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ATTENTION C-128 OWNERS Now that Commodore has released the C-128D with 64K of video RAM, we should be seeing 128 programs address this fantastic new feature

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e have several longer, possibly more significant features in this month's issue that we could begin this column by talking about-but to us, this month's biggest news

VIEW FROM THE BRIDG

is the return of Buck Childress with his first full-length program in six months. We join Buck in thanking the many readers who've written to ask about his progress. Happily, the eve ailment that sidelined our most prolific programmer is all but licked, and Buck's output should rise steadily in the months to come. (As for Buck's program, Vari-Scan, it safeguards C-64 and C-128 programmers from reusing variable names and crashing works in progress. Turn to page 30.)

After good news like that, we hope you won't find our description of the rest of the July Ahoy! too anticlimactic:

• As Dale Rupert points out, past Rupert Reports have involved connecting your computer to photo-cells, LED's, potentiometers, and relays. This month Dale helps you make the Thermal Connection, and turn your 64 or 128 into a digital thermometer. What's next: a Commodore-driven vacuum cleaner? Satellite dish? Roller coaster? Only time will tell. (Turn to page 32.)

· Window Dressing means curtains for those drab displays called up by the C-128's WINDOW command. Richard Cur-



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The Ahoy! Disk Magazine is also available at Waldenbooks and B. Dalton's bookstores, as well as other fine software outlets.

cio's quartet of routines let you print attractive boxes and headings, manipulate text, and more. (Turn to page 37.)

· Adventure game fans registered one complaint about Vault of Terror (Oct. '86) and Crypt of Fear (Feb. '88)their fingers were trembling so hard that they couldn't type the commands. So Cleve Blakemore designed Tomb of Horror, the last entry in his 3-D trilogy, to work entirely via pulldown menus. If you find yourself shaking so much that you can't wiggle a joystick, you're on your own! (Turn to page 48.)

· Mindful that some readers don't like typing in listings of 8+ pages in length, Cleve offers two games that can easily be entered in a single sitting. Guerilla lets you go bananas gunning down terrorists who shoot at you from the ruins of bombed-out buildings. (Turn to page 16.) And Lunar Buggy dispatches you on an equally patriotic mission-to recapture the stolen artifact of the Apollo space program and drive it across treacherous terrain to safety. (Turn to page 15.)

 Once you've played all three of the above and asked the inevitable question -- "How does Cleve Blakemore do it?" -refer to Programming Your Own Text Games, in which Cleve continues to reveal his secrets. (Turn to page 13.)

· Once again, Arnie Katz and the undersigned have been chosen (along with Betsy Staples of Atari Explorer) to select

> the programs for inclusion in this year's CES Software Showcase. We're proud to feature game reviews by Arnie and his partners, Bill Kunkel and Joyce Worley, in every issue. This month's Entertainment Software Section covers Stealth Mission, Speed Buggy, Wooden Ships & Iron Men, and Plasmatron. (Turn to page 20.)

> If you've been putting off looking into our COMAL Column, you're almost out of time. Richard Herring presents the penultimate installment in this issue. (Turn to page 45.)

In case anyone is still confused by our division into Ahoy! and Ahoy!'s AmigaUser, remember-the next Ahoy! for the C-64 and C-128 will be the September issue, on sale August 2. On the stands next month will be the second issue of Ahoy!'s AmigaUser-coverdated August, and on sale July 5. And remember, if you're upgrading to the Amiga and want to switch your Ahoy! subscription to Ahoy!'s AmigaUser, you can-but please call 815-734-4151 or write Ahoy!, P.O. Box #341, Mt. Morris, IL 61054. Do not call us at our New York number with subscription problems-we can't help you from here. If you have any non-subscription questions, we'd love to help you. Call or -David Allikas write anytime.

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· List all variables to screen

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· Restore newed Basic

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1541/1571 DRIVE ALIGNIVIENT

Compute!'s Gazette Dec. 1987

1541/1571 Drive Alignment reports the alignment condition of the disk drive as you perform adjustments. On screen help is available while the program is running. Includes features for speed adjustment. Complete instruction manual on aligning both 1541 and 1571 drives. Even includes instructions on how to load alignment program when nothing else will load! Works on the C64. SX64. C128 in either 64 or 128 mode, 1541, 1571 in either 1541 or 1571 mode! Autoboots to all modes. Second drive fully supported. Program disk, calibration disk and instruction manual only SUPER



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SCUTTLEBUT

EXPORTER SERVICES

A new online system offered through CompuServe allows US firms to identify export opportunities and speed up the processing of export licenses. Under the terms of a contract with the US Dept. of Commerce (DOC), exporters can submit their license applications to DOC electronically. A DOC licensing officer will process the application, send a response to the exporter electronically, and follow up with a hard copy of the validated license.

Also new to CompuServe is a database providing detailed information, updated daily, on worldwide trade opportunities. Exporters can search the database by country, SIC code, posting date, and type of procurement.

CompuServe, 614-457-8600 (see address list, page 12).

ILLINOIS SHOW

The third annual Chicagoland Commodore Computer Fest is scheduled for August 28 at the Exposition Center at the Kane County Fairgrounds in St. Charles, IL. National speakers and 64, 128, and Amiga vendors will be featured. Admission is \$5.00.

Computerfest, 312-897-5788 (see address list, page 12).

LET ME TELL YOU 'BOUT ...

Why embarrass yourself by your lack of knowledge? *Birds 'N Bees* lets your kids learn the facts of life interactively. The program, designed by a team of psychologists and consultants, includes treatment of reproduction and child development, plus a special section on protecting children from strangers. The program is designed to let children of any age and either gender receive information specific to their needs. Price is \$49.95 for the C-64, \$59.95 for the Amiga.

8 AHOY!

THE PROGRAM FOR TEACHING YOUTH THE FACTS OF LIFE



Sex education for kids of all ages. READER SERVICE NO. 174

IntraCorp, Inc., 305-252-9040 (see address list, page 12).

SUPER 81 FOR THE 64

A C-64 adaptation of *Super 81 Utilities* joins the C-128 version introduced earlier by Free Spirit. *Super 81/64* will copy whole disks or files from 1541/ 71 drives to the 1581. The user can back up disks or files with one or two 1541's, 1571's, or 1581's, or any combination thereof. Also included are a full-featured sector editor and utilities for partitioning, scratch and unscratch, lock and unlock, rename, format, and direct DOS commands.

The program is supplied on both $5\frac{4}{2}$ and $3\frac{1}{2}$ disks, and boots on either device 8 or 9. Price is \$39.95; shipping is free.

Free Spirit Software, Inc., 312-352-7323 (see address list, page 12).

PAPERCLIP PUBLISHER

PaperClip Publisher (\$49.95) offers all the text formatting, layout, and design capabilities needed for creating multiple-column page layouts for newsletters, flyers, price lists, menus, greeting cards, and the like. Documents up to 50 pages in length are supported. Other special features are the ability to temporarily hold and work on text or graphics outside a given document, and a "refreshing" feature that automatically updates any altered section.

Electronic Arts, 415-571-7171 (see address list, page 12).

MUSIC SOFTWARE

Low-cost music programs for the pro or semi-pro:

Passport Sequence Editor (\$14.95) allows step-editing of the MIDI 4+ and 8+ sequence files.

Studio One Editor (\$14.95) works with Syntech's Studio One program.

DX21/27/100 Librarian (\$14.95) stores banks and individual voices from Yamaha's 4-operator FM synthesizers.

Generic Librarian (\$19.95), a 32K system-exclusive recorder, works with any instrument capable of bulk Sys-Ex dumps.

SoundWare (see address list, page 12).

CP/M STARTER SET

The PDS *CP/M Starter Set* (\$29.95) is comprised of four disks of utilities and applications for the C-128, plus printed documentation explaining booting up, transient and resident commands, and creating and dissolving library files.

Public Domain Solutions, 813-378-2394 (see address list, page 12).

DRIVE ENHANCEMENT

Microteq's *Drive Box* (\$29.95) permits hardware configuration of the 1541, the 1571, and the C-128D's builtin drive. The box allows for setting the

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CHIP LEVEL DESIGNS PRESENTS 128 mode &

CP M version now HE SUPER-FAST PARALLEL DISK OPERATING SYSTEM FOR THE COMMODORE 64 AND 1541 DISK DRIVE!

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- Many useful, timesaving features (DOS) Wedge, screen dump, resident monitor).
- No loss of compatibility.
- . Far too many features to list in this ad . . . and perhaps in this magazine!
- (Call or write to get all the details!)

. . . and if you want the ultimate, get RapiDOS Professional!

- ·Gives even faster disk access!
- . Uses 8k RAM track buffering and hardware GCR conversion!
- Provides 40 track extension (749 blocks free!) Adds 20 new disk commands (i.e., lock files, change disk name).

Here's what people are saying about RapiDOS:

Mike J. Henry (Basement Boys Software) - "It's amazing how incredibly fast it is, I'm impressed!" Mitch S. (Eaglesoft Inc.) - "Very fast, very reliable, and very compatible. I love it!" J.F. Jones (ADP) - "Superbases' speed is increased greatly, and it's now a dream to use!"

Function	Normal DOS	RapiDOS	RapiDOS Pro	Your System
Load 202 blocks	128 sec.	15 sec.	3 sec.	
Save 202 blocks	196 sec.	98 sec.	8 sec.	
Format 35 tracks	90 sec.	24 sec.	18 sec.	

Compare these speeds with your current system and see why RapiDOS puts the C-64 into a different league!

RapiDOS requires a socketed kernal ROM U4, and is available in versions for the 64c, 128 in 64 mode, and 1541c (please specify when ordering). RapiDOS is easily upgradeable to the Professional Version. RapiDOS Professional drive controller is (c) '87 mts data GbR, the creators of the best European parallel systems.

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- Loads 100 blocks in 6 seconds on a 1571, 4 seconds on a 1581!
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- Lets the 128 run at 'Burst' speed when in 64 mode!
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device number from 8-11, as well as for writing to the reverse side of the disk without cutting an extra notch. Six solder connections are required in order to install the $3\frac{1}{8} \times 2 \times 1^{\circ}$ unit; or, Microteq will install it in your drive for \$10 plus shipping (you must insure your drive).

Drive Box is available through Software Support and Free Spirit.

Microteq Systems, 701-232-4033 (see address list, page 12).

KETEK SUPPORT

Computer accessories from Ketek, makers of the Command Center line of system enclosures for the 64, 64C, and 128:

The Sound Trap (\$49.95) encloses almost any 80 column printer with sound-absorbing foam and wood to reduce noise by up to 90%. Included are an acrylic lid and a slide-out shelf for catching printout.

The Remote Power Controller (\$89.00) provides outlets for up to five



devices, each offering 3-way protection against surges and spikes. The base unit can mount behind or under your desk, while the $3\frac{3}{8} \times 5\frac{3}{4} \times 1\frac{14}{7}$ controller is kept close at hand.

Data Director (\$39.95) makes it pos-



sible for two 6-pin serial devices to share one 64, or for two 64's to share one serial device. The unit works with all Commodore-compatible drives, printers, and interfaces.

Pete Rose

Reds star.

run, field,

You can hit.

and presumably throw

body blocks

at opposing

catchers.

READER SERVICE

NO. 175

Pennant Fe-

ver incorpor-

ates the strategies of the

The Tilt/Swivel Monitor Stand (\$14.95) lets you turn your monitor to the desired angle, with cushioned pads to hold the monitor securely in place.

Ketek, 319-338-7123 (see address list, page 12).

GAMES

Scheduled for C-64 release in November, Pete Rose Pennant Fever lets you guide an expansion team through a 10-season, 24-team race for the pennant. Rather than looking down on the diamond from overhead, you experience the action from the perspective of one of Charlie Hustle's teammates. You pitch, hit, run, field, throw, and steal as you would on a real diamond. Managerial strategies actually employed by Rose are available. In addition, you can act as General Manager, drafting and acquiring computerized players while maintaining control of the club's finances and player salaries. Is there a collusion option? Wait and see.

Activision/Gamestar, 415-960-0410 (see address list, page 12).

Two for the 64 from EA:

Scheduled for late summer release, Wasteland (\$49.95) challenges players to survive in the post nuclear year of 2087. As you and your band of Desert Rangers roam the southwestern United States, trying to help other survivors rebuild and live in peace, you'll en-

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Tank's-eye view of the WWII clash. READER SERVICE NO. 176

counter a cast of hundreds, including mutant villains who endanger the population. At certain points in the game, you'll be directed to the included Paragraphs book which enhances the detail of the game and provides descriptive text. After the game is over, you may return to explore locations you were not able to the first time around.

Patton vs Rommel (\$29.95), designed by Chris Crawford, lets the player become either General Blood and Guts or the Desert Fox on D-Day. Each commander has numerous infantry and armor divisions at his disposal, plus a historically and geographically accurate map of 150,000 locations. 10 different kinds of tactical orders are possible, and each division can have up to 32 different orders at a time. To give orders, the players just point at a division and an objective-the army does the rest. As the strategies come to life, players can watch the battles take place, with realistic sound effects. For the C-64.

Electronic Arts, 415-571-7171 (see address list, page 12).

Rommel stars as well in *Tobruk* (\$19.95), in which you command 10 divisions of the Afrika Korps in an attempt to capture the key Libyan port city. Action can be controlled from tactical maps, or directly in land and sea battles. Players view the battle from the turret of a desert tank, with access to

machine gun controls and mines. Air tactics include ground attacks, air-toair skirmishes, and long-range bombing. The C-64 simulation is designed by Datasoft and distributed by Electronic Arts.

NEWS

Electronic Arts/Datasoft, 415-571-7171 (see address list, page 12).

Under Fire! (\$34.95) consists of nine WWII scenarios involving the US, Germany, and the Soviet Union, plus a construction set enabling the C-64 gamer to create more.

Avalon Hill, 301-254-9200 (see address list, page 12).

Three C-64 racing games – Richard Petty's Talladega, Shirley Muldowney's Top Fuel Challenge, and Grand Prix Motor Mania—have been combined into Cosmi's Motor Racing Trilogy (\$24.95).

Cosmi, 714-240-8985 (see address list, page 12).

Black Jack Academy will teach you to play the game, or help you brush up your skills. Online help explains all play options and coaches you along. Special ease-of-use features include multiple play speeds, card counting option, player card total option, money management guide, and preset multiple table rules from Las Vegas, Reno, and Atlantic City. For the 64 or Amiga; \$39.95.

MicroIllusions, 818-360-3715 (see address list, page 12).

Bridge Baron II (\$39.95), an improved version, plays the complete game of bridge, allowing you to bid and play more than a billion different deals with your C-64 as both your partner and your opponents. New features include two-person mode, rubber bridge scoring, automatic play mode, Baron's recommended bids and plays, the ability to claim or concede tricks, simplified card play, weak 2-bids, and the option to save deals to disk.

Great Game Products, 800-GAMES-4-U (see address list, page 12).

MORE CP/M

Poseidon has published the spring '88 addendum to its catalog of CP/M software, priced at \$1.75 plus a 45¢ SASE (if paying by check, it must be made out to Ralph Lees). New software prices are \$16 for the first disk, \$12 for the second, and \$7 each for all subsequent ones.

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> ESP Corporation PO Box 1248 Holmes Beach, FL 34218 Phone: (813) 778-5773



Reader Service No. 173

Poseidon Electronics, 212-777-9515 (see address list below).

BBS FOR 128

Dragonfire BBS 128 (\$100) is designed to allow a novice to get a bulletin board up and running within 20 minutes. It supports 300, 1200, and 2400 baud modems, up to 100 public and 40 private message bases, full Email system, remote SYSOP capabilities, auto maintenance mode, security option, self-maintaining system files, and more. Versions for the 64 and Amiga are forthcoming, as are terminal programs for the 64 and 128.

YodaHead Software, 609-596-1772 (see address list below).

SWEEPSTAKES

Computer Learning Month has launched a School Certification Program and Sweepstakes, with a first prize of a computer and software and 30 second prizes. To become eligible, teachers in grades K-12 must use three software programs they have not tried

Activision/Gamestar

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

Avalon Hill 4517 Harford Road Baltimore, MD 21214 Phone: 301-254-9200

CompuServe 5000 Arlington Centre Blvd./P.O. Box 20212 Columbus, OH 43220 Phone: 614-457-8600

Computer Learning Month P.O. Box 60007 Palo Alto, CA 94306-6007

Computerfest P.O. Box 28 North Aurora, IL 60542 Phone: 312-897-5788

Cosmi 415 North Figueroa Street Wilmington, CA 90744 Phone: 714-240-8985

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

Free Spirit Software 905 W. Hillgrove, Suite 6 LaGrange, IL 60525 Phone: 312-352-7323 Companies Mentioned in Scuttlebutt

Contact manufacturers directly for additional information.

Great Game Products 8804 Chalon Drive Bethesda, MD 20817 Phone: 800-GAMES-4-U

IntraCorp, Inc. 14160 S.W. 139th Court Miami, FL 33186 Phone: 305-252-9040

Ketek P.O. Box 203 Oakdale, IA 52319 Phone: 319-338-7123

MicroIllusions 17408 Chatsworth Street Granada Hills, CA 91344 Phone: 818-360-3715

MicroProse 180 Lakefront Drive Hunt Valley, MD 21030 Phone: 301-771-1151

before between August 1 and October 31. Further details are available from CLM, an official project of the Software Publishers Association.

Computer Learning Month (see address list below).

PAINT PROGRAM

The *Masterpiece* graphics package (\$29.95) lets the C-64 artist move, copy, scale, rotate, twist, and fold the onscreen artwork. Other features include picture compression for saving memory, and the ability to load pictures from BASIC.

Scorpion, 201-663-0202 (see address list below).

GOOD NEWS

P.A.V.Y. has lowered the price of Landmark, The Computer Reference Bible from \$164.95 to \$129.95. If you're reading these words before June 1 (as only subscribers are likely to be), you may still be able to get in on P.A.V.Y.'s limited time special price of \$119.95

Continued on page 81

Microteq Systems 1430 9th Avenue South Fargo, ND 58103 Phone: 701-232-4033

P.A.V.Y. Software P.O. Box 1584 Ballwin, MO 63022 Phone: 314-527-4505

Poseidon Electronics 103 Waverly Place New York, NY 10011 Phone: 212-777-9515

Public Domain Solutions P.O. Box 832 Tallevast, FL 34270 Phone: 813-378-2394

Scorpion 19 Harbor Drive Lake Hopatcong, NJ 07849 Phone: 201-663-0202

The Software Toolworks One Toolworks Plaza 13557 Ventura Blvd. Sherman Oaks, CA 91423 Phone: 818-907-6789

SoundWare P.O. Box 1913 Nederland, TX 77627

YodaHead Software P.O. Box 177 Marlton, NJ 08053 Phone: 609-596-1772

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ngenuity lies not in further complicating definitions and concepts, but in reducing the number of contradictions and terms to the fewest possible true sets. Any given system design must begin with the sum of its parts, and then define these parts.

er m

> This is the essential theory behind "black box" system design, or modular programming. We begin by describing what we want the system to do, then breaking this idea down into the necessary steps to accomplish it. Whether you are pursuing a personal goal or creating a computer program, you will find that this approach is always the most effective.

> Last month we published a short text adventure called Lost Dutchman's Mine. In this installment we will examine this program in detail and demonstrate how a series of modules (or subroutines) can be tied together into one cohesive system that is greater than the sum of its parts. None of the routines by themselves would constitute a game-but working in tandem, they create an interactive adventure.

> If we wanted to describe the player's purpose in Lost Dutchman's Mine in one sentence, we could say:

> "To move around within a network of locations, collect various objects, return them to a specific location, and win the game."

> This is the simplest way to define the program's operation. In last month's column, I advised designing your adventure on three separate pieces of paper before touching the keyboard. Page one of my scenario for *Lost Dutchman's Mine* read like this:

> "The object of the game is to wander around within a series of caves, collecting up three treasures as you go. When you have all three objects, you return them to a specific base location, drop them, and win the game."

> On page two I listed the obstacles I wanted to hamper the player's efforts:

> "1. A timber wolf guards the entrance to a burial mound where one of the treasures is buried. The player must find the gun and bullets to kill the wolf.

"2. A secret word is required to pass from the base location to the caverns. (Kind of like PLUGH in *Colossal Caves*.) The secret word is written inside a matchbook cover. "3. A whistling spirit guards the entrance to the caverns. The player must blow on an empty 7-UP bottle to scare the spirit away.

"4. The burial mound is submerged under water. The player must find and open a reservoir lock through which the mound room can be drained.

"5. A shovel is needed to dig up the third treasure (Dutchman's nugget).

"6. The player must also light a torch, drop enough equipment to fit through a narrow crack, and escape from the room after he opens the reservoir lock."

You may have noticed that a lot of these ideas are taken from other adventure games, many of them classic puzzles. I wanted them to be familiar enough that the game could be solved without too much trouble. I could just as easily have made the game much harder.

On the third and final page, I drew a map detailing all nine locations in the game, complete with references to the objects that would be found there, and the various puzzles specific to those spots.

Using the modular approach, I broke the program down into seven discrete boxes.

- 1. Initialize arrays and variables
- 2. Read in data
- 3. Get command
- 4. Find verb in command
- 5. Find noun in command (if any)

6. GOSUB to appropriate subroutine pertaining to verb 7. Data lines

Modules 3, 4, and 5 could all be considered part of the parser, the routine that gets and analyzes player input. I define them separately here to make it clear what goes on inside the routine.

The first thing I typed in, as always, were lines 1530-1610. These lines contain descriptions of the nine locations in the game. I immediately followed with comments to accompany each, in lines 1630-1670. These comments are specific observations in each location. For example, the gas station has a "metal plaque above a glass shelf."

Then, using the third page of my notes (the map) as a

guide, I typed in the data for an array of nine dimensions, each dimension having six elements. This dimension will be known as D(9,6). The six elements consist of the directions North, South, East, West, Up, and Down. This is a numerical array, and the number in each element indicates the location to which that direction connects. Any nonzero number is a pathway; otherwise there is no exit in that direction. I did not type in directions for the gas station, because it is only accessible by use of the forementioned "magic word."

In the fashion of any sensible hacker, I jumped to lines 120 through 210 and designed a data loader. Once I made sure that the arrays were dimensioned properly in line 120, I read them in a couple of times in lines 190 and 210 just to make sure everything was going smoothly before I continued. This type-n-run approach is the hacking method, and it works. Trust me.

Now for the tough part. I had to figure out all the verbs and nouns that would be needed for the parser's vocabulary. In lines 1800-1850 I tried to give the program a reasonable dictionary of words to work with for player input. An advanced parser would recognize far, far more than this simple collection of words.

Again, I skipped back to the beginning and made sure these strings loaded in correctly before going on.

Lines 1870 through 1900 are detailed descriptions of the objects that can be carried in the player's inventory. Although an object might be referenced by the parser as "diamo," it will be described on the screen as a "glowing diamond." This gives character and atmosphere to the adventure.

Line 1920 is a list of numbers that tells the program where to place objects initially. The first number indicates the location, the second is the object number itself in the inventory. The -1, -1 at the end of the line signals the end of the data.

Lines 1940-1970 are end of game messages, for when the player is killed or is victorious. If the player is killed, these lines help tell him where he made his mistake.

With this, I completed the data lines, the major stumbling block of any adventure game. Although I made many changes afterwards and altered these lines considerably before finishing, these lines gave me something to work with, the meat of the text adventure. The remaining program portions manipulate the data loaded in from here in many ways, but it is in these lines that the game gets its substance.

Important variables to be defined are CL (Current Location) and the arrays 0(9,8) and I(8). The former is an array that tells what objects are in what rooms, and the latter is the player's inventory array. I(8) refers directly to the eight objects listed in line 1840, the objects in the game which can be carried. Any non-zero number in element I(1), for example, would indicate that the player is carrying the torch. However, a -1 would mean the torch is burning, while a 1 would mean it is out. I also set up meaningful flag names in line 150. These flags indicate the status of certain items.

In lines 340-540, I fleshed out the parser routines. First the directions, then once the program is recognizing them correctly and responding, I introduce the other verbs. It is better to make sure that all the directions are functioning correctly first before continuing, because a flaw that shows up later might take a lot of work to repair. Make certain that the directions in the game correspond identically to your map. It is very common to make errors here. I often get East and West mixed up while typing them in.

Line 340 gets the player's input. If he enters nothing, the program checks again. Line 370 checks for a single character input (either a direction or the letter "i" for inventory) and acts accordingly. Since the six compass directions match up with the six single character commands perfectly, I just reduced any of these terms to a number between 1 and 6, subtracting 7 if necessary. I can then use this number to reference the corresponding element in direction array D(9,6). Once a match is found for the verb, the number is placed in the variable V.

The verb is the important part. We use the verb to jump to the subroutine that designates the action, so we must have a verb. The noun, on the other hand, is not always necessary for many actions, and so our parser only looks for it. If it finds one, it places the number of the noun into the variable N before branching off to our routine. The subroutine can then check this variable to see if the player is referencing the correct object. For example, if the player gives the command to dig, we check the variable N to determine whether or not he wants to dig in any particular spot, as in DIG MOUND. If N=0, we simply print a standardized message that reads "YOU DIG FOR A WHILE BUT YOU DON'T FIND ANYTHING."

After the parser has both these variables, V and N, assigned with values, it drops through to lines 570-580, the branches. These lines will steer the program flow into the correct verb actions that alter program variables and the game environment.

These lines run from 700-1520, accomplishing every possible action that the player is permitted to take in our adventure. If you study them carefully, the variables are selfexplanatory and it should be readily apparent that they act on values to change location inventory, specific flags (mound full-empty, wolf dead-alive, etc.), and print messages for the player's benefit.

After program flow returns from these subroutines, the main parser program executes a series of critical checks in lines 600-690. These flags count elapsed time in the current location and check on the player's status relative to certain non-player characters and events. For example, if the player is in room 4 for more than four turns with the spirit, he is going to get it good. The same goes for being in a river full of water too long or beside a hungry wolf.

The check for a win is in line 600. This line checks if a variable called WINGAME has been set yet by the drop subroutine. If the player drops all three treasures in location zero, this flag will be set upon returning from the routine, telling the main program that the player has succeeded.

With as little work as all this, an adventure game was born. We have a full-fledged story, with a plot, characters, and suspense. Next month, we'll go over the specifics of the way the parser functions, and methods we could use to upgrade the routine so that it could recognize complete sentences.

Until then, remember-stop wrestling with the program as a whole and break it down into modules. You cannot move mountains unless you do it one bucket of dirt at a time! \Box

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n the year 2009 A.D. it was discovered that a colony of extraterrestrials had established itself on the dark side of the moon. A Russian installation was attacked

and totally obliterated in 2011 when it attempted to approach the alien base to make contact. Following that incident, a United Nations security resolution placed the aliens' location off limits to all international teams until further notice, for fear of antagonizing the otherworldly visitors.

You are a government agent assigned to a secret mission of the highest priority: to recover one of the greatest of all historical artifacts, the Apollo lunar buggy. If you can drive the vehicle over the treacherous lunar plain and past the alien forces, the buggy can be returned to the Smithsonian Museum for posterity. It seems like an impossible gamble, but you know it will be worth it if you can recover this national treasure.

Lunar Buggy is a jump-and-shoot game similar to Moon Buggy, an arcade favorite. It requires a joystick in Port 2. Press the fire button to escape from the title screen.

This game for the C-128 features a background that smooth scrolls past at two different speeds to give the illusion of depth. You've probably seen it before in many arcade games. Lunar mountains pass in front of one another as they move, with the smaller and slower moving terrain in the rear of the display.

To jump, you push up on the joystick. Press the button and push either up or right to fire a laser torpedo. You can jump and fire at the same time if necessary.

The alien ships are a mere nuisance at first, but they can become a real threat later on in the game as they begin to move erratically and with greater speed. Destroy them as quickly as possible, but don't let them distract you from jumping over the many craters in the lunar surface.

Each time you go 500 miles across the moon towards safety, you'll pass an American outpost. These small bases provide short stops to rest and refuel before moving on.

The alien ships are worth the current base number X 100 points each.

If you manage to go 5000 miles in Lunar Buggy, you'll have escaped safely and returned the buggy to American soil, where it belongs.

STATION -

SEE PROGRAM LISTING ON PAGE 67

WE WALK THE WALK



By now you've probably seen all the ads for all the different "Super Cartridges" on the market. And they can talk all day, but let's get real: no cartridge is going to back up 100% of anything, no cartridge is going to turn your C-64 into an Amiga, and no fancy screens or hyperbolic claims are going to give a cartridge any more power than it really has. That's why SUPER SNAPSHOT is still the best multi-

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Reader Service No. 162

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CRYPTO-SECRET-CRYPTO (BURN THIS MESSAGE AFTER IT HAS BEEN READ)

TO: RED LEADER TEAM AT: FORTRESS REGARDING: GREEN FORCES PENDING AGGRESSIVE ACTION. FROM: RED TEAM COMMANDER

WARNING! WE HAVE RECEIVED ADVANCE SCOUT REPORTS OF VERIFIABLE ENEMY ACTIVITY IN YOUR AREA. WE CURRENTLY ESTIMATE THAT ANYWHERE BETWEEN 5 AND 15 BATTALIONS OF ENEMY TROOPS ARE EMPLACING OPERATIONS IN THE RUINS OF CIVILIAN BUILDINGS OPPOSITE THE WALL OF THE RED TEAM FORTRESS. WE ARE ONLY ABLE TO PROVIDE YOU WITH FOUR BOXES OF AMMUNITION AT THIS TIME, AS WE HAVE TO CONSERVE OUR OWN SUPPLY. YOU ARE TO HOLD THE FORTRESS AT ALL COSTS. THIS IS A DIRECT ORDER. THERE CAN BE MO WITHDRAWAL UNDER HOSTILE FIRE. WE EXPECT THAT THE GREEN TEAM WILL BEGIN THEIR ASSAULT ON YOUR CURRENT LOCA-TION AT DAYBREAK TOMORROW MORNING. EXPECT ENEMY INCOMING BY 0800. IT WILL PROBABLY GET PRETTY HAIRY DOWN THERE.

GOOD SHOOTING. . . AND GOOD LUCK!

---END OF MESSAGE---



e've never published a really gung ho military game in *Ahoy!*, so I figured it was time to do one. In this short and sweet BASIC-ML hybrid program, you fight off

a communist horde who are launching a massive assault on your location. As they appear in the windows of the bombed out ruins on the other side of the stone wall of your fortress, you attempt to shoot them before they can get a bead on the wall with their LAWs (Light Antitank Weapons). If you are too slow, they fire a rocket which blows away a portion of the wall. The resulting damage is registered on the red bar at the bottom of the screen. When this bar vanishes, the fortress has been overrun.

The game uses a joystick in Port 2. The white cross represents your aiming point. Center this on a soldier as he appears in the window and press the button. If you hold the trigger down, the gun will fire continuously. This is very unwise, however, because you only have four boxes of ammo to begin with, and when they are used up, you're at the mercy of the GREEN aggressors.

The game has four different attack waves, with complete havoc breaking loose on the fourth one. Soldiers will be popping up in every window and firing everything they've got left to try to destroy the fortress. If you manage to survive this last attack, the RED army will be victorious over the GREEN forces. Otherwise, you'll end up reading propaganda and growing potatoes.

The soldiers are worth 150 points apiece, multiplied by the number of the wave. Any score over 70,000 is good.

It's very difficult to repel the GREEN forces. They're mean. They're hateful. They cross the street against the light. They've got tons of overdue library books. Just last week, they killed Rambo by inserting bullets into his body manually.

Good luck! SEE PROGRAM LISTING ON PAGE 70

Reader Service No. 158 -

TTAKES ALOTTO INPRESSIVE

Learni

BRIAN DOUGHERTY Software Designer/CEO Berkeley Softworks

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nd Q-Link, the dynamic telecommunications service for Commodore[®] owners, does just that!

D)

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The Ahoy! Art Gallery offers the opportunity for fame and fortune to aspiring Commodore artists. Send your work on disk to Ahoy! Art Gallery, Ion International Inc., 45 West 34th Street—Suite 500, New York, NY 10001. Indicate the drawing package or file format of the images. Graphics produced on the Amiga are eligible for inclusion in Ahoy!'s AmigaUser; C-64, C-128, and Plus/4 images are eligible for inclusion in Ahoy! If your image is published, you will receive a free one-year subscription. Current subscribers will have their subscription extended by one year.

Note that the Art Gallery is not a contest. Published pictures are selected in an arbitrary and capricious fashion by the Ahoy! Art Director, based solely on their artistic merit.









Irony of ironies - only two Americans are among the contributors to this month's 4th of July edition of the Art Gallery. (Although, as the old joke goes, they have a 4th of July in other countries - they just don't celebrate Independence Day.) At left are two treatments of Presidents' Day - traditional and punk-by Michael Mikottis (Berwyn, IL). Above is Marching Band by Heinz Diekert (Vernon, BC), pounding out "Stars and Stripes Forever" just as surely as mom made little green apple pie (or something like that). At right is an unforgettable Reagan by Alberto Valsecchi (Milano, Italy), Fireworks by Tom Kane (Buffalo, NY), and Post Office by Robert M. Ellis (LaSalle, Quebec). True, it's a Canadian post office. But where would our neighbors north of the border be without the American Revolution? Still trapping furs, no doubt, and trading them to us for three-cornered hats and powdered wigs. Here's wishing all our readers a safe and enjoyable holiday.

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PLASMATRON Avantage Commodore 64 Disk; \$14.95

Plasmatron is a perfect example of what can only be called "generic entertainment software." These generally well-executed but hackneyed game programs are produced in Europe and sold in the U.S. by mainstream publishers. Often the American publisher uses a "discount" label name. In this instance, the Avantage banner signifies Accolade's lower-priced software.

European programmers grind out these rehashes of arcade "standards" like sausage. Games which should be the result of a creative process are instead formulaic and predictable.

On the other hand, as with all generic product, the user knows what he's getting and he gets it at a good price. The entertainment is based on play mechanics that are already proven successes, and the lower price gives gamers a chance to acquire playware at bargain rates.

Plasmatron is just such a piece. Originally produced by The Zen Room and brought to these shores by Avantage, it's a horizontally scrolling science fiction shootout set against a variety of scrolling backgrounds. The user pilots a Plasmatron fighter, a futuristic combat aircraft, over the planet Loughton 2, encountering fierce resistance from hostile forces. (Unfortunately, the skimpy instructions never specify whether these "aliens" are native to this world.) The objective is to blow up as many ships and other targets as possible, then make it back to base before the limited shields are exhausted.

The enemy ships in the initial attack wave are sitting ducks, but before long the opposition stiffens. Then the player is up against giant insects, floating asteroids, and multicomponent fighter ships which take up to five hits to eliminate completely.

The only remotely original aspect of *Plasmatron* is its visual presentation. At first look, it *seems* to be the familiar side perspective seen in earlier games like *Defender* (Williams) and *Super Cobra* (Stern). The designers, however, actually "tilted" the lower part of the landscape and added the Plasmatron fighter's shadow to help manufacture a 3-D look. This is a purely cosmetic innovation that has no impact on the game whatsoever. But when it comes to generic software, one takes one's innovation where one finds it.

Plasmatron offers simulated threedimensional graphics, but the inspiration for this pseudo-3D seems to be the old View-Master slide viewer system. When you looked into a View-Master, the world indeed had dimension, but only as a series of spaced backdrops. These backdrops were flat, like two-dimensional stage scenery. That's how *Plasmatron* looks. There's a horizon line about a third up the display area with backdrops slotted in sequence to create the illusion of depth.

The playfield also includes a console which displays the status of the ship's shields, damage, ETA, and lives remaining. It's difficult to speculate about the purpose of a damage reading on a





ENTERTAINMENT SOFTWARE SECTION

Featured 1	his Month:
Plasmatron	
Wooden Ships &	Iron Men20
Speed Buggy	
Stealth Mission .	

ship which is destroyed as soon as its shields run out, especially since the instructions never even mention that there *is* a console! Damage is accumulated, however, even while shields remain intact, but the game plays at such a high speed it isn't possible to determine how it is being accrued. Current score and high score displays flank the console.

Plasmatron has some nice graphics and an original look, but there's nothing else here that hasn't been seen hundreds of times already.

Avantage/Accolade Software, 20863 Stevens Creek Blvd., #E, Cupertino, CA 95014 (phone: 408-446-5757).

V W W W



For the hard corps computer wargamer. READER SERVICE NO. 152

WOODEN SHIPS & IRON MEN The Avalon Hill Game Co. Commodore 64 Disk; \$35.00

Transferring a military simulation from the tabletop to the computer screen is always a chancy undertaking. Avalon Hill, which has a board game catalogue full of non-electronic classics, has tried numerous times with varying results.

⁻Bill Kunkel

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Game Play

of baseball like never before. Within this framework the program considers each player's batting statistics against both LEFT- and RIGHT-handed pitchers, where available, and pitchers stats vs. both LEFT- and RIGHT-handed bat-ters. Every player's fielding and base-running abilities are also considered (an important factor when attempting to steal a base, etc.)

Select the team you'd like to manage, then pick the team you want to play against. Every team from the 1985 season is accurately represented, along with eight classic teams from the past. Determine your starting lineup, designate a starting pitcher, and make player substitutions when necessary. You call the plays, offense and defense. In a one-player game, your com-puter opponent displays un-canny intelligence in reacting to your managing

Built-in manager's functions provide extra versatility. The Trading function gives you the opportunity to create the "what if" team(s) you've always dreamed about. With this function you can have Dwight Gooden playing with Mickey Mantel and Babe Ruth. Or, if you like, you can form your own draft leagues from existing teams and play against your friends for your own pennant and World Series.

The Stat-Keeper function compiles all of the players' statistics for you and calculates Batting Averages and pitchers' ERAs. You can track your own teams' performances and print the season statistics for your club or league.

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Reader Service No. 161



Wooden Ships has few computer frills.

When S. Craig Taylor, Jr. unveiled the original edition of "Wooden Ships & Iron Men" under the Battleline Games imprint, strategy gamers hailed it as the greatest simulation of naval combat during the age of sail. Time has scarcely dimmed its reputation, so the release of the home computer disk ranks as one of the year's most important electronic gaming events.

Programmer Jim Jacob has executed a fairly literal translation of the board game. As a result, the Commodore edition of *Wooden Ships & Iron Men* makes virtually no use of the unique advantages of the computer. The sound is minimal, the graphics vaguely ape the counters and map of the board game, and gameplay is quite similar to Taylor's original creation.

If Jacob has transmitted the limitations of the board game to the computer version undiluted, the same can also be said of the simulation's strengths. The computerized *Wooden Ships & Iron Men* features the same wealth of detail, historical accuracy, and lively gameplay as its cardboard inspiration.

The main display of this one- or twoplayer contest is divided into two sections. The upper portion is a scrolling map with a movement grid. Each ship occupies two adjacent hexagons. Although the drawings are not especially detailed, players should have no trouble distinguishing friend from foe.

The lower portion of the screen presents option menus, ship status reports, and results of combat. The computerist employs the joystick to choose orders from menus and confirms them with a press of the action button. The program automatically puts a joystickcontrolled cursor on the map when the player needs it for specific movement and firing commands.

Like most Avalon Hill creations, Wooden Ships & Iron Men subdivides turns into phases for ease of play. The sequence for a complete turn consists of the following phases: wind changes, unfoul tangled ships, movement, drop or raise anchors, grapple with nearby ships, boarding preparation, combat, melee combat and crew transfer, reload guns, and change sails.

Although this list of procedures hints, correctly, that this is one complicated game, it's really not so daunting taken step by step. A mammoth 56-page manual contains exhaustive tutorials on both the routine of play and the construction of customized scenarios.

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The ability to create additional battles is a great feature, especially for the naval historians among us, but the prepared scenarios are of paramount importance to most gamers. *Wooden Ships & Iron Men* really shines with 25 engagements drawn from the period from the American Revolution to the War of 1812.

The variety is incredible. The battles range from ship versus ship slug-



While Stealth Mission boasts remarkably accurate cockpit displays, its emphasis is on flight and combat elements. READER SERVICE NO. 153

Speed Buggy offers five tortuous courses, all utilizing big rocks, wooden fences, and brick walls in various combinations as obstacles. READER SERVICE NO. 154



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ENTERTAINMENT SOFTWARE SECTION

fests like Constitution against Insurgent to huge multiship actions like the Battle of the Nile and Trafalgar. Most of the battles involve vessels from the US, France, and Britain, but there is some use of lesser powers like Spain and Venice when history so dictates.

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For all its outstanding qualities, Wooden Ships & Iron Men appeals most strongly to hard corps computer wargamers. It minutely duplicates the board game, but does not add many of the trimmings non-wargamers have grown to expect from their software. Those who want an uncompromisingly authentic recreation of this colorful period in naval combat could well find a new favorite program once they set sail with Wooden Ships & Iron Men.

The Avalon Hill Game Co., 4517 Harford Rd., Baltimore, MD 21214 (phone: 301-254-9200). -Arnie Katz

SPEED BUGGY Data East Commodore 64 Disk; \$29.95

To paraphrase an old saying, "God must love driving games. Otherwise he would not have made so many of them." It sometimes seems as though there's a new one every month, each only microscopically different from those which preceded it.

Speed Buggy, the latest title in this genre to reach market, breaks out of this automotive rut. It provides a totally original gaming experience that could never be confused with the sports car and race car simulations.

The gamer employs the joystick to control a four-wheel off-road vehicle. It turns on a dime, accelerates rapidly and, best of all, can skim along on two wheels if the player drives over one of the rocks which the designer has planted so helpfully in the middle of the road. After hours behind the wheel of electronic Indy cars and Corvettes, it's quite a shock to see the buggy launch into the air and sail over road obstacles.

The control scheme is simplicity itself. Moving the stick to the left or right governs lateral motion, slamming it forward puts the pedal to the metal, and pulling it back applies the brakes. The action button shifts between high and low gears. A rudimentary control panel in the upper right quarter of the screen presents all pertinent data, including the speed, lap number, current gear, and elapsed time.

The disk provides five tortuously twisted courses. The easiest is called "Off road," possibly because it has more hazards than the other four, which are labeled "North," "South," "East" and "West." Each has extensive scenery themed to its name. For example, "South" is a symphony of palm trees, sandy beaches, and pastel colors. All five utilize big rocks, wooden fences, and brick walls as the major obstacles, but the combinations vary greatly from course to course.

Speed Buggy is a race against time. The vehicle must pass the finish line before the countdown clock reaches zero. If the buggy navigates the entire course fast enough, the player earns the right to try another lap. The hazards are positioned differently for each lap, so there is pleasing variety even for the most skillful drivers.

The scoring system might dampen the spirits of a few novice drivers. Completing that first lap causes a tremendous increase in total score for most players. It is common to leap from a total in the 7000-8000 range to 30,000 in a single race just by beating the first time cutoff. So, until the computerist leaps that hurdle, be prepared for point totals to stay fairly static from round to round.

Like many other Data East productions, *Speed Buggy* bears the telltale traces of insufficient attention to detail. The program itself is fun and highly playable, but all the little things which enhance the gaming experience are either wrong or missing.

The implementation of the vanity board is a perfect example. Because *Speed Buggy* was obviously programmed for use with a tape drive, the disk does not retain high scores once the computer shuts down. There is no reason why this could not have been corrected before American republication. The same goes for the ludicrous title screen. It calls the game, presumably in an English transliteration of the original Japanese, "Buggy Goy." Insert snickers and ethnic jokes here.

Fortunately, none of these trivial flaws directly impacts the gameplay of *Speed Buggy*. It is tons of fun and a



Included among Stealth Mission's eight scenarios are a mountain conflict, a battle at sea, and a bomber marathon.

terrific addition to the Commodore 64's library of driving games.

Data East, 470 Needles Dr., San Jose, CA 95112 (phone: 408-286-7074). -Arnie Katz

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ell people, I'm about to hand down a secret recipe for the best RAM chip soufflé this side of Pluto. Just add a head full of frustration, a dash of space bar, and a couple of cursor keys to taste. Mix well, then jump up and down on Ol' Reliable till your anxiety is overtaken by grief. Heck, you've just hurled your trusty companion up to that Great Microchip in the Sky.

Of course I'm just kidding...I think. At any rate, we all get overwhelmed by frustration from time to time. After all, *some* of us are only human. Well, I suppose an explanation is in order.

Variables (or should that be frustration-ables?) have got to be one of the biggest contributors to premature hair loss, fried brain cells, and unintelligible babbling amongst computer programmers. Have you ever been in the process of writing a program, added a new (or so you thought) variable to the list, and then watched in total disbelief as your masterpiece took a nose dive? Shucks, if you'd only known that not-so-original variable was in there, you probably wouldn't be dangling from the ceiling right now. Why don't we get you off that ceiling (how are you going to explain the footprints to the landlord?) and lower the old blood pressure a bit. Maybe with a little bit of practice you'll be able to talk again. As for me, my brain cell just multiplied. With some luck both of them might do it again. Then I'll have four.

There have been programs written that will give a list of variables currently in the program. They work well, but you have to trace through the list to see if the variable you want to use is there. That's okay so long as the program isn't too long and you're not in any kind of hurry. But, when you get on a roll and your creativity and fingers are flying like a Concorde jet, those programs just won't do. So... *Vari-Scan* to the rescue. When you want to find out if a variable is in use, just type it, press RETURN, and bingo. You'll know in less time than it takes to yawn.

Vari-Scan automatically searches out any variable you choose, whether string, numeric, integer, or array. It's easy to use, and gets the job done pronto. It works equally well on both the C-64 and C-128.

After saving a copy of Vari-Scan, run it. The loader

POKEs the machine language data into memory and checks for errors. When it's done you can activate *Vari-Scan* by typing SYS 52000 for the C-64, or SYS 4864 for the C-128, and then pressing RETURN. Whenever you want to see if your program contains a certain variable, just type the variable name and press RE-TURN. If your chosen victim is in the program, *Vari-Scan* returns the line numbers that have it. They can't run and they can't hide. You've got 'em now.

If the variable you're searching for is an array, you have a couple of options. You an scan for an exact match by entering the entire name such as A(1). A(1) would have to be in the program for a match to occur. But, if you want to know if the variable A is used in any arrays (e.g., A(J), A(1,5), A(2,X,7)), enter the variable name like this:

A (£

The LIRA (£) sign tells Vari-Scan to list all occurrences of A as used in arrays.

Vari-Scan can discern the difference between all variables. For example, let's say that you want to search for the variable A1. *Vari-Scan* will only scan for the numeric variable A1. It will not report any integer, string, or array variables of the same name, nor will it inadvertently report a variable containing an A, such as AB. The same holds true for other types of variables. *Vari-Scan* won't scan for anything in quotation marks, or on a line following a REM or DATA statement.

Vari-Scan checks for extended variable names. If you've used HOME\$ in a home budget program, Vari-Scan recognizes it as HO\$ (the same as the 64 and 128 does). So you don't have to worry about some weird variable sliding by your prying eyes.

Vari-Scan can be deactivated by pressing the BACK AR-ROW (-) key. SYS 52000, or 4864, to reactivate it.

The next time you need an instant variable check, give *Vari-Scan* a try. It's easy to use, gets the job done fast, and keeps variable frustration at a minimum. Besides, who wants to do a tap dance on the keyboard? Then you couldn't use it as a frisbee. \Box

SEE PROGRAM LISTINGS ON PAGE 64

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Thermal Connection

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Real-World Interface: Temperature Sensing

he computer can do much more than merely execute programs. When connected to the proper devices, the computer can measure various characteristics of the real world (the world outside of the computer's circuitry), and it can control some of those characteristics. In previous articles we have connected the computer to photo-cells, light-emitting diodes, potentiometers, and relays. This month we will use a temperature-sensing device, a thermistor, to turn the computer into a moderately accurate digital thermometer.

Both the C-64 and the C-128 have built-in analog-to-digital converters. These are called "A to D" or simply "A/D" converters. The function of an A/D converter is to receive an analog input signal and to convert it to a digital value. Specifically, the A/D converters in the Commodore computers give an integer value from 0 to 255, which is proportional to the amount of resistance applied to their inputs.

A TO D FUNDAMENTALS

If you apply a short circuit between the 5 volt supply voltage and the A/D's input, the A/D sees a resistance of zero ohms and converts this to a digital value of 0. If you leave the input to the A/D converter unconnected or open, the A/D sees essentially an infinite resistance between its input and the 5 volt supply. Then the A/D converter gives the largest value it can, namely 255.

The A/D converters in the Commodore computers give an output value of 1 for approximately every 10,000 ohms of input resistance. That is, 50,000 ohms corresponds to an A/D output of roughly 50. This is fairly accurate for resistance below 100,000 ohms and output values of less than 100.

Because of different A/D input circuitry, the C-64 reaches its maximum value of 255 with an input resistance of roughly 500,000 ohms, whereas the C-128 gives a maximum output of 255 with an input of about 250,000 ohms. Note that these are only "rules of thumb." Any serious application requiring actual resistance values must calibrate the A/D converters. If you need only relative values ("is the paddle turned more to the left or more to the right?", for example), calibration may not be necessary.

Just to eliminate any confusion, I should mention that A/D converters generally convert analog input voltages (not resistance) into digital quantities. (Refer to Analog to Digital Adventures, October 1986 Ahoy!, for further discussion of A to D conversion.) Since voltage and resistance are related, it is appropriate and more useful to talk about input resistance in this application.

CONVERSION SOFTWARE

The A/D converters are accessed through Control Ports 1 and 2 (the joystick ports) on the right side of the computer. Each port can handle two resistance inputs. Normally game paddles are plugged into the A/D pins of these ports. There are only two A/D converters in the Commodore computer, but there is an electronic switch which can select the inputs from either Port 1 or Port 2. That way two A/D converters take care of four analog inputs.

BASIC 7.0 in the C-128 uses the POT command to read the A/D converters. POT(1) and POT(2) give values corresponding to Control Port 1 inputs (closest to the front of the computer). POT(3) and POT(4) correspond to Control Port 2.

For the C-64, you must read the A/D converters by other means. On page 346 of the C-64 Programmer's Reference Guide (PRG) is a machine language program for reading all four A/D ("paddle") inputs. It states that reading the paddles from BASIC is not reliable. The machine language program C-64 Paddle Routine on page 66 of this magazine is a condensed version of the PRG program which allows inputs only in Control Port 1.

The procedure to perform an A/D conversion and to read the results is as follows:

1. Set the electronic switch at address \$DC02 (addresses

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(CF)





are in hexadecimal) to enable Port 1 or Port 2 (or both) inputs to the A/D converters.

2. Wait briefly for the inputs to be converted.

 Read the outputs of the two A/D converters at \$D419 and \$D41A.

The remarks at the beginning of the machine language program provide more details. Note that interrupts must be disabled. The Complex Interface Adapter (CIA) chip has pins which can be inputs or outputs. Two of its pins (PA7 and PA6) are tied to the electronic switch. The Data Direction Register (DDR) of the CIA at address \$DC00 must be programmed so that those two pins are outputs. Then I's are written to those two pins to close the switches and bring the Control Port paddle signals to the A/D converters.

This machine language program enables the inputs from both Port 1 and Port 2, although only Port 1 will be used. The A/D converters are part of the Sound Interface Device (SID) chip. They continuously convert whatever input is available. If nothing is plugged into either control port, the A/D converters see infinite resistance and give values of 255.

Although the *PRG* says BASIC is not reliable, I have found that these statements work nearly as well as the machine language routine:

PRINT PEEK(54297)

PRINT PEEK(54298)

for each) to pin 9 and pin 7 of the 9-pin connector. Pin 9 is the POT X (paddle) input, and pin 7 is 5 volts. For convenience, you may twist the wires together.

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Thermistors come in a variety of sizes and shapes. The one listed above is a small bead about the size of a pencil tip. Thermistors have two wire leads attached to them. The two leads of the thermistor are soldered to the other ends of the wire. It doesn't matter which wire goes to which lead of the thermistor. The schematic of the finished apparatus is in Figure 1.

Before using the thermistor with the program we will discuss, you must make its leads waterproof. Daub some epoxy, silicone glue, or other waterproof glue around the leads of the thermistor and the ends of the wire to which they are soldered. Don't coat the body of the thermistor itself any more than necessary to seal the leads. (Be sure the leads are not touching each other.)

PLUG IT IN

After constructing the thermistor apparatus, plug it into Control Port 1 (the joystick port on the right side of the computer, the one closer to the front of the computer).

Remember that computer chips connected to pins on the Control Port connectors are static-sensitive. Chips in the computer can be damaged by electrostatic discharge. Discharge yourself by touching something metal before connecting or disconnecting anything (joysticks included) at these connectors. Don't use your computer in a very dry, static-prone environment without proper precautions.



They read the SID chip's A/D registers at \$D419 and \$D41A. The first address is for the A/D converter for input resistance between pin 7 (5 volts) and pin 9 (POT X) of the control port connector. The second address is the A/D converter which measures resistance between pin 7 (5 volts) and pin 5 (POT Y). Here "POT" stands for "potentiometer," which is a variable resistor.

HARDWARE PREPARATION

You need less than \$5 worth of parts to convert your computer into a digital thermometer:

 Subminiature D 9-pin female connector (Radio Shack 276-1538 or equivalent).

2. Thermistor (Radio Shack 271-110 or any other with at least 10,000 ohms at 25 degrees C).

3. Wire: any length, 20 to 24 gauge.

4. Epoxy or waterproof glue.

Solder two equal lengths of wire (I used about four feet

Turn on the computer and enter this quick program:

C-64 VERSION:

10 PRINT PEEK(54297), : GOTO 10

or

C-128 VERSION:

10 PRINT POT(1), : GOTO 10

You should see a series of very close numbers, typically about 15 for the thermistor listed above at room temperature (70 degrees Fahrenheit). Those numbers are the digital outputs from the A/D converter as it measures the resistance of the thermistor.

If you get very erratic numbers, or all zeros, or all 255's, then something is wrong. All zeros means that either the

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wires or thermistor leads are shorted together (touching). Look closely at both ends of the wires and check the connector for solder bridges.

All 255's means that either the wires are not well-soldered to the connector or to the thermistor, or the connector is not plugged into the computer connector firmly, or the thermistor is open-circuited (faulty), or the connector is plugged into the wrong control port.

If you see very random numbers, make sure you are plugged into Port 1. Turn your computer off, then back on, and reenter the program (make sure some other programs in the computer are not interfering with the thermistor this would be a problem with only the C-64 version).

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If all went well, the number repeatedly displayed is a digital representation of the thermistor's resistance. Squeeze the thermistor in your hand. You should see the value on the screen change. It should decrease since the resistance of a thermistor decreases as the temperature rises. Notice that the value on the screen gradually changes to the new value. It takes a while for the thermistor to change temperature.

The advantages of the thermistor for our application are that it is a resistive device (unlike a thermocouple which is a voltage device), it is inexpensive (unlike a platinum Resistive Temperature Device or RTD), and it has a relatively large thermal sensitivity (its resistance changes by a factor of ten or more for a one hundred degree temperature change).

The disadvantage of a thermistor is that it is very nonlinear. This means that its resistance does not change uniformly with temperature. In fact, the relation between resistance and temperature for a thermistor is given by this equation:

$$1/T2 = 1/T0 + 1/B * LN(R2/R0)$$

If the thermistor's resistance R0 is known at a certain temperature T0, and if a calibration constant B is known for the thermistor, then any other temperature T2 may be calculated from the above formula by measuring R2, the thermistor's resistance at that temperature. Note that LN is the natural logarithm function given by LOG in BASIC. Also note that temperatures must be given in degrees Kelvin. More on that later.

As we have seen, our computer has the ability to measure the thermistor's resistance. We will also let the computer perform the calculations in the formula to tell us the new temperature.

CALIBRATION CAN BE FUN

We must measure the thermistor's resistance at two different known temperatures in order to calculate B, the calibration constant. The procedure we will use is this:

1. Measure resistance R1 at room temperature T1.

Measure resistance R0 at ice water temperature T0.
 Calculate B, derived from the previous equation, since T1 and T0 are known:

$$B = LN(R1/R0) / (1/T1 - 1/T0)$$

You could use any two temperatures, but these are easy to obtain.

Once the computer determines the calibration constant



AHOY! 35

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B, the thermistor can be used to measure any other unknown temperatures. The computer will determine any new temperature T2 with this procedure:

1. Measure resistance R2 at the new temperature.

2. Calculate the new temperature T2:

$$T2 = 1 / [(1/T0) + (1/B) * LN(R2/R0)]$$

Notice that since this formula depends upon the ratio of the two resistances, it doesn't matter what units they are measured in as long as they are the same. We will use arbitrary Commodore A/D converter units for measuring resistance. Temperatures must be in degrees Kelvin.

PUT IT ALL TOGETHER

If all the preceding has seemed too complicated, fear not. The program *Thermal Connection* on page 66 takes care of all the difficulties. Before you run this program you must

 find out what your room temperature is (use a thermometer or look at your thermostat) and

 put some cold water along with some ice cubes or crushed ice into a dish and set it where your thermistor plugged into the computer can reach it.

Plug the thermistor into Control Port 1 and run the program. Note that C-64 users must change lines 100, 1020, and 2030 as shown in lines 5001-5003. Also, C-64 users must add line 11 (shown in line 5000) and add lines 5010-49184. These changes for the C-64 replace the POT(1) function of the C-128.

The program asks if you already know the calibration constants for the thermistor. If you reply "N" to indicate that you don't know them, the program starts the calibration process beginning at line 3070. You must have the thermistor at room temperature (or any other known temperature except the freezing point of water). Enter that temperature in degrees Fahrenheit. (The computer will convert it to degrees Kelvin in line 3180.)

The program calls the routine at line 1010. You will see a display on the screen similar to the earlier test of the thermistor. Once the numbers appear to have settled to one or two values, press any key. The program calls the routine at line 2010 to read and average the next ten resistance readings. This value is R1, which corresponds to your room temperature T1.

Now you are instructed to put the thermistor into the ice water. The computer assumes its temperature T0 is 32 degrees F. Press any key to see the new A/D values on the screen. You should see them gradually increase until they reach some steady level. Again press any key once the numbers appear to have settled to one or two values. The computer averages the next ten readings and calls the result R0, corresponding to T0.

The computer has all the information to calculate the calibration constant B in line 3200. The values of B, T0, and R0 are then shown on the screen. You should write them down. That way, the next time you run the program you can enter them manually rather than going through the calibration process again. (My values with the listed thermistor are typically B=2884, T0=273, and R0=29. Room temperature T1 of 293 degrees K (68 degrees F) gives an A/D reading R1 of 15.)

Press any key once you have recorded the calibration con-

stants. You are returned to the main loop at line 100 which repeatedly reads the thermistor's resistance R and converts it to a temperature T in degrees Kelvin in line 110.

There are four user-defined functions beginning at line 20. FNR takes any number and properly rounds it off to one decimal place. FNK2F ("K to F") takes a temperature in degrees Kelvin and converts it to degrees Fahrenheit. FNF2K converts degrees Fahrenheit to degrees Kelvin. FNT is the basic thermistor formula which converts resistance into temperature in degrees Kelvin.

Line 120 converts the calculated temperature to degrees Fahrenheit, rounds it off, and displays it. Line 130 converts degrees Kelvin to degrees Celsius (TC = TK - 273), rounds it off, and displays it as well. The Kelvin temperature scale is sometimes called the "absolute" temperature scale since 0 degrees Kelvin is absolute zero—the lowest possible temperature.

ON YOUR OWN

Even though the temperature is displayed to the nearest tenth of a degree, the thermistor and the A/D converter in the computer do not really provide that resolution or accuracy. You will notice that at higher temperatures such as 130 degrees F (holding the thermistor near a light bulb), the readings jump by as much as 20 degrees at a time. This is because a difference of one in the A/D reading corresponds to 20 degrees in this temperature range. The resolution is even worse at higher temperatures, but it is still adequate for many applications.

You can write a program to monitor the temperature every fifteen minutes and to graph the results. You might have the computer generate an alarm sound whenever the temperature exceeds a specified range. Data logging and remote sensing are just two of the advantages of using your computer as a thermometer.

A second thermistor can be easily added to Control Port 1. Add another wire to pin 7 (5 volts) and a wire to pin 5 (POT Y). In *Thermal Connection* read the second thermistor with PEEK(252) instead of PEEK(252) for the Commodore 64, or use POT(2) for the Commodore 128. It is possible to connect and read as many as four thermistors at once, but C-64 owners should use the four-paddle program given in the *Programmer's Reference Guide* if more than two are used.

You can measure relative humidity with two thermistors. Wrap one in a cotton wick and keep it wet. Spin it rapidly overhead in a medium-sized circle and record the temperature. Leave the other one dry and record its temperature. The temperature difference between the two is because of the evaporation rate from the wet one, and that depends upon the relative humidity. A book on meteorology or psychrometry will show you how to convert the temperature difference into relative humidity.

Let me know what other applications you come up with. Hmmm. I wonder how cold the rock salt and ice makes my ice cream freezer. I wonder if my old 1541 disk drive is really hot enough to melt steel. I wonder how well my attic insulation works. I wonder how much the temperature in my refrigerator varies throughout the day. How did I ever manage without a computer-based thermometer? \Box

SEE PROGRAM LISTINGS ON PAGE 66

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WINDOW DRESSING For the C-128

By Richard Curcio

well-placed window can give a C-128 BASIC program a very sophisticated look. The WINDOW statement in BASIC 7.0, however, is essentially a no-frills command. Window Dressing provides four routines to enhance your text screen displays. Program 1 POKEs the machine language for Window Dressing into location 4864. It can be located elsewhere by changing the variable SA in line 110. The program uses 247 bytes plus 200 bytes for storage immediately after the ML. The four routines are accessed with SYS statements. If SA is the start address, then FRAME=SA, AT=SA+3, CR=SA+6, and ED=SA+9.

WINDOW FRAME

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Calling FRAME quickly prints a neat box around the perimeter of the current window and (optionally) a heading at the top of the box. A window is then opened inside the box. Your WINDOW statement should therefore open a window two columns wider and two rows taller than needed. The syntax is SYS FRAME [,,,,, heading]. The five commas *must* be present if a heading is called for. The routine uses the current character color and mode (normal or reverse) for the frame. The characters used are COM-MODORE A, SHIFT *, and COMMODORE S for the top, SHIFT-, cursor right, and SHIFT - for the sides, and COMMODORE Z, SHIFT * and COMMODORE X for the bottom. These characters were chosen because they appear the same in uppercase/graphics or upper/lower case. They can be changed.

The heading can be anything PRINTable: string or numeric variables or literals, color changes, cursor controls, etc. The heading begins at the upper left corner of the frame. Start the heading with a cursor right if you don't want to overwrite the corner character. There is no error checking of the length of the heading versus the width of the window. If the heading is a string variable, the LEN and RWINDOW(1) functions can be used to determine if the heading is too long for the window's width. Note that RWINDOW(0) and (1) return the number of rows or columns minus one.

Once the inner window is opened, the routine performs a "dummy" PRINT. This turns off reverse printing if it was enabled.

PRINT AT AND CURSOR RESTORE

While CHAR can be used as a form of PRINTAT on a text screen, there are a few problems with this. The CHAR statement will only print characters within quotes or string variables. Numeric values must first be converted to strings using STR\$. Strings must be concatendated if you want to include more than one in a CHAR statement. CHAR0,5, 10,M\$;H\$ causes a SYNTAX error. Once CHAR has moved the cursor, it cannot easily be returned to where it came from. Early versions of the C-128 ROMs have a bug when CHAR is used in 80 columns.

The Kernal PLOT routine at 65520 (or 49176) could be used to move the cursor to a selected row and column before a PRINT statement. The "AT" routine provides a few enhancements to this approach:

SYS AT, flag, row, column [,,string]

The first value, flag, determines whether the cursor will be returned to where it was before SYS AT. This parameter cannot be omitted. If 0, the cursor is restored. Any value from 1 to 255 defers cursor restoration. The cursor position is saved, but will not be restored until SYS CR. This allows us to follow SYS AT with multiple PRINT statements before returning the cursor to its original position, if at all. Row and column refer to the current window dimensions. Note that these are in a different order than that used by



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PHOTOS:

CHAR. If row or column are beyond the dimensions of the current window, AT returns with ILLEGAL QUAN-TITY. Error messages for this routine and the next can be turned off by POKEing any non-zero value into SA + 21. Your program could use RWINDOW(0) or (1) to determine the window dimensions and make corrections if an upcoming row or column will be out of range.

The double commas preceding "string" must be present. String is anything PRINTable, including ESC codes. Although there are routines in ROM to save and restore the cursor position, these are used by a number of ESC characters. If AT were to use these routines, certain ESC codes in the AT string would destroy the previous cursor position. The AT routine stores the cursor column and row in more secure locations (SA+22 and 23). SYS CR restores the cursor to where it was before the most recent SYS AT.

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A number of locations in zero-page and page three keep track of the screen dimensions, character color, cursor location, where the tab positions are, and which screen lines are linked or continued from the previous line. These values are called the Screen Editor variables. The final routine saves and recalls five sets of editor values: SYS ED, set, dir

where "set" is 0 - 3 and "dir" is 0 to save, and any non-zero value to recall. This will allow a program to jump from window to window, printing menus, receiving INPUT, or resuming PRINT where it left off. For four sets of editor values, the routine uses 200 bytes immediately following the ML. Storage can be moved elsewhere. Note that the contents of the screen are not saved – only those parameters mentioned above.

THE DEMO AND ALTERATIONS

Program 2 demonstrates usage of the Window Dressing routines. It assumes that the ML is located at address 4864. Change the value of SA in line 520 if Window Dressing is located elsewhere. The program determines which screen is in effect using RWINDOW(2) in line 510, and adjusts itself to 40 or 80 columns. In line 530, alternative frame characters are defined. The codes for these characters are POKEd into the cassette buffer. When needed, the FRAME routine is altered to use these characters by POKEing SA + 172 and 173 with the low byte and high byte of the first address of the new characters. (POINTER cannot be used for this because the characters must be in RAM 0 with the

10 SYS700 20 .OPT P.00 30 *= \$1300 41) ; 50 ;--- WINDOW DRESSING 60 70 CHRGOT = \$0386 80 90 ; ENTRY POINTS 100 110 CLV: BVC BEGIN; DRAW WINDOW FRAME 120 : 130 CLV: BVC PRTAT; PRINT AT 140 150 CLV: BVC RSTCRS; RESTORE CURSOR 160 170 CLV: BVC LINKS; SAVE/RECALL ED VALS 180 ; 190 FRAME .ASC "[c A][s *][c S][s -][RI GHT][s -][c Z][s *][c X]";FRAME CHRS 200 ERRENB .BYT O; ERR MSG ENABLED 210 TEMP .BYT 0.0; HOLDS CRSR ROW/COL 220 ADDTBL .BYT 0.40,80,120,160; USED TO CALCULATE STORAGE LOCATION 230 240 BEGIN JSR \$C150:CRSR HOME 250 LDA \$F8 260 STA \$CF; SAVE SCROLL FLAG 270 JSR \$CAE5; DISABLE SCROLL 280 LDX #\$FF 290 ISR FRPRT 300 LDY. \$E5; GET TOP ROW 310 INY 320 STY \$CE 330 LFTEDG JSR FRPRT; START AT LEFT EDGE 340 INC \$CE 350 LDY \$CE 360 CPY \$E4; HAVE WE REACHED BOTTOM"?" 370 BEO BOTTOM 380 DEX 390 DEX 400 DEX 410 BNE LFTEDG 420 BOTTOM JSR FRPRT 430 JSR \$C854; CRSR RT MOVES TO HOME 440 JSR CHKSTR; PRINT ANY HEADING 450 LDA \$CF 460 STA \$F8; RESTORE SCROLL FLAG 470 480 SMALL INC \$E5 490 INC \$E6; OPEN A WINDOW

Source Code for Window Dressing

Compiled in 64 mode using the PAL assembler (Pro-Line, Inc.)

500 DEC \$E4 510 DEC \$E7; INSIDE THE FRAME 520 JSR \$CA32;CLR SCREEN LINKS 530 JMP \$C76F; PRINT RETURN & RTS 541 550 PRTAT PHA: RESTORE CURSOR IF A=0 560 LDA \$EC 570 STA TEMP; SAVE CRSR POS 580 LDA \$EB 590 STA TEMP+1 600 MOVEIT CLC; WILL MOVE CRSR 610 JSR \$C018;CALL PLOT. X=ROW, Y=COL 620 BCS ERR1; IF X & Y INVALID 630 JSR CHKSTR 640 PLA; GET ACCUML 650 BEQ RSTCRS 660 DONEPLOT RTS 670 ERR1 PLA 680 ERRMSG LDA ERRENB; IF ZERO PRINT MESS AGE 690 BNE DONEPLOT 700 JMP \$7D28; ILLOTY 716 : 720 LINKS CMP #\$05 730 BCC LINK2 740 BCS ERRMSG 750 760 RSTCRS LDA TEMP 770 STA SEC 780 LDA TEMP+1 790 STA \$EB 800 JMP \$C15C;SET POINTERS 810 820 CHKSTR JSR CHRGOT; PRINT ANYTHING"?" 830 BEQ DONEPLOT; NO 840 JSR \$795C;CHK COMMA 850 JMP \$555A; PRT STRING 860 870 FRPRT JSR PRTIT; LEFT EDGE 880 LDY \$E6; LEFT COL. 890 INY 900 INX 910 CENT JSR PRTIT+1; CENTER 920 INY 930 CPY \$E7; RIGHT COL 940 BNE CENT 950 :

960 PRTIT INX 970 LDA FRAME, X 980 JMP \$COOC; PRINT CHR IN A & RTS 990 ; 1000 LINK2 STX \$C3 1010 TAY 1020 LDA #<AREA 1030 LDX #>AREA 1040 CLC 1050 ADC ADDTBL, Y 1060 BCC LINK3 1070 INX 1080 LINK3 LDY \$C3 1090 STA \$C3 1100 STX \$C4 1110 LDX #\$1A 1120 TYA 1130 BNE LINK6 1140 LDY #\$25 1150 LINK4 DEY 1160 LDA \$E0,X 1170 STA (\$C3),Y 1180 DEX 1190 BPL LINK4 1200 LDX #\$0D 1210 LINK5 DEY 1220 LDA \$0354,X 1230 STA (\$C3),Y 1240 DEX 1250 BPL LINK5 1260 RTS 1270 1280 LINK6 LDY #\$25 1290 LINK7 DEY 1300 LDA (\$C3),Y 1310 STA \$E0,X 1320 DEX 1330 BPL LINK7 1340 LDX #\$0D 1350 LINKS DEY 1360 LDA (\$C3),Y 1370 STA \$0354,X 1380 DEX 1390 BPL LINKS 1400 RTS 1410 1420 AREA .BYT 0; EDITOR STORAGE BEGINS