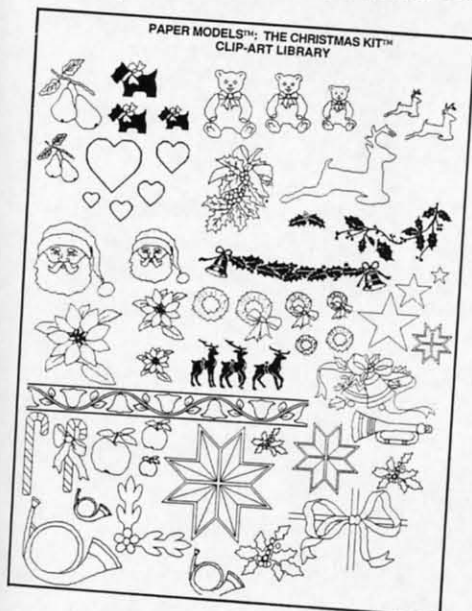
Omnitronix's new Serial Printer Interface (\$79.95) circumvents software incompatibility problems by connecting to the Commodore serial bus, not to the user I/O port like most serial interfaces. DIP switches permit selection of baud rates in eight increments from 75 to 19200, word, parity, and Xon/Xoff handshaking. All standard Commodore printers commands and secondary address printing modes are supported. Power is provided through the cassette port or an optional power supply.



Commodore users can fully interface and adapt serial RS232 printers with the Serial Printer Interface from Omnitronix, supplying full voltage levels on standard RS232 pins. READER SERVICE NO. 256

Omnitronix, Inc., 206-236-2983
(see address list, page 14).

XMAS ORNAMENT MAKER *Paper Models: The Christmas Kit*



Paper Models: home decorating kit.
READER SERVICE NO. 257

(\$24.95) permits C-64 users to create Christmas ornaments and decorations. Patterns can be selected and printed out from a collection of holiday items such as gift boxes, toy trains, sleighs, and complete Dickens-style villages. Included is a glue-stick and ruler, marking pens, and 10 sheets of card stock.

Activision, Inc., 415-960-0410 (see address list, page 14).

BIBLE ON DISK

Intended as a serious Bible study tool for C-64 users, *Landmark 1.0* (\$179.95) contains the entire King James version on 20 double-sided disks. Users can view any part of the Bible (each chapter of each book is in an individual file), access references for any verse or chapter, outline text in colors, keep permanent notes, search a chapter, book, or entire Testament for up to 12 phrases at a time, and copy scripture from any part of the Bible. The main program, written entirely in machine language, completely fills the 64's memory. Accessories, including a concordance, are planned.

Bible Bytes (see address list, page 14).

3-D GRAPHICS FOR 64

Perspectives II (\$59.95) permits the C-64 user to create and manipulate 3-D images onscreen. Objects can be viewed from any horizontal or vertical position. By manipulating objects and capturing the individual screens in frames, an animated film-strip can be created. The program can be driven by joystick, mouse, graphics pad, or light pen. 2-D images can be exchanged with popular graphics programs.

KIRA Corporation, 215-683-5699
(see address list, page 14).

PHOTO-SCANNING SYSTEM

The Scammadore photo-scanning system (\$54.95) consists of a scanning head that is attached to any typewriter and connected to the 64 or 128 user port. With the picture to be scanned inserted in the typewriter, the user hits the typewriter space bar on program cue, and the picture is scanned line by line. The resulting printout lacks the realism of output from more expensive systems, but experimentation with the included customizing programs can yield some interesting results. The scanhead alone is priced at \$39.95; software \$14.95; demo disk \$5.00.

Kaltek Labs, 809-829-4220 (see address list, page 14).

TERM PAPER WRITER

The latest release in Activision's Personal Choice line, *Term Paper Writer* (\$59.95) for the C-128 consists of four modules that help the student organize his notes and format and write his paper. The Notetaker, an electronic card file, facilitates the collection of information by source and topic. The Outliner permits the organization of ideas into topical groups. The Writer is a full-featured word processor. The Footnoter and Bibliography Compiler inserts footnotes on appropriate pages and compiled information for the bibliography directly from The Notetaker. But you may have to pay off the genius down the hall for one last semester; release is

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\$104.90 regular price. No manual.
Add \$15 plus \$3 shipping for manual

not scheduled until late fall.

Activision, Inc., 415-960-0410 (see address list, this page).

FREE PLAYNET TIME

The PlayNET bulletin board service's revised rate structure includes four free online hours with payment of the \$12 monthly account maintenance fee. The former monthly charge was \$8, with no free time. The hourly rate remains \$2.75.

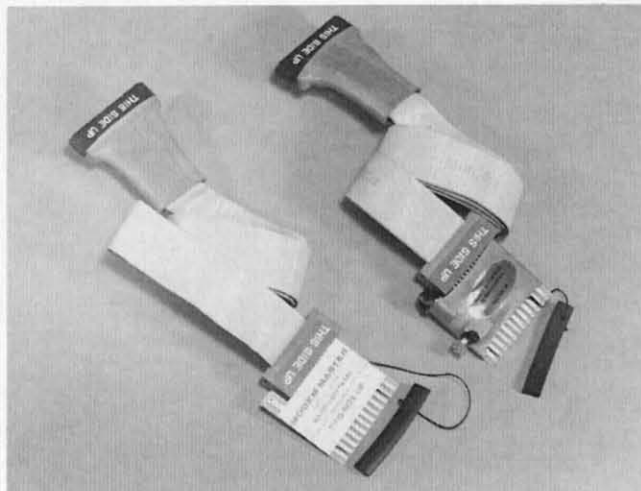
For more information on PlayNET, and how you can obtain a \$19.95 membership kit free, see page 6.

PlayNET, 1-800-PLAYNET (see address list, this page).

CABLE NEWS

Four hardware connection items from Master Software:

The *Modem Master* (\$29.95) 4' extender cable lets the 64, 128, VIC 20, or Plus/4 user place user port devices in locations other than the rear of the computer, along with permitting the use of devices which otherwise



The Modem Master four-foot extender for the user port lets Commodore owners place user port devices in places other than the rear of the computer.
READER SERVICE NO. 258

wouldn't fit due to interference of plastic housings. *Modem Master Plus* (\$34.95) adds a system reset switch, buffered to prevent electrical damage

and including programs to recover the BASIC program in memory at time of lockup.

Continued on page 146

Companies Mentioned in Scuttlebutt

Activision, Inc.
2350 Bayshore Parkway
Mountain View, CA 94043
Phone: 415-960-0410

Aegis Development, Inc.
2210 Wilshire Blvd. #277
Santa Monica, CA 90403
Phone: 213-306-0735

Applied Computer Consultants
Pentagon Towers
P.O. Box 36186
Edina, MN 55435
Phone: 612-827-2425

Bear Graphics Software
P.O. Box 12206
New Brighton, MN 55112

Bible Bytes
P.O. Box 1584
Ballwin, MO 63022

CBS Interactive Learning
CBS Inc.
One Fawcett Place
Greenwich, CT 06836
Phone: 203-622-2500

Dynacomp, Inc.
1064 Gravel Road
Webster, NY 14580
Phone: 716-671-6160

Electronic Arts
1820 Gateway Drive
San Mateo, CA 94404
Phone: 415-571-7171

Ellicott Creek Software
30 Chestnut Ridge Lane
Tonawanda, NY 14150

Gamco Industries, Inc.
Box 1911
Big Spring, TX 79720
Phone: 800-351-1404; in TX 915-267-6327

Great Game Products
8804 Chalon Drive
Bethesda, MD 20817
Phone: 301-365-3297

Howard W. Sams & Co.
4300 W. 62nd Street
Indianapolis, IN 46268
Phone: 317-298-5409

Intelligent I/O
P.O. Box 70
Potsdam, NY 13676
Phone: 315-265-6350

JDK Images
2224 East 86 Street, Suite 14
Bloomington, MN 55420
Phone: 612-854-7793

Kaltek Labs
Adjuntas, PR 00601-0971
Phone: 809-829-4220

KIRA Corporation
P.O. Box 3183
Falls Church, VA 22043
Phone: 215-683-5699

KnowledgeWare
2013 N.E. 55th Blvd.
Gainesville, FL 32601
Phone: 904-371-6523

Master Software
6 Hillery Court
Randallstown, MD 21133
Phone: 301-922-2962

MicroComputer Accessories
5405 Jandy Place
P.O. Box 66911
Los Angeles, CA 90066-0911
Phone: 213-301-9400

Networx
203 Harrison Place
Brooklyn, NY 11237
Phone: 718-821-7555

Omnitronix, Inc.
P.O. Box 43
6014 East Mercer Way
Mercer Island, WA 98040
Phone: 206-236-2983

PlayNET
200 Jordan Road
Troy, NY 12180
Phone: 1-800-PLAYNET

Readup Inc.
P.O. Box 95
Port Edwards, WI 54469
Phone: 715-887-2333

Roberts Information Systems
P.O. Box 666
152 W. 4th
Prineville, OR 97754
Phone: 503-447-6275

SubLOGIC Corporation
713 Edgebrook Drive
Champaign, IL 61820
Phone: 217-359-8482; orders 800-637-4983 except IL, AK, HI

Tensoft
P.O. Box 86971
San Diego, CA 92138
Phone: 800-828-1829

The Computer Club
4843A South 28th Street
Arlington, VA 22206
Phone: 703-998-7588

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Blue Ridge Summit, PA 17214
Phone: 717-794-2191

Thoughtform
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Hemet, CA 92344

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P.O. Box 1378
Coeur d'Alene, ID 83814
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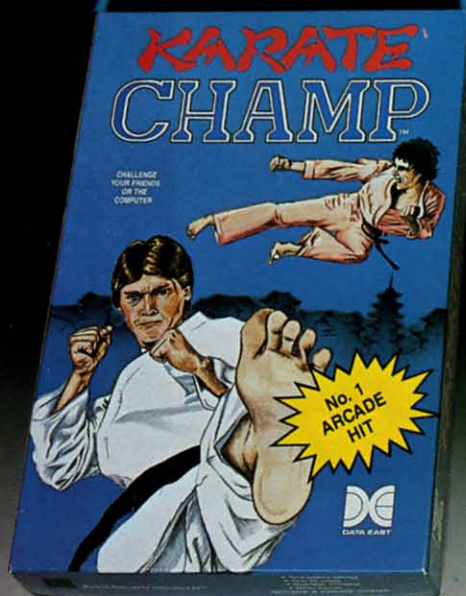
(Commodore is a registered trademark of Commodore Business Systems)
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NUMBER ONE ARCADE HITS...

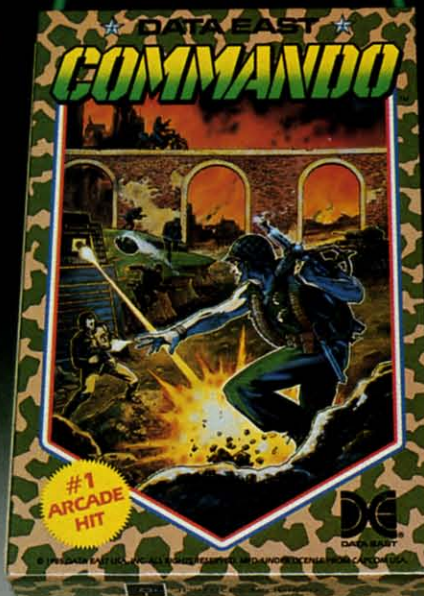


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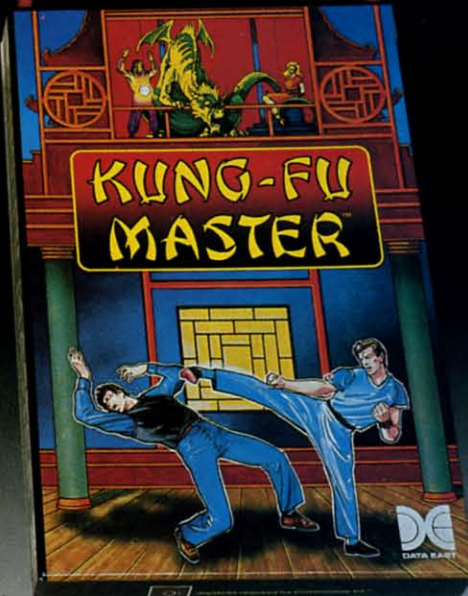
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DATA EAST

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SCIENTISTS A DISCOVER NEW

When we started our company on the west coast, people thought we were a little spaced out. So you can imagine their reactions when we announced we'd discovered a new universe.

People laughed. People scoffed. And they really freaked out when we told them where we'd found it:

Inside a Commodore 64.

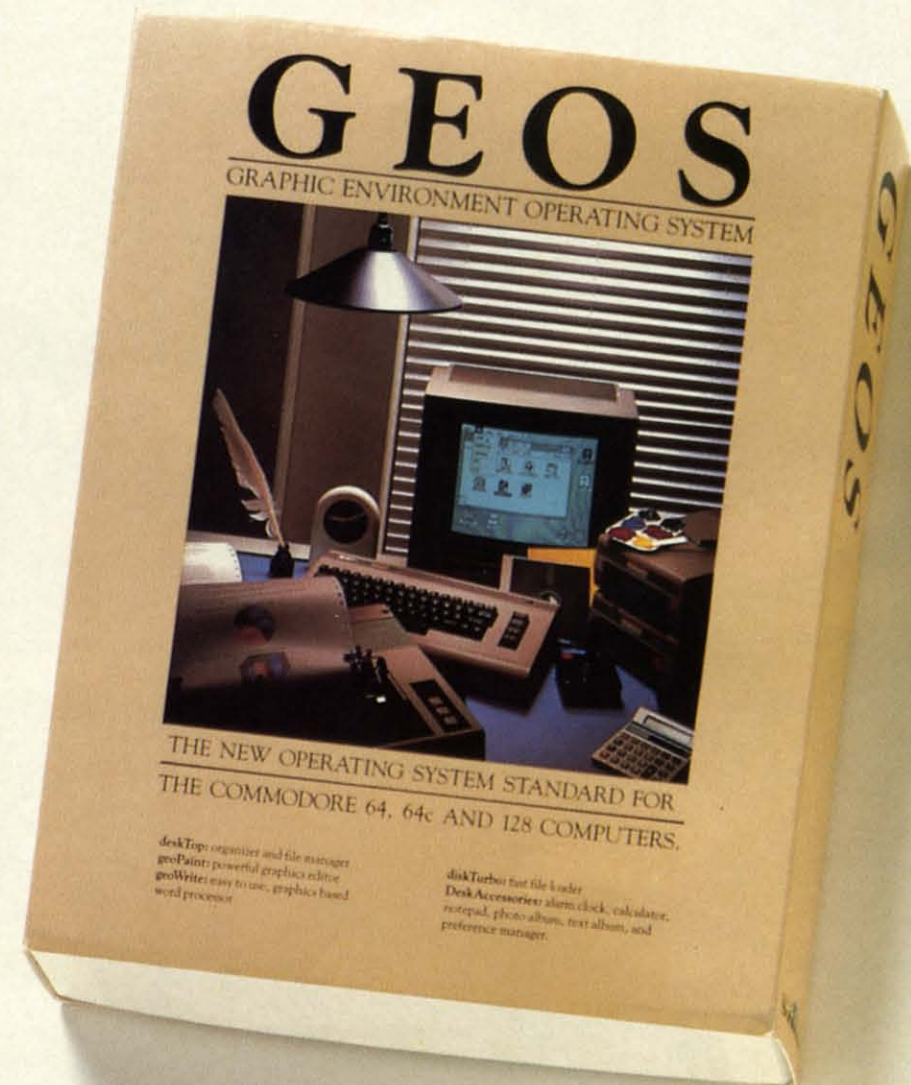
It's called GEOS. And it turns any Commodore into a powerful PC that holds its own against any computer, no matter what kind of fruit it was named after.

GEOS: The superior intelligence. Of course, we always knew Commodores possessed superior brains. It just took GEOS to discover them.

You see, GEOS opens your Commodore to a huge universe that can hold an infinite number of applications. Which means that GEOS can do just about anything the expensive PC's can do, including one thing they can't:

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Increase your speed to warp factor 7. The first thing you notice with GEOS is how its diskTurbo speeds up your Commodore's disk loading and storing time.



Not twice or three times as fast. But five to seven times faster than normal. Which lets you streak through files and documents at what seems like warp speed.

And that saves you endless time.

Every universe comes complete with a desk. The way to keep order in our universe is with the GEOS Desktop. It's just like your desk at home, only without the coffee stains.

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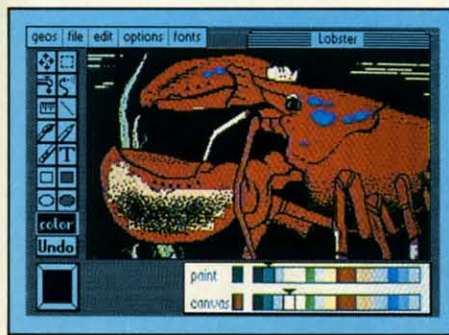
AT BERKELEY NEW UNIVERSE.

with all the accessories you need to keep you organized:

An alarm clock keeps you punctual. A notepad keeps your memos. And a calculator keeps your accountant honest.

How to communicate with a new universe. With geoWrite, you can rearrange your written words. Move blocks of copy. Cut and paste. And even display your text in fonts of different styles and sizes, right on the screen.

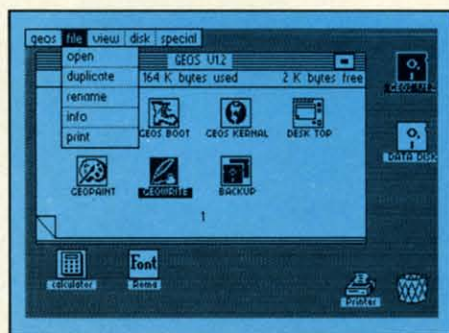
With geoPaint, you become a Michelangelo with a mouse.



Sketching and painting with all kinds of colors, textures and patterns.

You can invert, mirror and rotate images. Insert them into your geoWrite documents. And save them in your GEOS Photo Album for use later.

Finding your way through the universe. The most difficult



thing about a new universe is finding your way around. But with GEOS, you only need to remember two things:

Point and click.

When GEOS offers you options, you just point to your answers and click your mouse or joystick.

You want to draw? Point and click.

You want to write? Point and click.

You want to fill in that obtuse rhomboid with an air-brushed geometric pattern in a lighter shade of pink? Point and click.

Easy, huh? And in case you ever do make a mistake, GEOS backs you up with an "Undo" feature that undoes the very last command you entered.

 **Berkeley
Softworks**

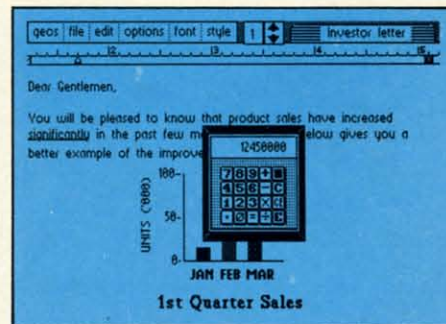
The brightest minds are working at Berkeley.

Running out of space.

With GEOS, that's hardly likely. Because there's endless space in the universe for new applications.

Unfortunately, there's only so much space in this ad.

So zip down to your nearest software dealer. Tell him you want to explore the new universe in your Commodore.



And if he looks at you like you're some kind of alien, well, just tell him Berkeley Softworks sent you.

The name is universally known.

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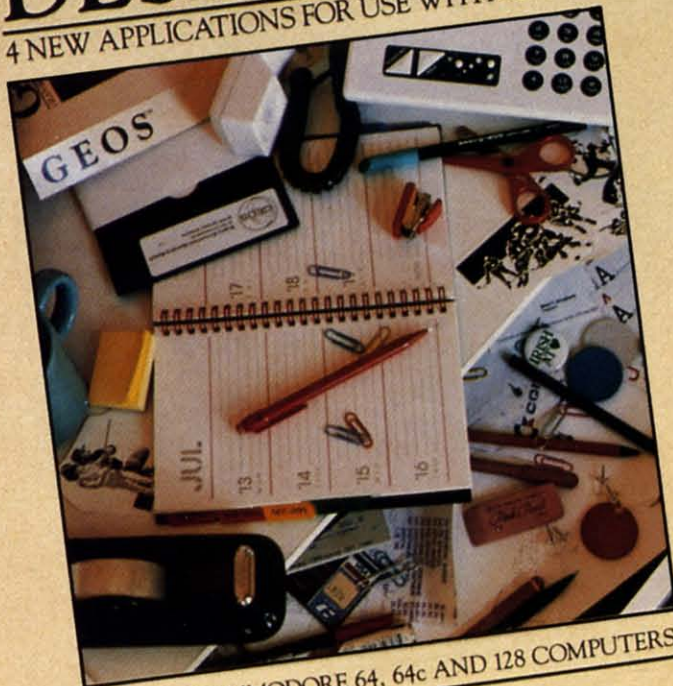
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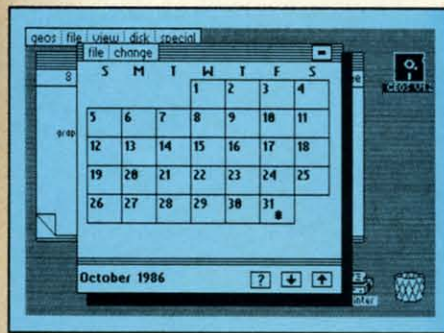
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File Manipulator

Virtues of Using Relative Files

By Dale Rupert

What? You have never used relative files? Rumor is that it takes some sort of programming genius to be able to use them. Perhaps a high IQ is a prerequisite for learning about relative files from the original *VIC-1541 Disk User's Manual*, but as we shall see, creating and manipulating relative files in BASIC 7.0 is quite straightforward, if not downright child's play.

So what are these relative files with their strange accompaniment of "side sectors," "pointers," and "records"? A relative file is a type of disk file which allows easy, random-order access to each of the elements in the file. The elements in the file are called "records." To identify which record you wish to access, you simply set a pointer to that record. The computer automatically finds the location of the selected record on the disk and allows you to read it or write to it. We won't worry about "side sectors" because it is not necessary to know anything about them in order to use relative files.

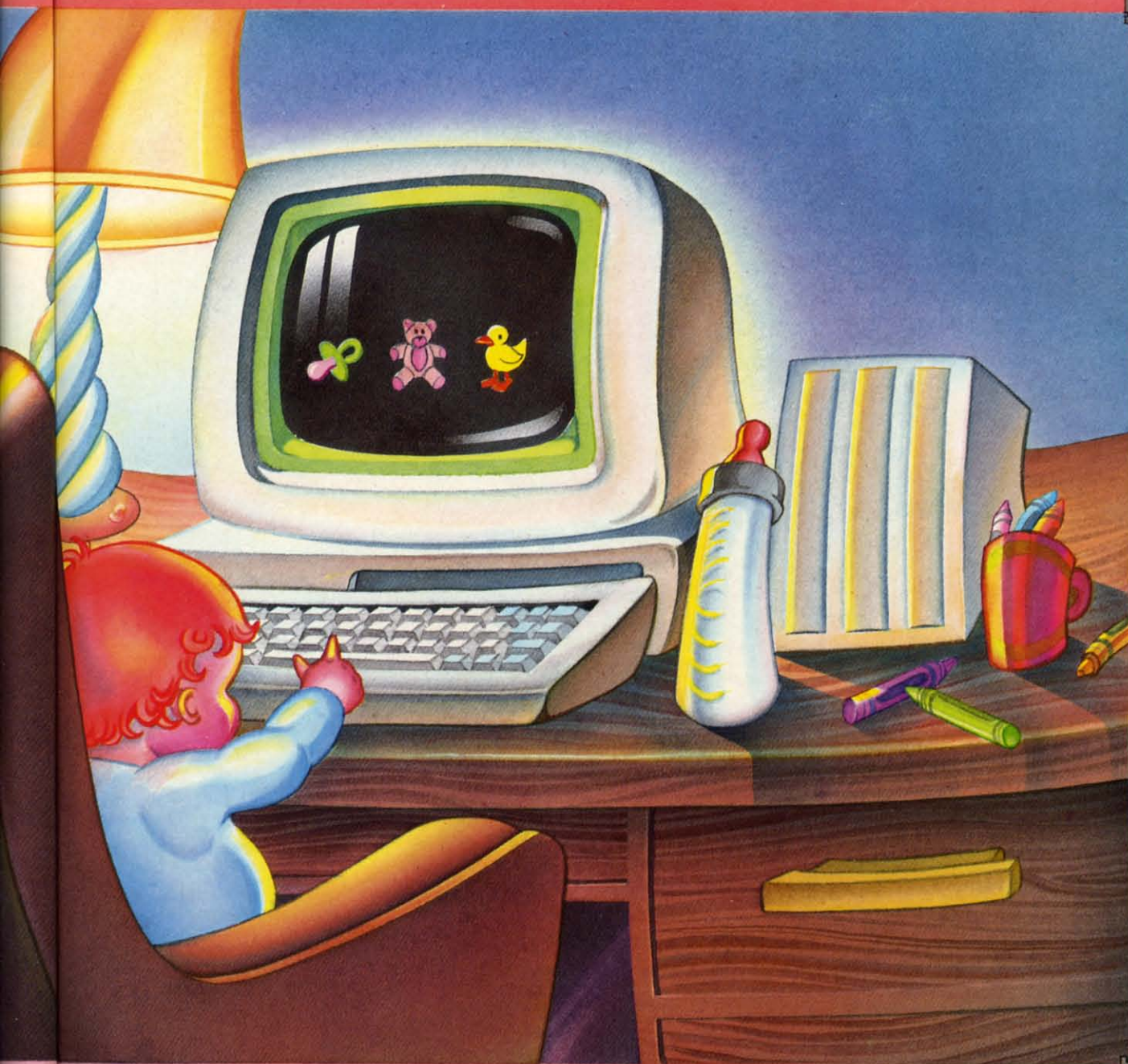
There is one more concept we must discuss. Each record in the file may be further subdivided into portions called "fields." Locating a specific field within a given record in a named file on a disk is really not a difficult programming task, especially with the model programs

we will create this month.

Our discussion and programs this month are for BASIC 7.0 on the C-128. The concepts are identical, however, for BASIC 2.0 on the C-64 and for other versions of BASIC. After studying the examples in this article, you should be able to translate the BASIC 7.0 command sequences into your own computer's language.

RELATIVE DIFFERENCES

Both relative files and sequential files provide structures in which data may be stored and accessed. Relative files are called random access files in other computer



JOSIE YEE

language dialects. The term "relative" obscures their primary distinguishing characteristic: that each record is individually and independently accessible. "Random access" is a more descriptive term than "relative" for these files, although we are not dealing with true random files as defined by Commodore. (See the March 1984 issue of *Ahoy!* for a discussion of random files.)

Sequential files also consist of records. Before reading the 30th record in a sequential file, the computer program must first read through the preceding 29 records in the file. This is the main disadvantage of sequential files. If records must be accessed in random order,

typically the program first reads them from the disk into arrays in memory. Once in memory, each record is located by an index of the array.

Each record in a relative file also has an index associated with it. The index is stored right on the disk with the file as it is created. (The storage areas for these indexes are the side sectors mentioned earlier. The computer takes care of all this for us.)

If each relative file carries along its own indexes, and if each record is easily accessed in random order, then why are sequential files even used? The disadvantage of relative files is that they generally require more disk

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space. Two reasons for the storage inefficiency are that the indexes are stored along with the data, and that the fixed-length record structure usually produces wasted space. That brings us to the topic of record length.

The lengths of the records within a sequential file may vary. The records are separated from one another by a termination character called a delimiter. For example, if the three records in a file contain the names Mercury, Venus, Mars, the sequential file might look like this:

Sequential File

```
MERCURY^VENUS^MARS^
Record # 1-----2-----3-----
```

The first record is 8 characters long including the delimiter, signified here by the caret. The second and third records are 6 and 5 characters long, respectively.

Contrast this sequential file with a comparable relative file. All records in the relative file must be the same length. There are two ways to accomplish this with the data in the example above. Either the longer data values must be truncated or cut off to the length of the shortest record, or the shorter records must be "padded" or filled with blanks to be as long as the longest record. Padding is usually more desirable than losing data.

Before we create a relative file then, we must determine what the longest possible record will be and use that as the record length. Now the storage inefficiency should be clear. If we choose a record length of 8, our relative file looks like this:

Relative File

```
MERCURY^VENUS00^MARS000^
Record # 1-----2-----3-----
```

The 0's represent null characters used as padding by the computer. The carets again represent a terminating character or delimiter, such as a carriage return CHR\$(13).

Perhaps it is more obvious now how the computer can randomly locate these relative file records. Since the record length is fixed at 8, record number 2 always starts with the 9th character in the file. Record number 3 begins with the 17th character. The 101st record begins with the 801st character. In general, the Nth record will be found starting with character number $RL * (N - 1) + 1$ in a file where the record length is fixed at the value of RL.

Where would the 101st record of a sequential file be found? Without knowing the lengths of each record, it would not be possible to predict where the 101st record begins. The computer finds the 101st record only by reading and counting the first 100 records.

WRITING RELATIVE RECORDS

It is not difficult to create the relative file described above. This program does it:

```
10 DOPEN#1,"EXAMPLE",L8
```

```
20 FOR N=1 TO 3
30 READ R$
40 RECORD#1,N,1
50 PRINT#1,R$
60 NEXT N
70 PRINT DS$ : DCLOSE
80 DATA MERCURY, VENUS, MARS
```

Line 10 opens a channel with a logical file number 1. The filename is "EXAMPLE" and the record length (L) is given as 8. Line 30 reads the data from line 80. Line 40 tells the computer which record is to be written. The #1 is the logical file number specified in line 10. The value of N goes from 1 to 3 as the three records are written. The 1 at the end of line 40 is optional. It tells the computer to point to the first byte of the Nth record. We will always use a value of 1 here.

Line 50 writes the data to the selected record. Once all three records have been written, line 70 closes the file. Actually the three records are first written to a buffer in memory. The DCLOSE statement causes the buffer to be physically written to the disk.

If a program error prevents the DCLOSE from being executed, the data remaining in the buffer could be lost. (Always type DCLOSE in direct mode if the "active" light on the disk drive is still on when the program stops. If the light is flashing, type PRINT DS\$: DCLOSE to clear the fault and close the file.)

Notice another difference from the way sequential files are opened. Once a relative file is open, it may be written to or read from. The DOPEN statement does not specify which type of operation will be performed on the file. The relative file is available for random-access reading, or writing, or both.

READING A RELATIVE FILE

After you have entered and run the program above, there is a new file on the disk called "EXAMPLE." To read the data in this file, add the following lines and type RUN 100:

```
100 DOPEN#1,"EXAMPLE"
110 FOR N=1 TO 3
120 RECORD#1,N,1
130 INPUT#1,RD$
140 PRINT RD$
150 NEXT N
160 PRINT DS$ : DCLOSE
```

Notice that once the file has been created, there is no need to specify the record length in the next DOPEN statement. The ",L" is needed only when the file is first written. We use the INPUT# statement to read each record just as with sequential files. This statement reads characters up to the first carriage return in the record.

This is about all there is to writing and reading relative file records. The sequence is simply:

1. Open the file (DOPEN)
2. Point to the desired record(s) (RECORD)
3. Read or write the record(s) (INPUT#, PRINT#)
4. Close the file (DCLOSE)

ERROR HANDLING

There are various conditions that cause errors when using relative files. The BASIC 7.0 variable DS\$ contains the error codes and descriptions for disk errors. If the disk drive light is flashing and the program has ended, you should type PRINT DS\$ in direct mode to display the error and to turn off the light. You may also have to type DCLOSE if the light stops flashing but remains lit.

In general when a program writes to a relative file for the first time, an error 50 "Record Not Present" occurs. This error occurs when the pointer is set with the RECORD statement to a record which has not yet been written. (In our sample program above, this error did not occur since the total length of the three records was less than 256 characters.)

The best way to handle the error 50 problem is to write the highest numbered record when the file is first opened and then read DS\$ to clear the error. Assume we knew that we would never have more than 40 records in the file. We could open it and write to the 40th record this way:

```
1 DOPEN,"TEST",L10
2 RECORD#1,40,1
3 PRINT#1,"DUMMY"
4 PRINT DS$
5 DCLOSE
```

Now the space on the disk has been allocated for 40 records, the 40th record has dummy data in it, and the error 50 has been cleared by line 4. If we later need to put more than 40 records in this file, we may simply open the file again, put the RECORD pointer to the new maximum number, and write the additional records. We must read DS\$ each time a record is accessed which has a higher record number than any previously accessed. That is an advantage of writing the highest numbered record first.

Another suggestion. Put your RECORD# statement immediately before the corresponding PRINT# or INPUT# statement. A bug in BASIC gives improper values of DS\$ if a GETKEY statement is between the RECORD# and PRINT# statements, for example.

Whenever a program opens a file, it should read DS\$ and act accordingly. VAL(DS\$) gives the error number of the most recent disk input or output. A value of 0 means that the file access was without error.

An error will occur if we try to write data which contains more characters than the record length specified for the file. For that reason, the program should carefully check the length of each string of data before it is written to the file. We will see how to do that in the

relative file model to be discussed.

INTO THE FIELDS

Relative files are more flexible if their records are subdivided into smaller segments called fields. Suppose we want to store the names of the planets and their numbers of moons in a relative file. Each record should contain two fields: a name field and a number field. The records for Earth and Mars would look like this:

Field 1 ---v	v---Field 2
Record #1: EARTH	1
Record #2: MARS	2

We could create variable length fields or fixed length fields. For example, Field 1 (the name field) of Record #1 must be at least five characters wide, whereas Field 1 of Record #2 would need to be only four characters wide. The sample program on page 123 uses fixed length fields. We will simply pad the data in each field with spaces as necessary.

For example, let Field 1 have a length of 14. That is longer than the longest name we have to store. Let Field 2 have a length of 10. That is certainly wider than necessary. Ten characters will allow us to store most floating point numbers easily.

Once we have defined the field lengths, we can calculate the record length. The lengths of the fields add up to 24. We must add one for the delimiter at the end of each record. That gives a record length of 25.

Field 1 starts at character 1 and is 14 characters wide. Therefore Field 2 starts at character 15 and is 10 characters wide. The delimiter fills the 25th character position in each record. The record for Mars and its number of moons looks like this:

```
Character #      1111111111222222
                1234567890123456789012345
                MARS-----2-----^
```

The number, structure, and control of the fields is up to us. The RECORD statement does allow us to move the pointer to a specific character within a record so that only a part of a record may be read or written. But we will not use that method of selecting fields. Instead, we will always read the entire record into a string variable. We will read or write the desired substrings, then we will write the modified record string in its entirety back to disk.

READY TO MANIPULATE

Now that we have covered the background of relative file handling, we are ready to put our knowledge into practice. Refer to the program *Planetary Moons Database* on page 123. This program creates a relative file called PLANETS. The file has a record length of 25 as defined in line 50. SP\$ is a string of 24 spaces to

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be used for padding. Line 70 reads a planet's name and its number of moons into P\$ and M\$ respectively. WR\$ is initialized to be a string of 24 spaces in line 80. P\$ is placed into WR\$ beginning at character position 1 in line 90. M\$ is placed into WR\$ beginning at character position 15 in line 100. WR\$ still has a length of 24 characters, but some of its space characters have been replaced by data characters within the two fields.

NR keeps track of the current record number. Line 110 points to the next record, and line 120 puts the data into that record on the disk. This is repeated for the other eight pairs of data. Line 130 displays the disk error status and the data just written. If more than ten 25-character records were written, an error 50 "Record Not Present" would occur, but as we discussed above, this is not really a problem.

The main program *File Manipulator* on page 123 is meant to be used as a model for creating your own relative file programs. The program can be easily modified and expanded to handle records of any size containing fields of any size and number. It is written to access the PLANETS file created earlier. Line 50 arbitrarily sets the maximum number of records to 60. The lengths of the fields are given in line 70. Pointers to the starting character position for each field are defined in line 90.

Lines 130 through 170 open the file with the filename

given to F\$ in line 40. The 60th record is written if it does not already exist. This initialization simply guarantees that the specified file exists.

The main loop asks whether the file is to be read or written, or if the user wants to exit the program. The two major parts of the program are the Read routine and the Write routine. Each routine opens and closes the file, although that could have been done once in the main loop instead, as discussed earlier.

The Read routine in lines 250 through 380 asks for the number of the record to be read. The subroutine in lines 320 through 380 reads and displays the selected record and shows it subdivided into its fields. The string function

MID\$(RD\$,PT(F),FLD(F))

picks out the Fth field of the chosen record. Recall that the field starts at position PT(F) and it has a length of FLD(F).

The Write routine is in lines 390 through 600. It asks the user for the desired record to be written or modified. Line 450 calls the read and display subroutine so the user can see how the record currently appears. The user specifies which field is to be rewritten in line 460. Enter 0 to leave the record unchanged. A template is shown so the user can see how wide the selected field is. The new data for the field is stored in U\$ in line 500.

In case the user enters fewer characters than the width of the field, line 510 pads the entry with spaces. Line 520 truncates the result to the proper field width. In line 540 WR\$ is given the current record data as read by line 340. WR\$ is padded with spaces in line 550. The new field data in U\$ is put into WR\$ in line 560, and line 570 truncates WR\$ to the proper record width. Line 580 sets the pointer, and line 590 writes the new data to the file.

The number of moons for each planet is correct at the time of this writing (August 1986). If more moons are discovered, as they probably will be (Uranus is a likely candidate), you now have the tools to get into the database and update it. In future columns we will see more advanced ways to access and sort the data in relative files. In the meantime, you should see if you can expand this program to handle three or more fields in each record.

A little time with this program should convince you that relative files are not as difficult as they are said to be. Relative files will become a very useful and powerful part of your programming repertoire. □

SEE PROGRAM LISTINGS ON PAGE 123

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COMMODORE ROOTS

THE SHADOW KNOWS: PART II

Exposed! What Commodore Never Told You About Programming Sprites in C-128 Assembly Language

By Mark Andrews

It's difficult to find a real piece of news for a column about assembly language programming. But last month's edition of *Commodore Roots* was a real scoop in the small world of assembly language journalism. It revealed that Commodore had omitted some important information about sprite programming from its official 744-page *C-128 Programmer's Reference Guide*, published by Bantam earlier this year.

In this column, I'll provide all of the vital material on sprite programming that you won't find in your *C-128 Reference Guide*—or in any other publication that I have discovered to date. Then we'll use the missing information in a type-and-run assembly language program that will create and animate a sprite on the Commodore 128 screen.

As noted last month, the data that was left out of the *C-128 Reference Guide* is so important that it is impossible to write an assembly language sprite program without it. If you follow the sprite-programming instructions presented in the reference guide—commissioned by Commodore and published by Bantam—your program won't work. Here's why:

On page 285 of the manual, there is a table of sprite position registers—registers in which values must be placed to position sprites on the screen. Two pages later, there is a segment of assembly language code showing exactly how a value can be placed in one of these registers in a program.

In a sprite program written for the Commodore 64, this example would work just fine. In the C-128, however, the sprite position registers listed on Page 287 are not directly accessible from user-written programs. That's because the C-128's sprite position registers must be accessed via a second set of registers, called *shadow registers*, that are situated in a completely different segment of memory.

Here is how these secret registers work: 60 times each second, during a period known as a vertical blank interrupt cycle, the contents of the C-128's sprite position registers are erased and replaced by the contents of a corresponding block of shadow registers. This operation takes place so often—and so rapidly—that you could sit and stuff values into the C-128's sprite position registers all day long, and you would never get a sprite to show up on the C-128's screen.

In preparing this two-part column, I spent days trying

to write an assembly language sprite program for the C-128 in accordance with the instructions provided in Commodore's *C-128 Programmer's Reference Guide*. Eventually, from some vague hints presented in passing in other books, I discovered what was missing from the instructions given in the manual. Next, with the help of some reverse engineering and more than a little luck, I figured out everything I needed to know to write a sprite program for the C-128. Then, finally, I managed to write an assembly language program that would create and animate a sprite on the C-128 screen. This program, titled *SPRITE2*, appears on page 120.

WHAT SPRITES ARE

Before we see how the program works, it might help to present some fundamental facts about Commodore sprites. (Much of what follows will bear a striking similarity to the explanation of C-64 sprite programming in the April '86 *Ahoy!*—only the values have been changed.)

As you recall from last month, sprites are graphics characters that can be created, colored, and animated quite easily, and can be moved around completely independently of anything else on a computer screen. Using ordinary programming techniques, up to eight sprites can be displayed on a screen simultaneously. These eight sprites are usually numbered 0 through 7.

Sprites are made of tiny dots, just like programmable text characters are; and, like programmable characters, they can be created using standard bit-mapping techniques. But sprites can be several times larger than text characters; up to 24 horizontal screen dots wide and up to 21 vertical screen dots high.

A sprite can be displayed in any of the 16 colors available to the C-128's VIC-II video chip. And sprites can be expanded to twice their normal width and twice their normal height, or four times their standard size. The sprite used in the program that goes with this column will be an expanded one.

BIT-MAPPING A SPRITE

Since a sprite can measure up to 24 screen dots (or bits) wide, and up to 21 screen dots (or bytes) high, a sprite can occupy a total of 504 screen dots. A sprite bit map is illustrated in Figure 1 on the following page.

A sprite can also be pictured as a byte map—a matrix that measures three bytes wide by 21 bytes high, for a

total of 63 bytes. Actually, the bytes that make up a sprite are stored in consecutive order in RAM, starting with the byte in the upper left hand corner of the sprite's bit map and ending with the 63rd byte, the one in the lower right hand corner. But when a sprite appears on the screen, it looks more like the byte map shown in Figure 2.

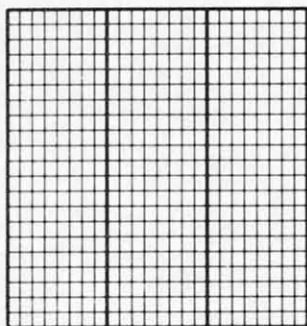


Figure 1: Sprite Bit Map



Figure 2: Sprite Byte Map

HOW SPRITES ARE PROGRAMMED

Although it takes only 63 bytes to form a sprite, each sprite consumes 64 bytes in RAM. The 64th byte of each sprite map marks the end of its location in memory.

Sprites can be placed anywhere in free RAM, and a special pointer is provided to mark the location for each sprite. Each sprite pointer is one byte long, so it takes eight bytes of RAM to hold the eight pointers needed to address the C-128's eight sprites. These eight pointers are always the last eight bytes of whatever block of RAM has been designated as screen memory. When the location of screen memory is moved, the addresses of the C-128's eight sprite pointers also change. But it's easy to find them, since they always take up the last eight bytes of whatever block of RAM is being used as screen memory.

A one-byte value is all that's ever needed to define the starting address of a sprite map, since sprites always fall into whatever 16K bank of memory is currently accessible to the VIC-II chip. That means that a sprite pointer is actually an offset that must be added to the starting address of the video bank currently in use to determine the starting address of the bit map that is to be used to form the sprite.

When the Commodore 128 is first turned on, its VIC-II chip is set to retrieve graphics information from Video Bank 0, in RAM Block 0, and to get its screen map from memory registers \$0400 through \$07FF (1024 through 2047 in decimal notation). At power-up time, therefore, the default address of the first sprite pointer, or Sprite Pointer 0, is \$07F8 (or 2040 in decimal notation). And the next seven bytes in RAM are the pointers for Sprites 1 through 7. So the default addresses of the pointers for the C-64's eight sprite pointers are memory addresses \$07F8 through \$07FF—the last eight bytes in the block of RAM designated as screen memory.

To find the data that it needs to display a sprite, then, all the Commodore 128 has to do is look at the 8-bit value stored in the appropriate sprite pointer. When that value is added to the address of the graphics bank currently in use, the result will be the address of the bit map

that must be used to define the sprite.

TURNING SPRITES ON AND OFF

Before a sprite can be displayed, it must be turned on. Sprites are turned on and off with a sprite enable register (abbreviated SPENA) situated at memory address \$D015 in Memory Bank 15. Each bit of the SPENA register is associated with one sprite; Bit 0 is used to turn sprite 0 on and off, Bit 1 is used to control sprite 1, and so on. If the bit associated with a sprite is set, the sprite is enabled. If the bit is not set, the sprite is not enabled and cannot be used.

POSITIONING SPRITES

Each of the C-128's eight sprites has two position registers: an X position register used to determine its horizontal placement on the screen, and a Y position register used to determine its vertical position. These registers are abbreviated SP0X through SP7X and SP0Y through SP7Y. In addition, there is a special "most significant X position register" (abbreviated MSIGX) that is used to designate the horizontal positions of all eight sprites. This register is needed because a sprite can be placed in 512 possible horizontal screen positions—too many positions for an eight-bit register to keep track of. If a sprite is to be placed in a position that can be stored as a value in an 8-bit register—a position with a value of less than 255—then the MSIGX register is not used. But if the horizontal position of a sprite has a value of more than 255, a bit in the MSIGX register is set. Each bit of the MSIGX register equates to the number of a sprite; bit 0 is used for sprite 0, bit 1 for sprite 1, and so on.

There is no vertical MSIGY register, because there is no need for one. A sprite can be placed in only 256 vertical positions, so only one 8-bit register per sprite is needed to handle the vertical positioning of sprites on the C-128's screen.

THE C-128'S 'SHADOW' REGISTERS

In the 128, the memory registers used to determine the screen positions of sprites are situated at addresses \$D000 through \$D010 in memory bank 15—the same addresses they occupy in the C-64's memory. And when the proper values are stored in a horizontal or vertical position sprite register, the C-128—just like the C-64—uses those values to determine position of the upper left hand corner of the sprite. There is an important difference, though, between the way the sprite position registers are used in the Commodore 64 and the Commodore 128. The difference is, of course, those mysterious shadow registers. Every 1/60 of a second, during the C-128's vertical blank interrupt, the contents of the sprite position registers are erased and are replaced by the contents of a block of shadow registers at memory addresses \$11D6 through \$11E6. So, when you use sprites in a C-128 program, you must set their positions on the screen using memory addresses \$11D6 through \$11E6 rather than using memory registers \$D000 through \$D00F.

MOVING SPRITES OFF THE SCREEN

Another important fact about sprite positions is that storing a value in a horizontal or vertical position register does not ensure that a sprite will be displayed on the screen. Of the 512 possible horizontal positions of a sprite, only positions 24 through 343 are visible on the screen. Of the 255 vertical positions that are available, only positions 50 through 249 are actually visible. It's therefore quite easy to make a sprite disappear; all you have to do is store the value of an offscreen position in its horizontal or vertical position register.

Figure 3 shows the shadow position registers that must be used to position each of the C-128's sprites horizontally and vertically on the screen.

FIGURE 3
Sprite Position Registers

HEX ADDRESS	POSITION REGISTER	HEX ADDRESS	POSITION REGISTER
\$11D6	SP0X	\$11DE	SP4X
\$11D7	SP0Y	\$11DF	SP4Y
\$11D8	SP1X	\$11E0	SP5X
\$11D9	SP1Y	\$11E1	SP5Y
\$11DA	SP2X	\$11E2	SP6X
\$11DB	SP2Y	\$11E3	SP6Y
\$11DC	SP3X	\$11E4	SP7X
\$11DD	SP3Y	\$11E5	SP7Y

\$11E6 — — MSIGX (Most Significant X Position Register)

SELECTING COLORS FOR SPRITES

In addition to the 2 bytes plus one bit that determine the position of each sprite, each of the C-128's eight sprites also has one color register. The color register for sprite 0 is at memory address \$D027 in Memory Bank 15, and the addresses of the color registers for the other seven sprites follow in consecutive order. The color address for sprite 7 is therefore at memory address \$D02E in memory bank 15.

To select the color of a sprite, all you have to do is store the standard value of one of the Commodore 128's 16 colors in that sprite's color register. Every bit that is set on the sprite's bit map will then be displayed in the selected color. Every dot that has a value of 0 will be transparent, and will not cover up anything that is beneath it on the screen.

EXPANDING SPRITES

As mentioned, a sprite normally measures 24 horizontal screen dots wide by 21 vertical screen dots high. But by using two special registers called XXPAND and YXPAND, a sprite can be expanded to twice its normal width, twice its normal height, or both. The XXPAND register is at memory address \$D01D in memory bank 15, and the YXPAND register is at \$D017 in memory bank 15. Each bit in each register corresponds to a sprite number, with bit 0 controlling the size of sprite 0, bit 1 controlling the size of sprite 1, and so on.

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ON WITH THE PROGRAM

Now we're ready to take a look at the SPRITE2 program. Actually, it's an improved version of the program that appeared in last month's column: a high-resolution program that printed a message in quadruple-size characters on the C-128 screen. This month, the program is expanded into one that also includes an animated sprite routine.

In its newest form, the program copies a character set from ROM into RAM and then prints a message on the screen in large type. It then clears a bit map for sprite 0, copies some data into the bit map from the character set in RAM, and places an expanded sprite in an area out of viewing range at the top of the screen. Next, the sprite descends into viewing range, and maintains a slow descent until it reaches a predetermined position. Then it stops and becomes a part of the message displayed on the screen.

THE 'INDFET' ROUTINE

One noteworthy feature of the program is its use of a C-128 Kernal routine called INDFET, which has a call address of \$FF74. With the help of the INDFET routine, a program can load the accumulator with any value from any of the C-128's 16 memory banks, without leaving the memory bank that is currently active.

The INDFET routine works much like indirect indexed

addressing—a form of addressing in which the Y register and a two-byte zero-page pointer are used in the following format:

LDA (POINTER),Y

Before indirect indexed addressing is used in a program, a base address must be placed in a two-byte zero page pointer, and an index value must be placed in the Y register. Then, when a statement that uses indirect indexed addressing is encountered, the value stored in the Y register will be added to the eight-bit address pointed to by the pointer, and the accumulator will be loaded with the contents of the resulting address.

To use INDFET, this is what you have to do: Store a base address in a zero-page pointer, load the accumulator with the address of the pointer, load the X register with the desired bank number, and load the Y register with an index. Then you can load the accumulator with any value you wish by simply doing a JSR to memory address \$FF74. When the routine ends, the value that has been fetched will be in the accumulator, and the C-128 will still be in the memory bank that it started out in.

Now you know how to set up a high-resolution program on the Commodore 128, and how to program the C-128's sprites. □

SEE PROGRAM LISTING ON PAGE 120

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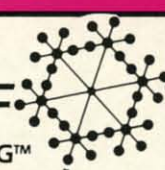
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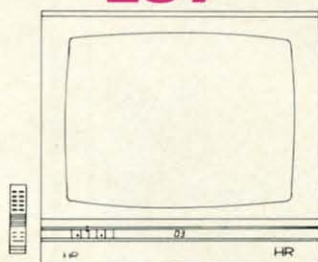


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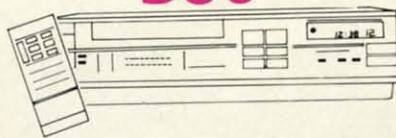


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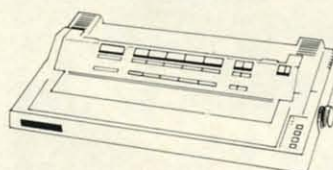
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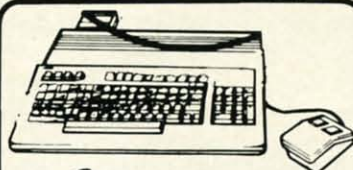
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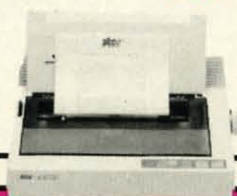
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
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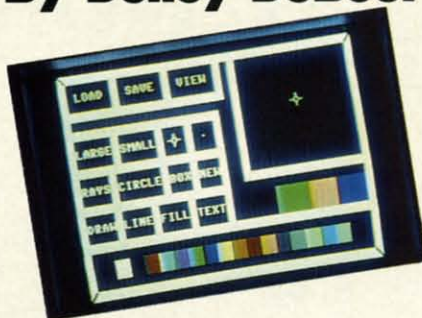
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THE ARTIST

For the C-128

By Denoy DeBoer



The Artist is a multicolor sketching program which, though written almost entirely in BASIC, supports many of the features found in commercial drawing programs. Because it is mostly BASIC, it is very easy to expand, as I'll explain below. But first let's look at some of the features *The Artist* supports:

DRAW—used to draw as you would with a pen. When you first enter this mode, the pen will be up. You can move the cursor anywhere on the screen without leaving a trail. Hit the fire button to put the pen down. A bell will sound to indicate that the pen is now down. Now, wherever you move the cursor, it will leave a trail in the current drawing color. To lift the pen back up, hit the fire button again.

LINE—simplifies the task of drawing a straight line between two points. To draw a line, place the cursor where you want the first endpoint to be. Hit the fire button and the computer will set a point at that spot and sound a bell. Now, move the cursor to the spot you want and other endpoint to be. Hit the fire button again, and...voilà, you have a line. To make connected lines, hit the fire button again (this will set another point where you just finished drawing the line). Move the cursor to where you want the other endpoint to be, hit the fire button once more, and there you have it—a connected line. You can continue this process for as long as you wish.

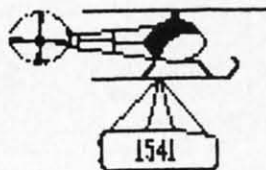
BOX—works somewhat like the LINE command, except now you select two opposite corners instead of endpoints.

CIRCLE—allows you to draw either circles or ellipses. First, move the cursor to where you want the center of the circle to be. Hit the fire button. You will then have to select the radius of the circle. The cursor will now only move either up or down. Once you have the desired length of the radius, hit the fire button. If you want a "perfect" circle, hit the fire button again. The computer will then draw the circle. If, however, you want an ellipse, after selecting the vertical radius, move the cursor left or right to select the horizontal radius.

RAYS—allows you to draw rays from a central point. First, select a point. Now, move the joystick and hold the fire button down at the same time. Rays will shoot out from the central point to the current cursor position. To draw a new ray, hold down the fire button without moving the joystick. The bell will sound indicating that rays will now be drawn from that central point. The most beautiful rays are drawn with a cursor speed of 1.

FILL—should be used with care. Move the cursor to the area to be filled and hit the fire button to activate the fill. First, the outline of the area to be filled must be completely connected. If there is a gap anywhere, the "paint" will spill out

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all over the screen and ruin your masterpiece. Second, the palette used for the FILL operation *must* be the same one used to draw the outline of the shape to be filled. Before performing any FILL operations where there is even a remote chance that you save the current screen to the safety buffer by hitting the "S" key. That way, if you mess up, you can hit "R" to recover your screen.

Note that in any of the drawing modes, you can hit the "S" key to save the current screen to the buffer, or "R" to restore the screen from the buffer. Please note that it takes approximately 10 seconds for the program to save or restore a picture from the buffer. To go back to the MENU screen, press any other key.

MENU SELECTION

When you first run the program, you will be greeted with a menu screen. The upper 4/5 of the screen is the Main Menu; the lower portion is the Color Menu. Most of the commands are self explanatory, or have been explained above. To make a choice, use the joystick (plugged into Port 2) to move the cursor to the box of the selection you want to make and hit the fire button. In addition to the commands already covered, there are a few more available from the Main Menu.

On the left hand side, near the center of the screen, you will find two boxes marked LARGE and SMALL. These boxes allow you to select the size of your pen strokes. When you are in LARGE mode, the cursor will be twice its normal size. In addition to the two brush (pen) sizes available, you will be

able to select from two types of cursors. The small cursor is good for precision work. The crosshair cursor is good for lining up corners and making sure that points are connected. The speed of the cursor can also be adjusted by hitting the numbered keys from 1-9. 1 is the slowest speed and 9 is the fastest. I recommend a speed of 1 for detailed work. The program also allows for placing text on the graphics screen. Use the TEXT option to do this. Please note that the RVS (reverse video) option will not work when you use palette number 3 as your painting color.

In the upper left hand corner of the Main Menu screen, you'll also find commands to LOAD, SAVE, or VIEW your work. When saving your picture, keep the name under 13 letters long. The program will automatically add the suffixes ".COL" and ".PIC" to your name.

COLOR SELECTION

Color selection is easier to do than it is to explain. In the lower right hand corner of the Main Menu, you'll find colored boxes. These are the four palettes available for you to work with. The leftmost is palette number 1. It controls the background (canvas) color for the whole screen. The next three palettes are numbers 2, 3, and 4 respectively. These are your painting palettes. However, keep in mind that you can also paint with palette number 1. This is useful for erasing mistakes.

Just below the palette is the Color Menu. To select a color you would like to use, move the cursor to that color and press the fire button. Now move the cursor back up to one of the four palettes and press the fire button again. The palette you selected will now change to the color that you have selected. Now anything you draw with that palette will be in the current color of that palette.

Although you can use all 16 colors on the screen at the same time, there is a restriction as to how the colors may be used. You can change the colors in any of the palettes as many times as you wish, but keep in mind that if you want two or more different colors right next to each other, they each must be drawn with a different palette. I suggest that you try out each of the commands and get a feel for what they do before trying to do any serious work.

SUGGESTIONS

You should keep in mind that *The Artist* is not a precision drawing program. Just like any other drawing tool, it may take some time to get used to. During your drawing process, you're sure to get messy (connected lines extending through each other, etc.). This is okay because you can always go back and touch up with the DRAW command. As a matter of fact, this is how you should work. Another bit of advice is to work from the background forward. In other words, draw (or paint) the sky and then add the mountains and streams later.

You'll also notice that the text looks a little strange on the multicolor screen. You can use the DRAW command to touch up the letters.

Last but not least, if the program should crash for any reason, just hit RUN STOP and RESTORE at the same time. You can then re-RUN the program and the picture you were working with will still be there. However, keep in mind that the safety buffer is now wiped out.

TYPING IT IN

To create a copy of *The Artist*, type in the BOOTER program on page 124 and save it as the first program on your

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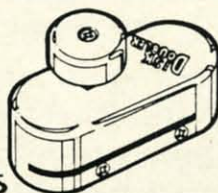
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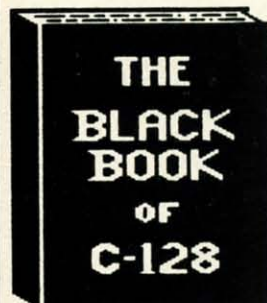


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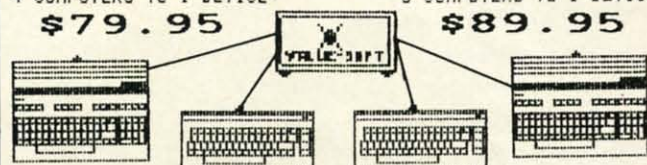
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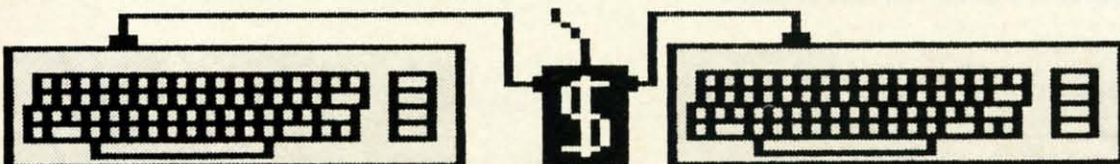


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disk. Now enter the C-128's built in monitor by hitting the f8 key. Type M 0E00 0EB8 and press RETURN. The screen will fill with hexadecimal numbers. Move the cursor up to the lines and change the hexadecimal values to match those in the listing of the second program (SPRITE DATA). Be sure to press the RETURN key at each line after you have made the changes. Once you have finished changing the values to match those in the listing, move the cursor to a blank line and type M 00B00 00B10. Change the values in these locations to match those of listing three (ML ROUTINE). You can now save the program. Type S"ART SPR",8,+3584,+4096 and press RETURN. Now, type S"ML",8,0B00,0B14 and press RETURN. You can now exit to BASIC and type in *The Artist*. Be sure to save *The Artist* before attempting to run it.

FUTURE EXPANSION

You may have noticed that the upper right hand corner of the Main Menu screen contains a large blank box. I purposely left this box blank for future expansion. Here is a brief description of how the cursor input routine works in case you would like to add some features to the program.

Lines 62-74 check to see where the cursor is along the y-axis when the fire button is pressed. Control is then transferred to the appropriate section (Lines 78-126) to determine where the cursor is along the x-axis. This is where the routine actually determines what function was selected. Take note of line 62. This line calculates the x and y coordinates of the cursor sprite and then translates it to x and y coordinates for a 40 column by 25 row screen. The upper left hand corner is location (0,0) and the lower right hand corner is location (39,24).

To demonstrate the process of adding new commands (options), I will show you how to add a BORDER command. This will allow you to change the border color of the graphics screen. First, we have to decide how the command will work. To keep things simple, I have decided that a box with the word BORDER in it will be used to activate the BORDER command. The user could move the joystick up to the box and hit the fire button to cycle through the 16 available colors.

The next thing to do is add the command box itself. I decided to add the command at Line 500. Here are the lines needed:

```
500 WINDOW24,1,39,14 : PRINT"[WHITE][8
" "][RVSON] ":PRINT" BORDER [RVSON] " :
PRINT"[8 " "][RVSON] ": PRINT"[RVSON][W
HITE][9 " "]: WINDOW0,0,39,24: RETURN
```

The first WINDOW command makes a window in the big blank box on the Main Menu screen. The BORDER command is then printed in the upper left hand corner of that box. The screen is then returned to normal with the second WINDOW command, and the program then returns from the subroutine.

To make sure that our new command is printed along with the Main Menu screen, we have to have a GOSUB to our routine from the routine that prints the Main Menu. Add the command GOSUB 500 to Line 274, right before the RETURN statement.

However, just adding and printing the command is not enough. We also have to add a routine to check for and activate the new command. Type in the following Line:

```
83 IFX>23 AND X<32 THEN C4=C4+1: IF C4
<17 THEN 52: ELSE C4=1: GOTO 52
```

We now have a command to change the border color. To finish things off, let's add a routine to save the border color information along with the picture data. Add the following statement at the beginning of Line 170: POKE 8172,C4. Now add this statement to Line 180 right after the BLOAD command: C4=PEEK(8172). We will also need to modify the BUFFER SAVE and BUFFER LOAD routine. Add the statement R4=C4 to the end of Line 230 and the statements C4=R4:COLOR4,C4 to the end of Line 242.

All the additional lines to add can be found in the Additional Lines listing.

Here are some suggested commands to add. How about COPY, HARDCOPY, or ZOOM? Or maybe a special effects command such as CYCLE. This command could be used to cycle through the border or background color of the picture. Some simpler commands to add would be disk commands such as DIRECTORY or FORMAT.

ADJUSTING THE PROGRAM

If you find that the computer reads the joystick fire button too fast, change the 150 in Line 322. Also, the CIRCLE function may not draw a perfect circle on your TV or monitor because it was adjusted for my TV. If the circle is too skinny, increase the value of the variable SC in line 280. If the circle is too fat, decrease the value of SC. As it is now, the border color is black. To change the border color, change the value of C4 in Line 280 to the number of the color you want. □

SEE PROGRAM LISTING ON PAGE 124

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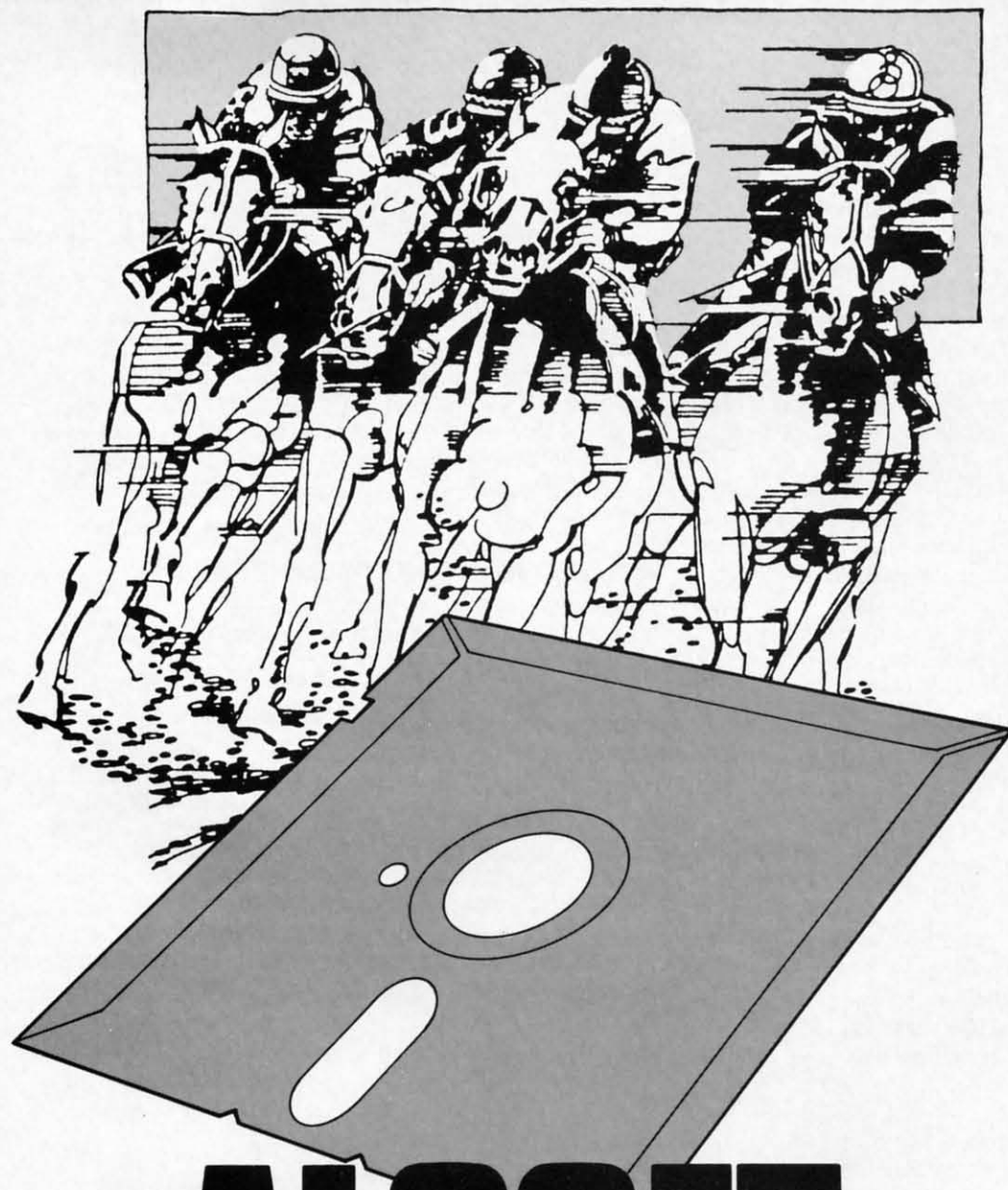


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PIGSKIN PROGRAMS FOR COMPU-COACHES

New titles give football fans lots of gaming choices

By Arnie Katz
and Bill Kunkel

The United States Football League's challenge to the NFL's monopoly failed, but Pete Rozelle's group still isn't the only game in town for football fans. There's a stadium built into every Commodore 64 and 128, and software publishers have filled it with a rich assortment of great gridiron disks.

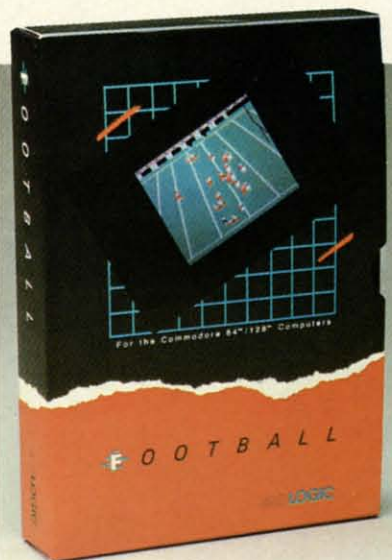
Four football games have appeared for the C-64/128 since *Ahoy!* last studied the category. As if that were not enough good news for computer sports fans, the new entries reviewed here represent a truly amazing variety of game-formats.

Whether the computerist enjoys pure arcade-style action or undiluted statistical accuracy, there's a first-quality game that can fill the bill. The four newcomers, together with the previously available *On Field Football* (Gamestar/Activision) and *Super Bowl Sunday* (The Avalon Hill Game Company), insure that there is a program to suit every football fancy.

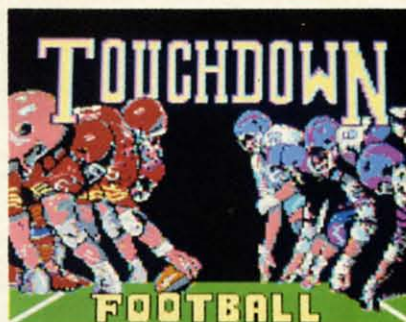
Fans of action-oriented gridiron simulations can start dancing in the end zone: Electronic Arts has released a Commodore version of Imagic's excellent *Touchdown Football*.

In this contest, the coach of the offense has a choice of eight formations, eight pass patterns, and three possible line blocking schemes, plus full kicking options. The defender selects from among eight regular and two kicking plays. All selections are entered via joystick, using a series of pull-down menus.

Once the strategy is set, the onscreen center snaps the ball. The user takes direct control of the quarter-



Football mixes action and statistics.
READER SERVICE NO. 213



Touchdown Football: 8 formations.
READER SERVICE NO. 214

back and either guides him through the line on a rushing play or sets up for a pass to a previously designated receiver.

A completed pass causes control of the onscreen athlete to immediately shift to the receiver. A pass catcher can try to dart downfield for extra yardage. On defense, meanwhile, the computer coach maintains joystick control over the middle linebacker

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while the rest of the team moves according to the preprogrammed instructions.

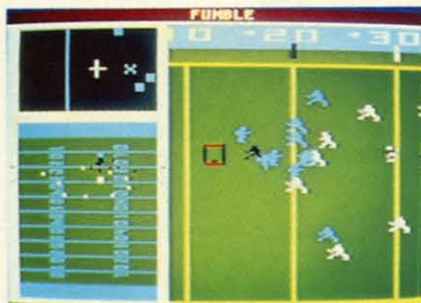
* *Touchdown Football* presents its two six-man squads in a realistic, three-quarters perspective with horizontal scrolling, visible officials, cheerleaders, and a pigskin that casts a shadow. There are punts, field goals, and even interceptions as the two squads march up and down the gridiron in this head-to-head or one-player action contest.

Unfortunately, this excellent program by Mark D. Klien, Michael Becker, and Wilfredo Aguilar was originally designed to be played on the 128K IBM PC and PCjr systems, and the translation to the Commodore 64 causes several problems. For one thing, the play entry system was created for use with a two-button joystick. In the original, one action button brings up the options and the other enters commands. Once the play begins to unfold on the field, the dual fire buttons allow the quarterback to throw to either the upper or lower wide receiver. While the lack of a second action button does not cripple the game, it significantly complicates the command control scheme.

Another noticeable flaw is that the graphics are not as sharp as one might expect in a game as sophisticated as *Touchdown Football*. The gamer must be able to follow the individual players as the lines collide, but this is often next to impossible due to the muddy animation.

Touchdown Football, even with these minuses, is still the best action football simulation around. The extensive choice of offensive and defensive plays and faultless joystick re-

SOFTWARE SECTION



WGFG: create your own book of plays.
READER SERVICE NO. 207

sponse make for a realistic and thoroughly exciting program.

Although coaches control their helmeted warriors with the joystick in *The World's Greatest Football Game*, the accent is definitely on strategy. The documentation quotes an adage to the effect that football is 85% mental, and this Nexa-designed program attempts to live up to that maxim.

The main display shows three views of the gridiron with players represented by easy-to-recall symbols. The right side of the screen presents the sideline view of the teams as they line up at the line of scrimmage. The lower left side displays an overhead view of the entire field. An overhead close-up view, located in the upper left corner, allows the coaches to watch the offensive and defensive players execute their assignments. Pressing the "W" key toggles between single- and multiscreen displays.

The main menu screen has four icons which represent time-outs, moving to the scoreboard screen, loading/saving games, and exiting to the "choose play type" menu.

Participants call plays by using the joystick to select choices from a series of menus. First the offense chooses "run," "pass," "punt," or "field goal." If it is a rush or kick, the next choice is whether it is to go left, middle, or right. If the offense is passing, the coach first selects a long, medium, or short throw before choosing the direction in which the play should develop.

The next menu lists all the plays in the team's customized playbook which fit the parameters. A diagram of the selected play appears on the

screen. The defense then chooses a setup from a menu, which it hopes will counter its rival's plan. After the offense determines the speed at which the play will unfold, *The World's Greatest Football Game* switches to its action phase.

The quarterback automatically follows his assignment from the snap until the coach decides to pass, hand-off, or improvise. Audio cues make it comparatively easy to time the handoff on running plays or the ball-release for passing.

The joystick takes control of the running back or receiver, depending on the call. Meanwhile, the defense



Football depicts the gridiron in $\frac{3}{4}$ perspective with full horizontal scrolling. While the players tend to melt together at the line of scrimmage, the game does blend sophisticated strategy and satisfying action.

controls either a linebacker or a safety, depending on which man the coach feels will be more important in the current situation.

The heart of the game is the Chalkboard, a sub-program which gamers use to create their own book of plays. The process is well-documented in the instructions, but it takes quite a while to pick the right formation and delegate routes to the individual athletes. *The World's Greatest Football Game* is not for believers in the philosophy of "boot-and-play": Expect to spend at least an hour, and perhaps several, to compile a reasonably varied playbook.

This is a difficult, demanding game, which is best-suited for solitary play, although head-to-head is possible. *The World's Greatest Football Game* is an intricately detailed simulation of the head games real coaches play with just enough action

to keep things from becoming too cerebral.

Football (SubLOGIC) is an unorthodox mixture of action and statistics. The same team which produced *SuperBowl Sunday* (The Avalon Hill Game Company) designed this unique action-strategy game.

Football simulations replicate reality in a variety of ways. Action contests try to capture the patterns of movement, the "look and feel" of the real sport. The computerist should actually feel as if he's down on the field, busting tackles, throwing touchdowns, and sacking the quarterback.

The statistically based games, on the other hand, test the user's ability to evaluate and deploy real athletes in a simulated environment. In this variety of contest, the computer coach wants to feel like Don Shula, the general commanding his troops from the mountaintop.

Football walks both sides of the street simultaneously. The computerist is the coach, but also gets to feel the heat of personal combat. The result is a game which is tough to categorize. It should especially appeal to joystick jockeys who want a game that also involves a lot of strategy.

SubLOGIC *Football* is an action-strategy game. The coach controls the team of individually rated players with the joystick.

Teams are drafted from a talent pool of fictitious but very representative and well-drawn footballers. The play book describes each player in

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"0300 Hours. Two hours until dawn. Radar picks up convoy, escorted by two destroyers. We believe that one of the enemy's valuable cargo ships is part of convoy formation."



"0400 Hours. Lookouts on the bridge. Target identification party reports one cargo ship, 4,000 tons, troopship of 10,250 tons, with two Kaibokan-type escorts. Moving into attack position."

Tandy 1000/IBM PC Jr. screens shown



"0500 Hours. Sound General Quarters! Battle stations manned. Preparing for torpedo run. Gauge Panel OK. Periscope OK. Charts and Attack Plot Board OK. All mechanical systems OK."



"0525 Hours. Torpedo rooms report full tubes forward and aft. Battery at full charge for silent running. We hope water temperature will provide thermal barrier to confuse enemy sonar."



"0600 Hours. We are at final attack position. Convoy moving at 10 knots. Target distance decreasing rapidly... Crash Dive! Escorts have spotted us and are turning to attack! Rig to run silent."



"0700 Hours. Depth charged for one hour. Some minor damage, but repair parties at work. Destroyer propeller noises receding. We'll come to periscope depth for our return punch."



"0715 Hours. Torpedo tubes 1, 2, 3 fired. Two destroyers hit and sinking. One of the enemy's last cargo ships coming into 'scope view — an ideal target position. On my mark... Fire Tube 4! Fire 5!"



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considerable detail, including a biography, scouting report, and career statistics. Most players are rated for speed, power, and the ability to catch the pigskin. Quarterbacks have ratings for release time as well as for their ability to complete both long and short passes. The user can alter any of these ratings prior to the start of the game.

Before each play, the offensive team determines whether it will run or pass. There are seven rushing plays which can be sprung out of three possible formations: "pro" (two backs); "I-formation"; or "power I" (three backs). On "pass" plays, the computerist chooses from among five basic patterns (post, flag, hook, slant in, square out) and four formations (pro, I, power-I, and four-receiver). It is also possible to run or scramble with the quarterback. A team can punt or attempt a field goal at any point. On defense, the player determines whether to set up for a run or pass play. On blitzes, linebackers are individually assigned, and if the pass defense is called twice in a row, the primary defender's speed rating is reduced. There are also several special defensive maneuvers. These include goal line stands, "keying" on runs, and a five-back setup for surefire passing situations.

Once the ball is snapped, the gamer on offense assumes limited joystick control over the quarterback. After a completed pass, the program transfers control to the receiver. On defense, control is assigned on a default basis to the "primary defensive player," generally the middle linebacker. The defensive coordinator may, however, change that assignment at any time in order to personally guide the movements of the strong safety, free safety, outside left linebacker, or outside right linebacker.

Football's graphics are acceptable, if unextraordinary. The gridiron is depicted in three-quarter perspective with full horizontal scrolling. The players do tend to melt together at the line of scrimmage, but the eye adjusts within a game or two.

This is really quite a remarkable game, though it is not for those who

only become pigskin partisans at Super Bowl time. It offers a unique perspective on the sport. While it's hard for any program to be all things to all gamers, *Football* succeeds admirably in its attempt to offer a multi-dimensional simulation which blends satisfying action and sophisticated strategy.

If statistical accuracy is the goal, *3-in-1 College & Pro Football* (Lance Haffner Games) can put the ball through the uprights from any point on the gridiron. There isn't even a pretense of graphics, but no other pigskin program can touch this all-text title when it comes to precisely reproducing the performance of real football teams.

And what an incredible variety of teams there are! With a commendable spirit of generosity, designer Haffner has included hundreds of clubs from the past and present on the two disks supplied with the game. The latest edition features the 1985 NFL and USFL teams, 176 major college aggregations, 174 outstanding college elevens of the past, and 96 famous professional football teams. (The Canadian Football League is ig-

nored, probably because that organization's rules differences would invalidate the algorithms which power the simulation.)

Like most stat game producers, the company updates its disks with the latest year's teams after the conclusion of each season. Team disks with the latest squads are available for separate purchase.

This one- or two-player contest plays rapidly head-to-head or against the computerized coach. The user can even sit back and watch the program direct both teams in pleasingly authentic "what if?" confrontations.

After the participants pick the number of contestants, the teams, and stadium, the main display appears. It isn't very fancy, but it does present the needed information in a succinct and easily understandable format.

Head coaches can tell at a glance which team has the ball, the down, yards-to-go for a first down, the position of the ball on the field, the quarter, and time remaining. The lower half of the screen presents menus of offensive and defensive options and prints out the results of each play.

Gameplay is quickly learned. First

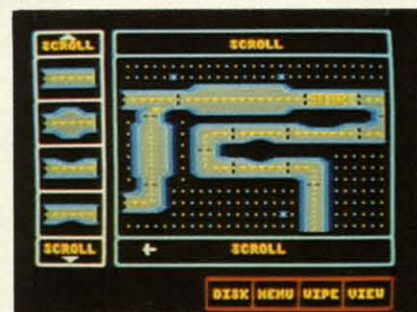
UNDER CONSTRUCTION

Fast Tracks / Activision

By Ted Salamone

Welcome to hard hat country. This is the first in a series of articles which will explore the intricacies of C-64/128 programs with screen editors and construction set capabilities. Be prepared to take a lot of notes. Since this work is pretty risky, keep that steel bonnet on at all times. Oh, one more thing: sign this waiver.

Fast Tracks is a slot car racing construction set. Would-be double shifters compete against three computer-directed cars on prebuilt or custom-designed tracks. Best of all, *Fast Tracks* makes it easy to send friends working copies of one's own world class tracks, complete with landscap-



Race on prebuilt or custom tracks.
READER SERVICE NO. 208

ing, worthy opponents, and fancy audiovisual effects. The recipient doesn't even need a copy of the program to enjoy your engineering and design feats.

Cars in *Fast Tracks* roll along smoothly, hugging curves and streak-

the coach whose team is on defense chooses one of six alignments; honest, inside run, spread, blitz, short pass, or long pass. The offense then selects one of the five running or seven passing plays. (A team can also punt or attempt a field goal.) The program quickly compares the ratings of the players, modified by the interplay of the offensive and defensive strategy, and prints the result.

One of *3-in-1 Football's* best features is that it moves the ball in tenths of a yard. This is, therefore, the only football game in which a team can be stopped agonizing inches short of a first down or a touchdown. That is realism with a capital "R".

Appropriately enough for a game which embraces statistics to the exclusion of frills, *3-in-1 Football* includes a module which compiles season, game, and individual stats which can be saved on a formatted disk. Typing in the name under which the numbers are stored calls up complete records in a flash.

Lamentably absent is any mechanism for trading players. Lance Haffner has concentrated on replicating the performance of teams, not individuals. This game is more con-

cerned with making the entire offensive line function correctly than with insuring that the left tackle piles up the proper number of blocks. Breaking up offensive and defensive units which worked together disrupts the game's complex formulas.

The play-system sacrifices user-involvement in the name of accuracy. The coaches pick only the plays, not who will carry them out. In other words, the computerist commanding the 1985 Giants can call for a blast over tackle, but the program decides whether Joe Morris, George Adams, or Rob Carpenter carries the ball.

An exacting simulation like *3-in-1 Football* is, of course, not for everyone. Even many closet Tom Landrys will recoil at the lack of visual excitement, but this title is surely the ultimate for Commodore owners who want total statistical verisimilitude.

And that's the computer pigskin lineup for this season. The established ones are still great, and the rookies add versatility and scope. With so many excellent choices, the Commodore computer may soon come to rival the flask as the football fanatic's best friend. □

ing down straightaways, especially after a quick spin through the officially sanctioned rulebook. Besides operating information, the 20-page manual offers basic design and racing tips.

Tools of the Trade

Taking a cue from the original construction set title, *Pinball Construction Set*, *Fast Tracks* displays a parts bin on one section of the screen and a "workbench" on the other. Though the onscreen work area is only 5 standard track pieces high and 5 pieces wide, a complete circuit of up to 19 pieces wide and 10 high can be achieved using the scroll boxes above and below the workbench. Don't be fooled by this seemingly constricted space; intricate layouts are possible.

The parts box holds 22 different track sections and displays four at a

time. Just like the work area, additional pieces are accessed by positioning the joystick-controlled cursor in the scroll box and pushing up or down. The course-architect selects and places parts by pressing the joystick button.

Straightaways include one lane wonders, two lane widow makers, and boulevard-sized roadways. A set of four 90-degree curves completes the basic components. Underpasses, overpasses, and intersections make tracks more challenging than the Detroit Gran Prix. Oil slicked sections, switchers (which randomly place cars onto connected throughways) and mergers (the opposite of switchers) add their own mischief to the mix.

The Blueprint

From the main menu, slot enthusiasts design courses, race on them,

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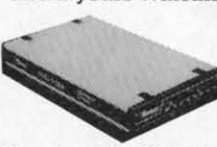
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or create game disks for friends. Though track design is the first selection on the menu, it is best to start with the second, racing on pre-designed layouts. Not only does such experience give the apprentice a good feel for the game playing portion of *Fast Tracks*, but it also is a solid foundation for designing realistic, challenging courses.

Once familiar with the courses included on the program disk, study other racing games for additional layouts. A less direct but nonetheless excellent source is photos and diagrams of the world's great raceways, such as the Brickyard, Lime Rock in Connecticut, or LeMans.

The easiest way to concoct a design for a new track is to lay it out on paper prior to booting the program. Graph paper isn't necessary, but it does make it easier.

Begin by placing the "start" track, then decide on the number and location of intersections, overpasses, and underpasses. Lay in the curves next, followed by the desired types of straightaways. The best time to add oil slicks is when fine tuning the course. Likewise, locate merges and switchers to tie loose sections together. Erase existing pieces to accommodate these final touches.

Pouring the Asphalt

During the construction process, the user places pieces on the work area as desired. Only a few rules must be firmly observed: Every course requires one "start" track, all tracks must connect to form an unbroken circuit, and *never* save anything to the *Fast Tracks* disk.

Follow the blueprint religiously, from placement of the "start" track to switchers and oil slicks. By this point in the design process, the user should have already made all adjustments on paper, so actual construction can proceed without a hitch. Though creation of a blueprint appears to be an extra, time-consuming step, it actually saves time in the long run. You'll avoid cost overruns and missed schedules due to "in the field" course redesigns. (It may also prevent you from arriving late to family meals and

burning the midnight oil.)

Dots spaced evenly throughout the workbench make alignment easier when stretching pliable sections, or just placing standard units. This grid becomes even more helpful as work nears completion. Just remember, clean (non oil-slicked) vertical and horizontal straightaways are malleable. The others won't bend, stretch, or budge for anything or anybody. Threats don't work!

Previously placed pieces can be erased, individually or en masse. Other than a finite work space, there is nothing to prevent you from duplicating sections, with the exception of the "start" track. Most engineers would swap a Porsche 959 for this combination of design power and ease of use.

When the track is completely laid out as planned, save the masterpiece to an initialized disk. The "create track" routine includes four disk options: load, save, delete, and initialize. To reduce the size of stored tracks, landscaping is done by the *Fast Tracks* program at race time. Simple track configurations occupy as much as 33 blocks on a disk.

In a nutshell, the entire process goes something like this. Load *Fast Tracks* and design a course; save the finished product to an initialized disk, and test via the race option. Replace the data disk with the program disk, then do the reverse when prompted. The new creation appears onscreen in synthetic 3-D, replete with greenery, an appropriate musical score, and sound effects.

This advice applies even when duplicating existing tracks from diagrams or photos. Remember, almost any real-life track will probably have to be adjusted to fit within *Fast Tracks*' parameters.

Tips

Don't keep *Fast Tracks* in overdrive; extremely complex courses are no fun. Besides being nightmares to design and construct, they often fail when it comes to racing. A single merge/switch set is enough. Two or more such combinations create roadways that look more like congested

interstates than high-speed race courses. Use oil slicks sparingly as well. Three on a course should be the maximum under normal design conditions.

The "real" world is more forgiving when it comes to overpasses and underpasses, though the finite course size tends to limit these. Strategic location of over/unders adds spectacular racing and visual excitement.

Fast Tracks' most useful track sections are those which can be stretched. Sprinkle a few (short) boulevard-size sections (to allow passing) to break up single-lane portions of the course. This forced course control builds tension and often frays nerves when competing against friends. Who will be in position when the track widens? Who will pass on the inside?

The Test Drive

In operation, *Fast Tracks* plays like a real slot car set. Speeding cars fish-tail around turns, hanging over the track edges as if they were about to launch into space. Sometimes overzealous driving does send a car careening off the track, but none, as far as is known, has attained Earth orbit.

The graphics are better than average, and the musical score and sound effects are at least adequate. Apart from the construction set, playability is the byword. Slot car Andrettis need plenty of practice; the computer-controlled cars provide stiff competition. Pay particular attention to the fine art of bumping.

For the glory seekers, a top five scoreboard reports the results of all five lap contests. The single and ten lap contest results are not saved for posterity.

What Activision says about *Fast Tracks* is true: "The only problem you will have...is deciding which is more fun: building a track or racing on it."

Activision, Inc., 2350 Bayshore Frontage Road, Mountain View, CA 94043 (phone: 415-960-0410).

—Ted Salamone

**Back issues of Ahoy!
are available for \$4.00
each. See page 98.**

ULTIMATE WIZARD

Electronic Arts
Commodore 64
Disk; \$29.95

Occasionally, a program comes along which reminds gamers that adventures and head-busting strategy contests aren't the only types of computer entertainment. This jumping and climbing epic spotlights joyously lighthearted arcade-style action with a secondary emphasis on seat-of-the-pants strategizing.

Wizard, designed by Sean A. Moore and Steven Luedders, was published a couple of years back by Progressive Peripherals and Software. Electronic Arts has taken the original design and added 20 more screens and a playfield construction kit. Paul Reiche II, Aaron Hightower, and Craig Smith, the main contributors of the enhancements, rate kudos for elaborating the *Wizard* concept with such sensitivity and spirit.

The player uses the joystick to roam a series of playfields. In each case, the goal is to find a key and fit it into the lock. There are point-scoring treasures to collect, and an assortment of stationary and mobile dangers to overcome.

Working fast is desirable, though not mandatory. The player can pick up bonus points by working the lock on the playfield before the timing bar in the lower left corner runs down. Sometimes greed and speed run afoul of each other, and the gamer has to make a split second decision about whether to snag the extra jewel or go for the bonus score.

The computerist directs a wizard in conical hat, so it's only natural that picking up the key on certain screens confers the ability to work a spell. The nature of the incantation varies from situation to situation, but includes things like invisibility and the temporary ability to survive falls from great heights.

Ultimate Wizard isn't just for joystick jedi, either. There are six levels of difficulty, and the game can be conducted at 10 different speed settings. The slowest ones are leisurely enough even for those of us who no longer dare show our faces at the lo-



Ultimate Wizard: 20 new screens.
READER SERVICE NO. 209

cal family amusement palace.

The sound and graphics are charming. The wizard's arm-flailing tumble and stars-circling-the-head landing are worthy of a Saturday morning cartoon show. The wizard's walk is not well-animated, but overall, this is a great-looking Commodore game.

The instruction folder explains the construction module very well, but most computerists will want to conquer many of *Wizard's* 100 standard screens before venturing to create new ones. There are 20 different monsters and a choice of a dozen spells (including none) to spice up the user's own designs.

Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404 (phone: 415-571-7171).

—Arnie Katz

THE ARC OF YESOD/ THE NODES OF YESOD

Firebird
Commodore 64
Disk; \$19.95

The British have a unique sense of humor and a distinctive approach to action computer games. They seldom break fresh ground in theme or format, but their implementation is excellent. While the games don't always suit the American taste, the multiprogram packages which Firebird now markets give players on this side of the Atlantic an opportunity to sample some of the big U.K. hits at a really attractive price.

This two-part adventure stars the Rt. Hon. Charlemagne Fotheringham-Grunes, "Charlie" for short. The computerist employs the joystick or keyboard to move the hero around the well-drawn playfields, which are full of precarious plummets and ravening

monsters.

The Arc of Yesod is a quest for a monolith that's really a computer. Charlie found it once on the moon, but it was whisked away before he could destroy it. Now it's on a planet called Ariat. The computer contains knowledge that could enable aliens to destroy earth, so Charlie must risk his three lives in an effort to find it and take the critical data.

The Nodes of Yesod extends the scenario introduced in *The Arc of Ye-*



Arc/Nodes of Yesod: 2-part quest.
READER SERVICE NO. 210

sod. Charlie is still looking for the monolith, but this time the intrepid adventurer must gather eight keys to get to the elusive object.

Charlie has special powers which help him battle the monsters which infest both adventures. In *Arc of Yesod*, a push of the joystick ejects a floating sphere from the astronaut's head. This highly mobile weapon can clear the skies, at least temporarily, of monsters. This gives the user time to concentrate on the tricky joystick maneuvers which are necessary to get Charlie through the action-quest.

Charlie doesn't really have a "special power" in *Nodes of Yesod*, but he can befriend a molelike creature before entering the caverns below the surface. If he does so, pushing the stick up frees the creature, who obligingly digs a tunnel for Charlie.

Like too many British imports, the documentation for this pair of contests verges on the enigmatic. The instructions don't even advise the gamer whether the creatures should be killed or merely avoided. The section on *Nodes* is hazy on such crucial details as how to cozy up to a mole and

what effect placing the gravity rods has on collecting the keys.

These things the computerist must learn through laborious trial and error. UK gamers reportedly prefer to learn as they go, but it is a good idea to provide more elaborate explanations in the documentation for programs which are to be sold to the American market.

Weak documentation doesn't automatically imply a bad game. Those who overcome the sketchy rules will find a pair of enthralling contests which invite repeated play.

The graphics are outstanding, certainly well beyond anything you might expect for about \$10 per game. The astronaut is well-drawn and realistically animated. His jumping, though difficult to control at times, is nonetheless extraordinarily eye-pleasing. The underground caverns, which serve as the playfield for both games, are expertly drawn and alive with beasts of every description.

The musical scores of *Arc* and *Nodes* are on the same high level as the pictures. The insistent beat of these jaunty tunes encourages the player to plunge into the unknown, to take risks.

The troublesome documentation shouldn't put anyone off these enjoyable action-adventures. Vague rules can be overcome with a little study, and the reward is a couple of entertainment bargains.

Firebird Licensees Inc., P.O. Box 49, Ramsey, NJ 07446 (phone: 201-934-7373). —Rick Teverbaugh

ELITE

Firebird

Commodore 64

Disk; \$29.95

Elite is nothing less than the high point in the history of British software design. This ambitious science fiction strategy contest presents the full breadth of trading and skirmishing in the vastness of intergalactic space.

A player begins as a recent graduate of an interstellar pilot's training course. The new spacefarer owns a Cobra Mk III, a fighter-trader with everything from dual Zieman Energy Deflection Shields to a choice of



For computer gaming's *Elite* only.
READER SERVICE NO. 211

HoloDirect or ThruSpace GravDistort communication system, not to mention a rapid-fire pulse laser mounted on the forward hull. Unlike other software spacecraft, however, the Cobra's interior includes a cargo hold, bridge, drive sector, living section, and equipment level. As in every other aspect of *Elite*, there is plenty of substance below the surface.

The pilot uses the keyboard to gain access to a series of data screens. The Status page shows the current location, inventory, and the player's current rank. There is also a Galactic Chart, a Worldata link with a readout on each planet in those systems, a local navigational chart, and a command to reveal the distance from the current location to any planet. In addition, the function keys control front, rear, left, and right views and steering. (Guidance functions can also be performed with joystick.)

The onscreen display includes the selected view and a series of console readings (cabin temperature, altimeter, gyro orient, flight grid scanner, compass, and forward velocity). The hyperdrive controls make getting



Macbeth remains faithful to text.
READER SERVICE NO. 212

around the eight galaxies a much less tiresome experience.

Two things are immediately obvi-

ous about *Elite*: It is a meticulously detailed combat-trading simulation, and it will take quite a while to learn, much less master.

The program offers players numerous incentives to keep them studying. A pilot accumulates not only abstract wealth, but such down-to-Terra goodies as fuel scoops, docking computer, energy bombs, and extra pulse lasers. Acquisition of such prizes enhances the player's status, which starts out "Harmless" but can eventually be worked all the way up to "Dangerous."

The graphics are simple but pleasing line drawings reminiscent of vector graphics, well-suited to the 18 types of spacecraft which must be visually portrayed. The onscreen console display is so well designed that each readout is clearly discernable, even amid the welter of gadgets and gauges.

Documentation consists of the excellent "Space Trader's Flight Training Manual," which includes everything from loading instructions to primers on the Cobra navigation systems and politics in the space lanes (the likelihood of establishing trade with a planet might turn on its status as a Corporate State, Dictatorship, or Anarchy). A Quick Key keyboard control guide and a scene-setting piece of fiction, "The Dark Wheel," are also included.

Elite is one of the richest, most satisfying space simulations ever produced. Don't be put off by its complexity, either. We're all "Harmless" at first, after all, but with *Elite*, we become more "Dangerous" every day.

Firebird Software, P.O. Box 49, Ramsey, NJ 07446 (phone: 201-934-7373). —Bill Kunkel

MACBETH

The Avalon Hill Game Company

Commodore 64

Two Disks; \$25

Double, double, toil and trouble await those who tangle with this two-disk adventure based on "Macbeth." Even armed with the copy of the play packed with the software, it's a long journey across the heath before the new king of Scotland is crowned. Not

for the fainthearted, *Macbeth* is a *tour de force*. The adventurer who stays until the battle's lost, and won, deserves a standing ovation for deciphering its murky passages.

Oxford Digital Enterprises authored *Macbeth* about a year ago in England. Now American computerists can follow their British cousins through the quartet of adventures which echo the plot of the play from its first scene to the curtain's fall.

The SID chip convincingly bagpipes "Amazing Grace" while the first episode loads. A view of Macbeth's dark castle against a stormy sky gives way to an animated sequence starring the three witches. As the shades twist and turn, subtitles deliver the opening lines, "When shall we three meet again? In thunder, lightning, or in rain?", concluding with the first real hint for the player, "Fair is foul, and foul is fair, hover through the fog and filthy air."

This clue may seem fairly foul when the gamer is entwined in the character of Macbeth. In action that borrows from the first four scenes of the play, the computerist must slay the rebel Macdonwald and assorted other warriors, while exploring the landscape. Only strict adherence to the play enables the user to solve the succession of puzzles. In fact, the words of the commands which the players type in on the keyboard must be taken direct from the text. A gamer can't just find a weapon and kill Macdonwald. Hints direct the gamer to the exact speech required: "Unseam Macdonwald with the axe." Next the gamer must affix Macdonwald's dripping head to the castle battlements, since that is how Shakespeare wrote it. Later, for exactly the same reason, Macbeth has to cut off a pilot's thumb in a gory bit of accuracy that seems overly bloodthirsty.

This reliance on the Shakespearean text plagues *Macbeth* throughout the tale. The parser for each episode understands roughly 80 words, and, in some instances, accepts full sentences. The computerist must have the play in hand at all times, to refer to the original for clues on how to proceed.

The second adventure, based on Scenes 5-11, features Lady Macbeth in a timed race to gather the contents of the king's stirrup cup, prepare the banquet, and persuade Macbeth to commit murder, then clean up after the foul deed.

Scenes 12-20 inspired the third adventure. The computerist must collect the ingredients for the witches' bubbling cauldron. The character moves through a beautifully drawn graphic world to locate the materials mentioned in the incantations in Scene 18. Even the clues which the player gets by typing "help" are only of minimal value in this section, since they appear in the form of riddles.

Part four is another timed adventure, based on Scenes 21-31. As Macbeth, the gamer must repulse the invasion, stop the fire, and prepare for the arrival of Macduff—then kill him before he disposes of Macbeth.

The graphics accompanying each adventure are atmospheric and, for the most part, evocative of the play. Many drawings are enlivened by touches of animation. Occasional bits of bagpipe music add a highland air to the proceedings.

As a bonus, there are four separate programs that let the computerist undergo "psychoanalysis" in the role of Lady or Lord Macbeth. The computer asks a series of multiple choice questions that explore each character's motives and feelings. It is not very complicated, but it is a painless way to familiarize oneself with the thought processes of these two ambitious schemers.

Macbeth is a delightfully exercise for a Shakespeare lover. By referring to the play, studying the copious notes provided with the software package, and a great deal of trial and error, it is possible that a Macbeth student might actually be able to complete the four adventures. As such, *Macbeth* may have great appeal to those with scholarly interest in the topic, or as an educational tool.

But the average gamer must anticipate many puzzling hours, made more painful by the lack of a save option. Perhaps the publisher should have scrapped the psychology game

and used the space for a save feature.

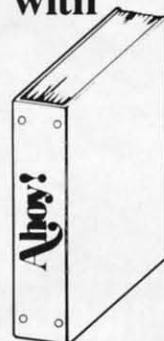
For many people, the challenge will prove too much. As the Bard himself said, "The play's the thing," and the action here is too closely tied to the dramatic work to be all that much fun. It might make a good gift for a high school or college English student who wants to get "inside" Shakespeare's classic characters.

Avalon Hill, 4517 Harford Rd., Baltimore, MD 21214 (phone: 301-254-9200).
—Joyce Worley

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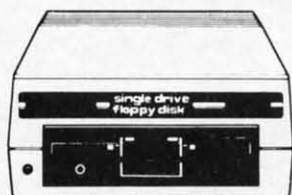
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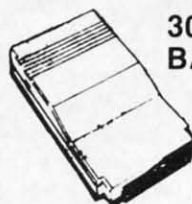
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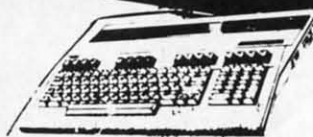
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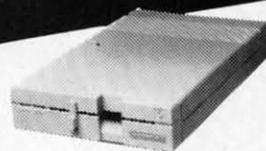
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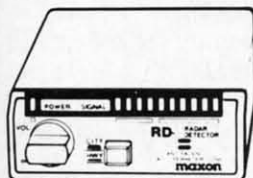


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Reader Service No. 248

MINOTAUR MAZE

For the C-64

By Cleveland M. Blakemore

Almost everybody is familiar with the mythological creature called the Minotaur, who inhabited a complex maze on an island in Crete in ancient Greece.

Less well known is the Minotaur's name, Dexter; and the fact that Dexter had a half-brother named Elrod who helped him comb the maze when he wasn't busy with odd jobs at the Greek rodeo.

Of course, their father, Smiling Jack Taurus, was the one who ended up as triple ground chuck roast when Perseus took the long way home after killing the Gorgon.

Anyway, the game is a simple, graphically interesting maze game of the classic variety. Two Minotaurs wander the maze, following the "left turn" rule. Under this programming logic, they will always take a left turn when confronted with a choice of more than one path. The player uses this knowledge to find suitable hiding places when the Minotaurs pass. Under this logic, the Minotaurs

will eventually explore every possible inch of the maze.

With a joystick in Port 2, your player, a gray figure in the upper left corner, can move in four directions. The object of the game is to grab the precious gems scattered throughout the maze. The Minotaurs also collect them up as they journey through the maze. You get 50 points for every gem you grab.

When the maze is devoid of gems, return to your starting position at the far upper left corner, and a new maze will appear, filled with gems. You receive a bonus of ten times the number of gems you captured each time you move to the next level.

There are eight mazes in all, each one completely different, each one a different color. Number eight is the "Night Search" maze. It is totally dark, except for the torch you carry with you that illuminates every adjacent block around you. This level is very difficult to survive, but if you do, the maze starts again at number one, with the Minotaur's speed picking up a little.

Each time you complete eight levels, the Minotaurs get a little faster. After 16 mazes, they really start booking, so you will need awesome reflexes to get the higher scores. After you complete eight mazes, the next maze will be white—the victory maze. Then the maze colors repeat over again. The higher level mazes have more gems.

You may be able to slip by a Minotaur without getting caught sometimes, but very rarely. You can try this if you get cornered.

Pulsing music beats in the background while you play, interrupt-driven.

You have four men per game. When all four men are captured, the game goes into demo mode until you press fl to start a new game.

My highest score yet is 12360, and I am particularly adept at maze games, so you will need some practice to get this high or higher. The hardest part about the game is predicting which path the Minotaur is going to take as it approaches. Once you get this down, you have a good start.

You will notice this game is very short, although it is near commercial quality. Using redefined character graphics instead of sprites saves an enormous amount of memory, leaving more room for program logic instead of simply binary files of sprite data. Although a good sprite game needs at least 10 shapes (640 bytes), a game using character graphics requires only 80 bytes for 10 shapes. Although character graphics are not suitable for many applications, and sprites are more versatile, characters are very appropriate for games like this, and much easier to program with. Getting the collisions worked out in a sprite game is the worst part of the program task, but with character graphics it is simple, because a character has a POKE code that is unchanging and constant.





In this game I have used character shapes for the stone walls, the Minotaurs, your player, and the gems, with enough room to spare to use custom characters for the lettering in the title.

Enjoy *Minotaur Maze*, and watch out for Elrod and Dexter! ☐ SEE PROGRAM LISTING ON PAGE 127

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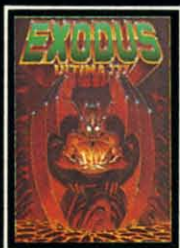


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MOUSE IN THE HOUSE

For the C-64
By James C. Hilty

Mr. Jones came home from work one day to a startling surprise—his wife was standing on the dining room table screaming. Between the “EEKS!” Mr. Jones was able to find out that there was a mouse in the house. Always one for overreacting, Jones went out and bought a cat and about one hundred mouse traps. He was determined to get that mouse.

Mouse In The House is a two-player game for the C-64. One player is the mouse and uses the joystick in Port 1. The other player is the cat and uses the joystick in Port 2. The objective of the game differs slightly for each player. The mouse must avoid the traps and the cat while trying to get the cheese. The cat must avoid the traps while trying to get the mouse. If the cat catches the mouse, the cat receives 10 points. If the mouse gets the cheese, the mouse gets 10 points. If either gets caught in a trap, the other receives 10 points. The game continues until time runs out on the timer. After every collision, the traps are rearranged on the playing screen. The cheese doesn't remain stationary. Just before moving to a new location, the cheese will turn green.

After testing the game, I can find no real advantage to being either cat or mouse. Each seems to win its share of games. Different strategies will be developed by each player.

Mr. Jones is waiting for his wife to get down from the dining room table. Maybe you can help by playing *Mouse In The House*. □SEE PROGRAM LISTING ON PAGE 143



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VIZASTAR for the C128

Vizastar, the integrated spreadsheet, database and graphics program that has the Commodore 64 world raving, is now available for the C128. It boasts 80 columns, and has over 40K of free memory in the spreadsheet. Those who already own Vizastar 64 will be pleased to know that your existing files can be read by Vizastar 128. Also, you can upgrade to the 128 version. Call us for details and pricing.

"The only other comparable product would be Lotus 1-2-3 for the IBM PC; nothing in the C64 world comes even close to the features of Vizastar."

AHOY July 85

"I found Vizastar would do anything Lotus 1-2-3 could, and then some. It's my Commodore choice to become the standard against which the others will be judged."

INFO 64 Magazine, Issue #7

"Vizastar is an exceptional package that rivals the features of programs such as Lotus 1-2-3 and offers C64 owners the kind of integrated software previously only available for higher-priced systems."

RUN Magazine, June 1985

"I scrutinized, tested and experimented with Vizastar extensively, but could find no weaknesses whatsoever. It is the most comprehensive, most flexible, most powerful and easiest to use integrated software package I've worked with."

Commodore Microcomputer, Sept/Oct 1985

"I use an IBM PC at work with Lotus 123. I feel Vizastar is just as good and in some ways better than 1-2-3."

Steven Roberson, NC, End User

"I have used Multiplan and Superbase; both are good pieces of software, but are inadequate when compared to Vizastar."

Jim Mathews, WA, End User

"So good, I bought a second C64 and Vizastar for my office. A wild bargain! You've saved me from having to buy IBM and Lotus."

Philip Ressler, MA, End User

VIZAWRITE CLASSIC for C128

This is the new word processor from Vizastar's author, Kelvin Lacy and is the successor to Omniwriter, which he also wrote. All the features of Omniwriter are there, plus many significant enhancements, like auto pagination, on-line help, pull-down menus, full-function calculator and more. Up to 8 'newspaper-style' variable-width columns can help with newsletters.

Three different proportionally-spaced "near letter quality" fonts are also built-in for use with Commodore or Epson compatible printers. You can merge almost any other word processor file directly into Vizawrite, including Paper Clip and Omniwriter. Naturally, it is also compatible with Vizastar. At all times, what you see on the screen is exactly the way it will be printed out. Vizawrite can do mail-merges and has an integrated 30,000 word spelling checker that you can expand yourself.

PROGRAM SPECIFICATIONS

Both Vizawrite and Vizastar are written in 100% machine language and run in the 128's FAST mode, making it lightning fast. They require a C128 with 80 column color or monochrome monitor. Both come with a cartridge, a diskette, and a reference manual. Vizastar also includes a 50 page tutorial book. Both work with 1541 or 1571 disk drives.

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AHOY! 55

THE EDITOR

For the C-64

By Buck Childress



h, what a machine! The Commodore 64 has so many features that it's hard to pick a favorite. For programmers, the built-in screen editor has to be a front runner. It really makes editing a breeze. With all its capabilities, it's hard to believe that the new Commodore 128 could have more. But it does. It's really something!

With that thought in mind, why don't we take some of the 128's best editing features, add some it doesn't have, stir well, and pour back into the 64? We'll call it *The Editor*!

In addition to retaining all the regular editing features of the 64, *The Editor* allows fast and easy placement of the cursor anywhere on a line or on the screen. It has an easy erase feature, and the ability to insert blank lines wherever you want. You can escape the quote, insert, and reverse modes more efficiently. *The Editor* has 'typewriter' sound. Now you can hear what you're typing as well. This is really useful, especially if you touch type.

After saving a copy of *The Editor*, run it. The loader will

POKE the machine language data into memory and check for errors. Once the loading is complete, type SYS 49152 and press RETURN.

USING THE PROGRAM

The CTRL key is used to activate the various functions. Press it simultaneously with the corresponding key.

You can tab eight spaces at a time in either direction. Press CTRL and f1 (function key) to tab forward. CTRL and f3 will tab in reverse. *The Editor* checks for the beginning and end of the current logical line and won't inadvertently tab off of it.

Oftentimes it would be handy if you could press a key and move to the end of the line you're currently working on. CTRL and f5 will do the trick. CTRL and f7 places you at the beginning of the line.

You can erase everything from the cursor to the end of the current line by pressing CTRL and the Greater Than (>) key. This is an easy key to remember, since it points toward the end of the line. Press the CTRL and Less Than (<) key to erase everything from the cursor to the beginning of the line (< points to the beginning).

Now that you can zip back and forth on a line, *The Editor* believes in giving you equal ability to move up and down on the screen. CTRL and RETURN moves the cursor down six rows at a time. If you're within six rows of the bottom, *The Editor* places the cursor at the bottom. CTRL and B moves the cursor to the bottom of the screen, regardless of your present location. Lest we forget, the HOME key moves the cursor to the top. I guess *The Editor* can't take credit for that feature, since it came with the 64. CTRL and CRSR UP moves the cursor up six rows at a time. If you're within six rows of the top, *The Editor* places the cursor at the top.

The Editor allows you to insert blank program lines in between existing lines. Let's say you're writing a program and want to add line 105 between lines 100 and 110. Using the old method, you would have to clear the screen, or cursor to the bottom (or wherever you could find a blank space), enter line 105, then list the program to have everything in order. With *The Editor*, just place your cursor anywhere on line 100 and press CTRL I. Bingo—a blank line has been inserted between lines 100 and 110. The cursor will be at the beginning of the blank line awaiting your command. If you do much programming, you'll like this goodie.

Ever find yourself inadvertently locked into the quote, insert, or reverse mode? Pressing the RETURN key isn't always the answer, especially if you're entering a line without a number (direct/immediate mode). It can make you lose your place or cause something to happen. Now you can escape by pressing CTRL and SHIFT.

The typewriter effect is 'built' into *The Editor*. All you have to do is adjust the sound on your monitor and type away. If you're touch typing, the sound insures that the keys are being pressed hard enough.

You can load, save, and work on all the programs you want without disturbing *The Editor*. If you wish to RUN your program, deactivate *The Editor* first by pressing RUN STOP/RESTORE. SYS 49152 will reactivate it.

Test drive *The Editor* and put your programming sessions in high gear! ☐ SEE PROGRAM LISTING ON PAGE 135

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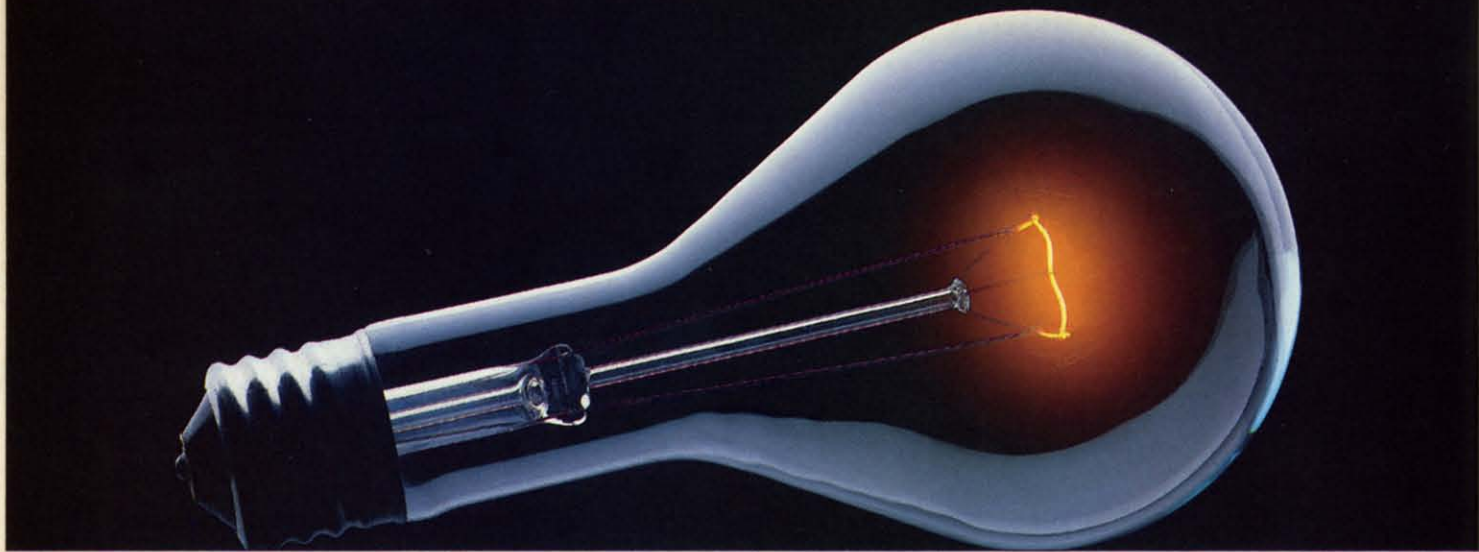
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DEVICE ONE

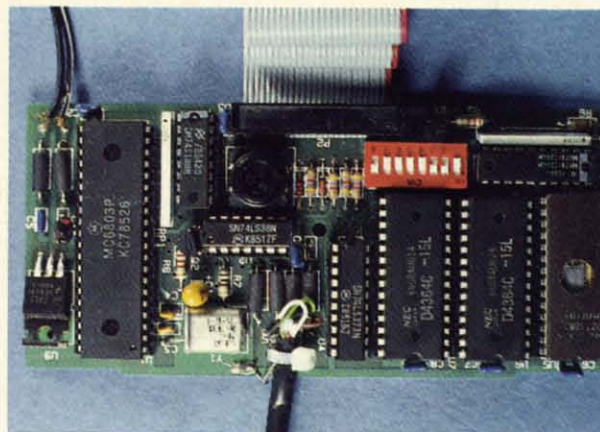
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Progressive Peripherals and Software is not a newcomer to the Commodore market. Over the years we have seen many worthy products pass through its portals to the hands of the users. In fact, we first saw an early prototype of Device One at the 1985 MARCA convention, where we were giving a presentation on printer interfacing. It was thus with great anticipation that we awaited our beta test unit of the nearly completed Device One.

Device One is a fully featured graphics interface for linking a Centronics-type printer to a Commodore computer via the serial bus. It performs the fundamental task of converting the serial data bit stream, as generated by the computer, to the parallel data byte stream required by the printer. In addition, as a graphics interface, Device One provides 100% emulation of the Commodore 1525 printer—an emulation which includes the entire Commodore character set as well as the 1525's bit map graphic capabilities. As with all current printer interfaces, Device One offers a choice among several degrees of partial emulation as well. These range from an easy to read mnemonic and keystroke translation of the Commodore control codes in program listings to a semitransparent mode with only PETSCII to ASCII translation. The latter mode is useful for sending non-Commodore control codes to your printer and with the C-128's CP/M mode.

"What's this?" we hear you exclaim. "What interest do we have in the emulation of an obsolete printer which has not been seen on a dealer's shelf for nearly two years?" It turns out that in spite of their shortcomings, the 1525 and its successors, the MPS-801/803, are the common thread which binds all C-64 printer-depen-



*Not just another pretty interface, Device One provides more features than we can summarize in a space this small. The circuit board (shown) packs over 2.6K per sq. inch. **READER SERVICE NO. 233***

dent software. Running in 1525 mode will virtually guarantee hard copy after all else fails. Besides, it is the only practical way to simply generate BASIC program listings from the VIC 20, Plus/4, and C-64/128 series of computers. For those of you who have recently come aboard *Ahoy!*, we strongly recommend the series of articles on printer interfacing previously presented (see sidebar, page 66).

The Hardware

We are not showing Device One in its final casing for the simple reason that it is not available at this time. The beta unit we received was squeezed into a Commodore surplus VIC 20 cartridge case (there seems to be an endless supply of these on the peripheral market). However, the unadorned circuit board shown here does appear to be the final version. The only significant changes we expect to see will involve shielding of the input and output cables to minimize TV and radio interference.

A quick glance at the accompanying photograph reveals a utilization of circuit board real estate which may be exceeded only by the concentration of office towers in downtown Manhattan. Upon this 12.5 square inches of fiberglass and epoxy we found no less than 16 kilobytes of RAM with an equal quantity of ROM, a 6803 8 bit microprocessor running off a 5 megahertz clock crystal, a 5 volt regulator, an eight position dip

switch, one pushbutton, three TTL chips, and several miscellaneous electronic components. This works out to better than 2600 bytes per square inch: an unconfirmed record for a Commodore printer interface. The whole thing is externally powered by a nine volt DC black box wall plug module rated at 500 mA.

Since Device One is completely self powered, there are no concerns for the source of a 5 volt supply as with most other printer interfaces. This has been a problem particularly for users of the SX-64 and the Plus/4 computers, which lack the standard Commodore cassette port, the favored source of interface power for most manufacturers. However, note that Device One has no on/off switch. Its 115 volt AC supply should come from a properly controlled source such as a switchable power strip.

The 5 volt regulator and the 6803 microprocessor sit side by side at one end of the Device One's circuit board. As a result, that end of the board tends to run a bit warm. This seemed to have no adverse effects during our many hours of testing.

The eight dip switches perform the expected printer interface functions. Three of these provide eight possible printer settings, including the Canon PJI080A color inkjet printer. Two more are for the four possible hardware operating modes ranging from full emulation to total transparency.

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D R A C O I M

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The reset pushbutton serves three functions. A quick press resets the interface; a one second press prints out the status of the interface; a three second press generates a one-page print-out of the interface's commands.

On Big RAM Buffers

RAM is to computers as horsepower is to cars. We're not always sure we will need it, but we all feel that more could be useful. Computer advertising has not failed to exploit this attitude. The amount of RAM plays a prominent part in the promotion of every computer device that uses the stuff. In the November *Ahoy!* we went into considerable detail on the value of serial port buffering. The actual benefits to be obtained are strongly related to the speed of the printer and the data transfer rate of the serial port. Device One's built-in 16 kilobytes is an effective amount. It is nearly large enough to accommodate two bit-mapped screen dumps and more than adequate for letter-sized text files. However, the real value of the 16K buffer is not in how much printer data it may hold but in the alternate uses to which it is applied. Device One can store up to eight printer character fonts in its buffer. In addition, Device One uses its

onboard RAM to optimize all its printer operations. We found its operating speed to be among the fastest we have seen.

What It Does

As a printer interface, Device One does a lot. As a printer utility, Device One does even more. In fact, Device One has so many features that it may be better thought of as a printer accessory than as a mere interface. The best part is that all of Device One's features are external to the computer. Thus no demands other than the issuing of commands are made upon the computer's memory.

We will concentrate on Device

similar to the 1541 disk drive. Finally, while in emulate mode, a double escape code (CHR\$(27)) will pass on the commands to the interface.

Perhaps the most popular feature will be the interface's custom fonts or character sets capability. Four fonts are stored in the interface's ROM. One of these is actually an emulation of the 1525 printer's font which even lacks lower case descenders! Now that's what we call emulation.

All of the interface's fonts, as well as the printer's own, may be printed in normal or near letter quality mode (NLQ). On the Star Micronics Gemini 10X printer, NLQ mode is a combination of high density (enhanced) printing and a double strike with a minute vertical offset. The result is a very good looking type. Of course NLQ does slow the printer down a bit, as two unidirectional passes of the printhead are required for each line of text.

In addition to the built-in ROM fonts and the printer's default font, the interface can store up to eight more RAM fonts in its onboard buffer. All of these downloadable fonts may be printed in normal and NLQ modes. The downloadable fonts come in four flavors. Lo-res fonts, based on a 6 x 7 dot matrix, are usable with all printers. Mid-res fonts, based on an

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One's unusual features rather than go into the details of each and every one. However, we will let Device One speak for itself with regard to all of its capabilities. The chart reproduced on page 66 is the actual command summary printout which is generated by the interface.

If you examine the chart you will notice that most features may be accessed in at least two and many times three ways. As with most interfaces, Device One responds to the secondary address of BASIC's file OPEN command. In addition, the interface has its own command channel (secondary address 15) which is very

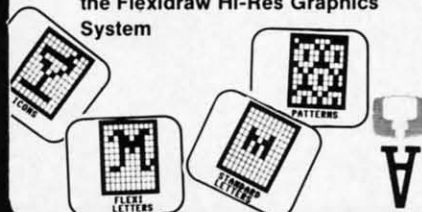
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REVIEWS

8 × 8 dot matrix, are usable with all but the Okidata printers. Hi-res fonts, based on a 12 × 8 dot matrix, may be used with Star Micronics and Epson printers. A second hi-res font, based on a 16 × 8 dot matrix, is for use with the C. Itoh, NEC, and Legend 880 printers. The hi-res fonts occupy two slots in the RAM buffer.

Device One comes with a utility disk which includes one sample of each font type, except for the 8 × 8 font, of which there are 22 varieties. These include disk files of the four ROM fonts. The disk also includes a full featured font editor to let you create your own or modify the provided fonts. Most of the fonts are complete upper- and lowercase sets. Seven are uppercase only and two substitute the Greek alphabet and a mathematical symbol set for one of the cases. The utility disk also includes a font capture program which will dump an 8 × 8 font from the computer's memory. This may enable you to capture fonts from some other programs.

Fonts are one of the less exotic features built into Device One. Have you ever forgotten a date? With Device One you may never again. Just feed it a month and a year along with the appropriate prompt and it will spit out a complete calendar for that month. If you need a banner in 8" high letters, Device One will do that as well. What's more, you can use any of the fonts as well as underlining and other text features in the banner.

Download Mode

We've saved the best feature for last. Device One has a special "download" mode which does some pretty amazing things. Upon receipt of the appropriate command, Device One will recognize one of four classes of data files and treat each one accordingly. Text files will be sent to the printer both with and without PETSCII to ASCII conversion. Font files will be automatically stored in the appropriate section of the onboard buffer. An eight kilobyte hi-res bit map will be automatically formatted to the printer in four possible ways: large or small in either fulltone or halftone.

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- Irregular-length measures and durations allowed
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Fulltone dumps may be further influenced by the status of the NLQ mode. Finally, directories will be automatically listed to the printer. All you need do is issue the appropriate command over the command channel or via a double escape code sequence and send the data to the interface via a file with secondary address one.

"Now that sounds great," we hear you exclaim, "but you have obviously taken leave of your senses. The screen dump sounds like a useful gimmick but aren't all interfaces supposed to send text files to the printer? Besides, what's the big deal about listing a directory?"

The real gimmick is that you don't have to send the data directly to the interface. From the time the download command is issued, Device One patiently listens for any and all serial bus file transfer activity between the computer and the disk drive. This could be a LOAD or SAVE operation or even a VERIFY. Once a file transfer commences, Device One greedily gobbles a copy of every passing byte till the file has completely gone by. Only then does processing begin. In the case of a VERIFY, the possibilities are awesome. Any of the four file formats may be passed on to and processed by the interface without disturbing the current contents of the computer's RAM!

In the case of text and directories, printing will start as soon as the file transfer is complete. Pictures are handled differently. Printing is delayed till a series of lines are sent to the interface. If these are all blank, just the picture will be printed. If the lines include text, it will overlay the image. This effect works well with a halftone dump as the image forms a background to the text. It is even possible to offset the image margin and print text and a graphic side by side.

Downloaded images must be pure, 8000 byte bit maps, stripped of all color data. *Flexidraw*, from Inkwell Systems, is the only graphics package we know of which normally saves images in this format. All others combine their image files, with the bit map's color information, in varying ways. To get around this problem,



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the Device One utility disk includes a *Printerizer* program which will process the image files of 10 popular C-64 commercial graphics programs in both hi-res and multicolor formats. Hi-res images have a 320 pixel horizontal screen resolution, while multicolor files have only 160 pixels. The tradeoff is that the latter can support nearly twice the color diversity of the former.

The *Printerizer* does more than just strip the color from the file. It lets you manipulate the image for the most pleasing results. The colors are analyzed so the resulting bit map may be transformed to a shaded gray scale representation. The shading may be either a predefined fixed pattern or

a randomized effect. You may also just strip the color or negate the entire image. All these effects are visually displayed and instantaneously reversible to the image's original state. This permits experimentation till the desired effect is achieved.

The download mode has one major restriction. It only works at normal 1541 speeds. Thus all fast loaders as well as 1571 fast operation must be disabled or removed. You will also discover many limitations to downloading when using commercial software. In this case all downloading should be done before booting the software.

With regard to commercial software, the Device One utility disk

DEVICE ONE COMMAND SUMMARY

DEVICE ONE SECONDARY ADDRESSES

- 0 Upper case/graphics emulate
- 1 Download mode, for fonts, pictures, text, and directories
- 2 Semi-transparent, all DEVICE ONE special features active
- 3 Semi-transparent with ASCII conversion
- 4 Transparent with switchable linefeeds
- 5 Transparent with no linefeed
- 6 Transparent with ASCII conversion and switchable linefeeds
- 7 Upper/lower case emulate
- 8 Calendar, send mm-yyyy and DEVICE ONE prints that calendar
- 9 Banners, all letters come out sideways and 8" tall
- 10 Decimal dump
- 11 Hexidecimal dump
- 12 Hi-res screen dump, send all bytes from hi-res screen
- 13 Upper case lo-res screen dump, send all screen bytes
- 14 Upper/lower case lo-res screen dump
- 15 Command channel
- 20+ Lock the interface

COMMAND CHANNEL COMMANDS

Command channel commands can also be sent in emulate or semi-transparent modes, simply send 2 escapes followed by the command. Commands may be stacked if sent to the command channel only, i.e. "UIB1."

- B Banner mode
- Cm-y Print calendar, m is the month number, y is the 4 digit year
- DA Download text file, print with ASCII conversion
- DLx Download lo-res font (6x7), x is a number between 1 and 8
- DMx Download mid-res font (8x8), x is a number between 1 and 8
- DHx Download hi-res font (12x8/16x8), x is a number between 1 and 4
- DP Download hi-res picture
- DT Download text file, print in transparent mode
- D# Download disk directory
- E Empty buffer contents
- FLx Enable lo-res font, x is between 1 and 8
- FMx Enable mid-res font, x is between 1 and 8
- FHx Enable hi-res font, x is between 1 and 4
- FRx Enable rom font, x is between 1 and 3
- FS Standard font
- FUx Font underline, x=1 for on, x=0 for off
- FXx Font expand, x=1 for on, x=0 for off
- Gx Print picture, x=1 for small, x=2 for large, merges picture with text that is sent subsequently
- Hx Print picture in halftone, x=1 for small, x=2 for large
- I Print the interface status message
- Lx Special listing mode, 0 is off, 1 is on
- MLx Set left margin, x is a 3 digit number or 's' for current cursor position, default is 1
- MRx Set right margin, x is a 3 digit number or 's', default is 80
- Nx Set NLG mode, x=0 for off, x=1 for on
- PFx Set last line of page (footer), x is a 2 digit number, default is 66
- PHx Set first line of page (header), x is a 2 digit number, default is 1
- PMx Set message line, x is a 2 digit number, follow the dash with whatever message you like, '#' will be replaced by the page number. Turn off with PM99
- PPx Set page length, x is a 2 digit number, default is 66
- P#x Set page number, x is a 2 digit number
- Q Print this quick reference sheet
- R Release buffer, erases stored fonts and pictures
- Sx Set bitsize, x=0 for standard, x=1 for proportional
- U Unlock DEVICE ONE, undo effects of secondary address + 20
- #x Set device number, x is between 4 and 7

FONT 3 SYMBOLS

a# b# c# d# e# f# g# h# i# j# k# l# m# n# o# p# q# r# s# t# u# v# w# x# y# z#

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The publisher cannot assume responsibility for errors in the above listing.

comes with prepared printer driver files for use with *Superscript*, *Paperback Writer*, and *Word Writer 128* for the three most popular printer types.

The Final Feature

Last but not least we mention Device One's letterhead mode. This lets you set top and bottom page margins, as well as header or footer text to be printed on every page. This text can also be a downloaded bit map for printing in halftone mode on every page to create the effect of customized stationery.

TABLE OF AHoy! REFERENCES FOR PRINTER INTERFACING

1. March 1984, pp. 27-30: *Printer Interfacing for the 64 & VIC*
2. April 1984, pp. 19-25, 78: *Printer Interfacing for the 64 & VIC Part II*
3. April 1984, pp. 53-54, 94: *Lower Case Descenders with the VIC 1515/1525 Printers*
4. December 1984, pp. 19-21, 85: *Printer Interfacing Revisited Part I: The 1525 Printer—A Tutorial*
5. February 1985, pp. 103-108: *Getting the Words Across: Printer Interfaces for the Commodore Computers*
6. February 1985, pp. 108-116: *Printer Interfaces: Four Reviews*
7. March 1985, pp. 101-108: *Printer Interfaces: Conclusion*

Conclusions

There is no question about it. Device One has more features and a bigger buffer than any other interface currently available. It will be sure to shake up the current state of Commodore printer interfacing. Many of its features have proven to be quite addictive in the brief interval that we have had the interface. Although a number of these features are available as separate utilities or as part of other software packages, several are unique to Device One. There is also something to be said for having these features always online. The real question is just how much you are willing to pay for all this power. Device One's asking price is nearly double the going rate of its most feature laden competitor. The decision will be even more difficult for owners of a per-

fectly functional, albeit modestly appointed printer interface. As usual, it is you the user who will make the final decision.

XREF 128

**Abacus Software
Commodore 128
Disk; \$17.95**

If you have ever programmed in a high level language on a mainframe computer, you already appreciate the value of a cross-reference utility. If your programming experience has been limited to microcomputers, a strong feeling of frustration may be your only indication that something is missing. In fact, the value of a cross-reference utility to the BASIC programmer is so great that we are puzzled that only Abacus Software offers one for the Commodore market. We find nearly as puzzling the fact that with no competition, Abacus has the nerve to charge so little for this product.

What *XREF 128* does is generate an organized listing of the line numbers on which virtually everything that is important in a BASIC program appears. The only things that *XREF 128* will not cross-reference are strings between quotes. If you have ever written, or analyzed, a BASIC program longer than 10 lines, you should immediately appreciate the value of *XREF 128*.

Although *XREF 128* lacks the bells and whistles (consisting of flashy colors and sounds) that many Commodore utilities feel obligated to provide, it does not lack convenience or operational flexibility. In fact, *XREF 128* may be tightly controlled to do only what you want it to do. This can be very useful when analyzing long programs. Searching, sorting, organizing, and formulating lists are time-consuming activities. The ability to limit a search and sort to specific items can be a great timer saver. *XREF 128* offers several degrees of flexibility for its sort criteria.

Your first selection is whether to cross-reference only BASIC keywords, only non-keywords, or both. Since the entire program is loaded into memory prior to analysis, choos-

REVIEWS

ing only one item lets you analyze a larger program. Programs up to 53 kilobytes can thus be processed in two passes. *XREF 128* makes this very convenient by letting you analyze a program as many times as you like while changing the analysis parameters between passes.

The analysis may be further refined by specifying a starting and ending line number, keyword range, or variable range. All parameters are entered in response to screen prompts. Choosing the conveniently provided defaults will result in a listing showing the line numbers where all keywords, variables, line number references, symbols, and values are to be found in your BASIC program.

Since *XREF 128* listings, for all but the shortest programs, are apt to be lengthy, the preferred output device is the printer. Just in case, *XREF 128* lets you select device number and secondary address for your printer. If you wish you may opt for screen output. If you do you will find the C-128's NO SCROLL key to be an invaluable aid. Screen output may be viewed on either the 40- or 80-column display. However, the only benefit of the 80-column display is output visibility when using fast mode. *XREF 128* always formats screen output to 40 columns. The only other side effect of the 80-column display is that you will miss a rather vigorous, and lengthy, copyright message while the program loads.

As is our custom, we have left *XREF 128*'s best feature for last. *XREF 128* gets its keyword token assignments from a disk file. This means that you can maintain different token files for extensions to, or different versions of, Commodore BASIC. While the manual specifically mentions Abacus' *Graphic System 128* as an example, we feel this feature will be of greater benefit for existing Commodore packages. Custom token files for C-64 BASIC extensions, such as *Simons' BASIC* or *Super Expander 64*, will let programs written for these extensions be analyzed on the C-128. Even programs for the *VIC 20 Super Expander* or the C-16/Plus 4 can be managed!

Of course a detailed knowledge of the keyword tokens for the BASIC extension under review is required. This can always be obtained by experimenting and PEEKing about, preferably with a machine language monitor. If *XREF 128* does encounter a token it cannot recognize, it will flag the corresponding ASCII value with a question mark. In any event, we can always hope that some altruistic user will generate the necessary token files and submit them to Abacus, who will see fit to include them on future releases of the program disk.

For modification of the token file, the KEYGEN utility is provided on the disk. *XREF 128* can manage up to 400 tokens. BASIC 7.0 uses about 170 tokens. All BASIC tokens have values greater than 127 (bit seven is always set). This limits BASIC to only 128 single byte tokens. BASIC 7.0 gets around this limitation by using two-byte tokens for most of its new keywords.

Operation of *XREF 128* is simple enough. Just respond to the onscreen prompts as they appear. The program to be analyzed as well as the token files will have to be on disk, but not necessarily the same one. If you cannot remember the file name, just enter a question mark and the disk directory will be displayed.

The printout is neatly organized with keywords first, numbers second, variables third, and functions last. All keywords are shown with an apostrophe as the first character. Keywords and variable names are limited to the display of only the first six characters. Just remember that BASIC only uses the first two characters to distinguish among variables.

At \$17.95, *XREF 128* is a true bargain. Even if you value your own time at no more than minimum wage it will pay for itself the first time you use it. The only complaint we can find about *XREF 128* is that the program disk is copy protected. We would hope this would not be necessary on such a low-priced utility.

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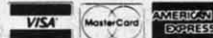
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Having been one of the most prominent manufacturers of games and entertainment software for the Commodore 64 for years and not content with their dominance in that area, Activision has expanded into productivity software: word processors, spreadsheets, databases, and other serious home and business-related products. Following their purchase of Creative Software, Activision improved and rereleased *Creative Writer*, *Creative Calc* and *Creative Filer* as the first installments in their Personal Choice line. While these packages were originally designed to run only on the 64, Activision created better versions for the 128 and offers both in the same package. Though both programs in each module function similarly, the C-128 programs take advantage to the 80-column screen and faster operating speed.

Three for the Price of One

Though they can work together, the three programs can't really be called integrated, since files created with different modules aren't interchangeable. Integration between the *Filer* and *Planner* modules is nonexistent, though information from both of these can be included in documents created with the *Writer* module.

Reports from the *Filer* and *Planner* are easily imported into letters and reports created with the *Writer* package. If you need to do some editing to the information in the imported reports, they can be read into the *Writer* document and then edited to add fancy formatting commands or to delete unneeded data. Or, if you are trying to conserve space in your *Writer* document, an include command is used to read the second file in when the document is actually printed.

Information from the *Filer's* fields can also be used to replace variables in *Writer* documents. For instance, names and addresses from *Filer* can be used for form letters.

All modules are menu-driven. The first function key calls up the menu. Options from the menu are chosen by first letter. Disk functions are limited to creating, deleting, and saving files, though the modules will initialize data disks.

Though there is no function to copy a file, it's easy to save the file under a different name for backup purposes. I find this a serious limitation, as it is easy to forget to make backup copies of your work. In addition, there is the problem of saving the file under the same filename. Having to delete the original and then resave the new copy under the old name is a hassle.

One major change made was the documentation. The new manuals are spiral bound, easy to handle, and look durable. Each contains a short tutorial demonstrating an actual working session with the software. A reference section at the back explains commands and procedures. A quick reference booklet is also included.

The appendix section on printers explains the limitations of the Commodore printers, as well as the suggested switch settings for the various third party printers and interfaces. A few printer and interface combinations won't work at all.

Writer's Choice

Documents created are limited in size to 600 lines by 40 columns (24,000 characters) in the C-64 version, 500 lines by 80 columns (40,000 characters) in the C-128. While the C-64 can only display 40 columns, documents can be as wide as your paper will allow. By linking files, longer documents can be printed with consecutive page numbers.

Writer's Choice has most of the commonly desired word processing features. According to the print time options, you can print up to 999 copies and you can start page numbering as high as 999. A pause between pages option allows the writer to use single-sheet feed printers.

A menu controls page formatting features. Right justification is supported. Page numbers can appear at top or bottom or be omitted, but can't

be automatically incremented in the single header and footer.

Line spacing is also set from this print formatting menu or from within the document. Up to 10 lines of space may be put between lines of text. All margins are set from this menu. Left and right margins can be set in the document. Page length is also fully adjustable. You cannot specify a header or footer margin size.

The forced page break option is simple to use, but the widow prevention option is limited to five lines of text or less. Thus, a table might get cut in half.

Block functions (copy, delete, place, move, and save) are also simple. A find/find and replace option is included. Non-printing comments can be included for reference.

Format codes can be imbedded to activate a printer's special functions. These aren't explained, so you must be familiar with your printer and know what commands to send. Although boldface and underline are offered as control functions, the documentation warns that they only work with a couple of third-party printers.

A spelling checker program is included. It is not integrated into the word processor and must be loaded separately. Suspected misspellings are displayed in context and alternatives can be substituted as the mistakes are checked. New words can be added to a special dictionary that is also used. While not the easiest spelling checker I've ever used, it is certainly a nice option to have.

I did have one unexplained difficulty. The display is supposed to present information in the top and bottom screen lines. Both these lines were missing on my C-128's display. Since the top shows the current cursor position and the bottom the memory space used, it was an inconvenience not to be able to see them.

Filer's Choice

Filer's Choice offers features typical of most database programs. Individual menu options control creating the database form, adding data, searching for and modifying specific information, and printing out reports.

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The design form section is relatively easy to use. Arrow keys are used to move the cursor around and place field names. Form size is limited to 80 rows by 40/80 columns depending on whether you're using the 40-column C-64 or 80-column C-128.

Adding data is simple. Moving between fields is done using the RETURN key. Information from the last record can be duplicated to the current record saving typing. Entries can be printed individually.

The report formats are quite flexible, though not as easily set up as the form design. Report forms can be saved and retrieved from disk for later

use. Reports can have a title and header. Page length, number of blank lines at bottom, page numbering, and number of characters for each field are specified at print time. Output can be sent to your choice of screen, printer or disk.

The upper leftmost field is the key field. One alternate key field can be selected. These are used to determine the order in which records are displayed when browsing through them.

The search function is very flexible, offering searches on any or as many fields as desired. Mathematical operators can be used to help isolate specific records.

Planner's Choice

Planner's Choice offers a slightly bigger spreadsheet than two top competitors, *Multiplan* and *SwiftCalc*. Its 255 by 255 cell work area is only slightly larger than *SwiftCalc*'s 250 by 250, but four times as wide as *Multiplan*'s 255 by 63. Of course, this means a tradeoff in features.

Cell size is easily set and adjusted. Rows or columns can be inserted anywhere provided there is enough room left at the outer edge of the spreadsheet.

Cell formatting options are adequate. Integer, fixed point, dollars, and left, right, or centered positions are offered.

Planner's Choice offers the most common spreadsheet functions: ABS, ATN, AVG, CNT, COS, EXP, FVL, LOG, MAX, MIN, PMT, PVL, SIN, and SUM. All the standard math operators can be in formulas. Cell references in formulas may be typed in or referenced by pointing them out with the arrow keys. Formulas may be adjusted as they are copied, so relative references are maintained.

Report margins, page lengths, and page numbers are set at print time. The program can be set to output ASCII or PETASCII. Control codes can be sent to turn on special print functions like condensed printing. Reports can be sent to screen, printer, or disk.

Conclusions

For a combined price of \$100, these packages are good for folks on a budget. Though probably adequate for home users, some small businesses will push the capabilities to their limits and want something more powerful. Because it's uncomplicated, though, this isn't a bad starter system.

Activision, Inc., 2350 Bayshore Parkway, Mountain View, CA 94043 (phone: 800-227-9759).

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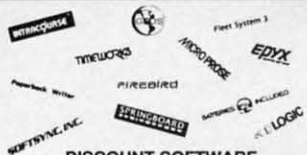
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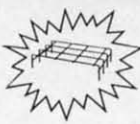
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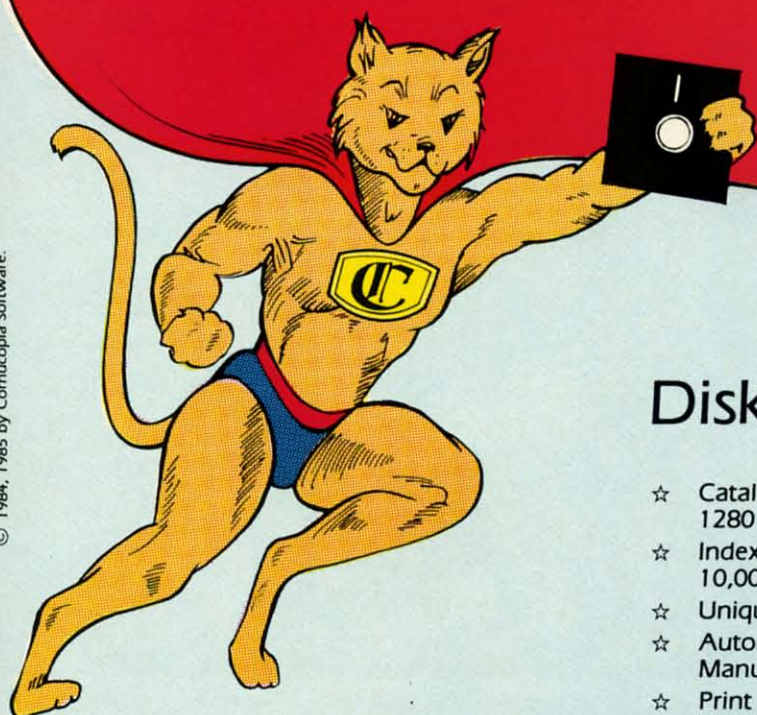
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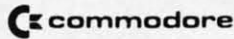
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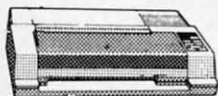
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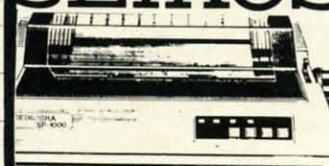
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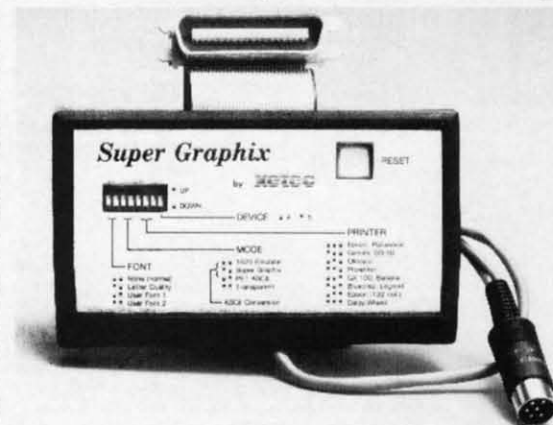
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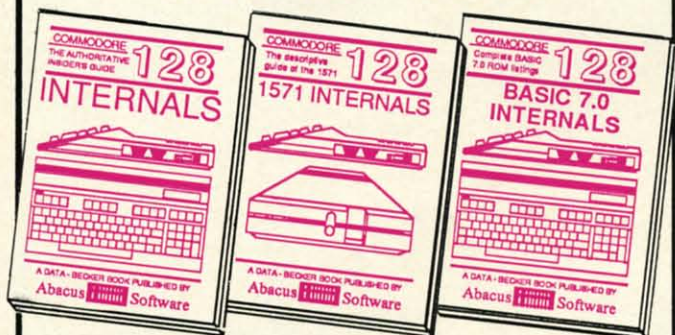
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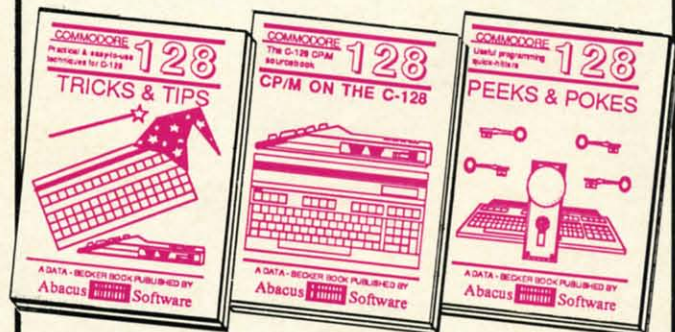
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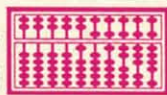
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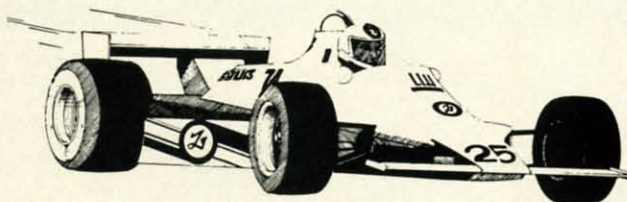
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By Tony Brantner

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The third prompt asks you to select the road condition. On a dry road, traction is excellent. A wet track makes steering more difficult, while an icy track makes driving hazardous.

After making your choices, the game screen appears. A joystick plugged into Port 2 controls the red car, and if the two-player version is chosen, a joystick plugged into Port 1 steers the yellow car. Pressing the appropriate joystick to the right turns the car clockwise, and pressing it to the left turns the car counterclockwise. The fire button represents the car's accelerator. At the bottom of the screen, you will find the laps completed by the red car, the elapsed time, and the laps completed by the yellow car.

Should the two cars collide, they simply bounce off each other. Likewise, no damage is done if your car runs off the road. However, getting back on causes you to lose time, since the cars tend to get bogged down in this area. □

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