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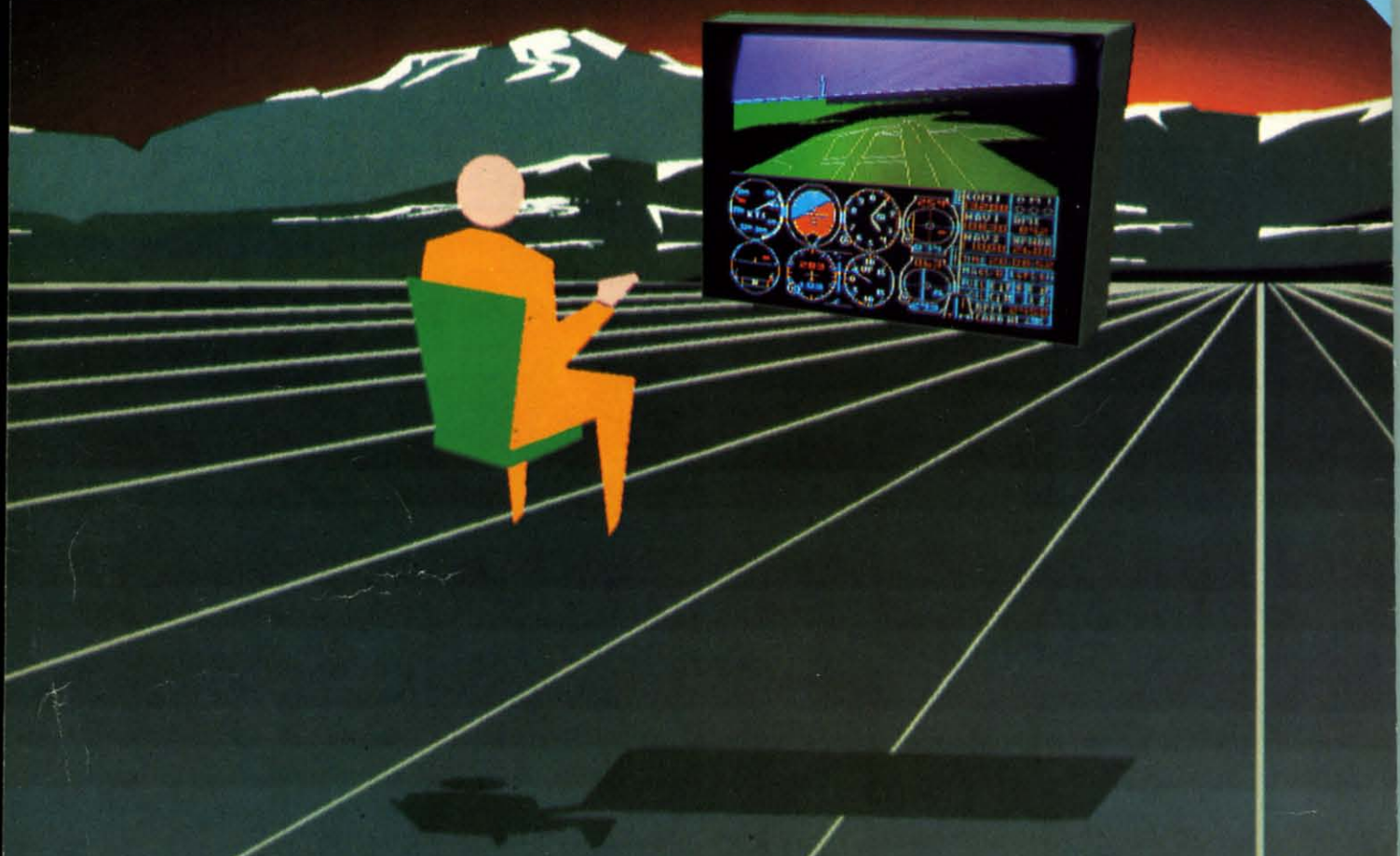

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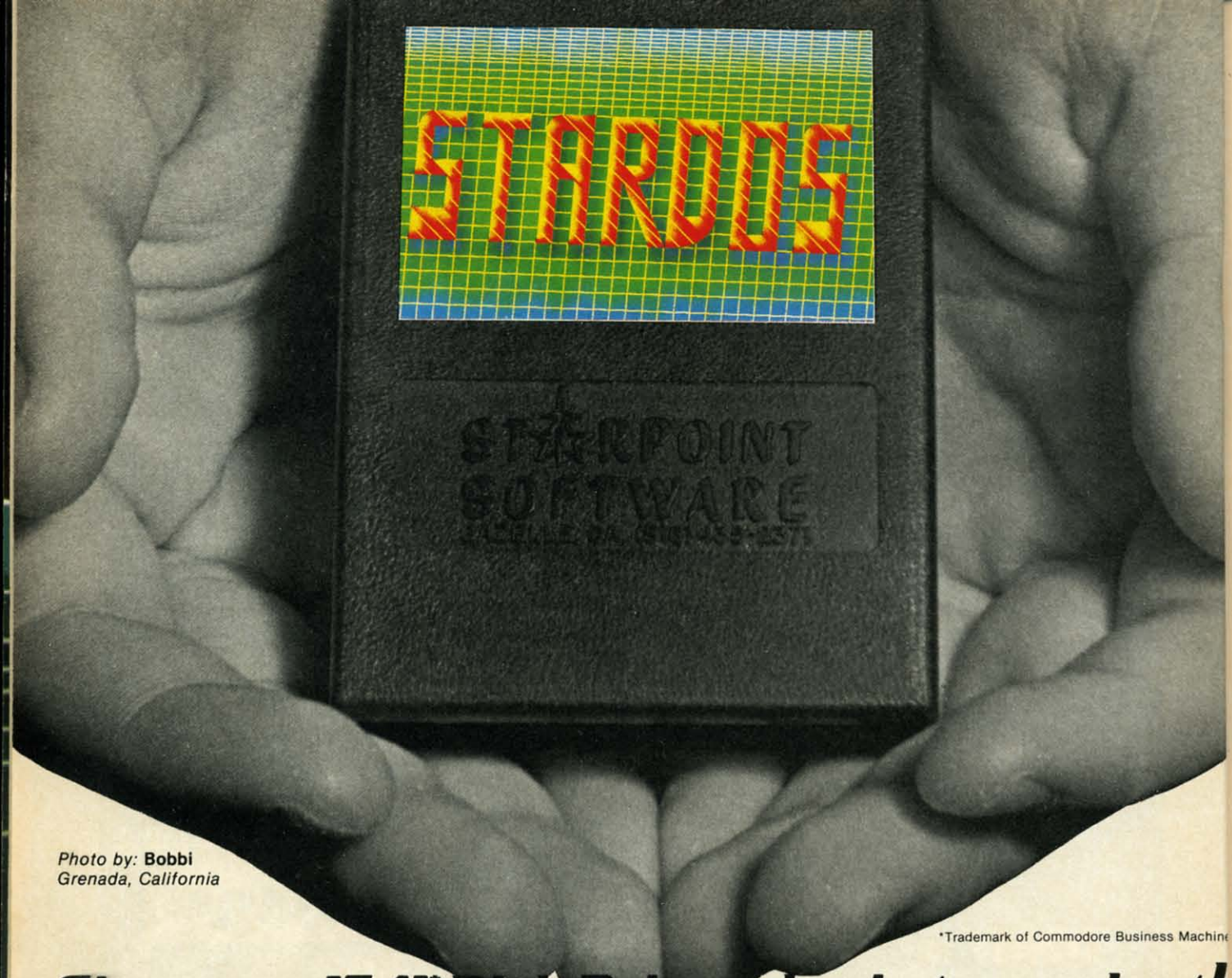

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VIEW FROM THE BRIDGE

We'd love to jump right on this month's big news—the debut of our Entertainment Software Section—but feel obliged to begin with an apology. Several features pre-announced last month do not appear in this issue. An assortment of factors combined to force us to do what we like to do least: break our promise to you. All this month's phantom features have been rescheduled for upcoming issues.

Another broken promise: we told you last month our entertainment section would be eight pages long. But Arnie Katz was so thrilled at the chance to establish a definitive monthly forum for the Commodore entertainment market that he ran on to ten pages. Arnie begins this month with *Call to Adventure*, a look into the theory and history of adventure games. He and other games experts provide reviews of six current Commodore titles, adventure and otherwise. (Turn to page 49.)

But our newly expanded coverage of the games market doesn't mean we'll stop offering the best program and articles available on every other aspect of Commodore home computing:

Caving in to the complaints of readers who can't wait until they've completely entered an *Ahoy!* program to see all their typos, we present the *Instant Bug Repellent*. (Turn to page 73.)

If your budget is so tight that you haven't yet purchased one of the many quick-loading utilities for the C-64, *Lightning Loader* will provide some low-budget relief. (Turn to page 74.)

File Scout supplies screen and printer output of the most important file parameters for PRG, SEQ, and USR file types. (Turn to page 70.)

Technical Editor David Barron's *Rhythmic Bits* provides control over the usually neglected component of Commodore music-making: rhythm. (Turn to page 76.)

The Knight's Tour brings to the computer screen a chess puzzle that dates back to the Middle Ages. (Turn to page 73.)

Chopper Flight requires you to maneuver between two adjacent apartment buildings, rescuing the prisoners of ruthless terrorists. (Turn to page 117.)

You've never seen a snake *Slither* as fast as the one you must maneuver through a vast array of mazes, gulping down prizes. (Turn to page 35.)

Sprites are by nature highly kinetic creatures, but Orson Scott Card has done a stellar job of pinning them down in the last few installments of *Creating Your Own Games on the VIC and 64. Interrupting Your Way to Fast Motion* provides a machine language interrupt routine that will let you move one sprite but animate eight. (Turn to page 18.)

What do you get if you place an infinite number of monkeys at an infinite number of typewriters? Don't drain your bank account to find out—Dale Rupert solves the age-old puzzle the mathematical way in this month's *Rupert Report* on *Monkey Business*. (Turn to page 37.)

Many writers have dealt with high-resolution graphics within these pages, but Mark Andrews approaches the subject with special attention to the student of machine language in *Getting Graphic*, this month's edition of *Commodore Roots*. (Turn to page 91.)

Envious of the great programs Dale Rupert, Orson Scott Card, and Mark Andrews include with their columns each month, Cheryl Peterson gets into the act with *CompuLoan*, a loan payment calculator provided with this month's *Cadet's Column*. Also included: *TX2BAS*, an enhanced version of one of the more useful short utilities available in the public domain. (Turn to page 97.)

There's much more inside, which we'll let you discover for yourself. (But don't overlook pages 75 and 77. They provide details on the new *Ahoy! Access Club*—an organization that will make you bless the day you became an *Ahoy!* subscriber. Or become one right away!)

—David Allikas

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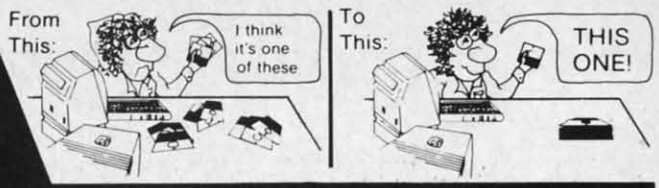

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The D12/10 prints at 12 characters per second, utilizing Brother ribbons and daisy wheels. Eight languages and numerous print capabilities are supported.

Included with both printers is a built-in Commodore interface and a disk-based version of Professional Software's *Fleetwriter* word processor (see review in May '85 *Ahoy!*).

Blue Chip Electronics, Inc., Two West Alameda Drive, Tempe, AZ 85282 (phone: 602-829-7217).

The SP-5500 Professional Printer will print up to 136 columns at 180 characters per second. Also offered are near letter quality print, graphic capabilities, downloadable character sets, and 3K buffer. Price is $699.00.

Sakata U.S.A. Corporation, 651 Bonnie Lane, Elk Grove Village, IL 60007 (phone: 312-593-3211).

OKIMATE 10 PRICE CUT

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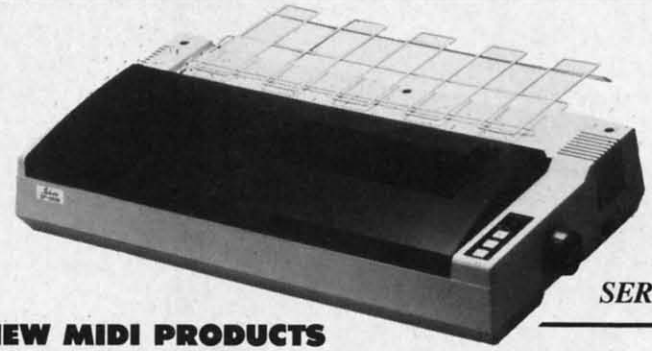
Okidata, 532 Fellowship Road, Mt. Laurel, NJ 08054 (phone: 609-235-2600).



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Passport Designs, Inc., 625 Miramontes St., Half Moon Bay, CA 94019 (phone: 415-726-0280).

From Q-R-S Music Rolls comes *MIDI Magic* ($49.95), a cartridge that connects the C-64 or C-128 to MIDI instruments. Included is a six-song demo disk.

Q-R-S Music Rolls Incorporated, 1026 Niagara Street, Buffalo, NY 14213 (phone: 716-885-4600).

BASIC HELP SCREENS

Help Master 64 provides the user a set of online help screens for all 69 commands of C-64 BASIC, supplying verbal descriptions of commands and their parameters, abbreviations, syntax examples, and reference page numbers for the *C-64 User's Guide, Programmers' Reference Guide*, and the *Handbook of BASIC for the Commodore 64* (included with the *Help Master* package). The program uses none of the BASIC RAM employed by programmers, or interferes with programming in any way. It is also compatible with the Commodore DOS wedge.

Master Software, 6 Hillery Court, Randallstown, MD 21133 (phone: 301-922-2962).

HARMONY NAME CHANGE

International Tri Micro's integrated spreadsheet/database/business graphics program, announced in the June *Scuttlebutt* (see page 7), has undergone a name change, from *Harmony* to *TEAM-MATE*. A C-128 version will be added by September 15; owners of the C-64 version will be able to upgrade for $5.00.

International Tri Micro, 1010 N. Batavia, Suite G, Orange, CA 92667 (phone: 714-771-4038).

FOUR HOME UTILITIES

Peace of Mind comprises four home utilities for the C-64: *Home In-*

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ventory (for up to 200 personal belongings), *Credit Card Guardian* (holds data on up to 60 cards), *Private Messages* (100 lines of requests, instructions to family members, sentimental messages—morbid enough for you?), and *Vital Statistics* (50 pages of important facts about bank accounts, location of will and safe deposit box key, etc.). On disk; $19.95.

Spectrum 1 Network, 9161 Beachy Ave., Arleta, CA 91331 (phone: 818-897-2060).

NEW GAME RELEASES

More details on the three new MicroProse simulations for the C-64 mentioned last month, each $34.95:

Gunship simulates the new AH-64 Apache attack helicopter, with multiple weapon and navigation systems and 3D graphics. The pilot maneuvers among multiple building and terrain environments on one of seven missions that include anti-tank sorties, rescues, and covert operations.

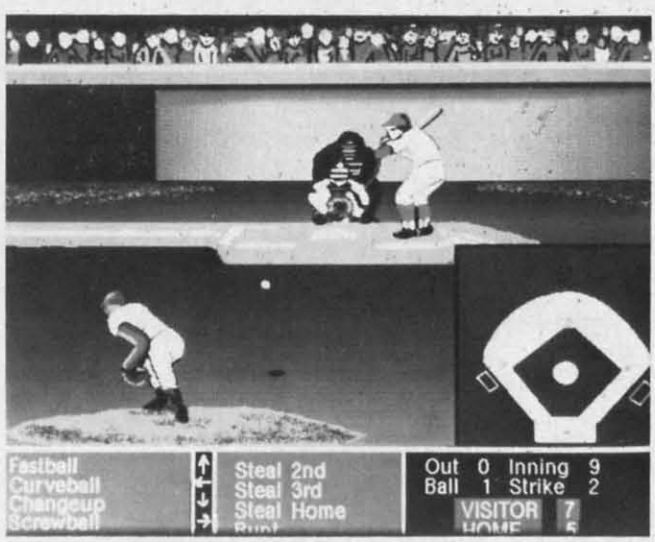
Silent Service lets you captain your own WWII United States submarine, with simulated views from the engine room, conning tower, and ship's bridge, combat with both the 5 inch gun and Mark XIV torpedoes, and strategic play utilizing maps and charts of the Southwest Pacific.

Acrojet allows pilots who have soloed in MicroProse's *Solo Flight* to fly their own BD5-J jet in an aviation decathlon that includes spot landings, ribbon cuts, and other high performance maneuvers.

In conjunction with Cessna Aircraft Company, MicroProse is holding a "Learn to Fly" contest. The winners receive a chance to qualify for a pilot's license, a solo package, or an introductory flight on a Cessna. Details will be packaged with MicroProse's *Solo Flight, F-15 Strike Eagle,* and *AcroJet.*

MicroProse Software, 120 Lakefront Drive, Hunt Valley, MD 21030 (phone: 301-667-1151).

Battalion Commander ($39.95), designed for beginning to intermediate C-64 war strategists, consists of five scenarios: Novice, Pursuit and Exploitation, Meeting Engagement, Attack, and Defense. Nationality of opposing forces (US, Soviet, or Chinese), their relative strength, and type of terrain can all be adjusted.



Hardball, *latest in a long line of computer baseball simulations claiming to be "the most realistic ever," is both action and strategy oriented. READER SERVICE NO. 299*

Penalty shot provides head on view of goaltender READER SERVICE NO. 300

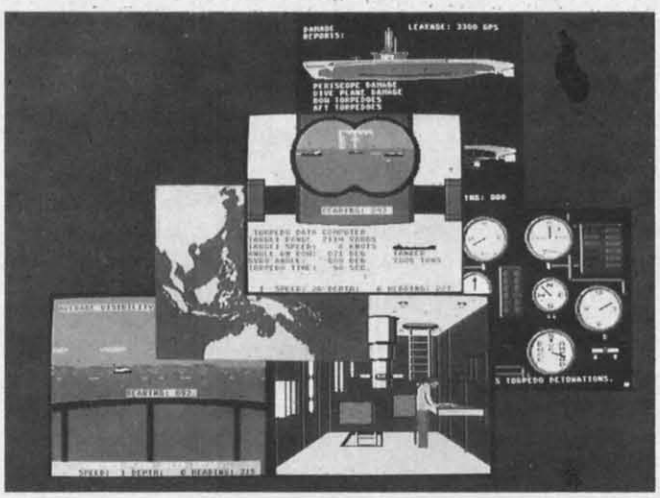
Automatic time scaling keeps action constant. Complexity is adjustable. READER SERVICE NO. 101

Strategic Simulations Inc., 883 Stierlin Road, Bldg. A-200, Mountain View, CA 94043-1983 (phone: 415-964-1353).

From Accolade, the new venture of Activision founders Alan Miller and Bob Whitehead, comes *Hardball* ($29.95), a baseball contest for the 64 and 128 offering three field perspectives and six different pitches—fastballs, sinkers, sliders, curves, screwballs, and changeups. In addition to controlling his players by joystick, the manager must make decisions concerning substitutions, base stealing, positioning of fielders, and more.

Accolade, Inc., 20863 Stevens Creek Blvd., Cupertino, CA 95014 (phone: 408-446-5757).

Brimstone ($39.95) challenges Sir Gawain to escape from the underworld of Ulro. Packaged in hard-



Silent Service *provides a variety of scenarios, from single ship attacks to multi-patron missions. Sophisticated attack plotting system utilizes maps and charts of entire Southwest Pacific.*

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bound book form, the interactive text adventure for the C-64 operates in real time, with a constantly changing universe of characters and events.

Synapse Software, subsidiary of Broderbund Software, 17 Paul Drive, San Rafael, CA 94903-2101 (phone: 415-479-1170).

International Hockey, a sequel to *Slapshot Hockey,* includes the same speech synthesis and true two-player action, but now allows the user to play against the computer. Additionally, overly aggressive play will now provoke a bench-clearing, glove-throwing fight scene, after which penalty shots can be awarded. For the C-64; $24.95.

Artworx Software Company, Inc., 150 North Main St., Fairport, NY 14450 (phone: 800-828-6573 or 716-425-2833).

Bust-A-Program challenges users to load, save, copy, and gain entrance into a basic program listing by discovering and using assorted programming clues. The program itself will show you how to copy and list protect your own programs. When you break into it and modify it, you'll get a chance to win some computer products. On tape or disk for the C-64, C-128, C-16, or VIC 20; $12.95.

Creative Enterprises, P.O. Box 4253, 1714 Sandalwood, Thousand Oaks, CA 91360 (phone: 805-492-0568).

Three new C-64 releases from Microphys, each $24.95; *Scrab Bull* (like the TV show of almost the same name),*Wrath of Otto* (patterned after the TV show *Press Your Luck!*), and *Cryptograms.*

Microphys, 1737 West 2nd St., Brooklyn, NY 11223 (phone: 718-375-5151).

SING-ALONG SOFTWARE

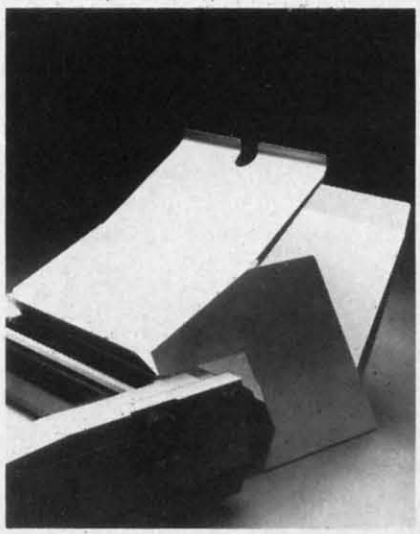
An improved version of *Christmas Carols* features professionally arranged versions of 18 traditional holiday songs, utilizing all three of the 64's voices and revised for easier singing. The words appear in easy-to-read verses under Christmas scenes.

Party Songs also features 18 traditional favorites arranged in three-part harmony, such as *Oh! Susanna, Red River Valley,* and *My Old Kentucky Home* (not to mention *Who Threw the Overalls into Mistress Murphy's Chowder?*).

Words appear onscreen while your favorite carols play. READER SERVICE NO. 102

Each is available on disk for $15.95.

John Henry Software, 1252 Crestwood Hills Drive, P.O. Box 745, Vandalia, OH 4537 (phone: 513-898-7660).



Holds paper entering/leaving printer. READER SERVICE NO. 103

FANFOLD I/O SYSTEM

Positioned behind your printer, the Porter system will hold blank paper and display and store the resulting printout. Up to 1000 sheets of fanfold paper can be accommodated in eight inches of space. Cables can exit from the left, right, or rear of the printer without interfering. Price is $64.50 for the 80-column model and $74.50 for the 136-column model.

Peri-Comp, Inc., P.O. Box 188, Lake Geneva, WI 53147 (phone: 414-248-8585).

EDUCATIONAL PROGRAMS

Utilizing animated color graphics, *The Body in Focus* lets children aged 10 and up examine the body's inner

NEW FOR COMMODORE 64 / 128

HOME INFORMATION MANAGEMENT SYSTEM

INTEGRATED HOME DATA MANAGER with WINDOWS, ON SCREEN CALCULATOR, and CALENDAR.
HOME CHECKBOOK maintains multiple accounts for quick and easy analysis.
HOME ADDRESSBOOK up to 200 records of mailing data with search and label options.
HOME INVENTORY provides valuable property information recall and analysis.

AVAILABLE ON DISK ONLY... $29.95
CHECK/MONEY ORDER + $2.00 SHIPPING.
NEW YORK RESIDENTS ADD SALES TAX.

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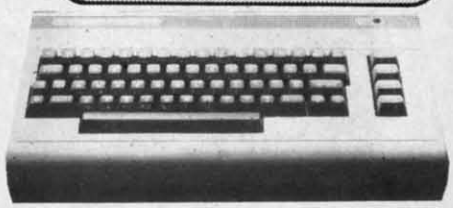
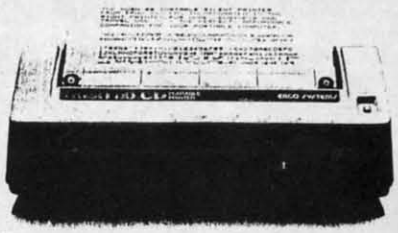
CAMBRIA HTS.N.Y.11411



Reader Service No. 119

WHY PAY MORE ?



$99.45 COMPLETE

Thousands of these MADE IN AMERICA printers have been sold worldwide at $140 for use in homes, businesses, and schools. Through our immense buying power for internal consumption we can offer you the identical printer at less than $100.

THE ONLY 80 COLUMN PRINTER FOR UNDER $100
..... ANYWHERE IN THE WORLD !

We use this printer in our own communications systems because of its small size, reliability, and quiet operation. You'll love it because of dot-addressable graphics that'll knock your socks off. It's even compatible with popular CBM and VIC20 graphics programs like:
BRODERBUN'S PRINT SHOP.
You'll love it because it's 80 characters per second, blows the doors off all other low cost printers. You'll even love it because of what it doesn't do.
.....MAKE NOISE.
This baby's so quiet you can run listings in the middle of the night and Mom and Dad won't even know you're up. If you're a tad bit older, you'll love the way it prints your spreadsheets in a full 160 COLUMN FORMAT on 8 1/2 inch wide paper. Schools buy 'em by the boatload. Now you can sail one of your own.

BUY ON YOUR BANKCARD FOR SAME DAY SHIPMENT.
MASTERCARD & VISA GLADLY ACCEPTED.
FOR IMMEDIATE ACTION CALL:

1-800-672-3470 X841 IN CALIFORNIA
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POST TECHNOLOGIES, INC.
CHOWCHILLA, CA

(SMACK IN THE HEART OF SILICON VALLEY SOUTH.)

Reader Service No. 120

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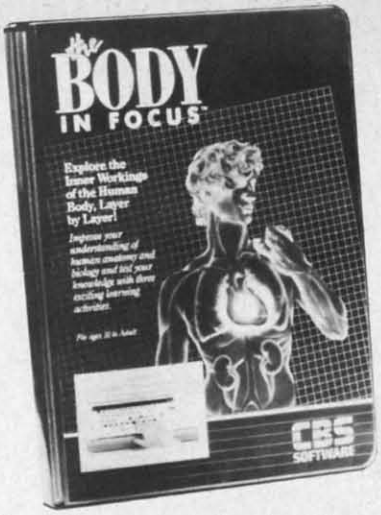
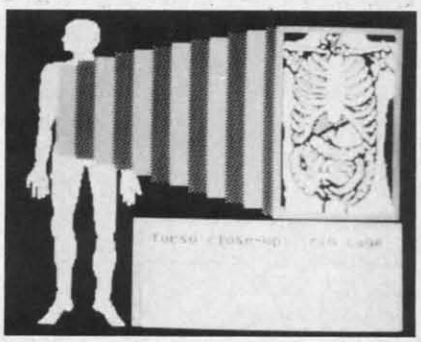
workings through three learning activities: *Body Systems* (demonstrates mechanisms of the muscular, digestive, nervous, skeletal, respiratory, circulatory, endocrine, and integumentary systems), *Body Close-Ups* (lets users peel away body layers to inspect organs in detail), and *Body I.Q.* (tests overall knowledge of anatomy). Included is CBS' EasyKey keyboard overlay, which provides easy access to program activities. For the C-64; $39.95.

Consumers who purchase a 10-pack of Elephant brand disks will receive a trial version of CBS' *Success with Math* and *Success with Algebra* tutorials, plus a $5.00 rebate coupon good for the purchase of *The Sea Voyagers, America Coast-to-Coast, Dinosaur Dig,* and *Dream House* and a $3.00 coupon good for *Astro-Grover, Webster: The Word Game*, and *The Railroad Works.*

CBS Software, One Fawcett Place, Greenwich, CT 06836 (phone: 203-622-2500).

Thinkers' Exercise, a brochure listing over 40 CP/M based educational programs for use with the C-128 and 1571 disk drive, is available on request from Resource International, 330 New Brunswick Ave., Fords, NJ 08863 (phone: 201-738-8500).





Observe how the body breathes, digests food, pumps blood, moves muscles, sneezes.
READER SERVICE NO. 116

Another of those astonishing programs that manage to be targeted for "the beginner as well as the professional," *Principles of Composition* teaches art students about color, texture, design, shapes, patterns, and more. Price for the two-disk C-64 program is $149.00.

Art Instruction Software, P.O. Box 1352, Patchogue, NY 11772 (phone: 516-654-0351).

Krell Software's *Logical Lynx* is designed to teach students basic scientific facts and how to fit these facts into meaningful patterns. System master disks are available in three levels of difficulty at $49.95, $69.95, and $89.95 each; twenty databases in the categories of social studies, humanities & language arts, and science & math are priced at $19.95 each (one free database is included with each master disk). For the C-64.

Krell has also announced that they will accept trade-ins of obsolete SAT and ACT preparation software—both their own and competitive brands—for up-to-date products.

Krell Software Corp., 1320 Stony Brook Road, Stony Brook, NY 11790 (phone: 516-751-5139).

Educational Activities' latest catalog for educators, listing over 50 new programs, is available upon request.

Educational Activities, Inc., P.O. Box 392, Freeport, NY 11520 (phone: 516-223-4666).

Classroom Tools for the Teacher, Sunburst's 1985-86 educational software catalog, includes 40 new programs for students from preschool through adult.

Sunburst Communications Inc., Pleasantville, NY 10570 (phone: 914-769-5030).

Elementary Math Skills teaches elementary schoolers fundamentals of arithmetic, on four levels of difficulty. For the 64; $24.95.

Microphys, 1737 W. 2nd St., Brooklyn, NY 11223 (phone: 718-375-5151).

Learning Guitar Overnight ($39.95) teaches C-64 users basic chord recognition, with strum-along sound effects allowing students to recognize and play simple songs immediately.

Chipware, P.O. Box 110, Chester, NH 03036 (phone: 603-432-1717).

PROMAL NEWSLETTER

PROMAL News, a quarterly compendium of news, programming tips, and articles, will be distributed free to all registered PROMAL users. For information, contact Systems Management Associates, 3325 Executive Drive, P.O. Box 20025, Raleigh, NC 27619 (phone: 919-878-3600).

VIDEOTAPE DATABASE

VideoFile allows C-64 users to keep track of up to 150 programs recorded on up to 50 videotapes, filing the programs by category, by length, or alphabetically. The program can locate the best space to record new material, or find any program. Price is $49.95; demo disk $10.00

THE PUZZLE GENERATOR

Attention puzzle fans! Use your computer to create criss-cross and wordsearch puzzles from any list of words, including foreign languages! Features:

- Over 1 Billion different puzzles included. This would cost over a million dollars anywhere else!
- Highly educational. Testing reveals that persons possessing basic puzzle solving skills have an easier time dealing with lifes everyday problems.
- Puzzle difficulty ranges from very easy to very difficult, to challenge even the most experienced puzzle solvers.
- Create special interest puzzles for your group or organization.
- Super easy to use. Just answer screen prompts and the program does the rest.
- Disk Drive and Printer are required. Supports all compatible drives and printers. Puzzles, answers and wordlists can be saved on diskette for future use.

Available for the Commodore 64*

ONLY $24.95
(Satisfaction Guaranteed)

Send Check or Money Order to:

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VideoFile, Box 480210, Los Angeles, CA 90048 (phone: 213-655-6795).

SOFTWARE DATABASE

.MENU, the International Software Database, keeps detailed information on over 3000 Commodore-compatible programs, and will help customers locate, evaluate, and order software (through the .Menu/STX Software Transfer Service).

To receive a list of currently available inventory or to order Software, write .MENU Customer Service, 1520 South College Ave., Fort Collins, CO 80524 or call 800-THE-MENU.

CPS-10 is fully serviceable.
READER SERVICE NO. 117

POWER SUPPLY

The CPS-10 improves upon the Commodore power supply with all metal casing, surge-protected outlets, and a one-year warranty. Most significant, the unit is completely serviceable (ever try to repair your Commodore power supply? Break it open sometime). Price is $59.95.

HBH Corporation, 225 West Main St., Collinsville, IL 62234 (phone: 800-448-5819 or 618-344-7912).

RS232 INTERFACE

The *Printmaster/S* hooks up to the Commodore serial bus and provides complete RS232 signals for using only RS232 printer. The interface is switch selectable for 300 through 2400 baud, plus parity, word, and stop bits. A full plus and minus voltage level is provided to insure compatibility.

Omnitronix, Inc., P.O. Box 43, Mercer Island, WA 98040 (phone: 206-236-2983).

COMPUTER CLASSIFIEDS

A monthly newsletter dedicated to swapping software and hardware, *A & S Software's Computer Classifieds* lets advertisers reach 1500 fellow users a month at a rate of 25 cents per word. Subscription is $12.00 per year.

A & S Software, Box 457-AH, Lakeview, MI 48850.

BOOK RELEASES

Five new volumes on the Commodore 128 have been announced by Abacus Software. Scheduled for fall release:

C-128 Internals examines the three computers inside the 128, with ROM listings of BASIC 7.0 and the operating system.

C-128 Trick & Tips combines numerous techniques for 128 programmers.

Artificial Intelligence is an introduction to the use of AI on the C-128 and C-64.

For winter release:

1571 Internals examines Commodore's 128-compatible disk drive, along with ROM listings.

CP/M on the C-128 details the CP/M operating system.

Abacus Software, 2201 Kalamazoo S.E., P.O. Box 7211, Grand Rapids, MI 49510 (phone: 616-241-5510).

COMPUTE!'s VIC 20 and Commodore 64 Tool Kit: Kernal ($16.95) describes the built-in programs that run on each computer.

COMPUTE! Publications, 324 W. Wendover Ave., Suite 200, Greensboro, NC 27408 (phone: 919-275-9809).

TELECOM NEWS

For a $25 initial signup fee and a flat $25 per month, the *PC Pursuit* service of the GTE Telenet Communications Company will allow users in 12 metropolitan areas to make unlimited calls to any computer in those 12 areas. Calls can be placed only during off-peak hours (6 p.m.-7 a.m. weekdays, and from 6 p.m. Friday through 7 a.m. Monday) and are limited to one hour each.

The cities currently serviced are Atlanta, Boston, Chicago, Dallas, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, San Francisco, and Washington, D.C.

To obtain more information, or to register, dial GTE's "In Pursuit Of..." bulletin board at 1-800-835-3001 any hour of the day; or if you prefer to speak to a GTE representative, call 1-800-368-4215 from 8 a.m. to 5 p.m. (eastern time) Monday through Friday.

GTE Telenet Communications Corp., 12490 Sunrise Valley Drive, Reston, VA 22096.

Three medical information services, two concerning women's health and one eye care, have been added to the CompuServe Information Service. These will serve as information exchanges for professionals and information sources for health care consumers.

CompuServe, 5000 Arlington Centre Blvd., P.O. Box 20212, Columbus, OH 43220 (phone: 614-457-8600).

Viewdata Corporation is now offering banks the opportunity to communicate with their customers through their personal computers via the Viewtron network. (For more information on Viewtron, see the review on page 83).

Viewdata Corporation of America, Inc., 1111 Lincoln Road, 7th Floor, Miami Beach, FL 33139 (phone: 305-674-1444).

DATA LOSS PROTECTION

Tripp Lite's Spike Bar, model SK 6-6 ($49.95) will convert a single outlet into six that are completely spike and noise protected. The unit has a six-foot powerline. Their Isobar Plus surge suppressor ($49.95) is available in 4- and 8-outlet versions. Because its components are wired in series instead of parallel, each 2-outler filter bank has double the protection of the previous bank, allowing you to apply varying levels of protection to the components of your computer system.

Tripp Lite, 500 North Orleans, Chicago, IL 60610 (phone: 312-329-1777).

The Pentron Power Surge Protector comes in four models, all providing 2,000,000 watts and 200 joules of spike and surge protection in under 5 nanoseconds.

Pentron Products, Inc., 1560 Trimble Road, San Jose, CA 95131 (phone: 408-946-7500).

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COMMODORE IC'S

K. Boufal has available a wide range of integrated circuits for Commodore computers and drives from the VIC 20 through the Amiga. Prices range from $16.50 for a 6510 CPU to $39.95 for a 6567 VIC-II in quantities of 1-9. (Prices are lower for large quantities: order 5,000 6510's, for instance, and the price drops to $7.60 each. Never hurts to have a few extras on hand.)

K. Boufal Consulting Services, 244 Fitswater St., Philadelphia, PA 19147 (phone: 215-925-6469).

MONITORING HARDWARE

An aid to data logging and temperature monitoring, Comp-u-Temp will display 8 or 16 temperature channels. It has a temperature range of −15 to +180 degrees Fahrenheit at approximately 1 degree resolution. The device's electronic interface plugs into the 64's joystick port. Version 1.0 (8 channels) is available for $89.95, version 2.0 (8 channels plus data storage to and from disk) for $109.95, and Version 3.0 (16 channels plus data storage) for $179.95.

Applied Technologies, Inc., Lyndon Way, Kittery, ME 03904 (phone: 207-439-5074).

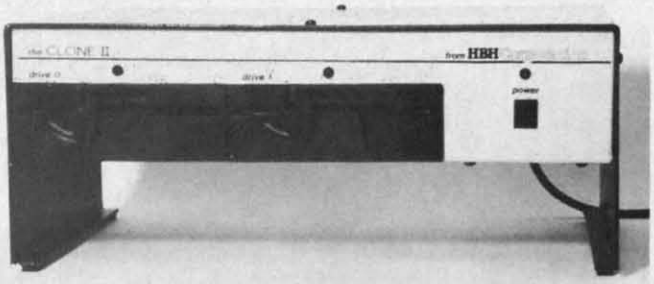
PROGRAM UPDATES

Version 2.1 of *The Whole Bit* ($24.95), Applied Technologies' C-64 word processor, includes a user manual supplied as text files on the program diskette. The user may chain print his own manual, or purchase the program plus 56-page manual for $39.95.

Applied Technologies Inc., Lyndon Way, Kittery, ME 03904 (phone: 207-439-5074).

Grade Manager III has been enhanced to allow teachers to set a range for progress reports (and thereby print reports only for students with averages below a specified point). An error in the Report to Screen program has also been corrected. (Bogus disks will be updated at no charge.)

Smoky Mountain Software, P.O. Box 1710, Brevard, NC 28712 (phone: 704-885-2516).



The Clone II has a 6K buffer, two serial connectors, and a total capacity of 340K. Up to 4 drives can be daisychained. Metal casing has very low heat retention. READER SERVICE NO. 118

CLONE II DUAL DRIVE

The $499 Clone II dual disk drive will allow a Commodore user to format, copy, and verify a new disk in under two minutes. The drive's metal casing, has very low heat retention and will, the manufacturer assures us, keep the Clone from overheating even under continuous operation. The case doubles as a monitor stand.

Included is a utility that will convert incompatible programs to compatible format. The drive carries a one-year warranty.

HBH Corporation, 225 West Main St., Collinsville, IL 62234 (phone: 800-448-5819 or 618-344-7912).

PICK A WINNER

Based on the book by Dick Mitchell, *A Winning Thoroughbred Strategy* ($59.95) allows C-64 users to enter data from the racing form, then computes the statistical order of finish for the contenders. It also determines the win, place, and show probabilities and advises the user how to wager to maximize profits.

Cynthia Publishing Company, Inc., 4455 Los Feliz Blvd., Suite 1106, Los Angeles, CA 90027 (phone: 213-664-3165).

If you can't make it to the track this fall, there's always the office football pool. *Pik'Em '85* ($49.95) promises to help you clean up, having proved 63% accurate versus the spread since 1981. The C-64 program, user-updated with statistics found in the local paper, provides predicted scores for each week of play.

Indeco Consumer Sales, 133-A W. Chapman Ave., Fullerton, CA 92632 (phone: 714-526-1297).

UPDATED PEEK A BYTE

Peek A Byte 64, V2.0 ($35.00) adds a track/sector editor that will read and write up to track 40, as well as do half tracks and read or write sector data with illegal track headers, allowing recovery of data under DOS header errors. Sector data in GCR disk byte format may also be read, edited, and rewritten to the same or a different disk. Included is *The Disk Mechanic,* which will do a fast disk format for a range of tracks or half tracks up to track 40.

Required for use is a 1541 or compatible serial bus drive.

Quantum Software, P.O. Box 12716, Lake Park, FL 33403-0716 (phone: 305-840-0249).

MULTI-PROGRAM DISKS

Three disks offering assorted programs for the C-64 and VIC 20 have been made available by RAK Electronics for $14.95 each plus $2.00 shipping per order: *Games Disk* (64 version, 5 games; VIC version, 16 games, some requiring memory expansion), *Utilities Disk* (6 home utilities on the 64 disk, 11 on the 64), or *Ham Radio Disk* (12 amateur radio application programs).

RAK Electronics, P.O. Box 1585, Orange Park, FL 32067-1585 (phone: 904-264-6777).

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MUST LIQUIDATE At Far Below Dealer Cost!
TOTAL Personal Computer System

Factory Reconditioned with Factory Warranty!

Carries easily as a suitcase! Plugs into 115V outlet!

GREAT GIFT IDEA FOR STUDENTS!

Sorry, we're not permitted to PRINT the famous brand-name. BUT, we CAN "tell all" if you call us TOLL FREE: 1-800-328-0609!

THE COMPUTER

Snap-on computer keyboard! 64K RAM, 20K ROM. Full-size typewriter keyboard. Upper and lower case letters, numerals, symbols, reverse characters. 2 cursor control keys, 4 function keys, programmable to 8. Music synthesizer with 3 independent voices, each with 9 octave range. Input/output ports accommodate . . . user, serial, ROM cartridge, joysticks, external monitor, phone modem.

Built-in disk drive! Intelligent high speed unit with 5¼" floppy disk recorder. 170K formatted data storage; 35 tracks. 16K ROM. Uses single sided, single density disk. Serial interface. Second serial port to chain second drive or printer.

Built-in color monitor! Displays 40 columns x 25 lines of text on 5" screen. High resolution. 320 x 200 pixels. 16 background, character colors.

Built-in ROM cartridge port! Insert ROM program cartridge. Multitude of subjects available in stores across the nation!

Mfr. List Price **$995.00**

Liquidation Priced At Only **$388**

Item H-581-63631-00 Ship, handling: $20.00

THE PRINTER

Print method: Bi-directional impact dot matrix.
Character matrix: 6 x 7 dot matrix.
Characters: Upper and lower case letters, numerals and symbols. All PET graphic characters.
Graphics: 7 vertical dots — maximum 480 columns. Dot addressable.
Character codes: CBM ASCII code.
Print speed: 60 characters per second.
Maximum columns: 80 columns.
Character spacing: 10 characters per inch.
Line feed spacing: 6 lines per inch in character mode or 8 lines per inch selectable. 9 lines per inch in graphics mode.
Line feed speed: 5 lines per second in character mode. 7.5 lines per second in graphics mode.
Paper feed: Friction feed.
Paper width: 4.5" to 8.5" width.
Multiple copies: Original plus maximum of two copies.
Dimensions: 13"W x 8"D x 3¼"H. Wt.: 6½ lbs. **Power:** 120V AC, 60 Hz.

Mfr. List: $200.00

Liquidation Priced At **$118**

Item H-581-63831-00 Ship, handling: $7.00

THE SOFTWARE

"Easy Script" One of the most powerful word processors at any price! Cut re-typing, create documents from standard paragraphs, do personalized letters, see and change a document before it is printed. Instruction manual has extensive training section that simplifies use . . . even for someone who has never used a computer or word processor before!

"The Manager" A sophisticated database manager for business or home use. Business uses: accounts payable/receivable, inventory, appointments, task manager. Home uses: mailing lists, home inventory, recipes, collection organizer, investment tracking, checkbook balancing. School uses: research article index, gradebook.

Mfr. List: $73.98

Liquidation Price **$24**

Item H-581-64011-03 Ship, handling: $3.00

BUY INDIVIDUAL UNITS OR GET THIS ULTRA-FAMOUS SYSTEM AT ONE LOW PACKAGE PRICE!

TOTAL Personal Computer System available at FAR BELOW dealer cost!

Mfr. Sug. Retail .. **$1,268.98**

TOTAL PACKAGE PRICE **$488**

Item H-581-64011-02 Shipping, handling: $24.00

Compatible with above Computer System (Not included in package price.)

JOYSTICKS (Set of 2)
Mfr. List: $59.90 pr.
Liquidation Price ..... **$18 pr.**
Item H-581-63622-01 S/H: $6.00 pr.

64 MODEM
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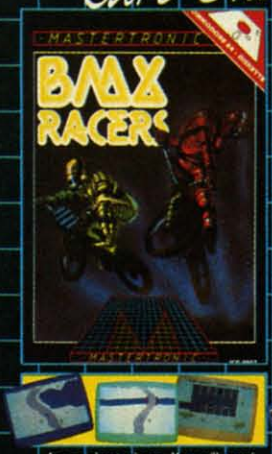

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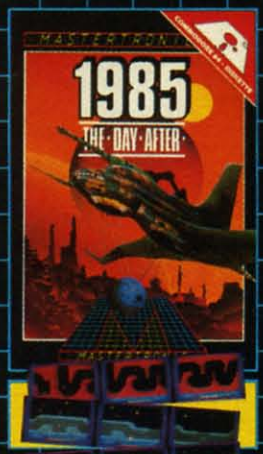

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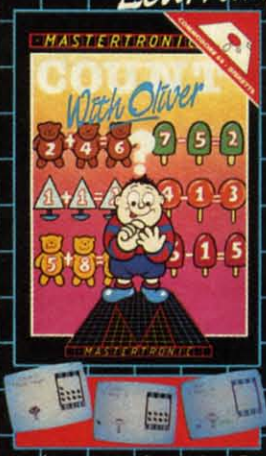

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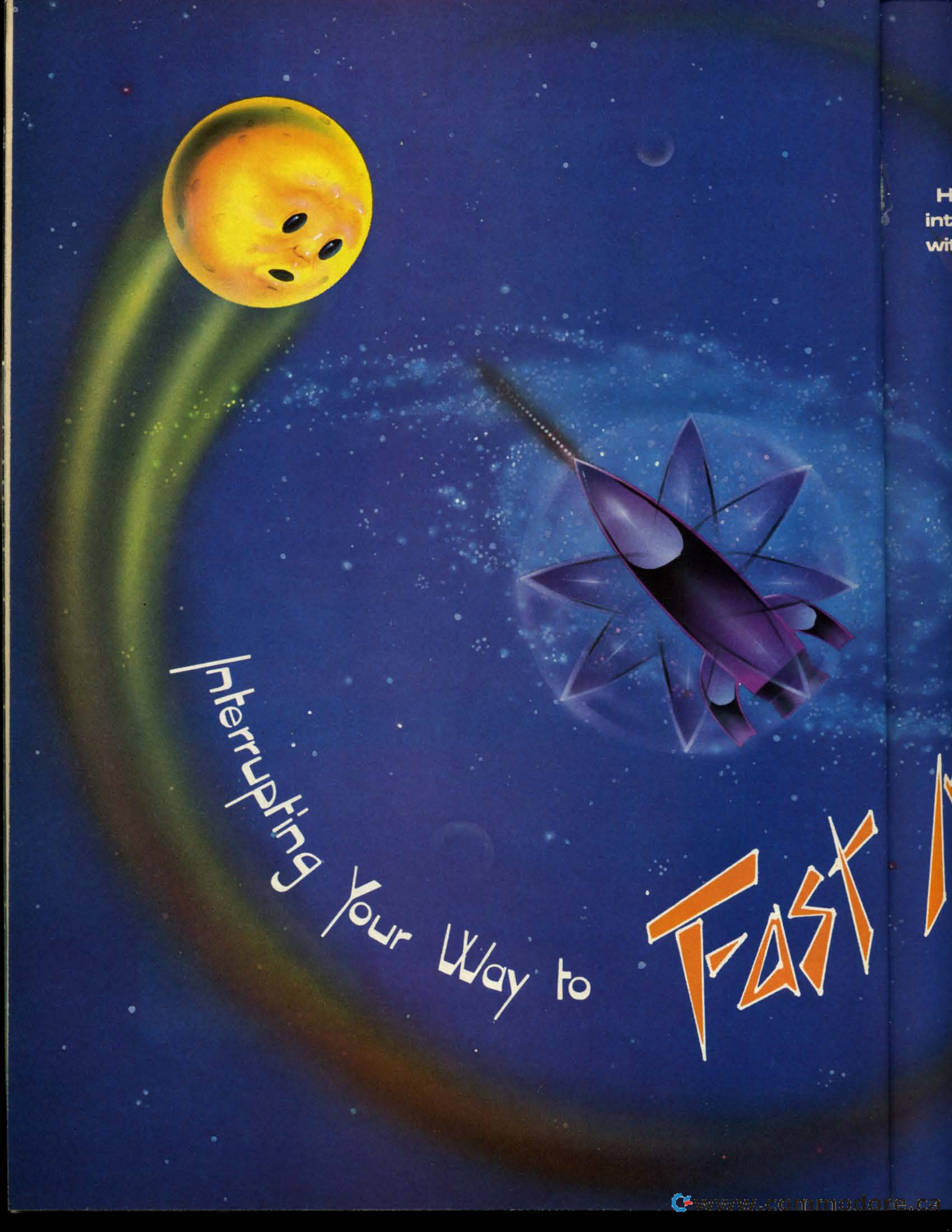

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CREATING YOUR OWN GAMES ON THE VIC AND 64

Here's a machine language interrupt routine you can use with your BASIC programs to move one sprite—and animate all eight!

Motion

BY ORSON SCOTT CARD

During the 16 months this column has appeard, we've run into the same problem time and again: BASIC is a fast language, but not fast enough for arcade-quality game programming.

There are simply too many jobs to do all at once. Moving the player-figure, animating sprites and characters, checking for collisions, keeping score, playing music—methodically, patiently, BASIC does the job.

Meanwhile, the player breaks the joystick to get the program to respond.

We've tried various tricks to get around the problem. By putting custom characters in strings and PRINTing them on the screen, we've achieved fast movement. By using sprites we've achieved smooth, animated movement.

Now it's time for the transition to real machine language speed. In the last two months, we've gone through all the steps necessary to create, animate, and move sprites. Now we're going to use BASIC to set up a machine language routine that will animate all eight sprites and move sprite 0 in response to either the joystick or the keyboard. Yet the machine language will happen in the background, so that BASIC can still respond to and control the major events on the screen.

INTERRUPTS—THE "BACKGROUND MODE"

Most of the Commodore 64's housekeeping work is done in the background. Sixty times a second, the internal timers cause an interrupt (IRQ), a signal to the central processing unit to drop what it's doing, take care of some chores, and then go back to its main business—your program.

What chores does it do? It blinks the cursor, checks the STOP key, scans the keyboard. It's tedious work, but somebody has to do it.

In the middle of all its chores, though, the interrupt routine does something wonderful. It finishes up one job and then jumps to whatever address is pointed to by locations 788 and 789. (788 contains the low byte of the address; 789 contains the high byte, or page number.)

A memory location that points to another memory location is called a *vector.* Vectors are used by the machine language instruction called JMP, or "jump." This is the machine language equivalent of GOTO, only instead of jumping to a line number, the computer JMPs to a memory address and starts executing whatever commands it finds there.

Vectors are used by the *indirect* form of JMP. In the direct mode, JMP 788 would tell the computer to go to location 788 and carry out whatever command is found there. In indirect mode, however, JMP (788) tells the computer to go *look* at location 788 (and the next byte),

JAMES REGAN

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find what two-byte address is contained there, and then jump *to the second address*. The vector "points to" the address where the program must go.

Normally, the vector at 788 and 789 points to the ROM routine at 59953. The low byte (stored at 788) is 49; the high byte (stored at 789) is 234.

But you can change that vector to point to any other location in the computer. For instance, suppose you put a short machine language routine at location 5000. All you have to do is change 788 to point to the low byte of that address, and change 789 to point to the high byte.

Once the vector is changed, your machine language routine will be carried every 1/60th of a second.

Your machine language routine should end with a jump (JMP) to 59953, so that the operating system can take care of the rest of its business. (Since you can't count on every Commodore 64 always working the same way, the best practice is to save the original vector address somewhere else, and then end your program with a JMP through that saved vector, instead of a direct JMP to 59953. That way if a future version of the 64 points to a different address, your routine will still work.)

With your interrupt routine in place, your job gets carried out by the computer along with its other housekeeping chores. Just as the housekeeping is invisible to the main program, so is your machine language routine. That means you could have two programs going on at once: your main program—BASIC or machine language—going on in the foreground, while other jobs were going on in the interrupts.

DON'T POKE THE VECTOR

You can READ your machine language program from DATA statements, POKE it into memory, then change the vector at 788 and 789 to point to your routine. Unfortunately, you can't change the vector from BASIC. That's because changing it takes two POKEs, one for each byte. It is possible that the interrupt will take place *between* the two POKEs. If it did, the computer would try to JMP through a vector that contained half of two addresses—the low byte of yours, say, and the page number of the regular vector. In this case, two halves don't make a whole. The computer will unquestioningly jump to this unplanned address, and chances are very good it will not find a meaningful program there. When a computer tries to execute garbage, ugly things happen. You usually end up turning off the computer and starting over.

So you can't use POKEs to change the vector. Instead, you have to use a short machine language routine to do the job.

And even then, your ML routine has to *turn off* interrupts using the SEI command, because if it didn't, the interrupt could still come in the middle of the operation. After the SEI, however, the interrupt can't happen. Your ML routine can safely change the vector, and then allow interrupts again using the CLI instruction. As soon as interrupts are enabled again, the interrupt routine will start to function.

A SIMPLE INTERRUPT ROUTINE

So you can see how it works, an example is provided on page 123. The short BASIC program *Border Interrupt* sets up an 11-byte interrupt program at location 5000, and a 13-byte setup program at 5011.

Line 10 READs and POKEs the data for the setup routine; line 20 READs and POKEs the data for the interrupt routine. Then line 30 tells BASIC to go execute a machine language subroutine at address 5011. When the subroutine ends, line 40 ends the program. Type in lines 10, 20, 30, 40, 50, and 60 (don't bother typing in REM lines). Then RUN the program.

Almost immediately, the BASIC program will end. You'll see the READY prompt, and you can move the cursor around just like always. You could even write another program (as long as it didn't reach location 5000!), and it wouldn't make any difference. The reason is that the *Border Interrupt* program is chugging away in the background.

And what is it doing? Something utterly useless, but kind of fun. The interrupt program looks at the first location in screen memory (the upper left hand corner of the screen, at location 1024). Then it POKEs the low four bits into the border color register that is located in line 53280.

In other words, whatever character is located in the

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upper lefthand corner of the screen will determine the border color.

To test it, press HOME and then any key on the keyboard. Try it several times, with several different keys. Typing the letters "@ABCDEFGHIJKLMNO" in order (press HOME or CURSOR-LEFT each time, of course) will cause the border to display all 16 colors in succession.

This routine is, of course, absolutely useless. But it has the virtue of being short—so I can easily explain what's going on in each part of it.

Let's look first at lines 48 through 50. Line 50 contains the actual DATA statements, but line 49 gives the assembly language mnemonics, and line 48 explains what's happening.

The SEI instruction (120) disables interrupts. Then the LDA instruction (immediate mode) picks up the number 136—the low byte of address 5000—and stores it (using the STA instruction) at location 788 (low byte 20, page number 3). This is the equivalent of POKE 788, 136. Then LDA picks up the number 19 (the high byte, or page number, of address 5000) and STAs it at 789. The vector is now changed. Then the CLI instruction enables the IRQ interrupt to take place again. Since the job is done, the RTS instruction (ReTurn from Subroutine) takes us back to the BASIC program, beginning at the next line after the SYS command.

BridgePro®

BridgePro is the first program I've seen that provides a challenge for the average-to-excellent bridge player. . . The documentation is excellent and allows a new bridge player to learn the basics.
—*Harvey Bernstein, Antic Magazine, Feb. 1985*

After having tried three other bridge programs, I find that BridgePro is indeed a pro game. . . It is designed for both the beginner and the advanced player. . . I didn't find anything that could be improved upon.
—*Helen Garret, Apple-Dayton Journal, March 1985*

If you like to play bridge and don't have three other players ever-eager to play, this software is a must. For bridge freaks it's good enough to justify buying a computer . . . Whether you are a "master" or a beginner, this is great software.
—*Christian Basler, NY Commodore Users Group Review, Sept. 1984*

BridgePro is designed to let you learn, improve, or just enjoy the card game of bridge. The program provides complete bidding, play and scoring for 1 or 2 players. Features include random hands, bidding help, demonstration mode, hand replay/quit, best hand, auto finish, duplicate mode, and fast machine language speed.

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Now let's look at lines 58 through 60. This is the interrupt routine. When the computer, during its housekeeping, JMPs through the vector at 788, it now goes directly to location 5000, where this routine begins. The first instruction picks up whatever value is found at location 1024, the first byte of screen memory (LDA followed by the low byte, 0, and the page number, 4, of location 1024). The AND#15 operation erases all the bits of that number except bits 0, 1, 2, and 3. The result is that the computer is now holding a number that must be less than 16. Then STA 53280 (low byte 32, page number 208) stores (or "POKEs") that value into the border color control register. Finally, JMP 59953 sends the computer on to do the regular housekeeping. (Notice that this is the *direct* JMP instruction—go directly to this address, without using a vector.)

To end this interrupt routine, press RUN/STOP-RESTORE. This sets the vector back to its original values.

EXCHANGING MESSAGES

Changing the border color by typing different letters in the upper lefthand corner of the screen is amusing for about 20 seconds. But try this anyway: Once the interrupt is in place and running, type in this BASIC line in direct mode.

```
FOR I=0 TO 15:POKE 1024,I:FOR X=0 TO 9
9:NEXT:NEXT
```

Obviously, the X loop is there for timing—change the number 99 to something else to slow the miniprogram down or speed it up. The BASIC program is, in effect, passing information to the interrupt routine.

There are many ways that the interrupt routine can, in turn, pass information to BASIC. The method I like best is the one used by the main program this month, *Starship* (see page 126). The interrupt-driven machine language routine puts crucial information directly into BASIC variables. Then the BASIC program has merely to check those variables: IF QQ=1 THEN QQ=0:GOSUB 9000 would be a good way of using the information. The line checks to see if QQ is 1; if it is, it immediately sets QQ back to 0, then goes and does whatever should happen as a result. The interrupt routine might use QQ to tell the BASIC program that there has been a sprite-sprite collision, or a sprite-foreground collision, or the direction that sprite 0 is moving.

Of course, this requires the interrupt routine to actively pass back information. BASIC could find things out by using the PEEK command to look directly at locations where the interrupt routine is storing data. What matters is that, in effect, BASIC and the interrupt routine are talking to each other—and yet both are able to act at the same time, without one having to wait for the other to finish in order to take its turn.

TIME LIMITS AND DAISY CHAINS

Unfortunately, the entire interrupt routine has to take place in far less than 1/60th of a second. You can do a

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lot in that amount of time, of course, because machine language thinks of a second the way human beings think of a week. But you can't do *everything*.

Besides, if your interrupt routine is too long, it will end up slowing down the main program after all. Interrupt time is stolen from main program time, and the more you put in interrupts, the less time there is for the main program, so the longer the main program will take to carry out its tasks.

Since our interrupt routines are going to control animation and movement, we don't want everything to happen 60 times a second anyway. That's *too* fast—the player couldn't possibly see or control what was happening in a game that moved that fast.

The solution to this is to write *several* machine language interrupt routines. Only one of them executes with each interrupt. But each routine changes the vector at 788 and 789 to point to the next routine; the last one points to the first one again. That way they make a sort of daisy chain, each program setting up the vector so that the next one will be executed the next time around.

Starship uses this pattern. The vector always points to the Animation Timer Routine. This routine simply counts down to see whether it's time to switch to the next animation step. If it is, the program JMPs to the Animation Routine, which changes the shapes of all the sprites and then JMPs back to the housekeeping routines.

If it isn't time for animation, then the program JMPs through the Player Vector to one of the Player Control Routines. This is not the interrupt vector at 788 and 789—it's a special vector at 37888 and 37889 used only by the Player Control Routines. It determines which routine will be executed when the Animation Timer passes control on to a Player Control Routine.

Usually, the Player Vector points to the Player Timer. It checks to see whether it's time for another player movement. If it isn't, the program JMPs to housekeeping.

If it is time for player movement, the Player Timer changes the Player Vector to point to either the Read Joystick or Read Keyboard routine (you select from BASIC which will be used before starting the interrupt). The Read routines will, in turn, set the Player Vector to point to the Movement Routine. The Movement Routine sets the vector to point to the Collision Routine. And the Collision Routine sets the vector to point back to the Player Timer, which again counts down.

This means that the interrupt will be executing different routines every time. It always begins with the Animation Timer, which then routes the computer to one of five different routines: Animation, Player Timer, Read (either Read Joystick or Read Keyboard), Movement, and Collision.

If Animation is carried out every 6th interrupt (once every 1/10th second), then the whole movement cycle can be as fast as once every 1/12th second. BASIC just isn't going to be able to match that. Yet the routines leave enough time for the BASIC program to do its own work. While the interrupt routines control the movement of sprite 0 and the animation of sprites 1 through 7, the *movement* of sprites 1-7 is left up to BASIC. Also, BASIC is required to respond to collisions—the only response the interrupt routines will make is to bounce back from collisions, and then only if the Bounce Flags were set from BASIC.

WHAT THE PROGRAM DOES

Now that you know the principles of interrupt-driven machine language programming, you can make use of the program *Starship*. If you know nothing at all about machine language, just type in the program and study the BASIC REM lines to see what changes you can control by changing BASIC lines.

For instance, you can set the Bounce Flags, to determine whether the player-figure will rebound from collisions with other sprites or with the foreground.

You can set the Animation Speed—how quickly the sprites cycle from shape to shape. A value of 1 is the fastest, causing the shapes to change with every interrupt—but it also makes it so that player-movement never happens at all. To allow player movement, select a value of 2 or greater. A value of 4 will cause the animation to happen every 1/15th second—just about the speed used by movies.

With Movement Speed (how fast sprite 0 moves across the screen), a value of 1 is the fastest possible—but *how* fast that is depends on the Animation Speed. The slow-

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er the Animation Speed, the faster each possible Movement Speed will be. So the best thing to do is choose the Animation Speed you like and then fiddle with the Movement Speed.

The Vertical Movement Increment and Horizontal Movement Increment decide how *far* sprite 0 will move with each step. A vertical or horizontal value of 1 causes the sprite to move one pixel at a time. Higher numbers mean bigger jumps. A value of 0 in either vertical or horizontal direction means that the sprite will not move at all in that direction. This allows you to have movement take place in one plane, by allowing only vertical or only horizontal movement.

You can also set colors and starting positions.

Sprite 0 is controlled by a joystick in port 2. This program passes information back to BASIC using seven variables. The integers C0%-C6% must be the second-through-eight variables declared in the program. (The first variable, a string, is left for the second routine we did a few months ago.) BASIC can read and respond to these variables as follows: C0%=1 (firebutton is pressed); C1%=*n* (if >0 sprite *n* just hit edge of the screen); C2% and C3% report the most recent collision register readings; C4%=1 (player is calling for sprite 0 move); C5% and C6% report whether sprite 0 is bouncing off sprites or foreground (this is necessary because these collisions won't be reported in C2% and C3%). In addition, the ninth variable declared, SP%, works in the other direction. If you want to move another sprite, set SP% to a number between 1 and 7; then SYS 38336. This causes sprite SP% to move in the direction called for in the SPRITE JOYDIR TABLE at 37963. The odd-numbered bytes from 37963 to 37977 can be loaded with a direction (1=up, 2=down, 4=left, 8=right—add for diagonals). Margins are set individually for each sprite in locations 37978-38009. The machine language routine at 38336 lets your BASIC program use the same movement routine that moves sprite 0 during the interrupts.

You can also change the shapes of the sprites, so that this starship-and-planets scenario could as easily be Dorothy and various other characters from the Wizard of Oz, or a sailing ship and various obstacles in the sea, and so on. You can redefine the character set to allow character graphics (though this program does not do so), and make many other changes, as long as you don't interfere with the sections of memory used by the machine language program.

USE OF MEMORY

This program—like all the sprite programs in this column's last two months—reserves the 8K from 32768 to 40959 for video memory. Screen memory is placed at 32768, which means that the sprite shape table is at 33784-33791. However, you won't ever have to deal with that shape table directly—the interrupt routine handles it for you.

Sprite shapes are stored from 33792 to 36863. The first 512-byte block holds the 8 patterns for sprite 0. These can either be an animation sequence or, as *Starship* has it, 8 shapes representing the same object, seen from above, facing in eight different directions. The Player Animation Flag, which you set from BASIC, determines which way the eight sprite-0 shape blocks will be used. If it is set to 1, sprite 0 is not animated, but faces in the direction it is moving. If it is set to 0, sprite 0 is animated just like the other sprites, but faces the same way regardless of how it is moving.

Starting at 34304, 34816, 35328, 35840, and 36352 are five more 512-byte blocks, each of which can contain up to eight sprite shapes. (Remember that each sprite shape block consists of 64 bytes, of which 63 are scanned by the VIC-II chip to determine the sprite shape. Even if the sprite is very small, all the bytes are still scanned, so every sprite shape must begin at a memory address evenly divisible by 64.) This program uses only two of these animation sequences. Sprites 1 and 3 both use the same animated sequence starting at 34304; sprites 2 and 4 use the sequence starting at 34816.

However, you don't have to use 8-shape sequences. You could just as easily have two- or four-shape sequences. This is because the interrupt routines look at the Sprite Animation Tables starting at 38080 to find out the sprite shapes to use for the different sprites. Each sprite, from 0 to 7, has an eight-byte table. Sprite 0's table is at 38080, sprite 1's at 38088, sprite 2's at 38096, and so on. Each time through the animation sequence, the Animation Rou-

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tine looks at the next byte in the block. For instance, at animation step 0, the Animation Routine looks at 38088+0 to find the code for sprite 1's shape, and 38096+0 to find the code for sprite 2's shape. At animation step 1, it checks 38088+1 and 38096+1, and so on. After step 7, it starts over again at step 0.

And what code numbers are placed in those tables? The sprite shape block numbers. You'll remember from last month and the month before that the video block is divided into 256 sprite shape blocks, numbered from 0 to 255. The sprite 0 shape blocks, at 33792, 33856, 33920, 33984, 34048, 34112, 34176, and 34240, are sprite shape blocks 16, 17, 18, 19, 20, 21, 22, and 23. The five 8-block animation sequences start at codes 24 (34304), 32 (34816), 40 (35328), 48 (35840), and 56 (36532). (Remember that the video block begins at 32768, so that block 0 is at that address.)

Now, any one of the eight sprites can call on any of these sprite animation sequences in its Sprite Animation Table. In *Starship*, sprites 1 and 3 use the same animation sequence, the one with codes 24-31. However, so that they aren't doing the same thing at the same time, sprite 1's table contains the values 24-31 in order, while sprite 3's table goes 27, 26, 25, 24, 31, 30, 29, 28. The animation will still proceed smoothly, but the sprite 3's planet will seem to rotate in the opposite direction from sprite 1's planet.

If you wanted to, however, you could give each sprite a four-step animation sequence by repeating: for instance, you might fill the Sprite 1 Animation Table with the codes 32, 33, 34, 35, 32, 33, 34, 35. Then, as the Animation Routine cycled through its eight steps, it would simply repeat the same four-step sequence twice. A two-step sequence would have a table like this: 32, 33, 32, 33, 32, 33, 32, 33. This gives you great freedom to devise many different animated sprites. Animating all eight sprites takes no more time than animating none. (Remember, though, that except for sprite 0, all the other sprites' movement from place to place on the screen is controlled by the BASIC program, and will be slower the more sprites you try to move around at once.)

The 1K of memory from 36864 to 37888 is reserved for a custom character set. *Starship* doesn't use one, but your program might. If you use the ROM set, as *Starship* does, the VIC-II chip sees the character set from 36864 to 40959. But the computer itself, the 6510 chip, doesn't

CARD OPCODES TABLE 1

MNEMONICS WITH ONLY ONE OPCODE

CONDITIONAL BRANCHING COMMANDS

Followed by one-byte relative address:
step forward 1 to 127 steps or backward (256-) 1 to 128 steps

BCC	144	branch if carry is clear (addition DID NOT carry or subtraction DID borrow)
BCS	176	branch if carry is set (addition DID carry or subtraction DID NOT borrow)
BEQ	240	branch if result is = or 0
BMI	48	branch if result is "minus" (128-255)
BNE	208	branch if result is = or not 0
BPL	16	branch if result is "plus" (1-127)
BVC	80	branch if overflow is clear
BVS	112	branch if overflow is set

UNCONDITIONAL BRANCH

JSR	32	Jump to subroutine at absolute (two-byte) address:

ONE-BYTE COMMANDS

BRK	0	break
CLC	24	clear carry flag (do before two-byte addition)
CLD	216	clear decimal mode
CLI	88	clear interrupt disable bit (allow interrupts)
CLV	184	clear overflow flag
DEX	202	decrement X register (X–1)
DEY	136	decrement Y register (Y–1)
INX	232	increment X register (X+1)
INY	200	increment Y register (Y+1)
NOP	234	do nothing for one machine cycle
PHA	72	push accumulator contents onto stack
PHP	8	push processor status (all flags) onto stack
PLA	104	pull accumulator value from stack
PLP	40	pull processor status (all flags) from stack
RTI	64	return from interrupt (to address saved on stack)
RTS	96	return from subroutine (to address saved on stack)
SEC	6	set carry flag (do before two-byte subtraction)
SED	248	set decimal mode
SEI	120	set interrupt disable status (block interrupts)
TAX	170	transfer accumulator to X register
TAY	168	transfer accumulator to Y register
TSX	186	transfer stack pointer to X register
TXA	138	transfer X register to accumulator
TXS	154	transfer X register stack pointer
TYA	152	transfer Y register to accumulator

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see the character set. So after that first 1K block, all the machine language routines and the tables and vectors used by them are in RAM "under" the Character ROM. (The interrupt routine in the simple example program above was also under the locations where the VIC-II sees the character ROM in the normal video block.) BASIC can't touch these routines, and they won't disturb the VIC-II chip, either.

The vectors and tables begin at 37888. The machine language routines begin at 38144. You can play around with video memory all you like, as long as you don't wipe out these crucial areas.

AND FOR YOU MACHINE LANGUAGE USERS...

If you know or are learning machine language, I've thoroughly REMarked the machine language routines so that you can follow exactly what's going on, almost as well as if you were reading ML source code. I've always hated typing in those endless meaningless DATA statements in long machine language programs, with never a hint as to what is going on. So I'm trying to do a bit better for you. Just remember that the REM lines are there only to help explain things. Don't bother typing them in; your program will take up a lot less memory and run a bit faster if you leave them out.

If you want to tinker with the machine language directly, right in the DATA statements, you may find the Machine Language OpCodes Table helpful. It lists all the assembly language mnemonics and then lists the *decimal* opcode for each of that command's modes—implied, accumulator, immediate, zero page, absolute, indirect, and/or indexed.

Be careful! This program disables the RUN/STOP-RESTORE keys. If you make a mistake typing in the machine language, the program will almost certainly hang up the computer, and the only way out is to turn off the machine and start over. So please, please SAVE a copy of the program before you ever RUN it.

WHAT ABOUT THE FUTURE?

In the 17 issues of *Ahoy!* that have contained articles in this series, we have covered all the graphics and sound features of the VIC 20 and Commodore 64 that are useful in BASIC game programming. (Some features, like the bit map, simply cannot be used effectively from BASIC.) Now, that doesn't mean we've covered all there is to know about game programming. We haven't dipped much below the surface there. But the machine-specific programming techniques have been pretty well covered.

So—where do we go from here? There are several possibilities. I could go on and explore the possibilities of

CARD OPCODES TABLE 2

MNEMONICS WITH SEVERAL ADDRESSING MODES

MNEMONICS AND OPCODES

Mode:	immed	Zpage	Zpg,X	AbsoL	Abs,X	Abs,Y	(Ind,X)	(Ind),Y	accum
ADC	105	101	117	109	125	121	97	113	"
AND	41	37	53	45	61	57	33	49	"
ASL	"	6	22	14	30	"	"	"	10
BIT	"	36	"	44	"	"	"	"	"
CMP	201	197	213	205	221	217	193	209	"
CPX	224	228	"	236	"	"	"	"	"
CPY	192	196	"	204	"	"	"	"	"
DEC	"	198	214	206	222	"	"	"	"
EOR	73	69	85	77	93	89	65	81	"
INC	"	230	246	238	254	"	"	"	"
JMP	"	"	"	76	"	"	108*	"	"
LDA	169	165	181	173	189	185	161	177	"
LDX	162	166	182**	174	"	190	"	"	"
LDY	160	164	180	172	188	"	"	"	"
LSR	"	70	86	78	94	"	"	"	74
ORA	9	5	21	13	29	25	1	17	"
ROL	"	38	54	46	62	"	"	"	42
ROR	"	102	118	110	126	"	"	"	106
SBC	233	229	245	237	253	249	225	241	"
STA	"	133	149	141	157	153	129	145	"
STX	"	134	150**	142	"	"	"	"	"
STY	"	132	148	140	"	"	"	"	"

*The JMP command's indirect mode has no offset: JMP (vector)
**LDX and STX, in zero-page indexed mode, are offset by Y, not X

DESCRIPTION OF OPERATION

MNEMONIC	operation performed
ADC	add value in accumulator with value at:
AND	logical AND accumulator bits with bits at: (clears all bits not "on" at both locations)
ASL	shift left all bits at:
BIT	test accumulator against bits at:
CMP	compare accumulator with value at: (subtraction sets flags without changing accumulator)
CPX	compare X register with value at:
CPY	compare Y register with value at:
DEC	decrement value at:
EOR	exclusive-OR accumulator bits with bits at: (clears all bits "on" or "off" at *both* locations; sets all bits "on" at only one location)
INC	increment value at:
JMP	jump to location:
LDA	load accumulator from:
LDX	load X register from:
LDY	load Y register from:
LSR	shift right all bits at:
ORA	logical OR accumulator bits with bits at: (sets all bits "on" at either location)
ROL	rotate left all bits at:
ROR	rotate right all bits at:
SBC	subtract value at ____ from value in accumulator
STA	take accumulator value and store it at:
STX	take X register value and store it at:
STY	take Y register value and store it at:

DESCRIPTION OF MODES

Mode (number of bytes following opcode): how following bytes are interpreted

Immediate (1): use next byte as value in operation
Zero page (1): get value from this one-byte zero-page address
Zero page,X (1): add next byte and X contents and get value from combined zero-page address
Absolute,X (2): get value from this two-byte address
Absolute,Y (2): add next two bytes and X contents and get value from combined address
Absolute, Y (2): add next two bytes and Y contents and get value from combined address
(Indirect,X) (1): add next byte and X contents, go to combined zero- page address, and use contents of that location (low byte) and next location (page number) as address where value to be operated on is found
(Indirect),Y (1): go to one-byte zero-page address; add Y contents to contents of that location (low byte) and next location (page number), and use combined address as vector to location where value to be operated on is found
Accumulator (0): get value from accumulator

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the much better BASIC in the C-128. I could use the Amiga as the centerpiece machine in articles about games. We could step away from arcade-style games for a while and play around with word games, puzzles, adventure games. What would you like to do? Of course, some decisions may already have been made by the time you read this column. But we really would like to know what you want in the future. I, for one, would much rather talk about something you want to learn about than go off into areas that don't interest you. And the good folks at *Ahoy!* have this crazy notion that if the magazine contains articles you want to read, they'll sell more copies. You have only to ask, and we will do our best to comply. (If, however, you would prefer to see no articles by me *at all*, then you may keep your opinions to yourself.)

And a bit of sad news. I'm retiring my VIC 20. I've done all that I can do with the unexpanded 5K machine; to do anything more would require far more resourcefulness and time than I have been able to discover in my admittedly lazy soul. If you VIC owners feel betrayed by this decision, please realize that you have been avenged in advance: I also own a PCjr, in which I have invested many thousands of dollars, while you couldn't possibly have invested more than $500 in your VIC even if you gold-plated it. I mean, if you want to see a loser...□

SEE PROGRAM LISTING ON PAGE 125

STARSHIP Memory Use

Page 148: Vectors, Flags, Timers, and Tables

address	low byte (148 is high byte)	FUNCTION
37888-9	00	point to ORIGINAL HOUSEKEEPING VECTOR
37890-1	02	address of READ STICK
37892-3	04	address of INTERRUPT MOVEMENT HANDLER
37894-5	06	not used
37896-7	08	address of MOVE COUNT
37898-9	10	point to MOVE ROUTINE (either MOVE COUNT or INTERR.MOVE.HNDL)
37900-1	12	point to WRAPUP (exit point for all)
37902-37919		reserved for future vectors/addresses
37920	32	ANIM TIMER (execute animation?)
37921	33	SET ANIM TIMER (reset value for ANIM TIMER)
37922	34	ANIM COUNT (where are we in sequence?)
37923	35	SPRITE 0 ANIMATION FLAG (1=animate spr 0; 0=directionalize)
37924	36	TIMER (execute move?)
37925	37	SET TIMER (reset value for TIMER; 1=fastest)
37926	38	SET GO (reset value for GO-SPEED)
37927	39	FIREFLAG (1=fire button pressed)
37928	40	GO-SPEED (how many sprite 0 moves per interrupt? 1=slowest)
37929	41	BOUNCING/SPRITE (sprite 0 is bouncing off this sprite)
37930	42	BOUNCING/FOREGROUND (sprite 0 is bouncing off foreground)
37931-37932		RESERVED
37933	45	PLAYWORK (used by READ routine)
37934		RESERVED
37935	47	MOVING (player is trying to move)
37936	48	WRAPFLAG (1=wraparound; 0=stop at edge)
37937	49	COLLISION/SPRITE (general sprite/sprite coll.)
37938	50	COLLISION/FIELD (general sprite/playfield coll.)
37939	51	RESERVED
37940	52	BOUNCE-S (1=sprite 0 rebounds from sprite collisions)
37941	53	BOUNCE-F (1=sprite 0 rebounds from foreground collisions)
37942	54	RESERVED
37943	55	EDGEHIT! (tells BASIC number of sprite that hit edge)
37944-51	56-63	LOCATION REGISTER OFFSET TABLE (:0,2,4,6,8,10,12,14) (use SPRITE NUMBER to index into this table)
37952-61	64-73	SPRITE 0 DIRECTION TABLE (:16,20,0,22,23,21,0,18,17,19) (indexed by JOYDIR as if 37951 were base)
37962-76	74+even	SPRITE BITMASK TABLE (:1,2,4,8,16,32,64,128) (indexed by LOC REG OFFSET to get horizontal bitmasks)
37963-77	75+odd	SPRITE JOYDIR TABLE (indexed by LOC REG OFFSET) (direction of movement 1=up + 2=down + 4=left + 8=right)
37978-92	90+even	TOP EDGES (indexed by LOC REG OFFSET) (set to top edge of screen for each sprite in order)
37979-93	91+odd	BOTTOM EDGES (indexed by LOC REG OFFSET)
37994-38008	106+even	LEFT EDGES (indexed by LOC REG OFFSET)
37995-38009	107+odd	RIGHT EDGES (indexed by LOC REG OFFSET)
38010-66	122–178	available for your routines

Pages 149-159: Machine Language Routines

addr.	(low,pg.)	ROUTINE (loaded at BASIC line number)
38067	(179,148)	INITIAL SYS ROUTINE (2000)
38144	(0,149)	ANIMATION SHELL (2020)
38272	(128,149)	MOVEMENT COUNTER (2050)
38314	(170,149)	BITSET (set horizontal high bit; 2060)
38324	(180,149)	BITCLEAR (2070)
38336	(192,149)	BASIC MOVEMENT HANDLER (2400)
38391	(247,149)	REPORT NON-0 WRAPS (2470)
38400	(0,150)	XMOVE (2100)
38528	(128,150)	UPMOVE (2140)
38592	(192,150)	DOWNMOVE (2160)
38656	(0,151)	LEFTMOVE/HI-BIT SET (2180)
38720	(64,151)	LEFTMOVE/HI-BIT CLEAR (2200)
38784	(128,151)	RIGHTMOVE/HI-BIT SET (2220)
38848	(192,151)	RIGHTMOVE/HI-BIT CLEAR (2240)
38912	(0,152)	READ JOYSTICK and MOVE ONCE (2500)
38976	(64,152)	INTERRUPT MOVEMENT HANDLER (2530)
39040	(128,152)	SET SHAPE 0 (2550)
39072	(160,152)	COLLISION CHECK for sprite 0 (2270)
39120	(208,152)	UNMOVE (2580)
39168	(0,153)	REPORT FIREFLAG to C0% (2700)
39184	(16,153)	REPORT EDGEHIT, COLLISIONS TO C1%,C2%, C3% (2710)
39232	(64,153)	REPORT PLAYER MOVING TO C4% (2720)
39248	(80,153)	REPORT BOUNCING/SPRITE to C5% (2730)
39280	(112,153)	REPORT BOUNCING/FOREGROUND to C6% (2740)

Pages 154-158: available for your machine language routines

40704	(0,159)	WRAPUP (2900)

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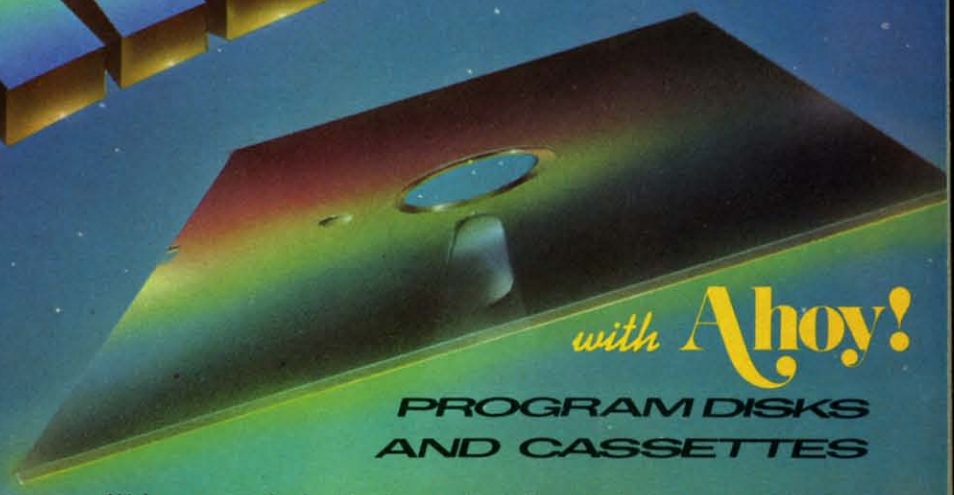

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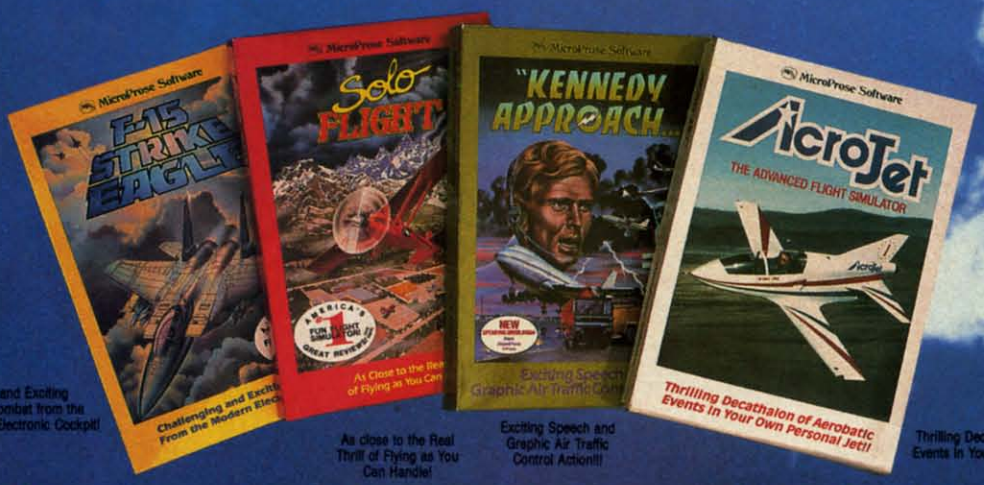

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SLITHER

FOR THE C-64

BY
NAT KOCH

Got fast reflexes? Then *Slither* is for you. The object is to collect prizes from the 40 rooms of a deserted castle by maneuvering the snake and avoiding walls and the snake's tail, which grows continuously (use a joystick in port 2). Collide with either, and you lose a life (you start with seven). If you succeed in gulping down the prize, you move to the next screen; the screens get more difficult as you go along.

After you complete a screen you get a bonus which is the same as the value of the prize on the next screen. If you complete all 40, you get a bonus equal to the sum of the values of all 12 prizes (1,860).

When you run *Slither,* after a delay of about 20 seconds the title screen appears and you'll be prompted to enter the difficulty (one is best for beginners and is the most playable). This corresponds to the number of prizes you must collect on each screen, so screens on difficulty level two are worth more than those on level one, but are harder. You also get more points for completing all screens on the higher difficulty levels.

The toughest screens are #24—Deathtrap I, #27—The Web, and #38—Deathtrap II. My high score is 52,940, starting on difficulty level one. □

SEE PROGRAM LISTING ON PAGE 132

SCREEN	PRIZE	COMMENTS
1. The Courtyard	strawberry (10)	no walls
2. The Gatehouse	plum (25)	one small room
3. The Barracks	lemon (50)	
4. The Garden	pineapple (75)	
5. The Chapel	apple (100)	a bit more difficult
6. The Pit I	banana (125)	one room inside another
7. Gallery I	silver bell (150)	all vertical walls
8. The Library	gold bell (175)	difficult when prize is in aisle
9. The Snake	candy cane (200)	narrow halls, dead ends
10. The Colonnade	silver ring (250)	all vertical walls, very narrow halls
11. The Wine Cellar	gold ring (300)	all horizontal walls
12. The Three Rooms	wreath (400)	three small rooms
13. The Double-E Room	"	narrow outer halls
14. Gallery II	"	very narrow halls, three areas
15. The Oval Room	"	one oval-shaped room
16. The Greenhouse	"	three long dead-end halls
17. The Mesh Room	"	all vertical, tricky maneuvering
18. The Prison	"	two rooms with narrow doors
19. The I-J-K Room	"	diagonal walls and one small door
20. The Cubicles	"	all short vertical walls
21. Triple-T	"	three areas
22. The Vestibule	"	very narrow doors, very tricky
23. The Arena	"	one semi-enclosed area
24. Deathtrap I	"	confusing layout, VERY difficult
25. The S-Chamber	"	s-shaped central wall
26. The Spiral Hall	"	two areas connected by a twisty hall, tricky maneuvering
27. The Web	"	very tight turns, the toughest
28. The Maze	"	two areas separated by one wall
29. The Pit II	"	two rooms inside another
30. The Atrium	"	three rooms, cross-shaped middle
31. The Cloakrooms	"	four very small rooms and doors
32. The Dungeon	"	thick-walled, two main rooms
33. The Shifting Hall	"	six rooms linked by two halls with broken wall, VERY difficult
34. The Suite	"	four rooms
35. The Pantry	"	mostly vertical walls
36. Gallery III	"	two main areas, one thick wall
37. The Windbreak	"	staggered vertical walls
38. Deathtrap II	"	four rooms, very narrow doors, connected by a chamber—tough
39. The Wall	"	one long horizontal wall
40. Deathtrap III	"	confusing layout, tight turns

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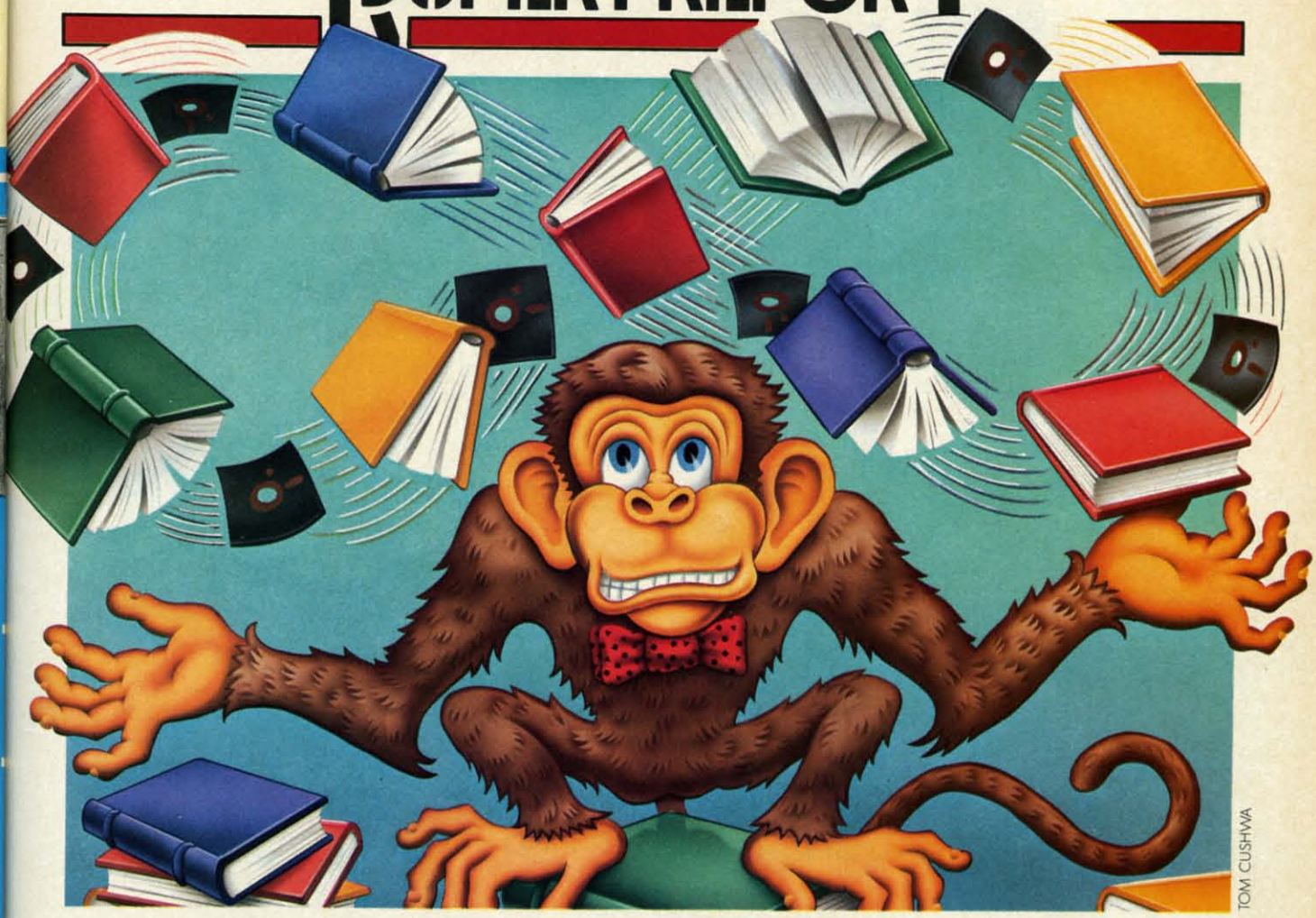

TOM CUSHWA

Monkey Business

Multitudes of Primates at Keyboards

By Dale Rupert

What do you get if you put an infinite number of monkeys at an infinite number of keyboards and let them type for a while? An infinite amount of garbage, you say? That is certainly true. In addition to the garbage, you will also find the complete text of the Encyclopedia Britannica and every other tome you can imagine. Furthermore, somewhere you will see the complete text of the Encyclopedia Britannica but with a single word misspelled, and one version with two words misspelled, and so forth.

Impossible, you say? Granted it is impossible to round up an infinite number of monkeys and keyboards, but if we could, every piece of writing (including this article) would be duplicated somewhere amidst the infinite number of typed pages. The fundamental concept here is never to underestimate the power of infinity.

Some basic mathematics should convince you that, given some quantity of the twenty-six characters in the alphabet, there is only a finite number of combinations of those characters. For example, if each monkey were allowed to type a specific number of characters at random, the number of differing results may be calculated as follows. There are twenty-six possible choices for the first character and twenty-six possible choices for the second character. If all the papers were collected after each monkey had typed just two characters, there would be 676 different types of papers (26 times 26 equals 676).

If three characters were typed on each page, there would be twenty-six variations for each one of the 676 two-character papers, giving a grand total of 17,576 pos-

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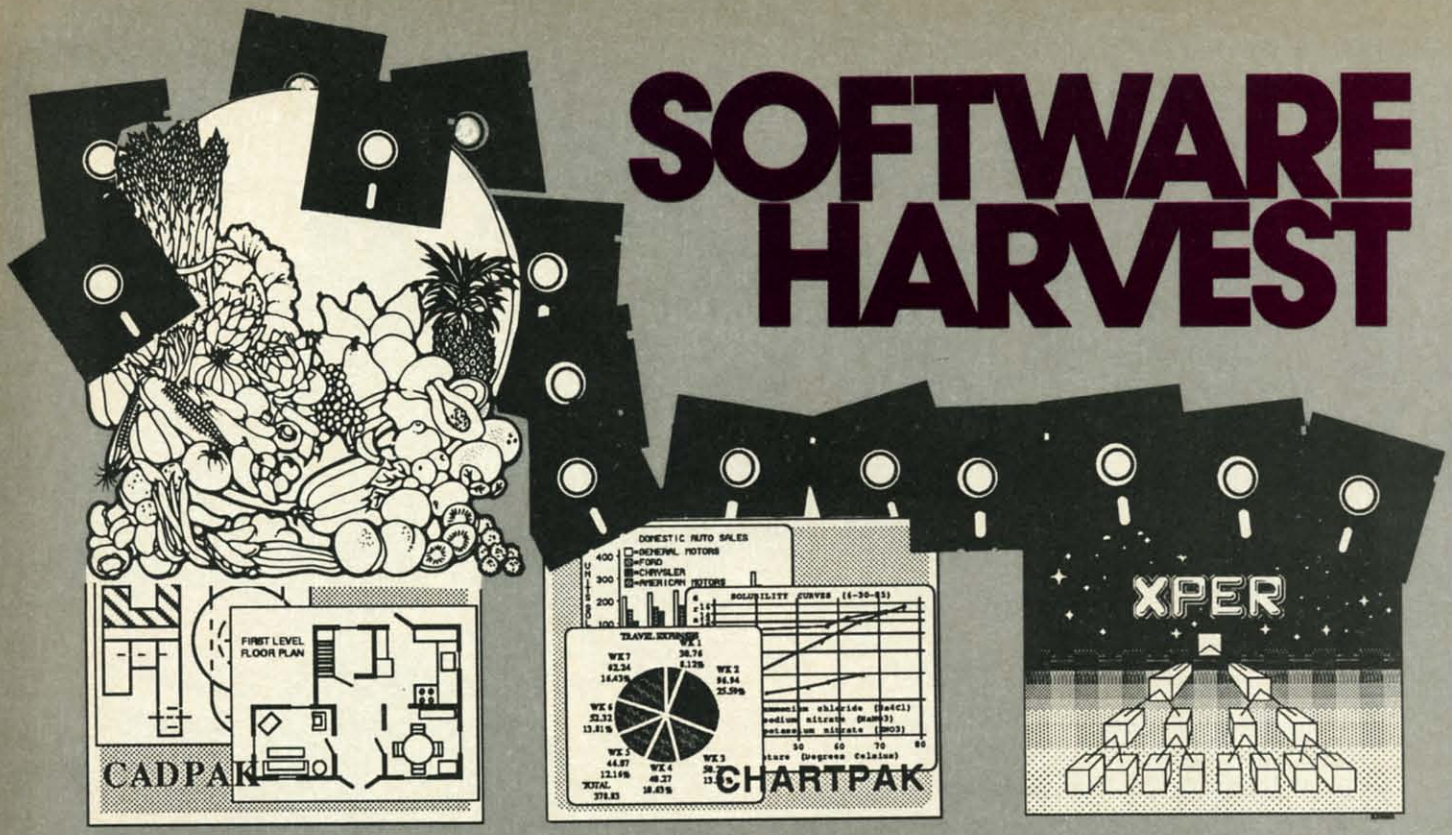

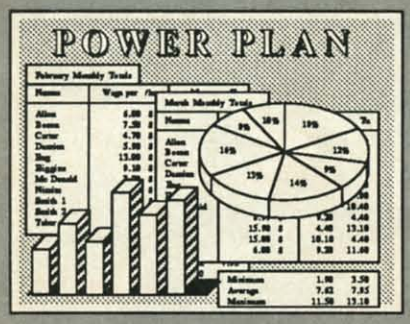

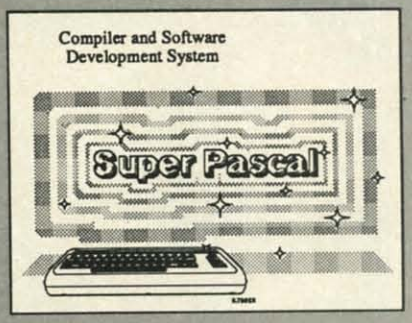

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sible results. In general, if each monkey typed X characters, the number of different results would be 26 raised to the X power. Clearly, if X is as large as the number of characters in an encyclopedia, the total number of combinations of those letters is incredibly huge.

Keep in mind, however, that this is still a *finite* number and could be calculated. With an *infinite* number of monkeys at work, there would actually be an infinite number of duplicates of each of the possible combinations! Mind-boggling, but true.

PRIMATE FUN

Throughout our discussion, we will assume that a monkey at a keyboard presses keys strictly at random. As you may have surmised, we will simulate the monkeys' keystrokes by means of the random number generator in our computer. In fact, that is very easy to do as the program *Strictly Random* (see page 124) shows.

We are assuming that the twenty-six letters of the alphabet are equally likely to be typed. The simulated keyboard actually consists of twenty-seven characters, including the space character. Normal text also contains punctuation marks and numerals, but we will not bother with them. The space character makes the random stream of characters appear somewhat like actual printed text.

Line 10 of *Strictly Random* defines the keyboard. Line 20 picks a random number from 1 to 27 (actually from 1 to 27.9999999) and prints the appropriate letter from the midst of A$. The MID$ function takes the integer part of N before picking a letter.

If you want to modify the keyboard, simply change the symbols in A$ and remember to choose a random number of the appropriate size.

You could probably let this program run from now until doomsday and not see many genuine English words. In fact, most of the display is rather uninteresting, to say the least. The problem is that the letters used in the English language do not occur uniformly. In most text, the letter "E" occurs more than one hundred times as often as the letter "Z." The space character separating words typically occurs more than twice as often as the letter "E."

If we want the random display of letters to look more like English, we must arrange things so that the monkeys are more likely to pick spaces and E's than Z's. We will use a weighting scheme which selects more common characters more often.

EVENING THE ODDS

In order to guarantee that a monkey randomly chooses an E more often than a Q, we may simply let it have a keyboard containing more E's than Q's. If you changed the string in line 10 of the previous program to contain 100 E's and only one each of the other characters, in a sense the screen would look more like real English.

We should also include more than one O and one A since they certainly occur more often than a Q or a Z. If we took a sample of text and counted the frequency of occurrence of each character, we could include proportionate numbers of characters on our keyboard.

With the proper ratios of characters on the keyboard, the monkey's printings will really look like English, or will they? Let's try it and find out.

The program *Weighted Keyboard* (see page 124) simulates a keyboard containing 1275 keys. Among the keys are 275 spaces, 130 E's, three Q's, and one Z. The relative frequencies were taken from the Cryptology section in the fifteenth edition of the *Encyclopedia Britannica.* The relative number of spaces was derived from an article on this subject in the book *Scientific and Engineering Problem-Solving with the Computer* by William Ralph Bennett, Jr. (Prentice-Hall, 1976).

It would be possible to write a program to analyze a sample of text and tabulate the relative frequencies of letters. We will save that for a future article.

As we did in the first program, we will define the keyboard by means of characters stored in a string variable. Since there are so many characters, we will use a string array. Each element of the array will store 255 characters. Consequently the array will require five elements, A$(0) through A$(4), to store the 1275 keyboard characters.

Lines 100 through 105 are DATA statements with the quantity of each character type and its symbol. Lines 190 through 260 fill the array with the proper numbers of characters. For example, the array's first element A$(0) contains 255 spaces. The next element A$(1) contains the remaining 20 spaces as well as 130 E's, 92 T's, and 13 of the 79 required N's, for a total length of 255 characters.

The computer takes a while to fill the array, but the remainder of the program runs quickly as a result of this approach. The last part of the program from lines 300 through 340 picks a random number from 0 to 1274 and selects the corresponding character from the proper element of the array.

K ranges from 0 to 1274. For example, if K is 257 (that is the 258th character), then X is 1 and CH is 3. A$(0) stores characters 1 through 255. The 258th character is the third character in A$(1). Thus the expression

```
MID$(A$(X),CH,1)
```

in line 320 selects the proper character from A$(1), and line 330 prints it. The process is repeated continuously.

The display is fascinating. Watching it is somewhat similar to watching the bells, bars, and lemons of a slot machine. You get the feeling that before long a genuine eight letter word will be generated before your very eyes. Alas, the payoff is comparable to that of a slot machine. Occasionally there are real three- and four-letter words generated, a mere pittance. It does become hypnotic after awhile. But even after more minutes of watching than I care to admit I have not seen any five-letter words surrounded by spaces that I recognize.

NO GETTYSBURG ADDRESS

Perhaps you will do better. Sooner or later the Gettysburg Address will appear before you. But if it does, don't tell anyone. No one will believe you. At least anyone who

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appreciates the improbability of such a sequence of characters being generated will dismiss your claim immediately.

To get an idea of the (un)likelihood of the Gettysburg Address being generated randomly, consider the mathematics. Assume that you have just seen the characters "FOUR SCORE AND " appear on the screen. Let's find the probability that the next characters are "SEVEN YEARS AGO". Since there are 1275 characters, 61 of which are S's, the probability that the next character is an S is 61/1275. The probability of an E being next is 130/1275. After that must come a V with its probability of 15/1275, and so forth.

The overall probability of the five letters "SEVEN" appearing next in that order is simply the product of the individual probabilities. Hence

(61/1275)(130/1275)(15/1275)(130/1275)(79/1275)=3.6 E−7

or not quite four chances out of ten million. What this means is that if you found ten million occurrences of the words "FOUR SCORE AND " throughout the randomly generated text, probably not more than four of them would be followed by the word "SEVEN".

In fact there will be more instances in which the other counting numbers "ZERO" through "NINE" appear instead of "SEVEN". (The previous statement is true with one exception. Can you find the exception?) The probability of the rest of the characters in the Gettysburg Address appearing in the proper order can be calculated similarly.

As we have stressed in previous articles dealing with random numbers and chances, probabilities help us predict average results, but specific results are unpredictable. Consequently it is certainly *possible* but very *improbable* that when you run the program *Weighted Keyboard* you will see very much intelligent prose.

FURTHER IMPROVEMENTS

The *Weighted Keyboard* generates significantly more valid words than the *Strictly Random* program does. One obvious shortcoming of the *Weighted Keyboard* is that it allows two or more spaces to occur sequentially. To remedy that situation, simply add these lines:

```
315 LO$=L$: REM SAVE PREVIOUS LETTER
325 IF LO$=" " AND L$=" " THEN 300:REM D
ON'T PRINT
```

Another addition to the program so that the output is more Englishlike is to eliminate Q's not followed by U's. Line 326 is a quick fix:

```
326 IF L$="Q" THEN L$="QU"
```

There are many other letter combinations which would never occur in normal English words, such as ZX, GQ, and so on. It would be straightforward to check for such occurrences and eliminate them before they are printed with statements similar to this one:

```
327 IF LO$="Z" AND L$="X" THEN 300
```

A more productive approach is to consider the frequencies of two-letter pairs, and to randomly choose one letter from a list of characters that is weighted by the previous letter which was chosen. For example, we could analyze English text to find out how often the letter E is followed by the letter A, and how often E is followed by B or by C and so forth. Once the letter E has been chosen, the program would use a special "E" keyboard from which to choose the next letter. The "E" keyboard contains letters in proportion to their frequency of following the letter E.

Similarly we would construct an "A" keyboard, a "B" keyboard, and so forth. The "Q" keyboard would contain only one character, the letter U, since once a Q has been typed, the next character chosen must be a U. Assume that we analyze some text and find that the letter O is followed by A three times, by B twice, by C zero times, and by D four times. The first characters in the string representing the "O" keyboard would be "AAABBDDDD...".

We can repeat this process for every letter and create twenty-seven different keyboards. Our program would choose a character at random from the *Weighted Keyboard* string. Depending upon which character is chosen, the next character would be chosen from that character's keyboard. The third character would be chosen from the second character's keyboard, etc.

Each character is randomly chosen, but the probability of choosing a particular character now depends upon the character which was picked just before it.

The framework is established for creating such a program. We must obtain letter-pair frequencies in order to create our keyboards, but they could be created just as we did in the *Weighted Keyboard* program. If you are inspired to undertake such a task, the details should not be terribly difficult.

For a much deeper analysis of this problem, as well as programs to implement it (although somewhat different in construction from the description above), I strongly recommend reading Dr. Bennett's book listed earlier. He deals with letter frequencies that vary from author to author and from language to language. In one of his talks on this subject, Dr. Bennett attached the computer to a speech synthesizer and generated sound as well as text. You might do the same.

It is possible to extend the concept of letter-pair frequencies even further. The program would choose the next letter from a keyboard with numbers of letters in proportion to the two previously chosen characters. Once A and H had been chosen, the computer uses an "AH" keyboard to select the next letter. If it happens to be an O, the next letter is chosen from an "HO" keyboard.

Once again, the computer provides a means of investigating phenomena which are impossible to control in reality. Taking care of a few hundred monkeys would be an enormous task—let alone an infinite number of them!

Now whenever someone asks what your computer can do, simply respond, "It writes Shakespeare (given enough time)." □ *SEE PROGRAM LISTING ON PAGE 124*

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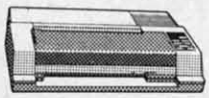

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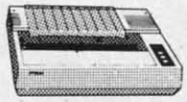

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TIPS AHOY!

CIA INFILTRATORS

The CIA1 chip in my Commodore 64 went bad recently. I suspected this chip to be defective because part of my keyboard was dead. Unfortunately of the eight keys dead, the RETURN key was one. I have a program that does a diagnostic check but without the RETURN key I couldn't load and run it.

On the Kaypro a control-m (CTRL-M) is the same as a return. I tried it on my 64 and it worked!

—Gary Smith
Ponca City, OK

SAVED AGAIN

Resaver is a short utility for the VIC and the C-64 that eliminates the risks associated with the infamous Save and Replace function of Commodore's DOS.

Resaver works by diverting the Save vector ($332-$333) to point to itself. When the operating system encounters the token for Save, it performs the preliminary steps, then jumps through the Save vector to Resaver where the command channel to the disk is opened, followed by the codes for scratch (S0:) and the file name. Once that is accomplished, the command channel is closed and control is passed to the Kernal Save routine.

```
10 REM **      RESAVER      **
20 REM ** BY SHAWN K SMITH **
30 :
40 REM SYS(830) ACTIVATES, RUN STOP/REST
ORE DE-ACTIVATES
50 REM LINE 110: 165,189, TO 169,008: DV
#=8: T=7495
60 :
80 FOR D=830TO885:READY:POKED,Y:T=T+Y:NE
XT
90 IFT<>7669THENPRINT"RECHECK DATA!":STO
P
100 DATA 169,073,162,003,141,050,003,142
110 DATA 051,003,096,165,186,133,186,032
120 DATA 177,255,169,111,133,185,032,147
130 DATA 255,169,083,032,168,255,169,048
140 DATA 032,168,255,169,058,032,168,255
150 DATA 160,000,177,187,032,168,255,200
160 DATA 196,183,208,246,032,174,255,076
170 POKE886,PEEK(818):POKE887,PEEK(819)
200 SYS830:POKE199,9:PRINT"RESAVER'S ACT
IVE"
```

The utility can be deactivated by hitting the RUN/STOP-RESTORE combination. SYS 830 will reactivate it. Addi-

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tionally, with minor changes to line 110, you can eliminate the ",8". It will be assumed! —Shawn K. Smith
Bronx, NY

FILE CAMOUFLAGE

Have you ever had a kid sister or brother, or for that matter anyone, snooping around your diskettes? Here is a simple way to stop them from meddling with your files. When you normally save a program you type SAVE"progname",8 and the directory will list the file as a program (PRG) file. BUT if you type SAVE"progname,s",8 the program will be listed in the directory as a sequential (SEQ) file. The only way to regain access to the file is to load it as follows: LOAD"progname,s",8. This way only people who know your program is not really a sequential file will be able to gain access to it. You can also use this idea with "progname,u" replacing "prognam,s". The disk directory will list the program as a user (USR) file.

—Wesley Vriend
Houston, B.C.

IN-CODE LOAD

The LOAD instruction in the Commodore 64 has a strange anomaly. When used inside a program, program flow does not return to the next statement, but back to the beginning of the program! LOADs inside a program are most often used to load in some accessory ML program. For example, consider the following bit of code:

```
10 LOAD "ML01",8,1
20 PRINT "READY?":REM CONTINUE...
```

If you run this code, line 20 will never be executed. Most people avoid this with:

```
10 IF A=0 THEN A=1:LOAD "ML01",8,1
20 PRINT "READY?":REM CONTINUE...
```

The following bit of code shows a better way, plus it allows for complete freedom in relocating the load.

```
10 OPEN 1,8,0,"ML01,P,R"
20 POKE 185,X:REM X=1 USE LOAD ADDRESS S
TORED WITH FILE, X=0 RELOCATE LOAD
30 POKE 780,0
40 POKE 781,LA:POKE 782,HA:REM LA, HA LO
W AND HIGH BYTE OF NEW LOAD ADDRESS
50 SYS 65493:CLOSE 1
```

It seems like more work, but it is much easier to debug than the other way, especially if the loads are scattered throughout the program.

Here is a small program which allows memory dumps to disk from inside a BASIC program:

```
10 OPEN 1,8,1,"ML01,P,W"
20 POKE 193,SL:POKE 194,SH:REM SL,SH LOW
 AND HIGH BYTE OF START ADDRESS
30 POKE 174,EL:POKE 175,EH:REM EL,EH LOW
 AND HIGH BYTE OF END ADDRESS
40 SYS 62957:CLOSE 1
```

—Don Lewis
Folsom, PA

See the bottom of the following page for information on submitting your programming hints to **Tips Ahoy!**

STRUCTURED BASIC?

Teaching students to write structured BASIC programs would be much easier if the computer would allow multiple spaces for indentations after a line number.

This IS possible on the Commodore 64. The line number can be followed by [COMMODORE J]. The remainder of the line can have any number of spaces left before the first keyword for indentation. The graphic symbol which appears the first time does not show up when you go to list the program. But the extra spaces disappear if the line is edited after LISTing (unless COMMODORE J is inserted again). Somehow, this simple procedure does not sink in on many students. However, an even simpler technique does: following a line number with a colon (:) has exactly the same effect as the COMMODORE J. The colon does show up when the program is LISTed, but editing the line does not eliminate the extra spaces.

—Jack Ryan
El Dorado, AR

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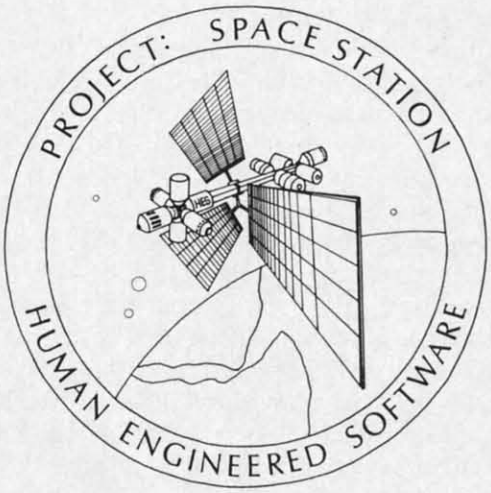

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INPUT RELIEF T-22

Many of us often become sick from having to view Commodore's seemingly mandatory question mark when using the INPUT statement. It's plain annoying sometimes! Any program without it is thought to possess a slight bit of added style. We all wish it were easier to eliminate that dreadful scoundrel.

Well, it is rather simple. The secret is a little-known fact that the keyboard has a device number of 0, and that any piece of hardware with a device number can have an input channel opened to it. One can accomplish the same effect as using the INPUT statement by trying the short and simple routine shown below.

```
10 OPEN 1,0
20 PRINT"TYPE SOMETHING: ";
30 INPUT#1,T$
40 PRINT
50 CLOSE 1
60 PRINT"YOU TYPED: ";T$
```

Line 10 opens the input channel to the keyboard. Line 30 gets the user's input. The PRINT in line 40 is necessary to move the cursor to the next line. And line 50 closes the channel. No question mark appears with this method, and it makes INPUT slightly more appealing.

—Kevin Brown
Anderson, IN

WRITE PROTECT TAB CHECKER

Have you ever wanted to put a simple routine in one of your programs to check to see if your diskette has write-protect on it? Here is a short routine that does so.

```
10 OPEN 15,8,15
20 PRINT#15,"M-R"CHR$(0)CHR$(28)
30 GET#15,A$:A=ASC(A$+CHR$(0)) AND 16
40 IF A=0 THEN PRINT"WRITE-PROTECT IS ON
"
45 IF A<>0 THEN PRINT"WRITE-PROTECT IS O
FF"
50 CLOSE15
```

The program reads bit 4 of a port at $1C00 on the disk controller. If the bit is set, the notch (write protect) is open.

How would you like to control the speed of your cursor in a program? To control cursor movement you can POKE56341,1 to speed it up and POKE56341,255 to slow it down.

—Mark Baker
East Wenatchee, WA

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Music Shop	?	105 sec.	105 sec.*	105*	**21 sec.**
Hitchhiker's Guide to the Galaxy	?	70 sec.	70 sec.*	N.G.**	**68 sec.**
On-field Football	?	159 sec.	66 sec.	63 sec.	**56 sec.**
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VIEW BAM (block allocation map)
1541 READ/WRITE TEST
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SYNC MAKER
DEVICE NUMBER CHANGE (disk drive)
ELECTRONIC ARTS BACKUP
DRIVE MON (disk drive m/l monitor)
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WEDGE-$8000
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DISK PROTECTION SYSTEM (stops copies)
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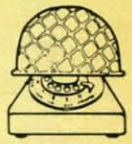

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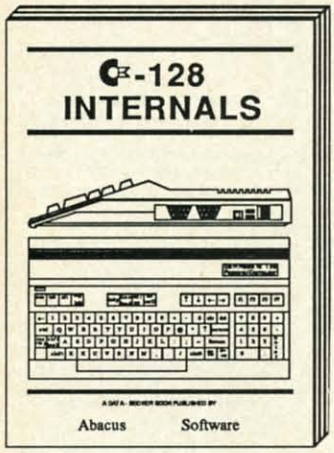

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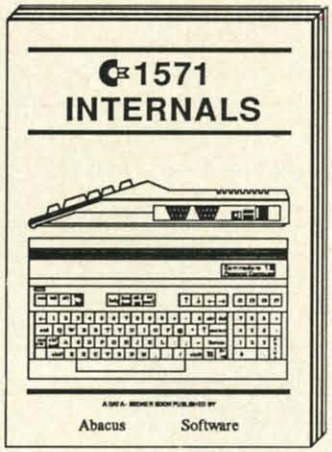

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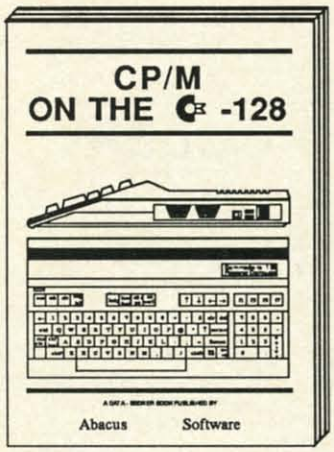

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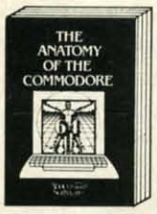

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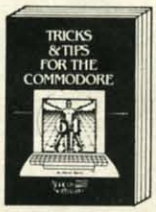

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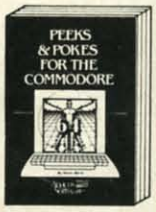

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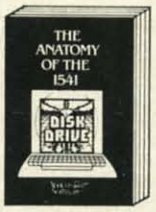

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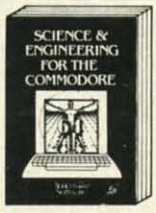

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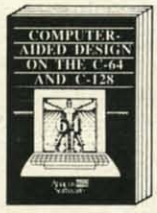

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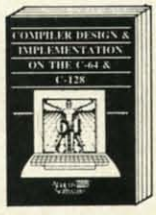

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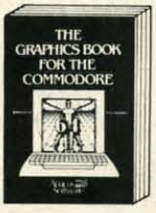

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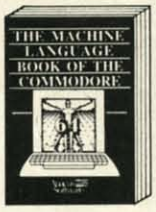

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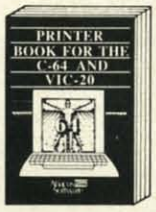

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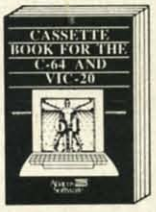

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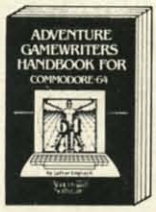

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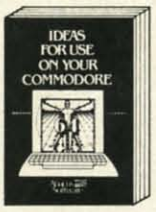

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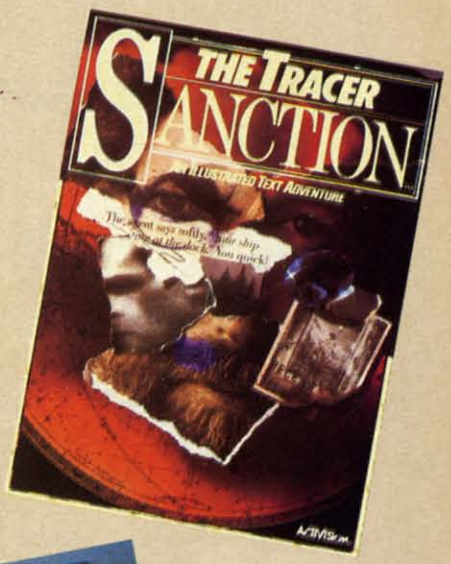
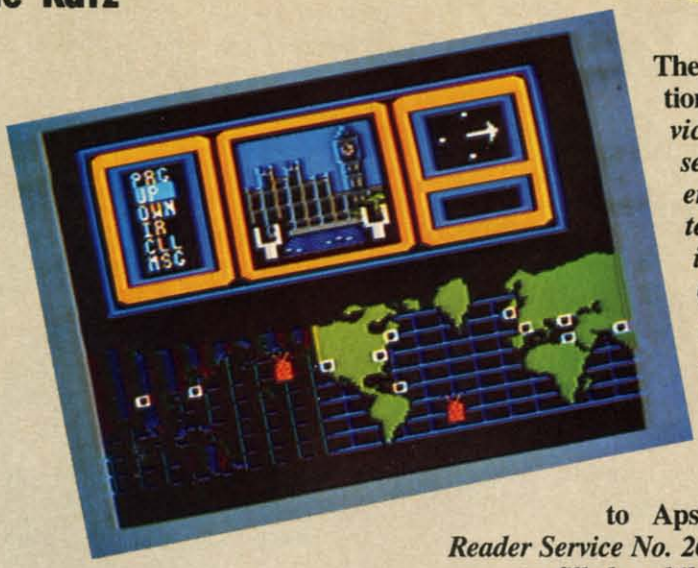




The Tracer Sanction *(Reader Service No. 266) sends adventurers after an interstellar criminal.* **Hacker** *(left; Reader Service No. 267) embroils the player in a vast conspiracy.* **Gateway to Apshai** *(bottom; Reader Service No. 268) includes a monster-filled multilevel dungeon.*

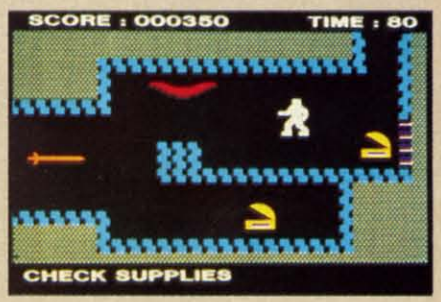
The adventure is now the most popular form of entertainment software, supplanting shoot-'em-ups. Computerists are discovering that blasting invaders can't compare with the rich, vicarious experiences available in role-playing programs.

As recently as 18 months ago, Commodore 64 owners must have wondered if the adventure game boom was going to overlook them. The system's software library included very few adventure titles, and publishers didn't seem in a hurry to rectify the situation. This paucity of adventure games resulted from a widely held belief that the Commodore 64 isn't suitable for such software.

What led people to this erroneous conclusion? Blame the Commodore's slow disk access. Adventures generally contain more code than most micros can hold at one time. Therefore, many titles periodically pull data from the disk to augment the information contained in the initial load.

According to the conventional wisdom of mid-1983, Commodore owners would not accept a long wait whenever the program returned to the disk. Since action contests reigned supreme at the time, publishers feared tackling a small, lukewarm market. They found it easier to ignore the problem than to solve it.

Several factors have turned scarcity into abundance. When adventures for microcomputers grew more popular, it heated up the demand among Commodore 64 owners, too. Software makers, reeling from the slump in action game sales, re-evaluated their earlier policies. Many decided that offering adventures for the Commodore 64 wasn't such a longshot gamble, after all. If Commodore owners wanted adventures badly enough, they would endure slow disk access.



The risk paid off handsomely. A few hits opened the floodgates. Now Commodore users can choose from among more than 60 titles with themes ranging from time travel to crook-catching.

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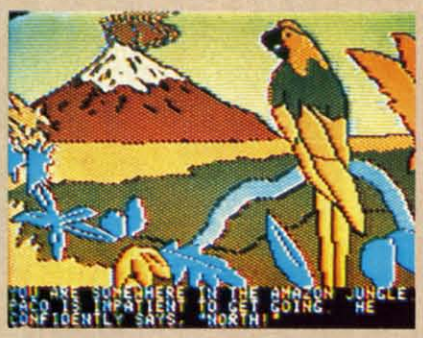

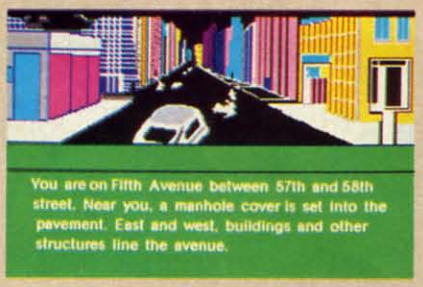

***Top to bottom:* Phantasie *(Reader Service No. 269),* Amazon *(Reader Service No. 270), and* Fahrenheit 451** *(Reader Service No. 271)*

Realms of Fantasy

Slaying dragons and rescuing fair maidens are still the most popular tasks for adventurers. Other themes are gaining, but fantasy is still king.

Zork I-II-III (Infocom) are classics which have stood the test of time. Although Infocom completed this fantasy trilogy in 1983, it holds its own against many newer programs. Although each third of the epic has a definite goal, the designers constructed the vast underground empire to encourage freelance exploration and adventuring.

Infocom has also published the first two parts of a new trilogy, *Enchanter* and *Sorcerer.* Similar to the *Zork* series in feel, it differs in one major respect: the hero is a magician instead of a warrior. Spellcasting makes a refreshing change from slinging a sword.

Ultima III (Origin Software) is the closest approach to a graphics adventure for the Commodore. Lord British's third game (following *Ultima I* and *Ultima II*) is his most majestic. The player can explore a fantasy wilderness and descend into dungeons, presented in first-person perspective, for some serious adventuring.

Questron (Strategic Simulations) is an especially good choice for those who've already tried the *Ultima* trilogy. The player must subdue a continent of monsters to reclaim the heart of a demon before its power engulfs the whole world. Charles Dougherty's design is less grandiose than *Ultima,* but it plays more smoothly thanks to a joystick-driven menu command system.

Doug Wood's *Phantasie* (Strategic Simulations) also owes something to *Ultima* in the areas of graphics and overall presentation. One to six characters cooperate to find the nine mystic rings which can vanquish the Black Lord. A party of mixed characters, each with a set of unique abilities, gives the gamer a lot to do.

Fantasy is a favorite subject for action adventure. *Gateway to Apshai* (Epyx) has a multilevel dungeon stocked with a wide assortment of monsters and treasures. Its sophisticated command control system, which works with keyboard or joystick, gives it features not normally found in action adventures, such as characters who gain levels of ability as they amass experience.

Return of Heracles (Quality Software) is not a real-time simulation, but it resembles other action adventures in most respects. Stuart Smith weaves classic Greek myths and legends into an open-ended mosaic. One or more players use a joystick-driven menu system to control as many heroes and heroines as it takes to per-

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The program author creates the background and characters and then thrusts the player right into the middle of the action. In a sense, adventures are like novels in which the reader and writer work together to construct the plotline.

Interaction is the key. The player enters commands, and the program reports the consequences. The nature of those commands and responses varies from title to title, but most adventures fit into one of four broad categories.

The most common format is the text adventure. Like radio, the all-prose game requires the player's imagination to fill in the visuals. Text partisans claim that even the newest microcomputers can't present illustrations as vibrant and detailed as the ones which the mind conjures.

Illustrated adventures follow the dictum that a picture is worth a thousand words. They employ a mixture of prose and artwork to inform players about what's happening in response to typed commands.

Manual dexterity plays a larger role in action adventures than it does in the other three types. The joystick moves the character around what amounts to a schematic map of the game's setting. The player can also perform simple actions like shooting and taking objects. Everything takes place in real time. This instant feedback gives action adventures a high excitement level and rapid pace which text and illustrated adventures can't match.

Graphics adventures blend aspects of the three other types to create a more encompassing and satisfying play-experience. They often use first-person or pseudo-3-D perspective to heighten the identification between the gamer and his or her onscreen surrogate. Animation, sound, and detailed

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form the 12 labors of Heracles.

Ali Baba (Quality Software), another Stuart Smith triumph, shows the author's penchant for offbeat subjects. "1001 Arabian Nights" is the theme for this one- or two-player real-time quest to rescue a kidnapped princess. Computerists can easily adjust the difficulty level of *Ali Baba* by varying the number of characters used to get the girl back. Anyone who can perform the deed with only the vulnerable and lightly armed Ali Baba deserves an "expert" rating.

Randall Don Masteller is the creator of *Dunzhin, Kaiv, Wylde,* and *Zigurat* (Screenplay), a quartet of action adventures. Each disk thrusts the hero into a different fantasy environment, from a subterranean maze to the spires of a fortress city. The graphics aren't as crisp as in *Gateway to Apshai,* but Masteller's tetralogy gives gamers at least as much scope for activity.

Visiting the Future

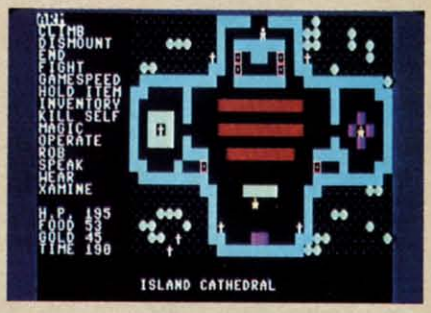
For some unfathomable reason, software publishers greatly prefer fantasy to science fiction as a theme for games. Yet there are a few notable titles.

Mindwheel (Synapse-Broderbund) incorporates aspects of both science fiction and fantasy. The protagonist is a volunteer who must travel telepathically through four linked minds before going all the way back to the dawn of society to fetch the Wheel of Wisdom. Only the lore contained in this mystic artifact can prevent the world from degenerating into bloody anarchy. Robert Pinsky, author of *Mindwheel* and a successful poet, writes lyrical prose full of striking images, but some computer adventurers may find it a bit flowery for their taste.

Fahrenheit 451 (Telarium) begins where the Ray Bradbury novel ends. As Montag, the player is a fugitive in a hostile city who must follow a twisty path to strike a blow against the tyranny of the book-burners. Excellent spot illustrations, printed along the top of the display, effectively complement the prose.

Suspended (Infocom) has one of the cleverest premises in the annals of gaming. The hero's brain is the human component of a vast computer system which runs a future society. An alarm device awakens this brain, because a worldwide catastrophe has occurred. The computerist uses a squad of sensor robots to discover and fix the problem before things fall apart.

Cyborg (Broderbund) is a new edition of a text adventure designed by Michael Berlyn in 1981. The man- machine protagonist returns to conscious-



Three scenes from Questron ***(Reader Service No. 272), featuring joystick-driven menu command system. See full review last issue.***

graphics add depth and richness to the game's world.

Order-entry systems proliferated in 1985, but three methods predominate in text, illustrated, and graphic adventures. Depending on the program, computerists use a parser, menus, or icons to convey their wishes to the computer.

A parser analyzes typed commands, isolates the main word or phrase, and selects the proper response from its memory. Onscreen menus list possible activities. Usually, the player highlights a choice with a joystick and presses the action button to implement it. An icon is a pictographic symbol of an action. The adventurer positions a cursor over the appropriate icon and clicks it to send the message to the machine. □

A LITTLE HISTORY

Non-electronic role-playing games (RPGs) inspired computer adventures. E. Gary Gygax and Dave Arneson got the ball rolling in the mid-1970's when they elaborated a fantasy miniatures campaign into "Dungeons and Dragons."

RPGs emphasize play-acting characters though a series of exploits. Questing parties explore the landscape and cooperate to achieve common goals.

The Dungeon Master (DM) is the driving force of a non-electronic RPG. This indispensible person designs the adventure and conducts the actual game. The party declares its intentions, and the DM responds with the results.

The catch is that the DM spends weeks or even months constructing the campaign. An episode that plays in three hours could take 10 times as long to write. And after all that work, the Dungeon Master never gets to play.

Electronic adventures replace the DM with the computer. No program can match the range and sophistication of a good DM, but computer adventures set up quickly and need no umpire. And unlike non-electronic RPGs, most computer adventures can be played solitaire.

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ness without even the memory of his own identity. Only by pooling the talents of both aspects of the hero can the gamer dispel the clouds of ignorance in time to avert total destruction.

Journey into Mystery

Deadline, *Witness*, and *Suspect* (Infocom) are three of the best detective stories on disk. *Deadline* challenges the investigator to bring the murderer of a rich man to justice within a 12-hour time limit. *Witness* puts the player right at the scene of the crime as a shot fells the patriarch of a family. *Suspect*, the most recently published of the three, turns the tables and makes the detective the chief suspect in the case.

These Infocom text adventures feature intricate plots and characters who act independently of the detective. A sleuth might find a particular room empty at 10 a.m., overhear someone talking on the phone at 10:30, and observe a different person reading a newspaper at 11 a.m.

Stopping crime in the far future is the goal in *The Tracer Sanction* (Activision) and *Robots of Dawn* (Epyx). *Tracer* sends the computerist on an interstellar hunt for a master criminal known only as the Wing. Multiple endings allow the gamer to wrap things up in a variety of ways, depending on personal preference.

Robots of Dawn is based on Isaac Asimov's 1984 best-selling novel of the same name. The gamer becomes a detective from a somewhat dilapidated earth who travels to an advanced planet to bring the killer of a famous scientist to justice. Reading the book won't spoil the game, either, because *Robots of Dawn* diverges from the novel in many important ways.

Ripper! (Avalon Hill) summons the computerist to a high-level conference to discuss ways to catch Jack the Ripper. Unfortunately, the fiend waylays one of the famous guests and prowls the mansion killing everyone he meets. The ominous tolling of a bell tells the user that the madman has struck again in this text thriller.

Another Victorian mystery is *Sherlock Holmes: Another Bow* (Bantam). The World's First Consulting Detective, faithful Watson in tow, is a passenger aboard a trans-Atlantic steamer filled with celebrities of the day. Holmes must solve a series of minor cases, and the larger one which underlies them, before the boat docks. The display contains a generous amount of text with atmospheric illustration across the upper quarter of the screen.

The Fourth Protocol (Bamtam) is more a spy story than a mystery, but it has plenty of opportunities for sleuthing. This icon-driven adventure, inspired by the characters and situations of Frederick Forsyth's best- seller, consists of three connected episodes. *The Fourth Protocol* puts the gamer into the role of agent John Preston, who must singlehandedly foil a world-threatening Soviet scheme.

Of Worlds Unknown

Movies like *Raiders of the Lost Ark* and *Romancing the Stone* have rekindled interest in tales of lost civilizations and uncharted lands.

Mac Steele, hero of *Mask of the Sun* and *The Serpent Star* (Broderbund), is the Indiana Jones of computer adventuring. His published exploits involve the search for a Mayan artifact, and an even more exciting tale in which he must reclaim Tibetan scrolls which lead to a timeless city and its magical jewel. Animated sequences enliven both of these adventures, but the actual artwork is too ordinary to create the proper mood.

Michael Crichton wrote *Amazon* (Telarium), and his deft touch saves what could have been a ho-hum title. The plotline is still too linear, but perfect pacing and varied locations make *Amazon* very enjoyable. When a satellite transmission shows a wrecked survey camp, the investigator-hero must venture into the jungles

Scott Adams converted a dungeon called *Adventure*, which ran on mainframes, for micros. Early text titles suffered from the memory squeeze. Most consisted of a series of puzzles which the hero solves in lockstep order.

Ken and Roberta Williams started Sierra to market their invention, the illustrated adventure. Memory kept the parser-driven text to a minimum, but seeing the people, places, and things on the screen proved a popular novelty.

Next came action and graphics adventures. Andrew Greenberg and Robert Woodhead's *Wizardry* sends six characters into a multilevel labyrinth to retrieve a stolen treasure. Each character class has unique abilities: mages cast spells, priests work miracles, thieves open locks, and fighters lead the way in combat. Other important contributors to the development of these two types were Lord British *(Ultima I-III)*, Stuart Smith *(Fracas, Ali Baba)* and John Bell *(Fantasyland)*.

Increased memory has fueled recent advances. Infocom upgraded the parser and has produced a library of intricately plotted games noted for extensive descriptive prosetext. Interplay Productions (designer of *The Tracer Sanction* and *Mindshadow*) premiered a new format for illustrated adventures which combines copious use of animated illustration with substantial text blocks. Telarium and Bantam have demonstrated other ways to mix text and graphics in new proportions in their adventures.

Most recently, Synapse has introduced a line of "electronic novels." They feature a parser which facilitates a greater amount of interaction between the player and the game's characters. □

ADVICE FOR NOVICE ADVENTURERS

This magazine does not dispense solutions for specific adventure games. Timely hints can get things moving, but they also spoil the fun if unexpectedly encountered before they're wanted or needed. If you get stuck on a particular game, investigate the hint booklets which many

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of the Amazon to find out what ripped apart the base and killed the whole party. Illustrations which include some animation work well with the extensive text.

When the curtain rises on *Infidel* (Infocom) the hero is in dire straits. While on an archeological dig in the Egyptian desert, he awakens alone in the wasteland near his destroyed camp. Getting out of this pickle with a whole skin, much less the treasure of the lost tomb, requires persistence and strong logical thinking.

The writing in this text adventure, more sober than in other Infocom titles, keeps the gamer immersed in the struggle. *Infidel* doesn't provide the freedom of movement found in *Zork,* but the twists and turns of the storyline, capped by a perfect surprise ending, more than make up for this.

Coming Attractions

That's the best of the current adventure crop, but what about next year's harvest? Though the future is never certain, the signs are overwhelmingly positive.

Things look especially promising for fans of mystery and spy adventures. *Hacker* (Activision) is the first adventure which actually stars a computer user. The hero logs onto a network and stumbles upon evidence of a vast conspiracy. The gamer uses a robot scout to gather enough evidence to sink the plot before it succeeds.

Activision is also readying an illustrated adventure with extensive text which should appeal to fans of hard-boiled detective writers like Raymond Chandler and Ross MacDonald. Knockabout gumshoe Sam Harlow plunges into a world of conspiracy, kidnapping, and death to protect the meek and catch the guilty.

Perry Mason: The Case of the Mandarin Murders (Telarium) brings Erle Stanley Gardner's lawyer to the gaming screen. The murder is diabolically complicated, and the plot is expected to incorporate more than two dozen possible endings.

The Alpine Encounter (Random House) is a super-spy caper set in the Swiss Alps. One highlight is an arcade-like ski chase.

Spectacular graphics are a highlight of *Alternate Reality* (DataSoft). This fantasy role-playing dares the hero or heroine to escape from an alien city.

Roger Zelazny's series of five science fantasy novels is the source for *Nine Princes in Amber* (Telarium). This tale of multiple realities and palace intrigue features a new parser which is said to facilitate a high level of interaction between the protagonist and the non-player characters.

These are only some of the forthcoming titles, but they suggest that the adventure game boom will continue for some time. There are exciting times ahead for Commodore adventurers. □

software manufacturers produce as a customer service.

On the other hand, there are a few things any player can do to make adventuring much more successful. The most important are:

Read the documentation. Even if you're a boot-and-bash person from 'way back, don't ignore adventure game rulebooks. It's frequently a fund of helpful information which never directly appears on the screen.

Make a map. Getting lost is all too easy in many adventures. Just draw a box for each location. Connect locations with lines labeled to show how one gets from one spot to the other. Put data about each location, like the existence of treasure, inside its box.

Read the screen carefully. Descriptions are worded to convey clues and information. Memory severely limits superfluous copy, so what's there is important.

Try things. It's only a game. The worst that can happen is that you'll have to restart. Sometimes, the results are positively shocking.

Save the game. Few players have the stamina to complete an adventure in one sitting. Saving frequently is also a good idea, because it eliminates the boring, needless repetition of starting from scratch whenever you make an error.

These guidelines don't guarantee a win, but they improve the odds. □

Deliver us some evil*—Mail Order Monsters *builds on 12 basic shapes.
READER SERVICE NO. 273

MAIL ORDER MONSTERS

Electronic Arts
Commodore 64
Disk; $35

This lighthearted program crosses "Rocky" with "Godzilla." The player becomes an owner/manager who designs and directs morphs (Mail ORder Psychon Heroes) in combats which take place on a variety of terrain.

Electronic authors Paul Reinche III, Evan Robinson, and Nicky Robinson provide a truncated version for beginners, and a little practice on that level won't hurt. Move up quickly, because a lot of the fun comes from actually designing the morph in the intermediate and tournament games.

The main difference between the latter two modes is that the tournament version links individual battles into a campaign. The result of each battle is saved to disk. Victory earns psychon points, which the manager spends like money to improve a fighter's abilities and equipment.

After the computerist enters the name of the manager, the program presents a selection screen. Use the joystick to walk the humanoid figure at the center to the morph vats on the far right.

This brings up an illustrated menu which depicts the 12 basic morphs. It's quite a menagerie, too. Possibilities include a crab, pterodactyl, worm, wasp, motile plant, hominid, and brontosaurus. Moving the shaft of the

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joystick highlights a potential selection and summarizes its natural abilities and cost in psychons.

Pushing the action button selects the highlighted morph and calls up the screen which summarizes its basic traits. You can improve the morph's armor, muscle, speed, mind, and life, but each increment has a price in psychons.

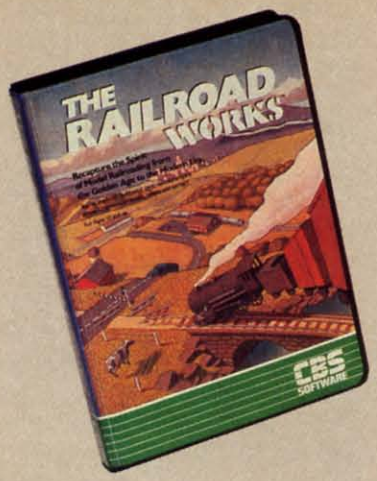
Next, shop for extra traits. These range from methods which increase movement speed, such as gills (for water) or teleportation to defenses like regeneration of life points or resistance to psi-attacks. Especially in the tournament game, which limits design costs for a morph, the manager won't be able to afford many of these extras. They can be added after a few victories.

The original selection screen reappears, but this time the manager is leading the Morph. A trip to the weapons shop comes next. There, the manager can purchase weapons, sundries, and supplies. The latter includes things like food to power physical attacks, energy packs for certain weapons, and ammo for guns and other projectile weapons.

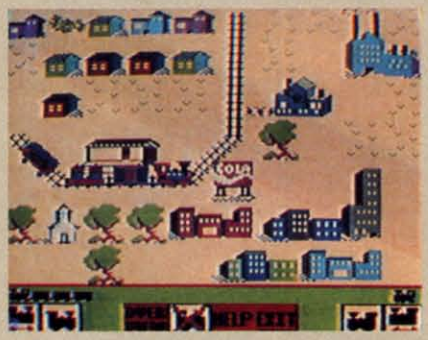
When the morph is ready, the manager heads for the Transmat. The players pick the terrain on which the battle will be fought and the exact nature of the contest. There are three different combats: a cooperative fight against a horde of invaders, a struggle to the death versus the other morph, and a contest much like "Capture the Flag." In the tournament mode, each manager choose one special rule such as "no chemical attacks" or "no surrender." The final step is to establish the number of victories needed to win the whole battle.

The battle starts on a multicolored strategic map of the selected battleworld. A solid square represents the location of each combatant. When these squares overlap, the display switches to a more detailed tactical screen for the actual fight.

The battle phase is a greatly elaborated version of the combat segment of *Archon*, which Reiche helped design. The manager moves a morph with the joystick and attacks by pressing the action button while pointing the stick in the desired direction.



The Railroad Works: ***right on track.***
READER SERVICE NO. 274



Player can lay track, insert receiving and shipping sites, and landscape.

Boxes in the upper left and right corners report the status of each morph. Double-clicking the action button activates the features of the box which permit the morph to change weapons or use special abilities which would drain energy too rapidly if continuously employed. It is best to make these changes while the fighters are moving around the strategic map, because combat proceeds so rapidly that there's no time for such complicated moves.

Mail Order Monsters can be played head-to-head or against the computer. Those electronic managers are pretty savvy, better than many experienced human players.

The instruction booklet is very entertaining, but it's not always helpful. In spots, jokes overshadow the essential information about designing and fighting the morphs. A straightforward summary would have been a good addition.

Fortunately, most computerists will have little trouble getting the hang of *Mail Order Monsters*. If you're really stuck, watch the demo game for some hints on mechanics and strategy.

Memory limitations may have kept this very good game from attaining true excellence. The construction portion is excellent, but the battle phase could have used some elaboration. Combat is exciting and entertaining as far as it goes, but a wider range or tactics would have improved it.

Younger gamers are most likely to be attracted by *Mail Order Monsters*. The slam-bang real-time fights are sure to appeal to blast brigaders. While the design portion of the program is reminiscent of the way many kids play with action figures.

Electronic Arts, 2755 Campus Drive, San Mateo, CA 94403 (phone: 415-571-7171). ***—Arnie Katz***

THE RAILROAD WORKS

CBS Software
Commodore 64
Disk; $34.95

Just as the arrival of efficient diesels led to the end of the steam railroad era, the urbanization of America has crippled the hobby of model railroading. Oh, clubs and some rich individuals own and operate sprawling panoramas of miniaturized trains and scenery, but most folks just don't have the space. The typical city apartment doesn't even have room for a rudimentary N-gauge layout, much less the sumptuous setups of Lionel trains which were once a Christmas staple in department stores.

Just when you thought that gray engineer's cap had found a permanent home at the back of a closet, The Connelley Group has produced an electronic model railroad. The computerist can lay track, insert receiving and shipping sites, and landscape with scenery. There's enough room—12 screens—to construct the kind of dream layout which few railfans have ever owned.

The Main Menu offers eight joystick-selectable options. They allow the armchair engineer to construct a layout, operate it, play a railroading game, save a setup to disk, recall one from memory storage, clear the

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screen or change from classic to modern rolling stock (trains).

"The Railmaster's Guide," the step-by-step documentation, wisely counsels would-be rail barons to sketch a track design before picking up the joystick. Plan in hand, the user picks "Construct" from the Main Menu to fetch the layout display.

The joystick controls the pointer which is initially located in the train-yard. Icons drive the construction process. Just move the pointer to the picture which symbolizes the desired activity and press the action button to implement the choice.

With the "lay track" icon engaged, the pointer becomes the railhead. The action button locks the pointer in place to lay a section of track. The builder sets the angle of the new piece relative to what's already in place and pushes the button to make the track section appear. The pointer automatically moves to the new railhead, which makes it easy to rapidly lay section after section.

There are no curved tracks, a major disappointment. Orienting a track 45 degrees from the piece behind it accomplishes the same purpose as a graceful curve, but isn't nearly as pleasing to the eye.

The four scenery icons work much the same way. Clicking one presents a menu of choices. The computerist puts the cursor over the desired building or terrain and hits the button to return to the layout. Moving the cursor to the desired location and pressing the action button positions the scenery. The user can repeat any selected piece of scenery by simply moving the joystick to a new spot and hitting the button. For example, repeatedly placing a picture of a tree creates a forest.

The "operate" option has an eight-icon control panel. This lets the model railroader control either of two trains and determine which one the omni-directional scrolling will follow as it navigates the trackage.

A throttle is a thin horizontal bar with "Reverse" on the left end, "Forward" on the right, and "Stop" in the middle. Side-to-side movement of the joystick pushes the throttle indicator in the corresponding direction. The further the engineer moves the indicator from the Stop position, the faster the train travels.

The game included on the disk is a fair approximation of the way model railroading clubs run their setups. An overall map shows the right-of-way and all potential shipping and receiving sites. A rectangle represents any business which might have cargo for your line to carry. The color of the box indicates how many cargos are waiting at each site. If you don't pick them up soon enough, the business ships by air instead, and the operator loses points.

The game isn't especially difficult, but it gives the computerist something to do with the transportation empire. It sure beats letting the train run around and around aimlessly.

The Railroad Works is right on track for all-family fun.

CBS Software, Greenwich, CT 06836 (phone: 203-622-2614).

—Arnie Katz

SUMMER GAMES II

Epyx
Commodore 64
Disk; $29.95 to $34.95

Light the torch and release the doves. Joystick-decathletes can enjoy a second helping of the only Olympic events nobody ever boycotts. Epyx has produced a sequel to their tremendously successful *Summer Games.*

The sequel presents eight new events, including the triple jump, rowing, javelin throw, equestrian, high jump, fencing, cycling, and kayaking. While spectators may consider some of these events a little esoteric, they are generally a lot of fun to play in this action strategy simulation.

The production values of *Summer Games II* are absolutely top of the line, even better than the original *Summer Games.* The lifelike animation of the well-drawn competitors dovetails perfectly with the excellent artwork. When an onscreen athlete fouls during the triple jump, his arms drop to his sides, his chin falls to his chest, and he walks a few sullen steps before stopping to contemplate his inadequacies.

Summer Games II: ***eight new events.***
READER SERVICE NO. 275

Despite poor color-coding, the fencing event is a highlight of the program.

Special themes accompany the play of each contest. The design team has done an excellent job of capturing the special ambience of every event in music.

As in *Summer Games,* players can compete in one event or try them all in succession. A practice mode lets the gamer hone his or her skills. The most useful option found in *Summer Games II* may well be the opportunity to connect the two disks for a 16-event tournament.

The triple jump is one of the most difficult events on either disk. Learning to time joystick motions to execute a hop, skip, and jump in rapid succession is sure to tax anyone's reflexes. Until fingers master the proper timing, be prepared to foul repeatedly.

Rowing and cycling employ substantially the same visual presentation. In both cases, the screen is horizontally bisected into two large windows. Each of these mini-screens is itself divided in such a way that each player has a complete view, objective and subjective, of the action. When the contestants keep the race close, all four viewing windows remain occupied. Should one rower or cyclist build a big lead, however, distance

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markers indicate the relative standing of the competitors.

The javelin toss is the first "throwing" event to be featured in the *Summer Games* series. The javeliner hits the button to trigger the release of the spear and points the joystick to establish the angle of flight. Too low an arc buries the javelin in the ground, while a cloud-buster doesn't yield enough distance.

Timing is everything in the high jump, which is faintly similar to the pole vault in *Summer Games*. The player sets the crossbar height prior to taking the leap and then attempts to take off at just the right spot to soar over the bar.

Kayaking is the pleasant surprise of the disk, an interesting, off-beat competition. Overhead perspective gives a bird's-eye of the one-man boats as they cut through the fulminating white water. The player sweeps the joystick back and forth to work the oars and steer the kayak through the numbered gates. The motion of the controller really conveys the experience of working the oars, because speed is secondary to maintaining the right rhythm.

The equestrian and fencing events are, unquestionably, the highlights of the program. The houseback-riding competition uses a complex joystick routine to spur the steeds into a canter and make them leap over the barriers. When the horse approaches one of the numerous jumps, the "rider" moves the joystick to the right and then quickly to the left before resuming full speed. Get too close to an obstacle, however, and the horse will stubbornly refuse the jump. And when that happens, all you can do is walk the beast back a few paces and try again. If the jump is not performed perfectly, the rider will be thrown from the saddle, losing more precious time.

The equestrian graphics are outstanding. There's a lush rustic countryside in the background and a variety of jumping obstacles, including ponds, posts, and gates.

Fencing is a positive joy, whether the player goes up against another human combatant, or faces a computer-controlled droid. An onscreen computer counts the hits, which makes it easy to keep track of the action.

The only drawback is the poor color-coding for the foils. Green and red seem silly choices for a pair of fencing foils, especially since the duelists wear white shirts. Darker colors would have contrasted much more effectively, especially considering the small size of the figures. It also would have been nice if the designers had included a beginner's difficulty setting for this contest. It's so demanding that some gamers will have a hard time even getting started.

These are only minor complaints about a game which covers itself with glory from the familiar opening ceremony to the closing festivities. Put simply, if you own a Commodore 64, this disk is a must.

Epyx, 1043 Kiel Court, Sunnyvale, CA 94089 (phone: 408-745-0700).

—Bill Kunkel

Computer Fireworks Kit: ***a sparkler.***
READER SERVICE NO. 276

THE COMPLETE COMPUTER FIREWORKS CELEBRATION KIT

Activision
Commodore 64
Disk; $29.95

Two years ago, every new entertainment program was "the next *Pac-Man*." Now every new disk is a kit of some kind. It's this year's marketing buzzword in the software business.

Occasionally, though, something like this fireworks show reminds the computerist what started the rage for kits in the first place. *The Complete Computer Fireworks Celebration Kit* lives up to its name. It provides everything needed to construct a pyrotechnic display, including music and customized messages.

One of the utility options, "create," even makes a disk which can be played back by anyone with a Commodore 64. That's right, the recipient doesn't have to own a copy of the kit.

Despite a somewhat hazy set of instructions, *Fireworks* is remarkably simple to learn and operate. The Design Screen is so logically organized that it becomes nearly second nature by the time you finish your first show.

Everything, except writing the messages, is accomplished with the joystick. The stick moves the little onscreen hand from selection to selection, and the action button locks in the desired choice.

The Design Screen functions are arranged in vertical columns. Along the extreme left edge of the display are the utilities. These can play a fireworks show, save one to disk, load shows from disk for replay, initialize storage disks, make sendable display disks, present the menu of 20 songs, transfer melodies created with Activision's *Music Studio* to the kit, or pick one of six background scenes.

A system of frames is the heart of this program. The fireworks fan builds the show in somewhat the same way as an animator produces a cartoon, one cell at a time. Thankfully, the program takes care of all the little details.

The gray frame area occupies about three-quarters of the screen. Horizontal dotted lines divide the area into individually numbered frames, each of which represents the opportunity to program one effect. A narrow control band along the left edge of the frame strip enables the computerist to insert a blank frame, delete the current one, or simply change it to something else.

Once the frame is blank, the first step is choosing the type of effect which should be located there. This can be an airborne or ground-based pyrotechnic, the start or end of a song, a message, a cue to repeat a sequence, a dramatic pause, or a timer which varies the interval between explosions.

Next, the player moves the pointer to one of the variables in the frame's sub-menu. The exact nature of the

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choices depends on the type of effect, but the designer gets to pick the screen location, color, and duration.

Hitting the action button when it's next to a sub-menu variable shifts the pointer one column to the right. The user moves the stick left or right to adjust the factor. Most factors are represented by horizontal status bars.

The composer can either estimate each bar by eye or check the gauge at the top of the screen for a numerical value. This makes it much easier to do things like having three roman candles detonate at the same height.

To see the whole display at any time, move the pointer to "play" and hit the action button. The Show Screen appears, and the fun begins. When working on a fireworks exhibition, it is sometimes helpful to see only a small portion of the total production. The "from" option starts the replay from the frame which is visible at the top of the screen.

The music included with the program is arranged in four groups of five tunes each. The player simply programs a song-start in the desired frame and then chooses the desired song or group. The renditions aren't the best ever heard on a Commodore, but they're more than adequate.

Messages can be inserted at any point in the display, subject to aesthetic considerations. The words can either pop into view or scroll across the screen from right to left.

The toughest part of designing a fireworks display is coordinating the timing of the various effects. A combination of pauses, time-delay fuses, and status bar adjustments can produce a slick-running finished display, but the fine-tuning procedure does tend to get laborious.

Playability is the strongest suit of *The Complete Computer Fireworks Celebration Kit.* Unlike most games, this creative pastime can't be mastered. This program can be used again and again, and in the hands of a creative composer, it will nearly always produce something fresh and delightful.

Activision, 2350 Bayshore Frontage Rd., Mountain View, CA 94043 (phone: 415-960-0410). *—Arnie Katz*

SUPER BOWL SUNDAY

The Avalon Hill Game Company
Commodore 64
Disk; $30

The Super Bowl may be well on its way to becoming a legal holiday, but the annual National Football League showdown is not a favorite of gridiron purists. Even leaving aside the monumental hype which precedes the game can't disguise the blunt truth: too many Super Bowls have degenerated into one-sided slaughters.

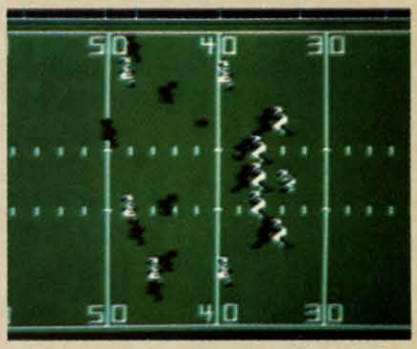
Maybe the next time one team blows the other out of the stadium before half-time, they ought to consider finishing the game on a Commodore 64. *Super Bowl Sunday* can't prevent one side from trampling the other into the turf, but it's generally faster-paced and more exciting than the real thing.

The program disk includes 10 Super Bowl match-ups, from the first game to the Miami v. San Francisco clash of 1985. (The person who did the team selection menu forgot that the Super Bowl takes place in January, so the listed years actually refer to the year in which the season started.) One or two computerists can either replay an actual Super Bowl or pair teams from different years for a "what if?" confrontation.

Super Bowl Sunday is a statistical replay simulation of professional football. Each player is a mathematical model which accurately reflects that athlete's performance in the season on which the simulation is based. When a compu-coach calls a pass from Joe Montana to Dwight Clark, the chances of success are the same as when San Francisco's Bill Walsh tries the same strategy in a game. Of course, the ability and positioning of the defenders has an effect, too.

The Main Screen appears prior to the start of every play. It contains a quarter-by-quarter score, time remaining in the quarter, the down, yards-to-go for a first down, the position of the pigskin on the field, and a summary of the just-completed play. One omission: nothing indicates which team has possession.

Super Bowl Sunday shines on defense. The coach can blitz any or all



Super Bowl Sunday: ***3 modes of play.***
READER SERVICE NO. 277

linebackers, key on either running back, use a six-man line in short-yardage situations, insert a fifth defensive back on sure passing downs, and double-cover receivers.

The defense begins each play by picking its strategies from a pair of menus. The first screen determines whether the defensive formation will anticipate a run or a pass. The next contains the list of options mentioned previously.

Manpower limits how many special moves a team can make. A lineback who's running the pass can't also drop back to double-cover the split end. The program doesn't tell the coach when he or she has chosen conflicting tactics. The absence of any form of feedback is frustrating and leads to annoying errors.

After the defense clears the screen, the coach of the offense chooses a play. There are four running plays, three types of passes, a quarterback sneak, punt, and field goal. You can even order the quarterback to fall on the ball to eat up the clock.

The formation screen appears next. The team with the ball can use a conventional pro set, a three-back "full house," or a four-receiver setup.

The coach selects the personnel who will actually execute the play. *Super Bowl Sunday* reflects the way NFL teams use situational substitutions. Any player can enter the game to participate in a play. Since the defense keys or double covers a position, not a specific player, free substitution can't be used to give the offense an unfair advantage.

After both teams input their signals, an overhead view of the field replaces the menus. Each team is represented by a full complement of 11

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players. The marvelous animation endows the graphic screen with a surprising degree of realism. It's exciting to watch each play unfold, with its fakes, blocks, tackles, and broken-field runs.

The trimmings are as good as the game they embellish. Either coach can view line or backfield matchups by hitting the "L" key. *Super Bowl Sunday* maintains individual player statistics throughout the game, updating the numbers after each play. Coaches can check this data during the game or print it out for subsequent study and analysis.

Perhaps the most useful option varies the duration of a quarter. Fifteen minute periods produce a regulation-length game. The 5- or 10-minute choices are ideal when you don't have an hour for a full game.

Super Bowl Sunday has three modes of play. One gamer can play against a savvy robot coach, two humans can go head to head, or everyone can just sit back and watch autoplay. The latter version produces a replay which exactly follows the real-life coach's play-calling pattern. If Dan Marino threw an average of 40 passes per game during the season, that's exactly what he'll do in autoplay.

The game's biggest omission is that the players can't be switched between teams to create customized squads. This makes *Super Bowl Sunday* unusable for draft league play, though a circuit with stock teams works just fine.

Avalon Hill plans to release supplemental disks containing additional teams which can be used with the game. The first one will present teams based on the 1984-1985 season.

Super Bowl Sunday is a championship caliber pigskin simulation.

The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214 (phone: 301-254-5300).

—Bill Kunkel

ALCAZAR: THE FORGOTTEN FORTRESS

Activision Commodore 64 Disk; $29.95

Deep within a mazework of ancient ruined strongholds lies the oldest and most guarded ruin of all—Alcazar, the forgotten fortress. Many stouthearted souls have sought to unlock its musty secrets and carry off a priceless treasure. None have returned. To survive the journey takes skill, tenacity, and a healthy dose of luck.

This action-adventure combines elements reminiscent of the old *Venture* with a few tricks from illustrated text games. The player becomes a hero who must travel the dangerous route to the dreaded Alcazar.

A small flashing cursor represents the adventurer's current position on the map of the countryside. A network of roads connects the many small castles which dot the landscape. Alcazar lies at the extreme right edge of the map, far from the starting point of the quest. The hero must survive journeys through smaller strongholds before assaulting the prime citadel. The ultimate goal is to find the throne in the well-protected crown room inside Alcazar.

The color of a castle provides a clue about its contents. A resourceful explorer can find useful equipment and provisions scattered throughout the rooms and corridors of blue castles, guarded by tigers, griffins, tarantulas, and flies. In a purple castle, the monsters range from oil amoebas to the ever-present spiders and flies. Extra lives are the main treasure in a black castle, though the hero must successfully face all the terrors of this deadly realm to gain them.

When a player enters a castle, the display changes to a bird's-eye view of each room and hallway. When the hero walks through a door, the screen blacks out for a split second before the new room appears. It's wise not to charge through entrances too quickly, though. Pit traps are plentiful, and it's a *long* way down!

Much of the mental challenge in this joystick-activated adventure comes from discovering how to handle the various guardian creatures. Each monster has a different strength, and many of them are only vulnerable to specific modes of attack.

Uncharacteristically for a fantasy game, the hero begins the quest armed with a prosaic handgun. It's only a six-shooter, so it's important to fire as infrequently as possible during the early stages. Replacement pistols and new, more exotic armament like burning oil and bleach, both effective against certain supernatural beasts, must be found in castle corridors.

Greed is counterproductive, since the hero can only carry four items at a time. The player uses the controller's action button to scroll through the inventory of possessions and pick the appropriate one for any given situation.

The player's movement through a castle draws a small map at the bottom of the screen. A white square represents an explored room, while unexplored rooms remain green. A blue dot marks the hero's present location. The map isn't detailed enough to furnish much aid. It's just about impossible to use it to find specific locations, though it can help determine the route to the exit.

The hero's hair turns bright red if he becomes weakened. That's a cue to leave the current castle as quickly as possible, because a monster attack at this juncture is almost invariably fatal.

Some treasures extend the hero's capabilities. For example, a raft lets the quester cross otherwise impassable bodies of water. A ring allows heroes to use one of the two flashing magic carpets on the outdoor map.

The beautifully written theme song shrouds *Alcazar: The Forgotten Fortress* in mystery. This is fortunate, because the visuals, while above average for this type of program, aren't really detailed enough to establish a definite mood.

Action adventures like *Alcazar* offer an enticing blend of mental and physical stimulation. The player gets to exercise the gray cells on an assortment of tricky situations and the trigger finger against a legion of monsters. *Alcazar: The Forgotten Fortress* is an electronic passport to hours of entertainment.

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

—Tracie Forman Hines

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Contributors to *Ahoy!'s Art Gallery* will receive royalties based on the sale of disks. Send your best work on disk, accompanied by a stamped and self-addressed mailer, to Morton Kevelson, P.O. Box 260, Homestead Station, Brooklyn, NY 11229. Indicate the drawing package that was used to create the image. If you employed a bit map of your own design, indicate the appropriate file parameters, i.e., hi-res or multicolor, location of bit map, screen or color data.

Exactly 16 years and 4 months ago, man landed on the moon. And to commemorate the anniversary, we've devoted this edition of *Ahoy!'s Art Gallery* to space travel. The exception is *Watchman* by Mark Richey (Boulder City, NV), forming the background for this month's selections and shown unobscured at left. All of this month's images were rendered on *Koala. Top row: Shuttle* by Don Cadle (Riverside, CA) and a screen from *Spaced,* an original game by Robert G. Geiger (Anchorage, AK). Characters in the latter are all sprites programmed with techniques gleaned from the book *Commodore 64 Color Graphics: An Advanced Guide* (Arrays, Inc.). *Middle row: Porozlo, ATV-5,* and *Guardbot* by Armand Suarez (New Iberia, LA). *Bottom row: Spacecrew* by Michael Montauck (Brooklyn, NY). Inset in the mountain is *Submarine* by John Matthews, Jr. (not strictly conforming to our space travel theme—but man had to learn to sail through the ocean before he could sail through space). This last was created by digitizing an image with the Computereyes video acquisition system (see review in the September '85 *Ahoy!*) and adding finishing details by hand.

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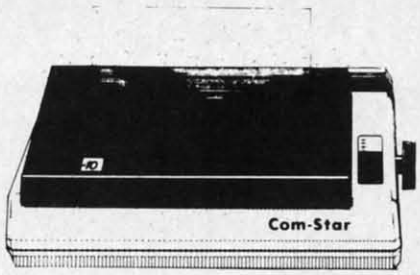

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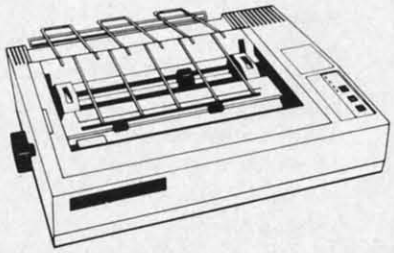

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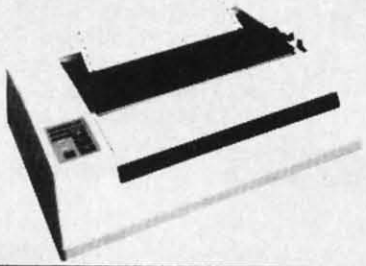

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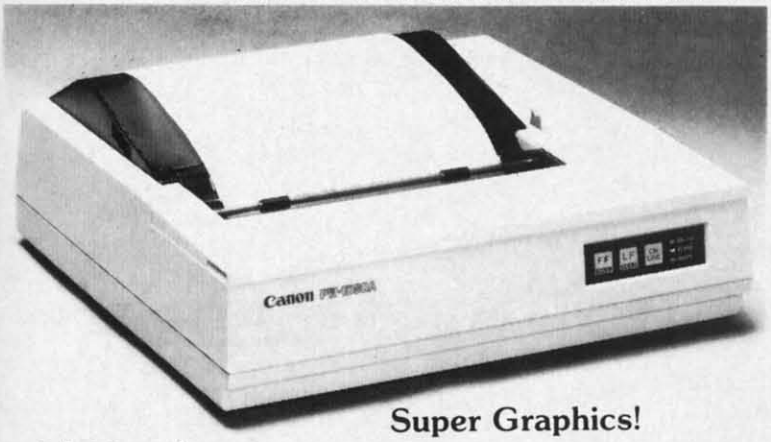

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Graphic Mode — Unidirectional

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Character set: Full ASCII character set (96), 32 special European characters

(Apple - Atari - Etc.)

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FILE SCOUT

For the C-64

BY DON LEWIS

File Scout is a file logger utility for the C-64 and 1541 disk drive. It provides both screen and printer output of the most important file parameters for PRG, SEQ, and USR file types. It does not log REL file types.

The structure for the various file types is explained on pages 66-68 in the 1541 reference guide. Each file is composed of a series of sectors, linked together by pointers. The first two bytes of a sector point to the next track and sector associated with the file. The DOS built inside the 1541 uses these pointers as a road map to accessing the information in a file.

Unique to PRG file types is the load address, stored as bytes number 4 and 5 in the first sector of a file. The 64 uses this data to tell it where in memory to store the data in a file. For a BASIC program, the load address is $0800 (2049 in decimal). Other common load addresses you might see are $C000 (49152 in decimal) and $CC00 (52224 in decimal).

File Scout has a very convenient user interface. It first prompts you to insert a disk, then reads the directory from the disk, and extracts the number of blocks in each file, the beginning track and sector, and, for PRG file types, the load address.

Eight file entries are displayed per screen. At the bottom of the screen is the command line. The following commands are available:

NEXT—advances to the next eight file entries.
SCOUT—traces out a file's track and sector links.
PRINT—hardcopy log of files. See sample below.
BOOT—restarts the program.
QUIT—exit to BASIC (READY).

The PRINT command produces hardcopy. I have a Cardco interface with an Epson MX-80 printer. If you have a different combination, you may need to rewrite some of the code in lines 800-899.

I log all of my disks using *File Scout* and keep the hardcopy in a three-ring binder for easy access. A sample printout is shown below.

SAMPLE *FILE SCOUT* HARDCOPY

```
FILE SCOUT          FS # FILES :  4
BLOCKS ALLOC:  89 BLOCKS FREE:  575

FILE              TYPE TRK SEC BLK ADDR.D ADDR.H

FILE SCOUT V0619  PRG 17  0   21   2049  $0801
FILE SCOUT COPY2  PRG 17  19  21   2049  $0801
C/FILE SCOUT      PRG 19  0   34   2049  $0801
FS.DOC            SEQ 20  8   13
```

The SCOUT feature traces out the track and sector links for a particular file. If SCOUT is selected, you will be prompted for a file name. A wild card(*) is supported. *File Scout* will then trace out and display the file's track and sectors in the order they would be accessed by the DOS. I have found this to be very useful in saving mangled disks, or modifying programs right on the disk using a good sector editor.

Thirty-four links are displayed per screen. At the bottom of the screen a secondary command line is displayed. The commands are:

NEXT—advances to the next screen of links.
PRINT—hardcopy of track and sector links.
RETURN—return to main *File Scout* screen.

Because *File Scout* is written in BASIC, it tends to be a bit sluggish in its performance. If you compile it with *BLITZ!* or another BASIC compiler, its performance is dramatically improved. □

SEE PROGRAM LISTING ON PAGE 139

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THE KNIGHT'S TOUR

For the C-64

BY RICHARD RAMELLA

A sprightly sprite of a chess knight challenges you to a thousand-year-old puzzle.

Put a knight on any square of an otherwise empty chess board. Making only legal knight moves, occupy every square once but no more. It's called *The Knight's Tour,* and it has charmed and vexed generations since the Middle Ages.

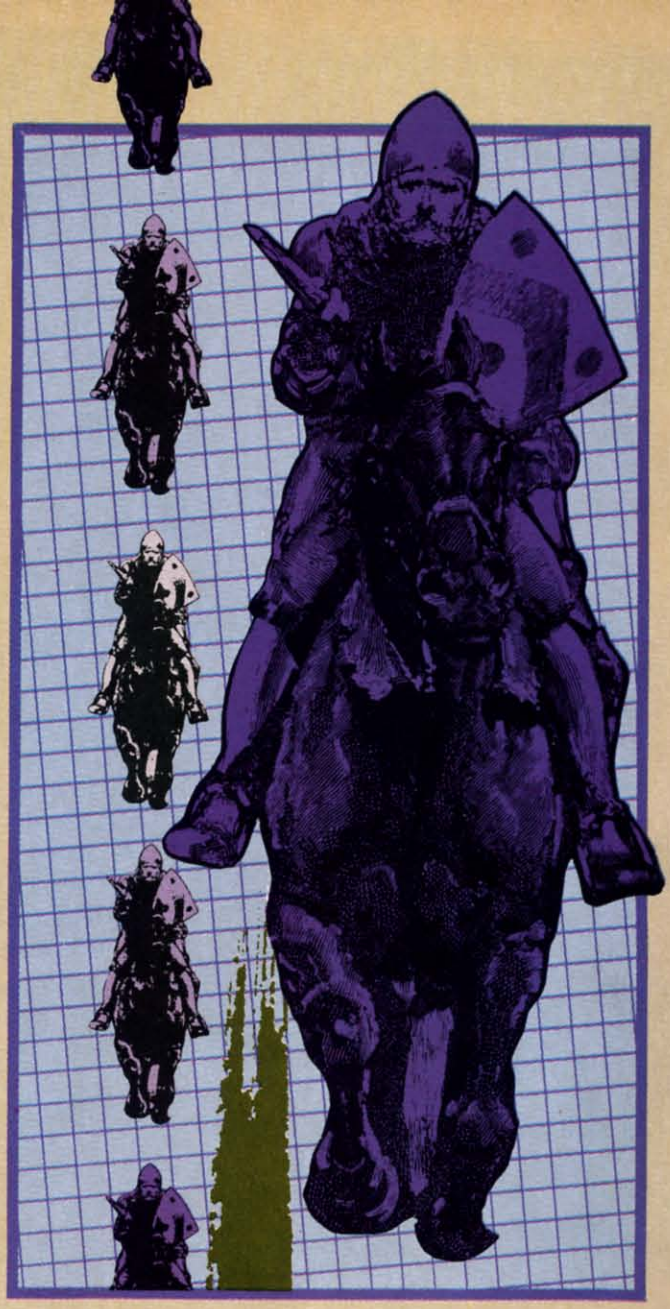
As a Commodore program, the knight is a sprite which can be moved around the board. Score is kept automatically. A perfect score of 64 is difficult. Program logic denies illegal moves: those other than the peculiar L-shaped gait of the knight, and those which would take the knight off the board or onto a square covered earlier.

When the program is run, a chess board is drawn. It has all open squares. At the northwest square is the knight. To take this playing piece to the square from which you want to start play, press the A key for north, Z key for south, comma key for west, and period key for east. At this stage it will travel freely in all directions.

On arriving at the chosen start square, press key K for knight. From this point you must make only legal knight moves. Use the directional keys to go one square in one direction and two in another (or first two squares, then one). Each square occupied will fill with a pattern and may not be entered again. Attempted illegal moves take the knight back to the square it just left.

Beware of leaving inaccessible squares and of moving the knight into a square from which no next move is possible. If this happens, the game is over. To play again, press the RUN STOP key and run the program once more. □

SEE PROGRAM LISTING ON PAGE 141



INSTANT BUG REPELLENT

For the C-64

BY KEITH JONES

For readers who prefer to correct their typing errors as they go along, I've created the Instant Bug Repellent. Instead of generating a list of Bug Repellent codes after you've finished entering the program, it will provide you with the code for a particular line immediately upon entering that line. Just hit RETURN and the *Bug Repellent* code and line number are printed at the top of the screen.

The program itself is a machine language program in BASIC loader form. The program begins at memory location 49152 in decimal and at $C000 in hex. To deactivate the program type: POKE 770,131:POKE 771,164 and hit RETURN.

Instant Bug Repellent uses the BASIC warm start vector to turn control over to the program. First it checks the locations $14 and $15 for the line number that was just typed. It then flips through BASIC memory for the line. When it finds the line, the program calculates the *Bug Repellent* and displays it at the top of the screen.

After you have typed in *Instant Bug Repellent*, save it to disk or tape. Then you may run the program to see if it has been typed in correctly. The words INSTANT BUG REPELLENT should then appear with a ready message. Next start typing in your program; your *Bug Repellent* codes should appear at the top of the screen. If the code is different from what is in the magazine listing, check the line and make any necessary corrections.

Sorry, VIC users—*Instant Bug Repellent* works only with the 64. □*SEE PROGRAM LISTING ON PAGE 125*

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LIGHTNING LOADER

For the C-64

BY DAVID ROSCOE

Lightning Loader is a machine language fast loader program that will load your BASIC and machine language programs up to five times faster than the usual load time. The program resides in memory from 51456-52224 ($C900-$CC00). Any programs that might load into these memory locations will clash with *Lightning Loader.*

Lightning Loader is entered using *Flankspeed* (see page 122). After you have typed in and saved *Lightning Loader*, reset the computer by turning it off and then on. Then type LOAD "LIGHTNING LOADER",8,1. Next type SYS 51456 and hit RETURN. After a short delay, "READY." should appear on the screen. This will tell you that *Lightning Loader* has been activated, and you are now ready to Lightning Load your programs.

You have the option of either loading your programs using *Lightning Loader* or, if you prefer, loading them as usual. To Lightning Load a program type QLOAD "progname",8. You may use "QLOAD" just as you would use the "LOAD" command. The load times for smaller programs is not greatly reduced. The larger the program is, the faster it will load. ☐

SEE PROGRAM LISTING ON PAGE 144

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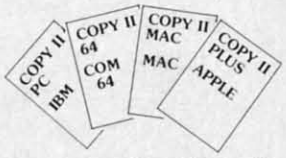

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If you don't read page 77 you will be missing *Ahoy!*'s newest addition.

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RHYTHMIC BITS

For the C-64

BY DAVID BARRON

By now, most people realize that computers play an important part in today's music. Current synthesizers are nothing more than dedicated computers. Even general purpose computers such as a Commodore 64 can be used as musical instruments, as shown by many previous articles in *Ahoy!* as well as assorted software packages. Most of these deal with the synthesis of melody; that is, the generation of a tune. What *Rhythmic Bits* deals with is the production of music's other key element, rhythm.

The program I am presenting allows for the definition of rhythmic sounds and their playback in a certain pattern. The program is menu-driven and fully self-documented, but to make things a bit clearer I will describe all the major parts.

Sound Definition—allows you to describe the type of sound you want included in your rhythm pattern. There is provision for eight sounds (zero through seven). You have control over three parameters: frequency, decay, and waveform. The frequency of the sound controls how high or low the pitch is. Be patient when modifying this, for the control responds slowly, but with great accuracy. Decay controls how fast the sound fades out after the initial sound is heard. A short decay gives a very percussive sound, while a long decay gives a more drawn out sound. The waveform option allows you to choose either triangle, sawtooth, or noise. The triangle and sawtooth waveforms produce a tone, with the sawtooth's being a bit harsher. These can be used for bell noises, or, with the frequency set low, a bass drum. The noise waveform produces noise that can be used for snare type sounds.

Pattern Entry—used to enter the rhythm pattern you wish to hear. When in this mode the screen will have a 32 by 8 grid on it. This is a representation of sound versus time. The eight vertical divisions represent each of the eight sounds you can define. The 32 horizontal spaces represent 32 divisions in time. This represents one measure that is repeated over and over when you play back the pattern. To select when a particular sound is to occur, simply place a marker in the corresponding time/sound spot. The only limitation is that for each time slot a maximum of three voices can be selected. This is because the SID chip only has three oscillators. One note: when you first enter this mode the screen may be filled with random nonsense. Simply clear this using the clear option.

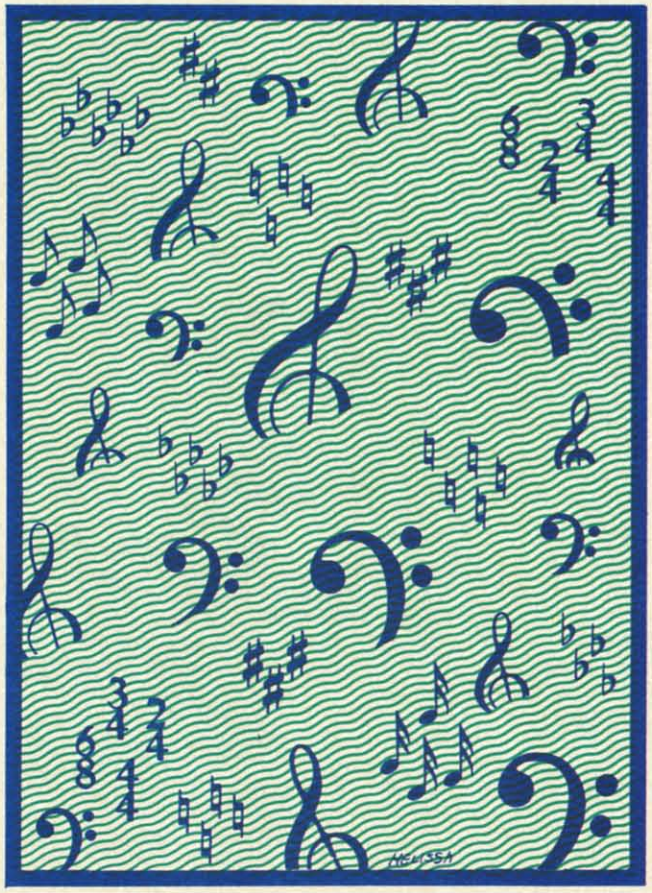
Filter Setting—functions as what could best be described as a tone control. A higher setting will give a harsher sound, while a low setting will give a more mellow sound.

Speed Setting—as its name implies, this sets the speed of playback for the pattern. If this is set too fast, the pattern becomes distorted and dissynchronous, so be careful when using it.

Playback—after all the sound and pattern definition is done, here is where it all pays off. Select this option and you will hear your creation. To stop the playback, hold down the space bar until it stops. You may then change whatever needs fixing by going back to the various menus.

That's all you need to know. The real fun of this program comes in experimenting with it. Don't be surprised if one day you spot your Commodore on MTV. □

SEE PROGRAM LISTING ON PAGE 142



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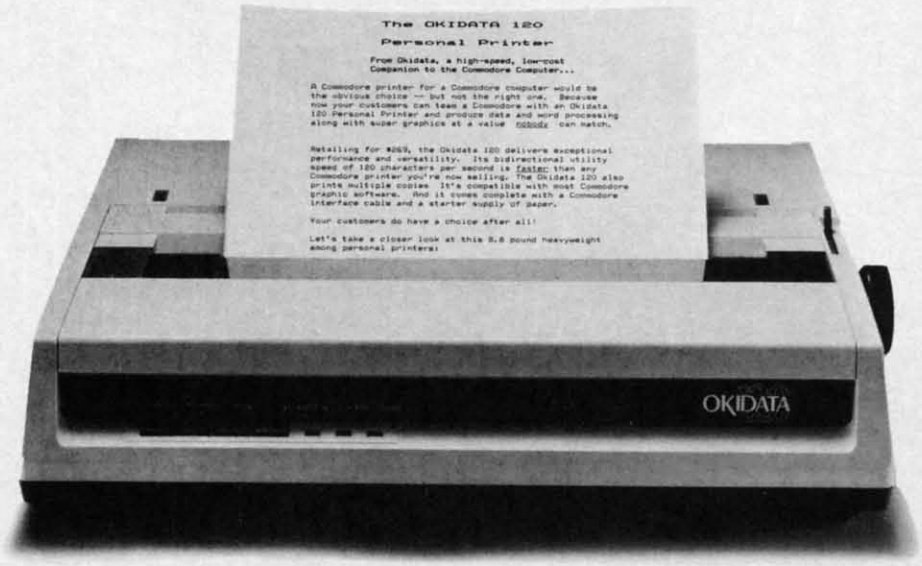
Left Brain.



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