

124
How To Buy The Right Printer

COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

**Using Printers
With The TI-99/4A
And The TRS-80
Color Computer**

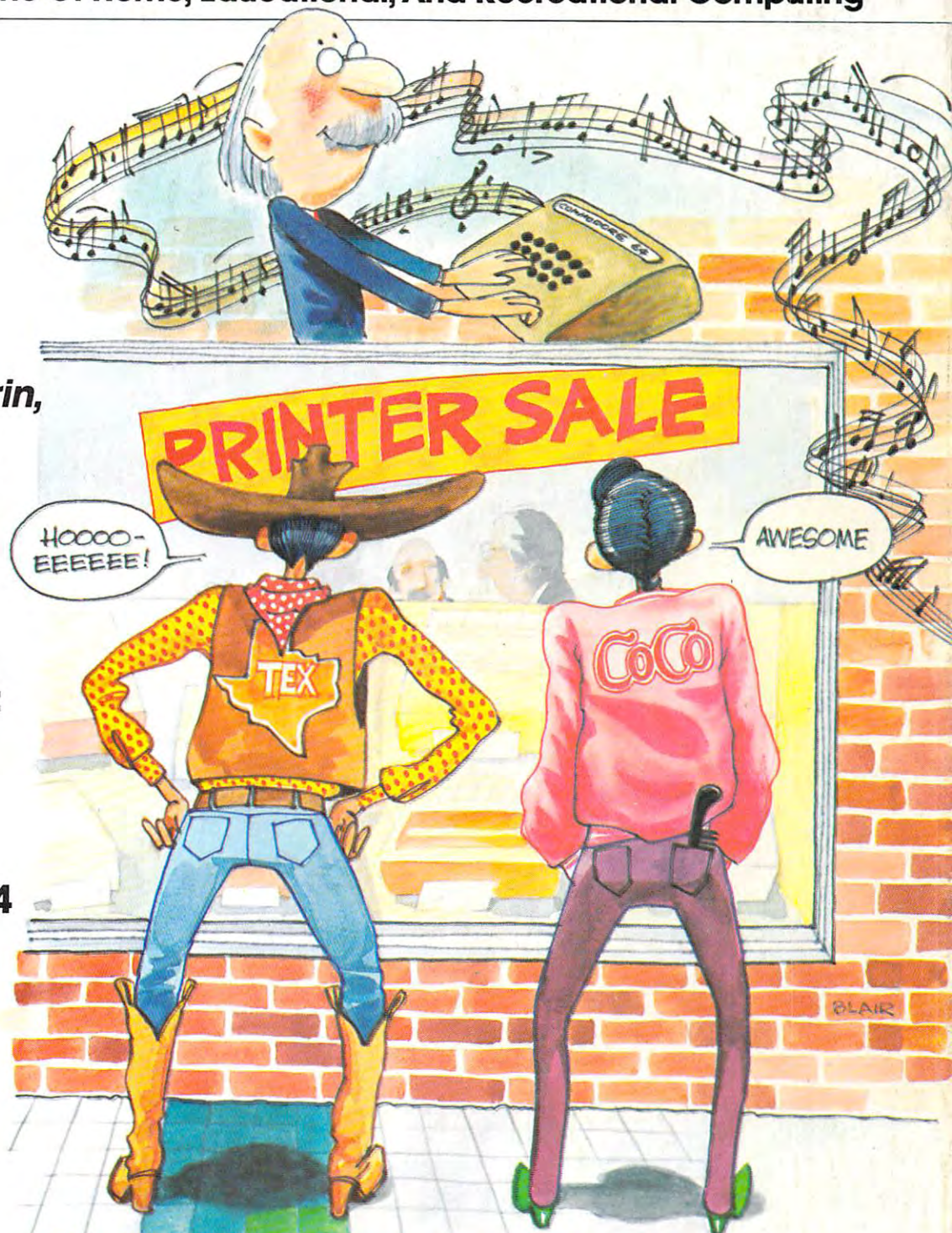
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Hawkmen Of Dindrin,
And More**

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Programs For VIC-20,
64, Atari, Apple, And
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Missiles Simplified:
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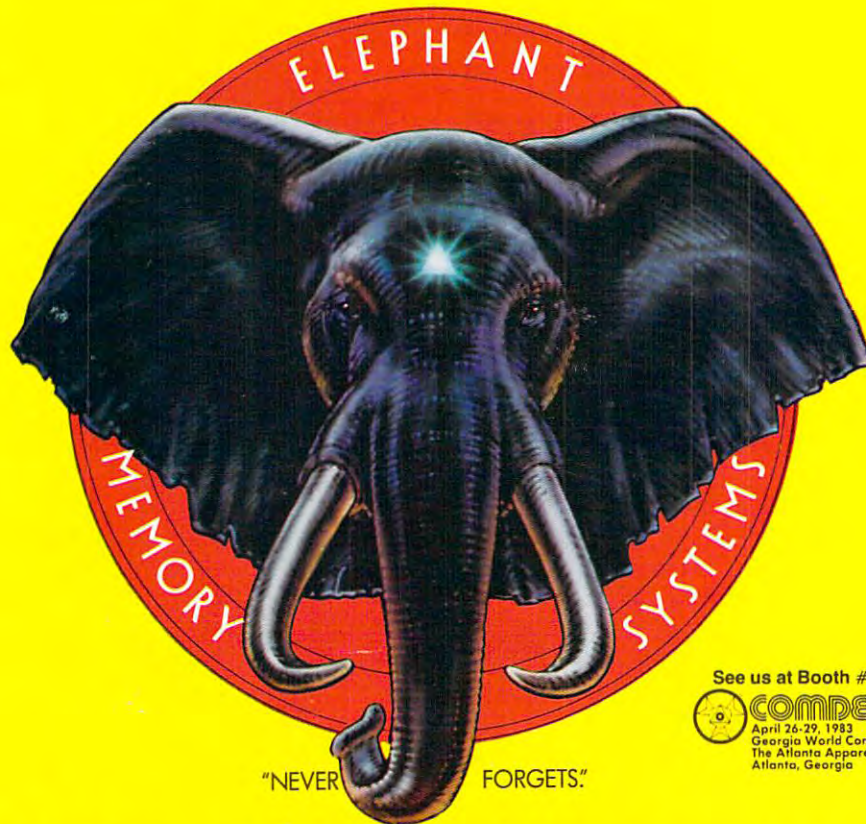
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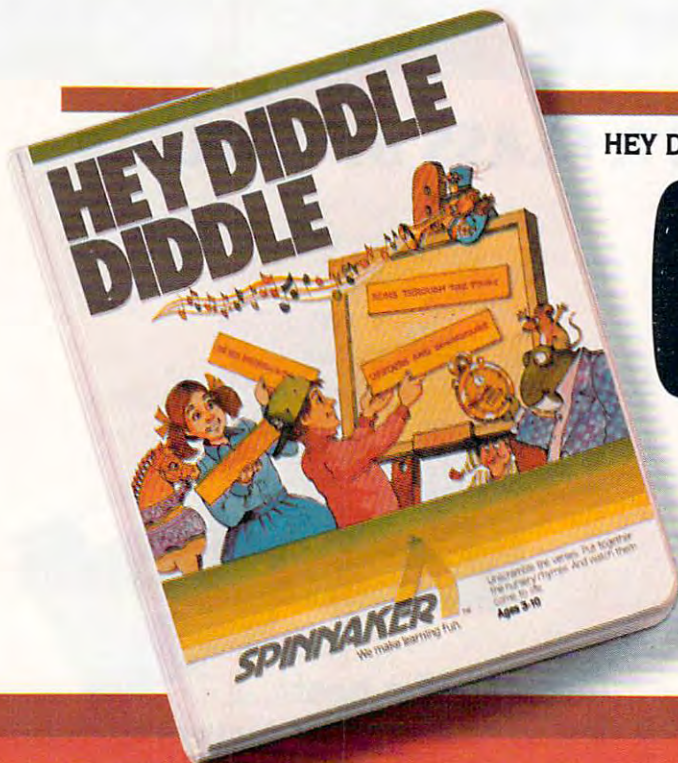
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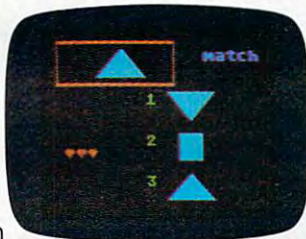
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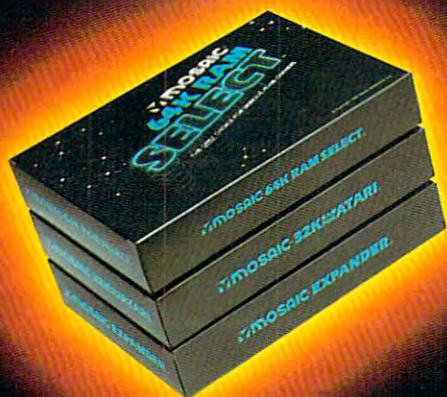
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NOTE: See page 148
before typing in
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GUIDE TO ARTICLES AND PROGRAMS

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EDITOR'S NOTES

COMPUTE!™ Publications 
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As many of you are aware by now, we have become the eleventh operating division of ABC Publishing. What it means initially is that we'll have available resources and support that we've never enjoyed before as an independent company. In addition to the general strengths that our alliance with ABC provides, we'll have senior management expertise and skilled business support of a type that we've never had available. We're all quite pleased with this mutual blending of the styles and strengths of two healthy companies, one old, one young, but both very much committed to the future of our industry.

Best of all, **COMPUTE!** Publications will continue to operate as a separate division, without internal changes, and from exactly the same perspective of superior quality and leadership in personal, consumer publishing. I even expect to find more time for planning, research, and new product direction and development.

It seems appropriate, on the occasion of this announcement, to recount the current growth of **COMPUTE!** Publications. Our **COMPUTE! Books** Division will have over 16 titles in print by the end of July; *COMPUTE!'s First Book of VIC* is currently in its sixth printing. *COMPUTE!'s Gazette* for Commodore VIC-20

and 64 computers is premiering this month with an initial press run of 175,000 copies. An incredible feat given that **COMPUTE!** broke 100,000 in October of last year. Finally, our flagship, **COMPUTE!** Magazine, has achieved the significant 300,000 barrier. Our press run for this issue is 315,000. Need I add, "and growing..."?

The latest round of price cutting has reached a level defying the most aggressive predictions. Prices have dropped so fast that Texas Instruments was caught while delaying the planned introduction of the TI-99/2. By the time the /2 series was scheduled to be introduced at \$99, market moves had brought the price of the /4 down to \$99. The Atari 1200, recently announced at the \$1000 level, has rapidly dropped to the \$600-700 range; the 400 is now below \$150. And then there's Commodore, with the VIC-20 below \$90 in many areas, and the 64 at \$399, or \$299, if you're able to take advantage of the trade-in offer (where you trade in your old computer or video game computer and receive a \$100 rebate).

What's in the wind at Commodore? We've heard rumors of pending change with the new President of North American Operations bringing in selected new key personnel. We've also

heard that some existing, previously key personnel are looking around for other opportunities in the industry. Is another famous Commodore shake-up on the way? Stay tuned, we'll try to keep you posted.

In another vein, the acknowledgment that software is a critical factor in the marketplace seems to be gaining strength on all manufacturers' strategy planning calendars. TI seems to be making progress with their licensing program for in-house sale of out-of-house developed programs. Commodore has established a new division to develop and promote the sale of Commodore software. And through it all, both established and newly formed software houses are pursuing the growth of the industry.

Next month: A superior special theme issue, our third on Games.

Robert Lock

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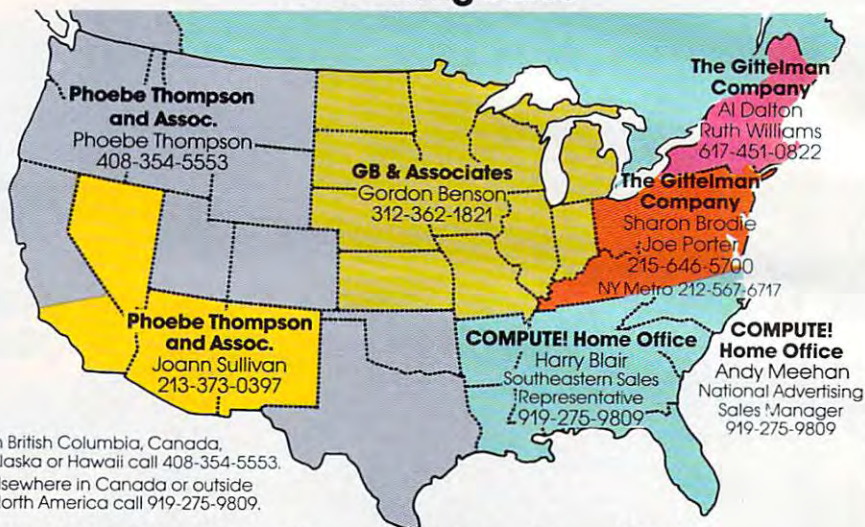
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READERS' FEEDBACK

The Editors and Readers of **COMPUTE!**

Copying VIC/64 DOS Wedge

I've tried to save the DOS support program from the test/demo diskette supplied with the VIC 1541 disk drive to one of my own. I also saved the loader. Both SAVE and VERIFY correctly, but when I run the loader my Commodore-64 spits back SYNTAX ERROR IN 52940!

Why does it do this, and if possible, how do I save it to another disk?

Erik Bard

You cannot SAVE or LOAD these programs as you would a BASIC program. This is the reason you are getting SYNTAX ERRORS. The DOS 5.1 program is in machine language, not BASIC.

Machine language programs have to be saved and loaded in a special way that specifies where they came from in memory. If you wish to copy this program to your own disk, here is the procedure:

1. First, you'll need a machine language monitor up and running in your 64. Supermon-64 (**COMPUTE!**, January 1983) is a good monitor to use for this purpose. Any monitor or assembler will do as long as it does not reside in the \$CC00 - \$CFFF range (decimal 52224 - 53247).
2. While running from within the monitor, LOAD the DOS 5.1 program into memory by entering L "DOS 5.1", 08.
3. Place the diskette you wish to save the program to into the disk drive, and save the program by entering S "DOS 5.1", 08, CC00, CF5A.
4. Place the Commodore test/demo diskette back into the disk drive, and from BASIC, LOAD the 64 Wedge loader into memory.
5. Place your new diskette back into the disk drive, and save the BASIC program in the normal manner (i.e.: SAVE "C-64 WEDGE", 8).
6. Now to run your new copy of the DOS 5.1 program, simply load the 64 WEDGE into your system, and RUN it as usual.

Epson Printer's Grafrax

Several readers have inquired about the review of the Grafrax-80, published in the December 1982 issue of **COMPUTE!**. Specifically, they want to know if it is possible to redefine the MX-80 codes to approximate those of the Centronics 737. That way, software written

for the 737 could run without modification.

The Epson MX-80 with Grafrax-80 can redefine its escape codes. These are printer functions controlled by sending the escape character, CHR\$(27), and then a letter such as "E" for Enhanced printing. There are many other functions, however, that are controlled by sending an ASCII value less than 32 (a control character), such as CHR\$(14), which signals double-wide characters. These functions cannot be redefined.

Current MX-80 printers are being shipped with Grafrax Plus. While Grafrax Plus improves on Grafrax-80 by adding underlining, super- and subscripting, and faster graphics, some functions of Grafrax-80 were dropped to make room for the enhancements. Epson feels that those functions were not used very often anyway. Specifically, these functions do not carry over from Grafrax-80 to Grafrax Plus: TRS-80 graphics, Vertical Tab, and escape code redefinition.

You can find out which version you have by sending the printer a CHR\$(129) with something like LPRINT CHR\$(129). If you get a small graphic box, you've got Grafrax-80. If you don't know whether you have any kind of Grafrax, send the printer:

LPRINT CHR\$(27); "4 Hello there!"

If you get italics, you've got Grafrax.

Rounding Numbers

In using the simple program below, I encountered a (possible) bug in Applesoft's handling of variables. After the program is RUN, and an input of 3,4,5 is given (a known right triangle), I get an output of "NO". When I PRINT X and D, I get 5 and 5, respectively. But when I PRINT X=D, I get a response of zero, meaning "false." Is this a known error, or is this a bug in my program?

Ken Carpenter

```
1 PRINT "THIS PROGRAM WILL DETERMINE THE "
2 PRINT "PYTHAGOREAN TRIPLE"
3 PRINT "INPUT 3 NUMBERS"
10 INPUT A,B,D
40 X=SQR((A*A)+(B*B))
50 IF D=X THEN INVERSE:PRINT "YES":GOTO 70
55 INVERSE
60 PRINT "NO"
70 NORMAL:GOTO 1
```

The problem that you speak of here is common to most forms of BASIC and has to do with the manner in which



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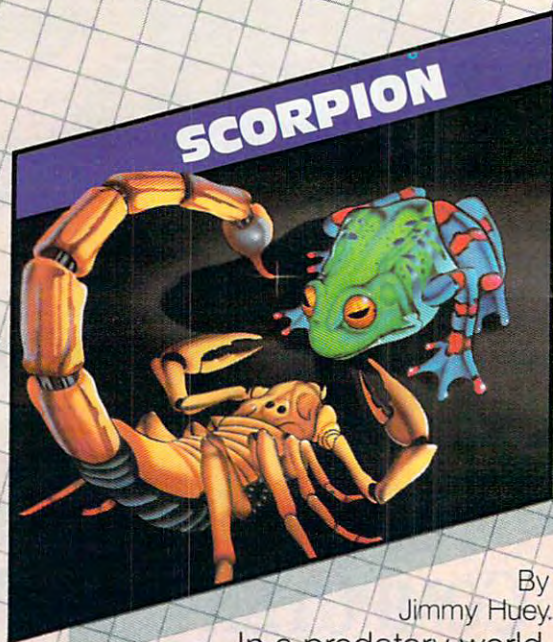
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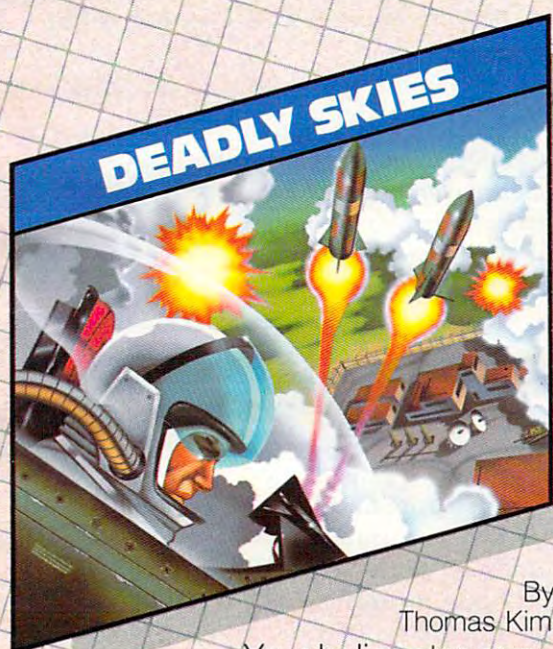
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By
Jimmy Huey.

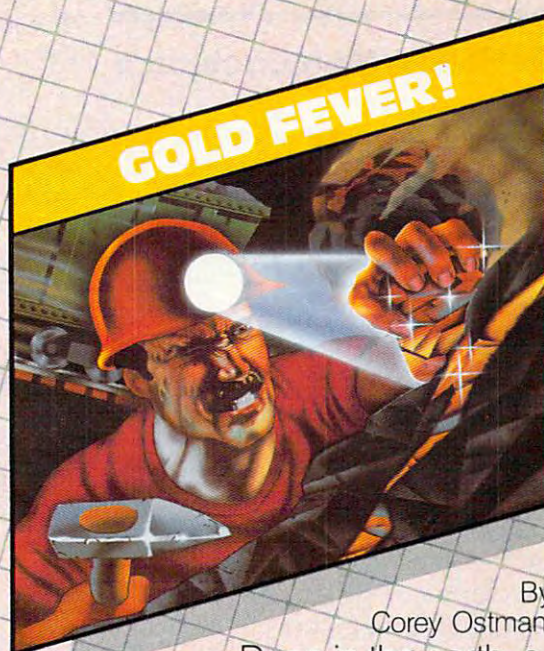
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computers handle real numbers. A very small calculation error will occur in some instances.

In your example, the number that is calculated for X on the Apple is slightly more than 5 (5.000000002, actually). PRINT X-D to see this difference after RUNning the program.

Before the Apple prints a value for X, it rounds this number to 9 digits and drops trailing zeroes so that 5.00000000 appears on your screen as 5. Internally, the Apple stores this number with greater precision (Recall that X was not equal to D in your example).

A way to get around this problem is to convert numeric values to strings and then compare the strings. In this way, the small calculation error is not seen. In your program, line 50 would then read:

```
IF STR$(D) = STR$(X) THEN INVERSE:PRINT "YES":  
GOTO 70
```

Promqueen Review: A Manufacturer's Reply

The following comments are excerpted from a letter received from Stephen Bolger, General Manager of Gloucester Computer Bus:

We read the review by Mr. Herman in January's **COMPUTE!** with disappointment. Mr. Herman evidently did not consider the Promqueen's merits as a development system; he merely considered it as an EPROM programmer. When a manufacturer places his product in the hands of a publication for review he places his trust as well that the product, if reviewed, be reviewed on the basis of its advertizing claims. Unfortunately, the review which eventuated does not appear to address, much less mention the product's claim to be a microprocessor development system. Such systems usually start at \$5000 and go up steeply from there. The Promqueen exists to give ultra low cost access to a microprocessor development system.

Stephen R. Bolger
General Manager
Gloucester Computer Bus

COMPUTE! endeavors to provide objective reviews. While we regret that Mr. Bolger feels that his product was not thoroughly described, the review was fundamentally positive and, we believe, balanced. Further, we cannot agree that the Promqueen is the equivalent of a \$5000 development system, and would have done our readers and the manufacturer a disservice if we had chosen to review it in that light.

An Answer To The Restless Atari ROM

Referring to the letter from Joe Cocuzzo in the March 1983 issue about the "Restless Atari ROM," I have had a similar problem with my Atari 800. After many trips to my authorized service center

the problem was still present.

I believe I know what the problem is. Placing cartridges in and out of the machine flexes the mother board. As this board flexes, the chips on it work loose in their sockets. Eventually intermittent failures can occur.

When the machine starts to misbehave, I reseal all of the chips. This corrects the problem for about six months, depending on how often cartridges are inserted.

David Fehr

Apple POKes

On the Apple, POKE 1011,0 re-boots on your disk when CTRL-RESET is pushed. This can be very inconvenient later on when you are in the middle of a program. Is there another POKE statement to get out of that?

A. Welch

If a value of 157 is POKed into location 1011, this feature will be disabled. This was determined by PEEKing the above location after powering up the Apple. PEEKing a particular location before and after a program is RUN would work on all computers which allow PEEKing and POKEing. This is a useful way to determine the default (normal) status of important addresses.

The New Timex 2000

In your article on the "New Home Computers" (March 1983), you wrote about the upcoming Timex/Sinclair 2000 computer.

I own the ZX-81 with T/S 1000 software and ZX printer. If I bought the T/S 2000, would I be able to use my T/S 1000 software and ZX printer with it?

Adam Schaffer

Sources at both Timex and Sinclair say that software written for the T/S 1000 will, in most cases, run on the T/S 2000. However, there could be a problem when transferring software from the T/S 1000 to the T/S 2000. At this time, the Timex people intend to provide a stringy-floppy disk drive for the T/S 2000. They are not yet definite about whether there will be a cassette player.

Even if a cassette is marketed for the T/S 2000, there is still some question concerning the compatibility of the two units. It's possible that a cassette for the T/S 2000 would load at a different speed than the T/S 1000 cassette, thereby preventing software transfer. But these peripherals are still in the planning stage, and we'll need to wait to hear more from Timex/Sinclair.

However, the ZX printer is expected to be fully compatible with both machines.

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Printing Atari Character Sets

Many of your game programs use a redefined character set, but access it by means of a POKE. What a headache! Is there any way on the 800 to change the ATASCII character set so that it can be accessed by PRINT statements?

Howard Fishman

It is possible to use strings to hold a redefined character set. We prefer the POKE method, however, because it is the easier one to type into the computer. Using strings would require the entry of quite long strings, filled with strange characters.

Genealogy

Recently I attended my first Computer Genealogy meeting and saw the program "Roots," used in building a family tree. Unfortunately, this program is not available for Commodore PETs.

I'm looking for a comparable program (price and capability-wise) that will run on a 32K PET. Any suggestions?

By the way, I noticed Genealogy (tracing your family back for generations) and Refunding (mailing in box tops and labels for cash, which I do) were two items not mentioned in the December '82 issue "How **COMPUTE!** Readers Use Their Computers" (pg. 30). So there's two more to add to that list!

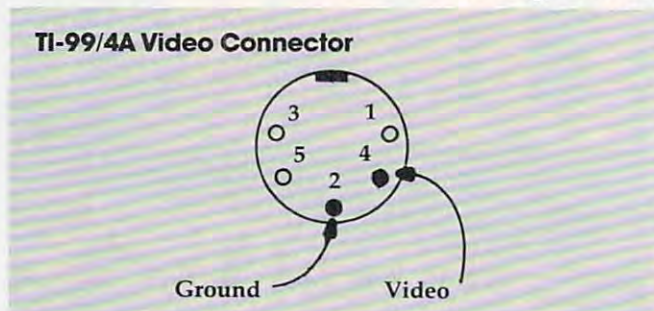
Rita M. Thrasher

TI Monitor Connection

Can you help me? Our school has recently purchased 8 Texas Instruments TI-99/4A microcomputers. Among the 8 donated black and white television sets was a Hitachi monitor used with an Apple computer.

Can I hook up the Hitachi monitor to the TI? If so, how?

George S. Ruff



Although the TI video output is a color signal, an acceptable black and white monitor picture can be obtained by taking the two signals shown in the figure below to the monitor input. The figure shows the video connector as you would see it facing the back panel of the TI-99/4A,

or the back side of an easily-obtainable five-pin DIN plug which plugs into the connector. Use shielded cable with the shielding braid connected to the GROUND pin. For the other end of the cable use whatever type of plug mates with your monitor's input jack.

Atari 400 Upgrade

In your December 1982, Issue 31, someone inquired about the flaws in the operating system of the 400/800 computers. I have an Atari 400 with the old operating system. Is there any way for me to get the new OS (revision B)? or is there any way to upgrade the existing ROM?

Rocky Boniello

No officially supported OS upgrade is offered by Atari, but you might contact your local Atari Service Representative. The ROMs are not on a removable board in your 400, so it is even harder to upgrade.

Understandable POKES

I have only had my Commodore 64 for a month, and I'm already becoming a fanatic.

I have a problem which I'm sure others have, and I also would like to propose a solution.

Most BASIC language programs can be followed with little difficulty, except for the POKE and PEEK statements. Without knowledge of each computer, one cannot follow or use the programs submitted in your magazine.

My solution is to use REM statements with each POKE or PEEK. For example, if I submitted a Commodore 64 program and had a statement such as

110 POKE 53281,1

many would not understand it. However,

110 POKE 53281,1:REM**SET BACKGROUND
COLOR TO WHITE**

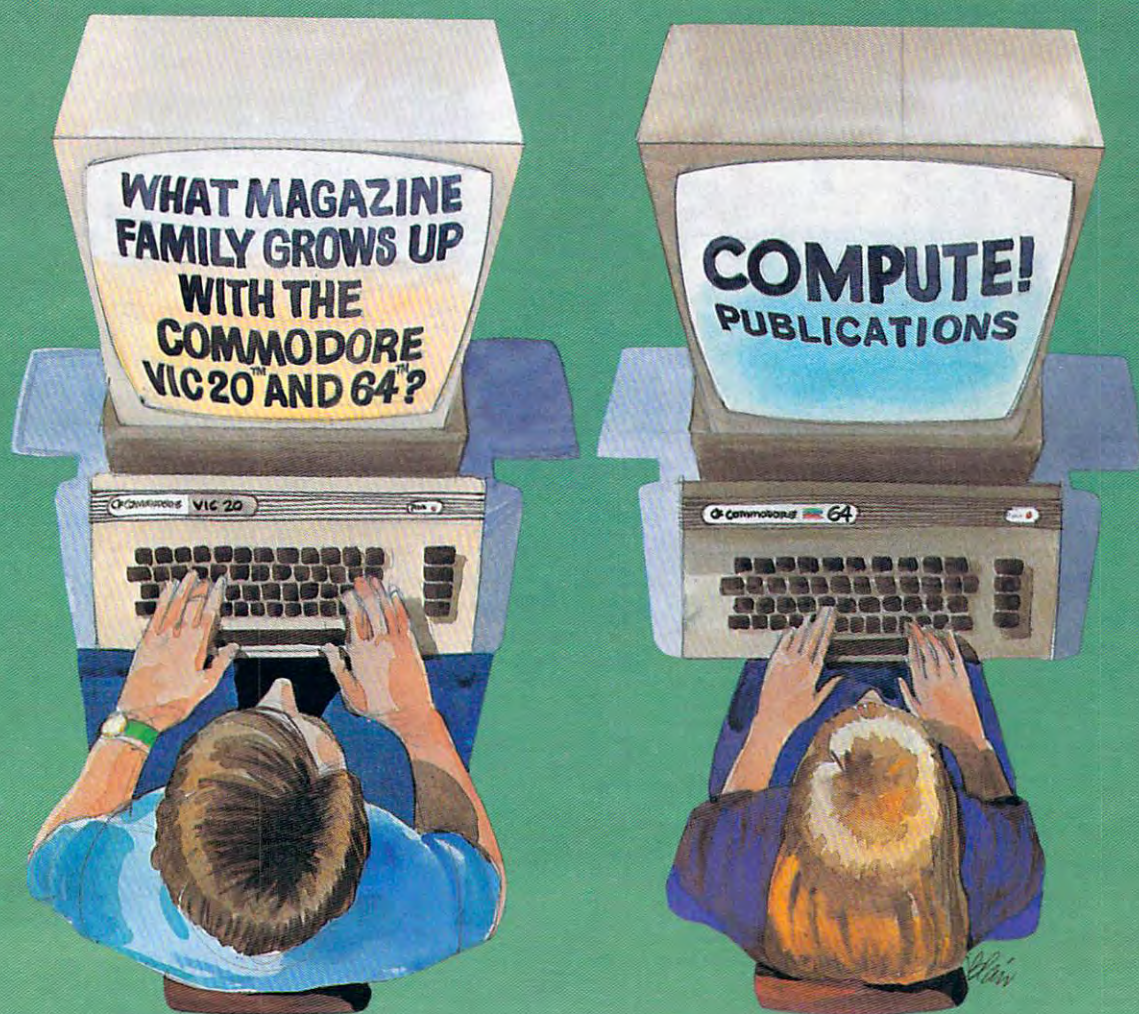
would assist people, since they could then use the appropriate commands or memory location to accomplish this on their computer!

Don Hollingsworth

This sounds like an excellent idea. Some complicated programs use POKES and PEEKs too often for this to be practical. However, many programs PEEK or POKE only a few times and such REM statements would be of real value to owners of other computers.

COMPUTE! welcomes questions, comments, or solutions to issues raised in this column. Write to: Readers' Feedback, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403. **COMPUTE!** reserves the right to edit or abridge published letters.

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Androids And Robots

The rain stopped falling as soon as he pulled his car into the parking lot at Polaris Astronautics. He was an hour early for his appointment, but his host had told him to come early for a plant tour. As soon as he checked in with the receptionist, he was greeted by his "tour guide."

"Hello, Dr. Calder. We at Polaris are glad you could visit today. I will conduct you on a guided tour prior to your meeting with Dr. Clevis in the propulsion laboratory. My name is BO-3, but most people call me Bothrey. I have been trained to recognize your voice, so if you have any questions, please don't hesitate to ask me to help you."

Jon Calder looked at Bothrey as he (or it) wandered (or wobbled) down the hall. He knew of recent advances in android design, but he hadn't expected to find an android working as a tour guide. As the tour progressed, he thought about all the time he had wasted at his company by personally escorting dignitaries on a "dog and pony show." The more he thought about it, this was a perfect application for androids. What he didn't know was that Dr. Clevis had even greater applications in mind

Is the preceding account fictional? As of this month it is, but I believe that by the end of 1983, androids like Bothrey will be serving us in capacities similar to the one mentioned. To understand why I can make this prediction, we need to first understand what an android is and how it differs from its robot cousins. Next, we will explore some of the advances that are needed to make creations like Bothrey possible.

Robots, the topic of last month's column, are mechanical devices that are controlled by external computers. For example, the Androbot robot, TOPO, is controlled by an external computer such as an Apple II using a language such as Logo. Androids, on the other hand, are totally self-contained. The distinction I make between robots and androids is that an android not only has a self-contained computer, but it is able to adapt its

programs on the basis of information it receives from its sensors. Because this field has only recently crossed the boundary from fiction to reality, there is no universally accepted definition of these terms. In this column, I will use the word *android* to refer to a mobile, self-adapting computer system.

Adaptable Androids

Do commercially available androids exist today? The answer to this question is "Yes." Both the Heath HERO-1 and the Androbot B.O.B. (meaning Brains On Board) are androids by my definition. They both have sensors that convey information from the outside world and can be programmed to use this information to adapt to their environments.

What kinds of things can an android do today? Since I am most familiar with B.O.B., I will outline its characteristics. B.O.B. is equipped with five ultrasonic sensors (of the type found on Polaroid cameras) and two infrared sensors. The ultrasonic sensors allow the android to create a map of its environment and to note the location of objects such as chairs, tables, sofas, people, walls, etc. If B.O.B. had ultrasonic sensors alone, it wouldn't be able to distinguish between people and inanimate objects. The infrared sensors provide the extra data needed to help identify the existence and location of humans. Unfortunately, B.O.B.'s infrared sensors can also identify other warm objects such as fireplaces. While B.O.B.'s vision is quite limited at this time, one can expect androids to have more sophisticated image-processing equipment in the future.

Because of the complexity of its mapping and moving tasks, B.O.B. is controlled by three 16-bit microprocessors. One of B.O.B.'s early tasks was to seek out humans and engage them in conversation, tell jokes, and follow people as they moved. The nature of B.O.B.'s tasks is determined, of course, by the software it runs.

The software to control an android must be quite sophisticated. Rather than programming the device to perform specific well-defined tasks, the programmer must make the android exhibit



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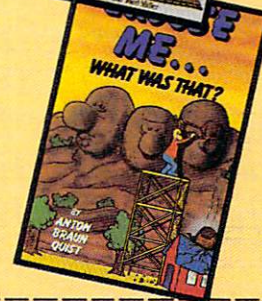
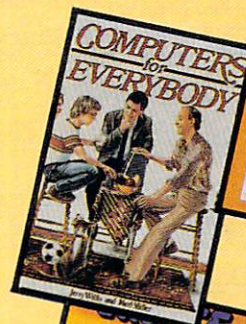
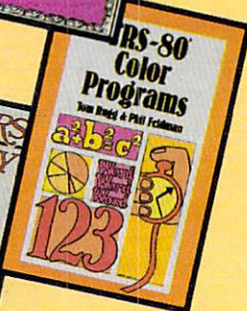
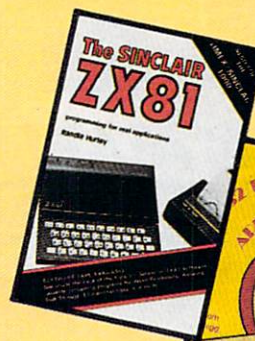
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certain behaviors when it encounters certain situations. To be truly flexible, an android should be able to pick and choose among several options, based on prior experience with a given situation. If it is provided with enough strategies, an android can make note of which strategies work in which situations, and dynamically adapt its programs to favor the use of these appropriate strategies. In humans we call this "learning from experience."

Asimov's Three Laws

If we accept that such program environments can be built, what basic behaviors should an android exhibit? In the 1940's Isaac Asimov developed the famous "Three Laws." (He wrote a guest editorial on this topic that appeared in the November 1981 issue of **COMPUTE!**.) While Asimov uses the word *robot* to describe what I have been calling an android, these laws are useful for both types of devices:

1. A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

(from *I, Robot*, 1950)

How can androids be programmed to obey these laws? Keeping in mind the relatively early state of development at this time, one can still see where these laws have been incorporated into android behavior.

First Law behavior can take many forms. In androids such as B.O.B., it requires that the device not run into people. When approaching a human being, B.O.B. automatically stops a foot or so away and can be programmed to keep its distance from someone, even if the person is moving.

The first part of the Second Law is the goal of every programmer. Who among us hasn't wished for a computer command called DWIM (Do What I Mean)? Having an android obey its user's instructions is essential if these devices are to serve any practical purpose.

As for the first part of the Third Law, androids can be provided with an ultrasonic sensor that looks down towards the floor at a 45 degree angle. Through use of this sensor, the android can avoid open elevator shafts, staircases, and other dangerous situations that would gum up the drive mechanism.

While it is easy to see how android designers can incorporate at least parts of the Three Laws into their device's behavior, there are portions of the Second and Third Law that will prove to be

quite challenging. These parts require that one law be obeyed unless the resultant behavior causes it to come into conflict with an earlier law. It is interesting to note that many of Asimov's robot stories center on conflicts arising from this hierarchical structure of the Three Laws. For those of us working with the nonfiction aspects of these devices, these laws give us much to think about.

Robot Personality

It is quite important that a programmer choose an appropriate language when modeling robot behavior. Fortunately, languages such as Logo and LISP provide an excellent linguistic environment for this application. These languages are extensible list-processing environments that can be used to create adaptive programs.

Rather than work with an android directly, it is easier for a designer to develop android-control programs using a remotely controlled robot driven by a separate computer. In fact, much work in this field can be done with no robot at all! Powerful versions of Logo (such as those for the Apple II and DR Logo for the IBM PC) provide the list-processing environment as well as a "screen robot" called the turtle. Various obstacles can be programmed to appear on the screen, and the turtle can be made to move in response to an adaptive control program. One can monitor the robot's behavior just by watching what happens on the display.

Of course, the real fun comes when a set of programmed behaviors is tried on a real robot. Some of the funniest things I have seen have come from watching an android behave "strangely." How do you respond, for example, to an android that moves partway down an otherwise empty hallway, stops, turns to face a blank wall, and starts talking to it? Androbot founder Nolan Bushnell has suggested that robot personality is actually a collection of program bugs.

While androids for the consumer market are just now a reality, one might well ask how they will be used. Fortunately, we have over 40 years of science fiction stories to help answer these questions. Androids can be used for tasks as diverse as helping with the grocery shopping, "watching" the children for a few hours, greeting guests, patrolling the house at night – the list is endless.

It is important that we all become sufficiently familiar with the capabilities and limitations of androids and robots to be able to use them effectively. Far from being menacing machines that deprive people of their livelihood, domestic robots and androids have the potential to enhance our lives in many ways. The extent to which they do rests largely with us, for *we* will write the programs that will shape the "behavior" and "personalities" of these creations. ©

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THE BEGINNER'S PAGE

Richard Mansfield, Senior Editor

This month we'll continue with our overview of the major categories of personal computer programs.

Artificial Worlds

A *simulation* is a dynamic model of something, a special kind of imitation of reality. Movies imitate images and sounds, but they aren't really simulations because the events are laid out in a pre-determined sequence. No matter how many times you see *Star Wars*, the princess is always captured and taken to the Deathstar. If you had a *Star Wars* simulation, events would be unpredictable – you might be able to rescue her and even lead the Rebel Alliance to a final victory.

Simulations, then, are full of *variables*, events that can change. And computers are ideal tools for constructing webs of interrelated, fast-acting variables.

"Spreadsheet" programs, like the popular *VisiCalc* financial simulator, allow you to make up lists of related items and then create interrelationships between the items. For example, you could enter all your normal expenses and link them to your income (as a percent of it). Then you could give yourself a simulated "raise" in the model by just typing over the previous income figure. All of the related items would then adjust, changing to respond to the new amount of income. It's like a spider web hit by a drop of water: some items change, some stay put. But by touching one part of the web, you can send vibrations throughout the whole structure. Like reality, a single action can cause multiple effects, and then these new changes can, in turn, cause further changes.

As the price of computer memory continues to fall, we will be able to create or buy simulations of ever-increasing delicacy. When you have enough interrelated events, you've built a *world*. In fact, many of the popular computer "adventure" games (where you explore a forest, a castle, or a cave, looking for treasure) are just such world simulations. Modelling will likely be a major computer application in the future. A simulation of sufficient complexity would be indistinguishable from reality.

Languages

Languages are another major category of personal computer programs, but many people don't realize that languages are, themselves, programs.

They're large, but they *are* programs.

Most versions of BASIC use up about 8K (roughly 8,000 bytes) of the computer's memory. Another 8K is devoted to the "Operating System" which looks after such things as communication with peripherals like printers, video management, and so forth.

You use a *computer language* whenever you need to communicate with a computer (this communicating is usually called *programming*). Languages like BASIC are programs to help you write other programs. There are dozens of languages you could try, but BASIC is by far the most popular and is available on almost every home computer. In fact, it's usually built into the computer so that when you turn it on, BASIC is waiting for your instructions.

There are other languages, though, and each has its own attributes and uses. Languages do differ: some are better suited to specific tasks than others. For example, *Pascal* is often favored by teachers because it emphasizes certain standardized rules of program writing. *Machine language* is the fastest-running language. *BASIC* is probably the easiest to learn. *Forth* is faster than BASIC and can be the language of choice for certain game, graphics, or music programming. *PILOT* and *Logo* are popular introductory languages for children, but *Logo* can also be a powerful tool in the hands of advanced programmers. Languages like *FORTRAN* and *COBOL* have been popular in the larger machines called *mainframe* or *minicomputers*.

Special Interests

Many programmers begin to specialize after a while. You might focus on writing games or graphics programs, and find that BASIC doesn't serve your needs as well as another language would.

Once you know BASIC fairly well, moving on to learn a new language is simplified. There are some underlying concepts such as loops, variables, and IF/THEN structures which are common to all computer languages. After you've grasped several of these main ideas, you'll quickly pick them up when you come upon them in a new language.

The Beginner's Page
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EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	15	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	10
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO I/O	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY (LOW PROFILE)	256K	143K	96K	170K	N/A	170K
	YES	NO	NO	NO	NO	NO
CP/M® COMPATIBILITY (80 column programs)						
CP/M® 2.2	YES	NO***	NO	NO****	NO	NO
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* 16K user addressable plus 16K graphic support

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**** Commodore 64 accepts 40 column CP/M

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Whether you're just wetting your toes in computers, or fully afloat on the waters, the SV-318 is a computer that will serve you for many, many years. You see, we believe that even in the computer age, you don't become an object of real value unless you're around for a while.

Questions Beginners Ask

Tom R. Halfhill, Features Editor

*Are you thinking about buying a computer for the first time, but don't know anything about computers? Or maybe you just purchased a computer and are still a bit baffled. Each month in this column, **COMPUTE!** will tackle some questions that we are asked by beginners.*

Q When the new Atari 1200XL computer was announced a few months ago, Atari said it would be "software compatible" with the older Atari 400 and 800 models. Doesn't this mean that software which worked on the 400/800 should also work on the 1200XL? Then why won't certain cartridges for the 400/800 fit into the 1200XL's cartridge slot?

A To be fair, this isn't Atari's fault. But before we get to the cartridge question, let's define exactly what is meant by "software compatible," since this question is coming up frequently, too. And this definition applies to all computers, not just Ataris.

Atari 400/800 software is *upward compatible* with the new 1200XL. This means that programs written *properly* for the 400/800 also will run on the 1200XL — although the reverse is not necessarily true. If a program is specifically written to take advantage of the 1200XL's special features (such as the HELP or special function keys, or the 64K of memory), it probably won't work on the 400/800 unless adjustments are made.

But note that we said "properly written" software. Some programmers take shortcuts which can cause compatibility problems. Usually these shortcuts involve what are known as "illegal calls" to the computer's *operating system*. The operating system is a built-in program in all computers which does routine "housekeeping" tasks necessary to a computer's operation. Machine language programmers sometimes "call" routines built into the operating system to save themselves the trouble of writing similar routines. This is perfectly okay, except that these calls must adhere to certain rules to insure that the program will work on all future versions of the operating system. Atari's operating system manuals state that if these rules are obeyed, future compatibility is assured.

That's why some machine language programs won't run on all versions of Ataris — the programmer took an unauthorized shortcut. Several popular commercial games were affected in this way when Atari revised the 400/800 operating system about a year ago. Late-model 400/800s have a "Revision B" operating system which fixes a few bugs in the old one. The changes were subtle, but some programs which depended on the old operating system were rendered unworkable.

The 1200XL has a somewhat different operating system than the 400/800. Among other things, it includes the 1200XL's built-in diagnostics. Machine language programs for the 400/800 which call the operating system properly should have no trouble running on the new computer.

Now, as for the cartridges: it's true that some Atari 400/800 cartridges made by independent software companies will not fit the 1200XL's slot. However, all cartridges made by Atari *do* fit. The slots are identical, except that the 1200XL has less room around the opening (the 1200XL's slot is external, while the 400/800 slot is beneath the front hatch). Some independent software companies made their cartridges oversized, which is why they won't fit a new slot.

Probably these companies will issue new versions to fit the 1200XL. If you recently bought an oversized cartridge for a 1200XL, you may be able to exchange it. If you can't, the only solution is to take apart the cartridge. The "cartridge" is really just a protective plastic housing around a small circuit board. One screw or some glue usually holds it together. When the housing is removed, the board can be plugged into the slot. But do this only as a last resort, because it involves two dangers: (1) Exposed circuit boards are delicate and easily damaged by mishandling, and (2) if you accidentally manage to plug in the board upside-down, the board can be ruined. If you take apart a cartridge, we recommend clearly marking which side goes up (or forward in a 400/800), and fashioning some sort of protective cover out of cardboard or a flexible plastic cassette tape box.

Q I heard that Commodore recently introduced a new model computer called the "VIC-21," and that it is already being sold in

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some cities. What is the VIC-21? Why didn't we read about it ahead of time?

A Not to worry, we didn't let you down. There is really no such thing as a VIC-21 - even though a store in Boston started selling them a few months ago.

Confused? So were a lot of Bostonians. What happened is that a store began advertising a sale on the "VIC-21," which was really just an ordinary VIC-20 with a 16K memory expansion cartridge included. The package sold for about \$200. As a promotion, the store pasted stickers on the boxes which said "VIC-21" - apparently derived from the sum of 16K plus the VIC's built-in 5K of memory. When people started calling competing stores and Commodore about the "new computer," Commodore immediately disavowed any connection with the promotion. Although it has been hinted that someday Commodore may upgrade the standard VIC, possibly with 16K, no such plans have been announced.

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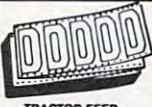
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TWILIGHT OF THE COMPUTER HACKER

*Fred D'Ignazio, author of the popular **COMPUTE!** column, "The World Inside The Computer," begins a second column this month called "On The Road." He will travel around the country visiting user groups, workshops, seminars, conventions, or anywhere else computers are having an impact on everyday life.*

This month I begin a new column.

My assignment: To go on the road, living the life of a carefree wanderer; to seek out computers and people; to write about the good things or the bad things – whatever I find.

The Twilight Of The Hacker

My first journeys as a gypsy computer reporter were brief and confined to my home city of Roanoke.

The first place I visited was the monthly meeting of the Roanoke Area Computer Enthusiasts (RACE). The meeting was held on a weekday evening in the Roanoke Valley Science Museum. I went to the meeting with great enthusiasm because several members planned to demonstrate a full-blown VIC-20 system (it occupied almost half the table). I especially wanted to see the demonstration because I will soon be writing a "kids and computers" column on the VIC-20 (and Commodore 64) in the new **COMPUTE!'s Gazette** for Commodore magazine.

The VIC-20 demonstration went fine. And we were also treated to a detailed description of RACE's current project – a homebrew computer modem. But what really impressed me was the club itself and the people who formed it. The club was small, old, almost exclusively male, and made up of computer hackers, people who enjoy rolling up their sleeves and diving into the bits, bytes, chips, and circuit boards that make up the average computer.

The evening was solid technically, and the people were all very nice, but I left the meeting feeling a little drained and lethargic. The club members called themselves "enthusiasts," but where was their enthusiasm?

Computer "hackers" were the pioneers of microcomputing. They were the enthusiasts – the zealots, even – who got this industry started, in the 1960s and the 1970s. Now we're in the mid-1980s, and what has happened to the hackers? They're the computer elders who are being shoved aside by a stampeding horde of new personal computer users who seem to share none of their characteristics.

Enter The Computer Humanists

What are these new personal computer users like?

To find out, I went to two recent events – the Computer Faire the following Saturday and Sunday at the science museum; and the "Computers in the Schools" conference at Hollins College, just outside Roanoke.

The best way to describe the new personal computer users is to say that they are the kind of crowd you'd find at a Roanoke bowling alley on a Friday night – only more diverse. There are a lot of them. And they are young, old, and in between. There are lots of women and lots of kids.

The new personal computer users talk funny, almost like regular people. You don't hear a lot about bits and bytes. Instead, you hear about computer model numbers. And computer components. And computer software. Most of the discussion centers on who has what piece of new software for which machine, and how it's the "neatest thing you've ever seen."

Another thing that distinguishes this new group from the old-line hackers is their energy. Everyone is so excited. Parents are excited about bringing all the new educational programs into their homes. Kids are excited about the games.

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See all those
glittering diamonds?
Grab 'em.

You need 1,000 diamonds fast.
To score, you have to
burrow deep. Deep
into the caverns.

You craftily cop a dozen
jewels. Then, jump to the ledge
below. Then down to another. And
another. But, STOP!

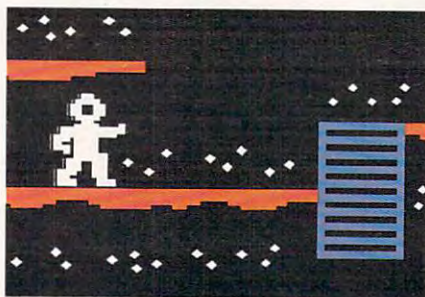
There's nothing but an abyss
below. Nothing for you there except
a bad fall—and even worse, delay!

No, don't
go there.
You've already
stripped that
vein of diamonds.
Go where no one
has ever dared
venture before.

Follow the caverns.
Deeper and deeper.

Down the ladders. Over to
the right—more jewels...and
CURSES!...you've fallen.
And you're losing time.

Grab those diamonds.
Ah ha! You've reached 1000!
The Flame Spirit has been set free.
Now you must capture it.



Quick—down another ladder.
Listen!

Ghostly music
floating
through the
black tunnels.
That means
the Flame Spirit
is hiding nearby.

The music grows louder as you
draw closer.

Now softer (quick, go back the
other way). Louder again. Shine your



flashlight.
The Flame Spirit
is very near.
A flicker. Out of
the corner of your eye.
Shine that light!

There
it is. Now,
kneel
before the
Spirit and
grab it.
Gotcha! Run!
Run to the
Temple. Watch out! Behind you!

A vampire bat trying to
steal the Flame Spirit. Climb down,
below the ledge. Another bat!

Down. To the very bottom of the
mountain.

To the pit. And the darkness.

Lit only by the shimmer of
diamonds. Suddenly there's a rush of
movement...a giant spider—after you.



Run. Jump. Up to the ledge. Hurry!
Jump again!

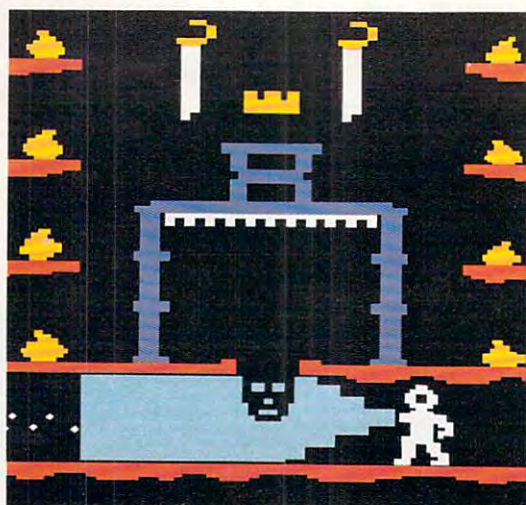
Aarrrrggghhhh! You're caught.

Woven in a tangled web. Hurry,
break loose before he returns and
you're devoured.

Ah! You've freed yourself. You've
lost time, but you've gained character.

Now, on to the Temple.

But beware of the guardian flames—one
false move and you'll end up charred
...and out of the game! Get to the
Temple Portal, the Spirit in your
grasp. Shine your light on the giant
guardian skull. You kneel. (Not out of
respect, but out of need—for without



kneeling,
entering the
Temple is forbidden.)

The entrance yawns
open. And you leap in. There,
enshrined deep within the

sacred Temple,
emblazoned
with gold, is the
sovereign
crown. You must
get that crown.
Without it, you
cannot become

Mountain King. With it, you'll rule.

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back to the surface? Can you
avoid the relentless bats and
spreading cave fires on the
way? Can you even find the way?

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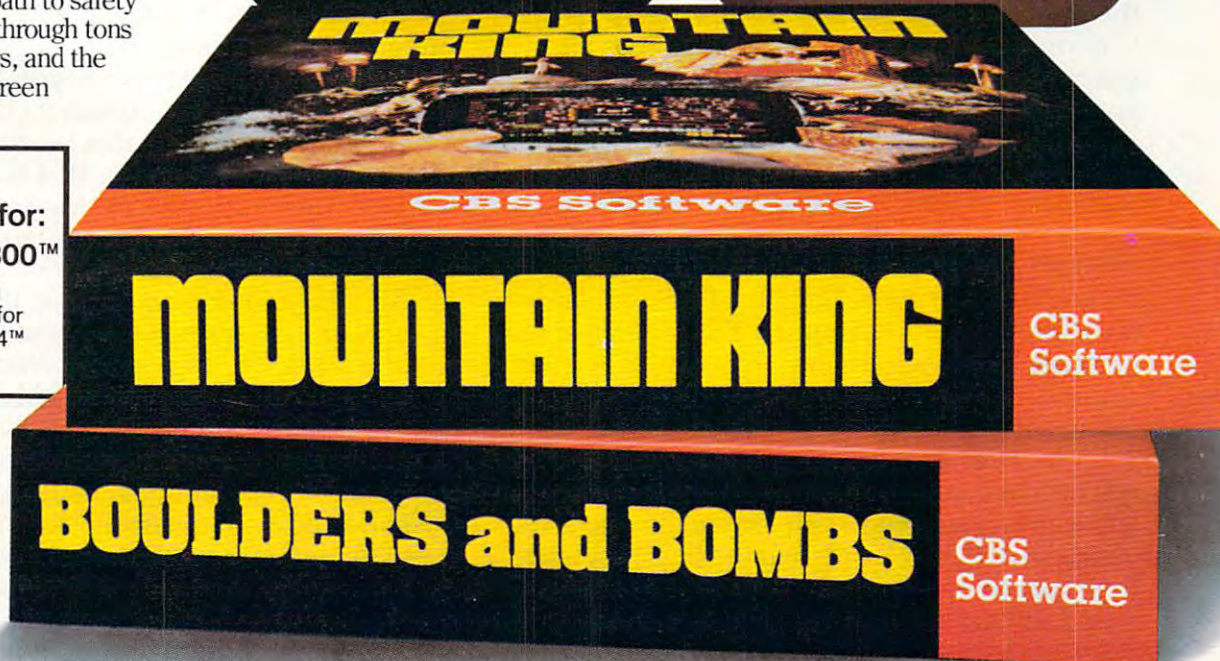
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Teachers are excited about the ways they can use the computers in their classrooms. I sensed some fear and anxiety in this group, too – a certain tentativeness about really moving into this strange new world. But mostly I sensed excitement – a lot of it.

And the questions. Here is where the computer hackers and humanists diverged completely. The hackers asked how soldering on certain boards is done and about which section of memory is switch selectable. The humanists asked how computers for very young kids would alter the way kids develop their fine motor skills and the way that they get along with other people.

For example, I conducted a workshop at Hollins College on "Computer Literature." During the workshop a man raised his hand and said, "I am an artist and a teacher. I teach elementary school children how to paint and draw. If little children learn to paint beautiful pictures on a computer just by pressing a couple of buttons, how will they ever learn to draw on paper?"

How do you answer a question like that? I didn't try, but other people in my workshop did. One woman, an elementary school teacher, said, "Who cares if they draw on paper? In the future, no one will be using paper. They will be using TV screens for everything. They are the new medium for creative expression, not paper. Kids have to learn how to do this to be prepared."

Another teacher disagreed. "If kids only learn how to push buttons," she said, "they'll never develop their bodies. Their gross and fine motor skills will never be developed. These skills are crucial to a child's becoming an adult."

Another teacher added, "And what about the pleasure children have using art materials? Children who only work with TV screens and plastic buttons will never know the joy of using gooey fingerpaints, and clay, and paste, and making cutouts out of construction paper. It doesn't sound modern to me, it sounds deprived."

Jiminy Cricket The Computer

During the workshop, I told the teachers about my concept of the "Computer Friend." I said that I thought all personal computers would one day assume human-like qualities and become intimate friends of their human masters.

One teacher applauded this prospect. "This will be a boon for human relations," she said. "It will let everyone, especially family members and young people, work out their feelings first with their computer. If something is troubling them, they don't have to keep it bottled up inside them. They can tell their computer friend. Then, after the matter is aired, they understand it more clearly, and they feel better about it and can ap-

proach members of their families and other human beings. A lot of situations are like powder kegs, ready to go off. Maybe the computer friend will help defuse them."

This point of view was echoed by another member of the workshop, who said she thought the computer friend might be like Pinocchio's friend Jiminy Cricket. The friend could be a person's conscience. The friend would hear a person's deepest secrets, his darkest and most whimsical fantasies and wishes.

At this point, two teenage girls raised their hands. "All this sounds dangerous to me," one of the girls said. "If computers are so friendly, they might lure people away from interacting with each other."

"She's right," said the other girl. "How can a human being be as patient as a computer friend? How can a person give another person their undivided attention the way a computer friend can?"

"And what about babies and toddlers?" added a woman teacher. "They may learn early in their lives to relate to a computer friend. But the friend may become a substitute for other people. This could stunt a child's ability to get along with people around her. Her earliest model for socialization wouldn't be a person, it would be a computer."

Computer Intimacy Vs. Computer Literacy

In one of our workshop discussions, I questioned the big focus on computer literacy. I said that computer literacy was fine now while we were still in an age of transition from a non-computerized society to a completely computerized society. In the future, however, when people have fully accepted computers and when computer technology has matured, we will move beyond computer literacy into computer *intimacy*.

I compared my audience to computer hackers, and said that it was obvious that the change from literacy to intimacy was already occurring. People were worrying less how computers worked and more how to "drive" computers the way they might drive an automobile. Also, they were showing concern about the impact of such a powerful technology on their lives, their students' lives, and the lives of their children. I likened introducing a computer into people's lives to sitting behind the wheel of a powerful race car. The car can take you places at breathtaking speeds, but, if mishandled, it can maim and ruin.

Computers are not a technology of the body but a technology of the mind. As carriers, amplifiers, and multipliers of symbols, concepts, and ideas, they are far more powerful than automobiles. Whether they cause us to benefit or suffer depends on how we use them. ©



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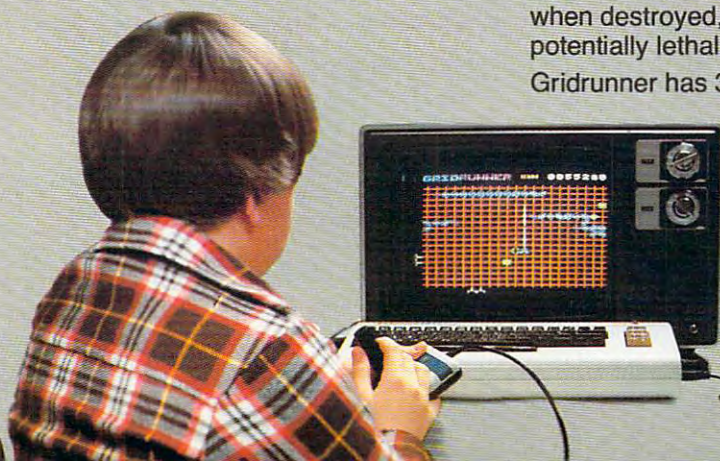
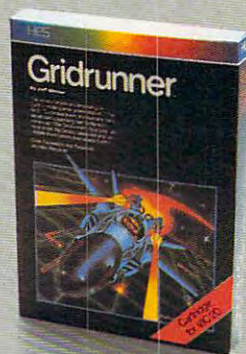
Gridrunner has 32 levels of difficulty (20 levels in the VIC 20 version). To this date, the 13th level has been the highest achieved.

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HOW TO BUY THE RIGHT PRINTER

Charles Brannon, Program Editor

You discover bugs (errors) in your 50-line BASIC program. If you could only see more than 20 lines at a time! You use your computer to keep track of your record collection, but realize that the valuable information on your TV screen is transient – erased when you “Press RETURN to Continue.” You subscribe to a telecommunications network and despair when your hard-earned 300-baud text scrolls off the screen into oblivion. You may feel that you need a permanent record of your text, want to write (word process), or hang your artistic efforts on the wall.

Even though prices are falling, a printer *is* an investment. Your printer could cost more than your computer. After you’ve realized you need a printer, you need to decide how much printer power you require.

Applications

First you should identify your application. Do you need only paper listings of your programs? Simple “printouts” from your home financial program? Will you want to use your computer for word processing? Do you need to print on plain paper, on special forms, or to produce extra-wide accounting reports? Consider also the fact that as you expand your computer system, your needs could change. Does a certain printer have enough features to be satisfactory in the long run? Remember that most printers cannot be expanded as easily as computers can.

Printing Techniques

Printer manufacturers have come up with many ways to solve the problem of getting words onto paper. The most obvious method is similar to the way that typewriters print. A formed character “stamp,” usually made of metal, is struck against a ribbon that leaves an impression on paper. On a typewriter, a series of levers controls which character hits the paper. IBM invented the “type ball,” a hemisphere containing all the characters in various rows. To print a letter, the ball turns and tilts to select the right letter, then the whole ball strikes the ribbon.

It is not easy to interface a computer with a typewriter. First, typewriters are not built to tolerate continuous operation. Second, some of the interfaces are cumbersome and expensive, usually a series of solenoids that push the levers around, or a keyboard overlay with a separate solenoid for each key to mimic a human typist. The third problem is speed; you still can’t drive the typewriter faster than about ten characters a second.

The old-fashioned typewriter layout is prone to jamming; the type ball is too slow. Printer technology diverged to solve the problem. *Dot-matrix* printing was developed as an appropriately digital way of producing text. The *daisy wheel* was developed as a high-speed, reliable way of printing formed characters.



Close-up of an IBM Selectric ball. Some electronic typewriters can also function as computer printers with the proper interface.



Some letter-quality printers are called “daisy wheel” printers because they use a print head shaped like a daisy with letters on the ends of the petals.

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A The Interbus Series. Three interfaces for the VIC 20 and Commodore 64: one for IEEE 488, one for RS 232 and one for Parallel.

The VIE and CIE are IEEE 488 interfaces for the VIC 20. When plugged into the expansion port, the cartridge is "transparent," that is, the user can still attach other peripherals without any interference. Devices such as 4040, 8050, 2031, 2032, 4022 and 8023 can be controlled. The IEEE software can be called by using the 'SYS' command, even in the middle of a BASIC program.

The V232 and C232 are serial interface cartridges which allow connection of various input/output devices such as printers, modems, plotters, etc. to VIC 20 or Commodore 64 computers. Features include: positive and negative voltage swings to meet full EIA standards, straps and jumpers to allow reconfiguration to meet pinouts for any RS232 device, and software selectable reconfiguration such as baud rate, parity, and duplex mode.

The VPI and CPI are parallel interfaces for the VIC 20 and Commodore 64. These interfaces provide direct BASIC use of the parallel printer bus and give "invisible" access to the bus. The VPI can be used only on the VIC 20 and uses the expansion port. The CPI will work with both the VIC 20 and Commodore 64 and does not use the expansion port. The CPI also has switches for setting insertion or deletion of line feed, conversion of Commodore ASCII into standard ASCII or visa versa, addresses printer to device 4, 5, 6 or 7, and allows normally unprintable Commodore characters to be printed in a recognizable form.

B Expandoport Series. Expandoport 3 and Expandoport 6 are three- and six-slot expansion boards for the VIC 20. Each slot on the Expandoport 6 has a switch for controlling power to that connector. The switch allows the use of cartridges which respond to the same memory space. The Expandoport 6 also has a fuse and reset switch. The fuse prevents excessive current drain from the VIC 20 and protects it from 'shorts'. The reset switch allows the user to 'Restart' the VIC 20 without turning power off. This feature allows RAM, which is located in the ROM expansion area, to be protected during 'Restart'.

Expandoport 4 is a four port expansion board for the Commodore 64. It has the same features as the Expandoport 6 and even allows for the use of varying width cartridges.

C Terminal Pak Series. The VTE 40 Terminal Emulator (VTE 40) is a hardware and software package which converts the VIC 20 into a 40-column communications terminal. The VTE 40 cartridge is complete. Various set-up parameters such as baud rate, parity, duplex, and bits per character can be selected through a 'menu' format. VTE 40 features are: 40 x 25 text display, user definable communication specs, smooth or normal scroll, print information to printer or disk, generation of control codes, selective omission of data, continuous status line.

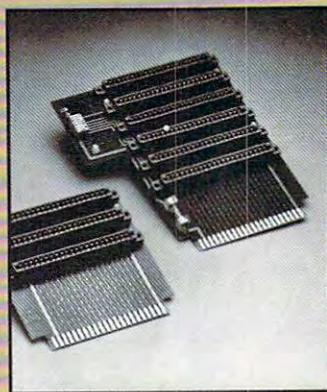
The CTE/VTE Terminal Emulator (CTE/VTE) is a software program which converts the VIC 20 or Commodore 64 into a terminal. The user can 'software select' the baud rate compatible with the modem used. Full upper and lower case characters are supported.

D Audio Link. An audio cassette adapter interface for the VIC 20. Features include: use of regular cassette recorders, conversion of VIC 20 digital data to audio and visa versa, normal and inverted cassette signal, remote on/off control and control of external devices.

E VRAM. These memory expansion modules are designed to provide additional user programming space for the VIC 20 system. VRAM plugs into the memory expansion port and requires no additional power or modification to the VIC 20 system. The units are packaged as 3K, 8K, 16K and 24K modules. Strapping is provided for mapping 8K blocks of memory into the various available memory blocks.



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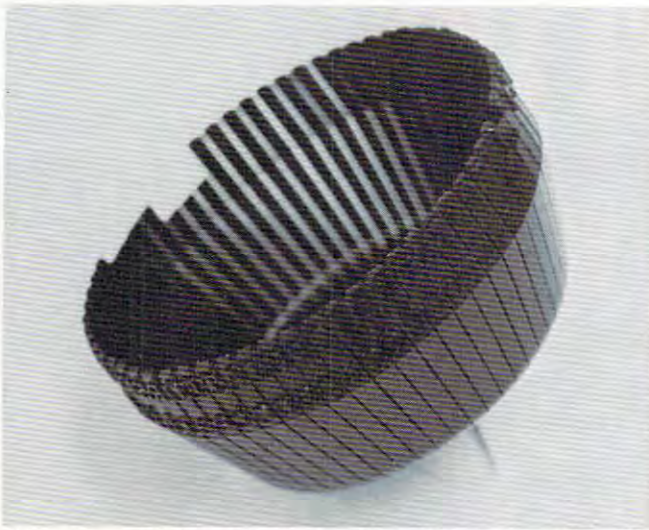
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Some letter-quality printers use a "thimble," a variation of the daisy wheel.

Dot Matrix

Take a look at the characters your computer displays on your TV screen. Each one is made of tiny dots, usually within an 8 x 8 box. Figure 1 shows a typical *dot matrix* representation of the letter "A". The dots are formed by a sweeping electron beam in your TV tube. Dot-matrix printers also use a series of dots to form characters.

The heart of a dot-matrix printer is the *print head*. Imagine it as a series of vertically stacked pins (see Figure 2). Each pin can be "fired" independently. To print a line of text, the print head sweeps across the paper. Characters are not formed "all at once," but one vertical line at a time.

There are several ways to print on the paper. *Impact* printers strike the pins against a ribbon to leave an impression on paper. *Thermal* printers use a column of tiny "spark plugs" to electrically vaporize (burn off) a special aluminum coating on thermal paper so that a black surface under the



A print head from a dot-matrix printer. The ends of the tiny wires which form the characters are barely visible at the front-center of the print-head.

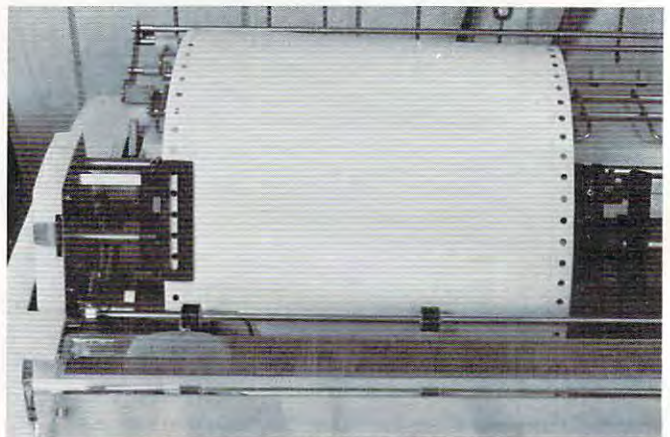
aluminum will show through. *Ink-jet* printers spray ink through tiny holes.

Each dot-matrix method has its advantages and disadvantages. Thermal printing is much quieter (and cheaper) than impact printing. Some thermal printers are virtually silent. Ink-jet printers are even quieter, but their price places them outside the home computer

market for now. Impact printers, despite their sound and higher price, do not require special thermal paper. Another disadvantage of thermal paper is that it does not age well. It oxidizes over time and darkens appreciably.

Friction Vs. Tractor

Also borrowed from typewriter technology, a *platen* is found in most friction-feed printers. The pressure of the rotating cylinder feeds single-sheet or roll paper. Unfortunately, friction-fed paper is subject to slippage and skewing. After ten forms, your printer may no longer be lined up with the paper. Skewing varies; some printers have excellent friction feed. However, the reliability of a tractor feed mechanism is generally superior for processing multiple forms. The "teeth" of a tractor feed mechanism fit into small holes on each side of the paper and pull it through the printer. Tractor feed is more expensive and requires continuous special pinfeed paper. However, the strips of holes can be detached and the paper separated into 8½" x 11" sheets.



A tractor-feed printer with its toothed wheels and perforated paper. (The right-hand tractor is unlatched.)

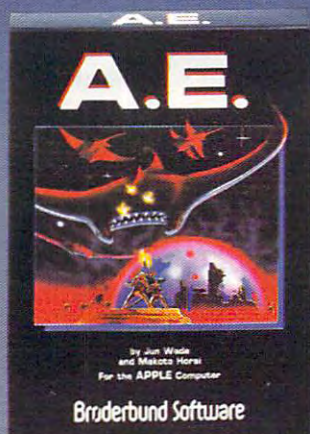
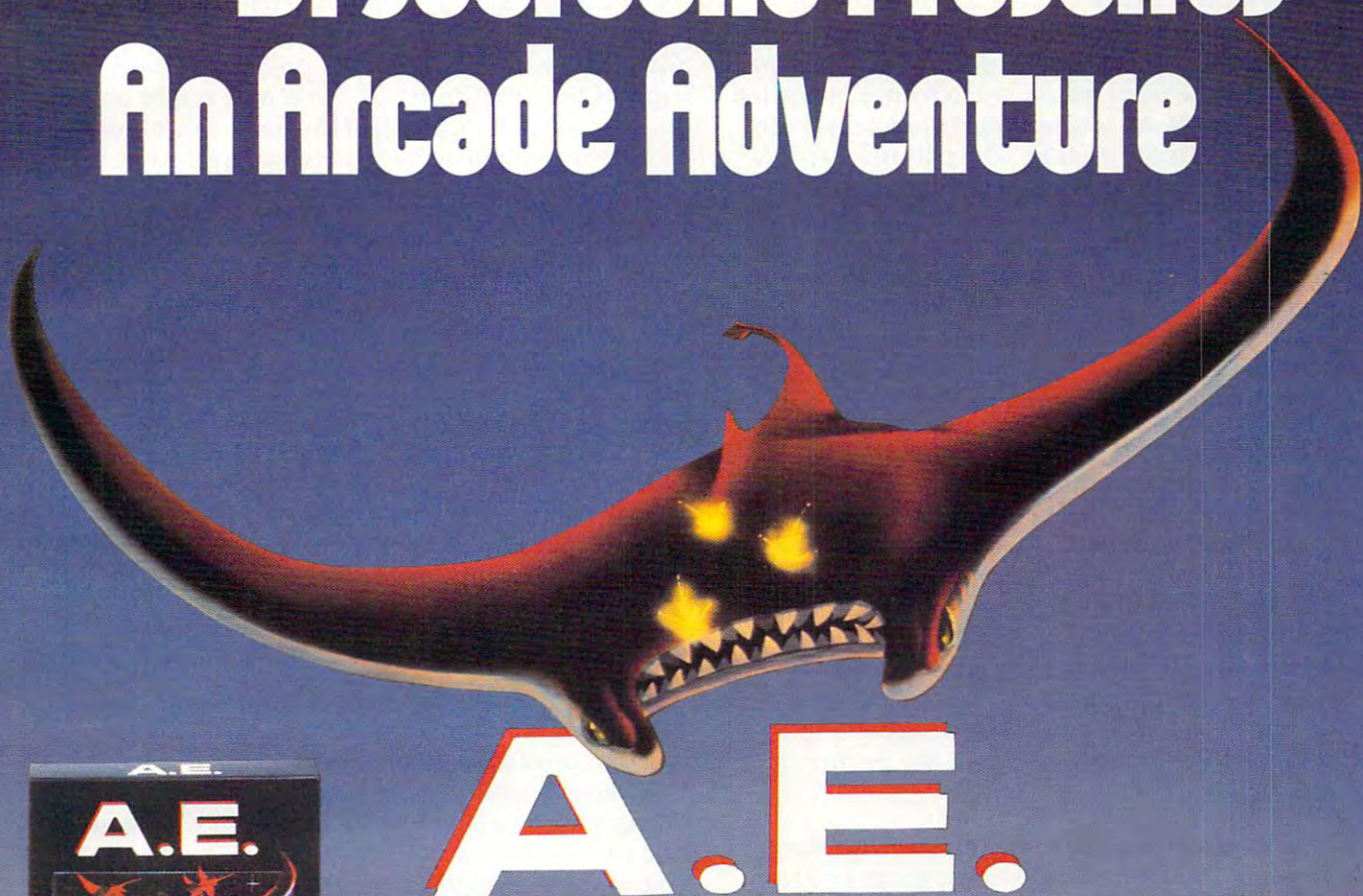
Print Quality

Obviously, formed character printers (daisy wheels) produce the best-looking text, indistinguishable from a typewriter. This is important for business, where the "computery" style of dot-matrix is often unacceptable for letters. Some dot matrix printers, however, have exceedingly fine print quality. This is called *correspondence quality*, and can approach a typewriter's quality.

Correspondence quality printers space the dots closer together. A 5 x 7 character matrix is standard on average dot-matrix printers, but correspondence quality printers use 9 x 9, 9 x 14 (or 9 x n, where n can vary), or even higher densities.

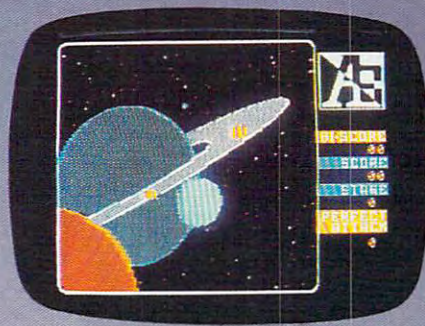
Related to dot density are lowercase descenders, the "tails" on the letters g, j, p, q, and y. A 5 x 7 matrix is not really adequate for good descenders, which should extend at least two dots below normal letters. See Figure 3 for an example.

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Descenders can make text easier to read, and if you do a lot of proofreading or copy-editing, this can make a difference.

Character Sets

Every printer has a slightly different typeface, or character set. The character set is the various patterns that the print head uses to form a character. Some printers use a simplified character set for high-speed draft printing. The patterns are less dense. However, that same printer might also offer high-quality dot-matrix printing, but at a lower speed. A printer should have upper- and lowercase, and all the normal symbols found on your keyboard. Some printers have special line-drawing graphics characters or foreign language symbols. Compare sample printouts from several printers when making your choice.

Variations

Dot matrix printers can also perform special tricks with the characters. They can elongate (print twice as wide) and condense (twice as small). Some printers can automatically underline text, others have horizontal or vertical tabs, or can double-strike or print in boldface. Printers can also vary the height of a printed line. Most printers are able to *form feed* (automatically advance to the top of the next page). This is done by sending a special message from your computer to the printer.

Graphics

In addition to printing predetermined patterns (ordinary numbers, letters, etc.), some printers also let you control the print head directly to create your own custom graphics. You can create special symbols. And you can "dump" (copy) graphics from your computer, if it has a high-resolution screen. High-resolution is measured in dots-per-inch or dots-per-line. You may not need more resolution than your computer has. If your computer can display 320 dots per line, you won't necessarily need a printer's capability to print 960 dots per line. One caveat of high resolution is speed; the more tiny dots you have to control, the more data needs to be sent. You may require a special machine language routine to effectively

use dot graphics, so check what's available before buying.

Printer Software

Look over the available software which is compatible with the printer you're considering purchasing. If your favorite word processor doesn't support the "FastPrint 110," you may not be able to use some of its features. However, some word processors let you embed special characters in your text to control any printer.

Speed

Generally, dot-matrix printers are fast – 60 to 80 characters per second (CPS). Letter quality printers (daisywheels) run from 25 to 50 CPS. Some low cost daisywheels print at around 10-14 characters per second, so consider your patience threshold before you buy. Several tricks are used to increase *throughput*. Time normally wasted during the carriage return, when the print head has to travel from the end of a line back to the beginning for the next line, can be used by printing backwards on the return. This is *bidirectional* printing, and can speed up overall output significantly.

Another trick used in conjunction with bidirectional printing is *logic-seeking*. A logic-seeking printer attempts to print the shortest line. If necessary, the print head may return at high speed to print a short line. Some printers, especially daisy wheels, also boast space skipping. This is most useful when the printer fills in blanks on a pre-printed form. Instead of advancing at a uniform rate, the printer counts all spaces received, and then quickly jumps directly to the next non-space printing location.

Random Access Printer

To free up the computer while the printer is zipping away, some printers contain an internal *buffer*. A buffer is just RAM memory, like your computer's RAM, but is inside the printer. The buffer accepts characters from your computer as fast as the computer can send them. It then feeds the characters to the printer at a more leisurely pace. If the buffer is large enough, your computer will be available almost instantly for other non-printer

Figure 1: Dot Matrix

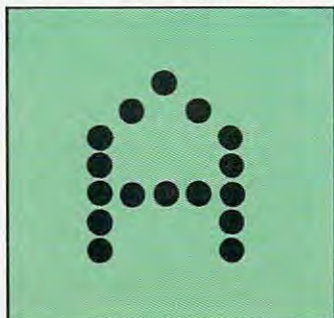


Figure 2: Print Head

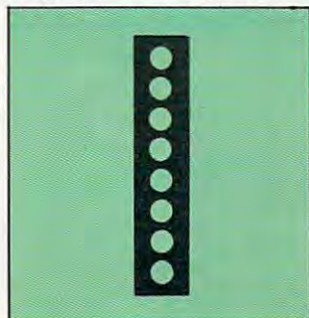
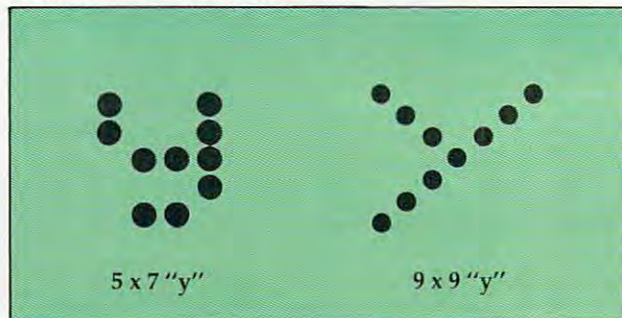
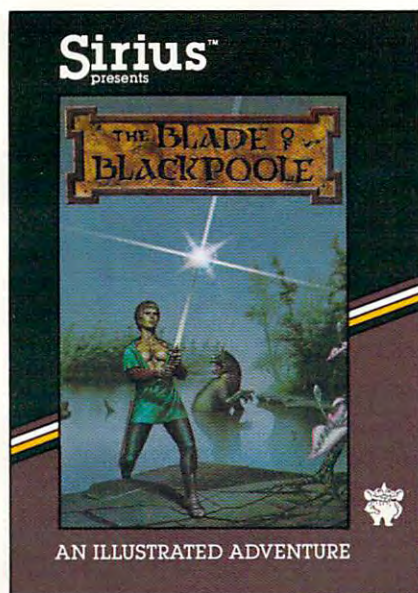


Figure 3: Descenders



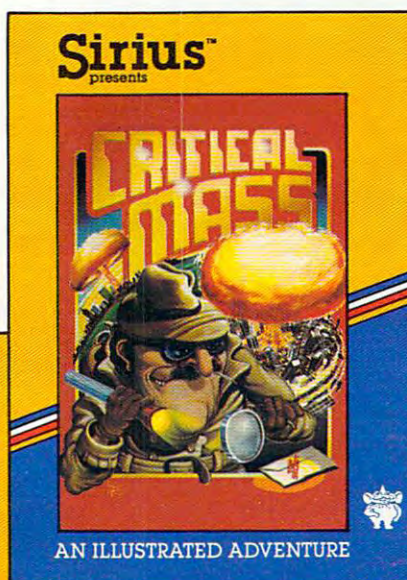
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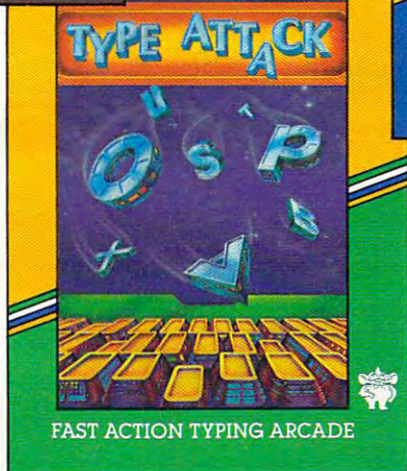
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On Jan. 1st at 10:00 am, the U.N. received this message: "Good Morning, in exactly 9 days, the world's 5 largest cities will be destroyed by thermal nuclear weapons." At 10:03 am, you received this assignment: STOP ... THIS ... LUNATIC!

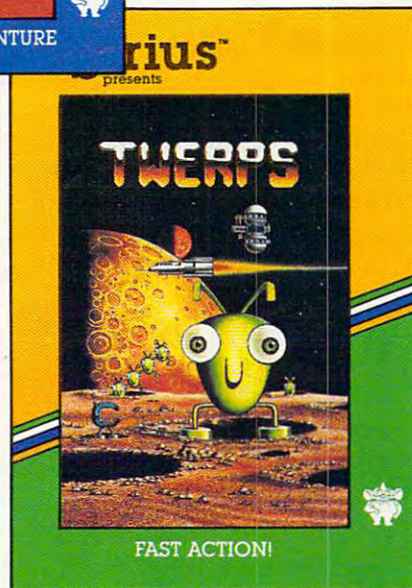
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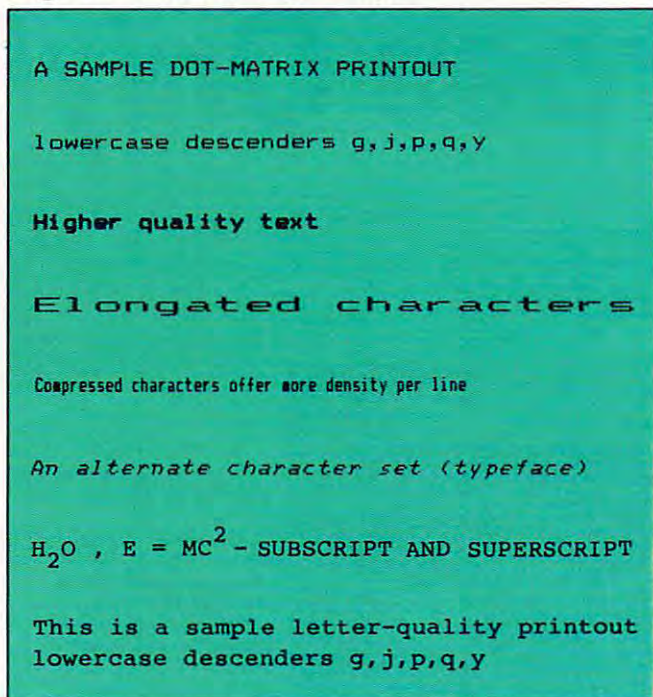
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Figure 4: Sample Type Styles



tasks while the printer is printing. Almost all printers have a one-line buffer, but some printers have 4K, 16K, or even 64K buffers! Also, some manufacturers market add-on buffers that attach between your computer and the printer.

The Interface

Most computer manufacturers have a line of "official" printers. These are usually relabeled versions of other commonly available printers. Sometimes, the company that made your computer customizes the printer to add extra functions, or just a built-in interface. If you are buying a printer from a third party vendor, you may need a special cable or interface.

The two most common printer interfaces are Centronics parallel and RS232C serial. Many home computers use a proprietary (non-standard) input/output port and special cables. This does not lock you out from other printers if an "interface box" is available. You plug your computer's special cable into this "black box" and run a cable from the interface to the printer. Some interfaces also perform intelligent tasks, such as code translation, if your computer does not use the standard ASCII code (a convention for sending text as numbers).

Print Width

Most printers can print 80 columns per line, although some can squeeze in condensed characters in 132 character lines. Some printers have an extra-wide carriage. There are also 40-column and 32-column printers. If you plan to do word processing, you'll need an 80-column printer, since it matches normal 8½" x 11" paper. Forty-column printers aren't as common as they once were,

since 80-column printers have become less expensive. If you are interested in screen dumps and program listings, you need a width equal to your computer's display width (22, 32, or 40 columns).

More On Daisy Wheels

A daisy wheel printer prints by rotating a small metal or plastic disk with characters on long spokes, or petals. A hammer strikes the petal against the ribbon and paper. A variation on the daisy is the "thimble," where the petals are curved up into a cup, with the hammer in the middle of the cup. There are more moving parts and more metal and plastic in a letter quality printer than in a dot matrix or thermal printer.

When you're shopping for a letter quality printer, see how many type styles are available. Also compare ribbon prices. Some daisy wheels can even superscript and subscript (roll the paper up or down half a line), type in boldface or "shadow," or even plot graphics using a period as a dot. Some lower price daisy wheels can mimic the features of their "big brothers," using the same daisy wheel elements and ribbons.

If you want to add the valuable features of word processing, or want convenient hard copy at any time, a relatively small investment in a printer can change your whole outlook on your computer system. ©

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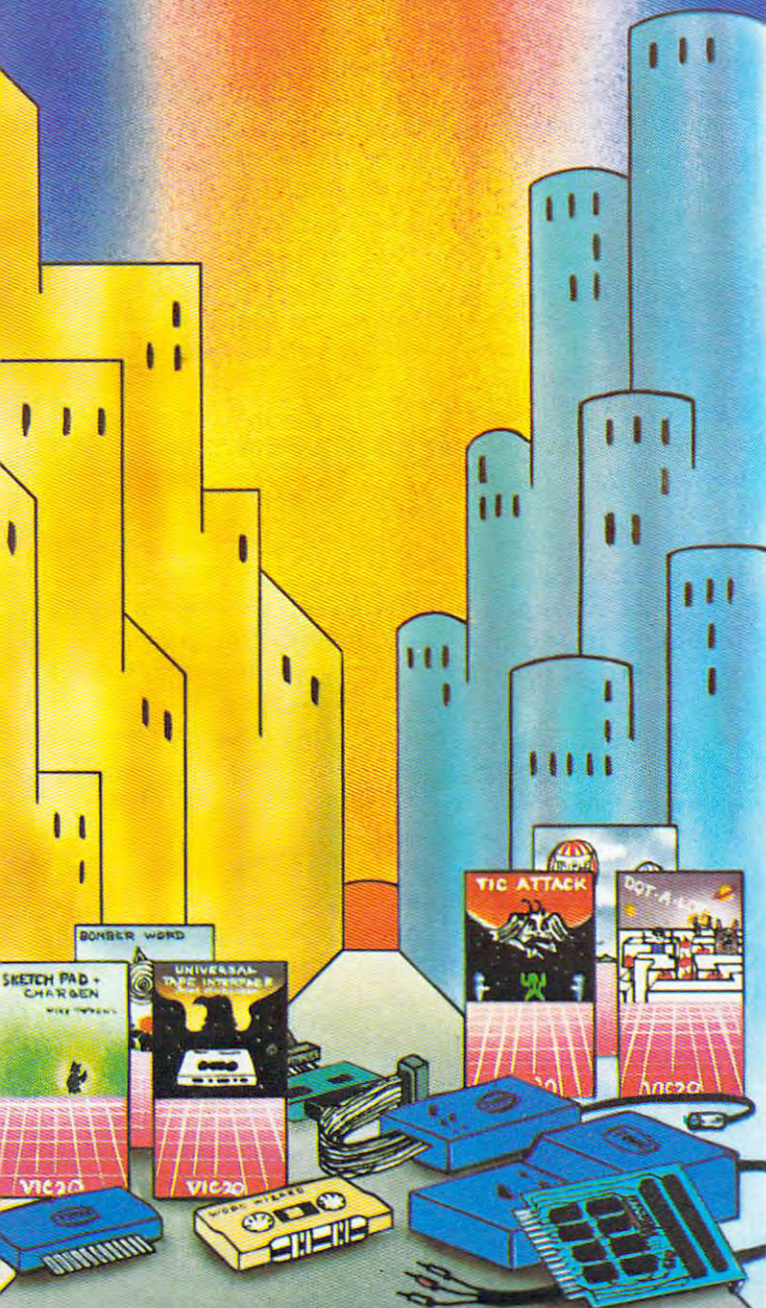
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The New, Low-Cost Printers

Kathy Yakal, Editorial Assistant

You no longer have to pay more for your printer than you did for your computer. There are now a number of good, low-cost printers that offer many of the features found in more expensive models.

If you've been putting off buying a printer because they're too expensive or they're too big, ugly, and noisy or there aren't very many to choose from – it could be that you just ran out of excuses.

Your best approach might be to ask yourself a few questions first so you don't find yourself buying a printer that goes beyond your needs or, worse yet, one that you'll outgrow in six months. If you're not sure what questions to ask, or if you want to familiarize yourself with the mechanics of these machines, see Charles Brannon's article in this issue on choosing the right printer.

The \$500 Cutoff

In this article, we'll be dealing with a group of printers in the under-\$500 price range. A year ago, that would have been a pretty short list. Many of these printers are new; the others have recently come down in price enough to be included.

What can you reasonably expect from a printer in this price range? More than you might think. You wouldn't necessarily want to use one of these models for business correspondence, but they would certainly suffice for personal correspondence, record-keeping, printing your own programs, and other personal uses.

As for features, there's no need to think that you can't expect a reasonable number of features found on more expensive printers. You just won't find as many. But several printers in this price range offer bidirectional printing, upper- and lowercase characters, some graphics capabilities, and at least one good interface. Also, most of these printers will accommodate full-size paper and offer a choice of friction or tractor feed.

Peripherals For Your Peripherals

When you bought your home computer, you might never have dreamed that you would need more than 8K RAM. If you found, a few months down the road, that you really did need it, you bought additional memory.

Likewise, it is possible to expand the capabilities of many printer models *after* you've bought them and used them awhile. You might find that a one-line buffer is so limiting that it's tying up valuable computer time or that your friction feed printer does not allow you to print long documents continuously without stopping to feed more paper into it. Or you might buy a new computer that does not have the appropriate interface. Such situations can be resolved. You'll have several options.

As for an additional buffer, this can be accomplished with a *data buffer*. A data buffer pulls the stored information from your computer, stores it within itself, and feeds the data into your printer at a measured pace, freeing up your computer for other uses while your printer is printing.

The Quadram Microfazer is one such device. The Microfazer plugs into a Centronics-compatible interface, and will give you up to 64K additional memory for under \$300.

Another is the Microbuffer from Practical Peripherals. The Microbuffer comes in three models. One fits the Apple II and can be expanded up to a 64K buffer. Another model interfaces with Epson printers and contains up to 16K, although it reportedly will soon go up to 64K. The third is a stand-alone model, which fits virtually any printer/computer combination that has the correct interfaces; this model contains 256K buffer. Microbuffers come with RS-232 and Centronics parallel interfaces and retail for under \$300. All of these units are stackable.

Adding tractor feed to your friction feed printer

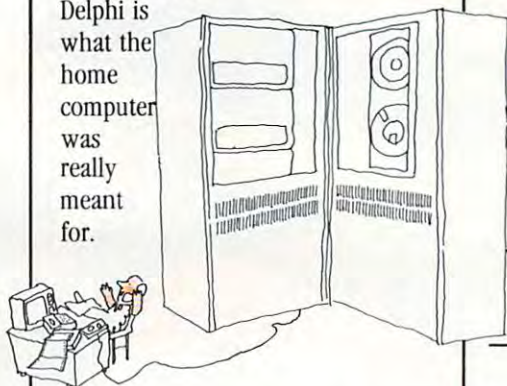
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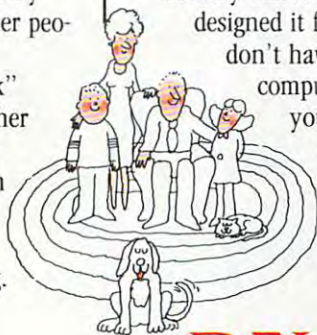
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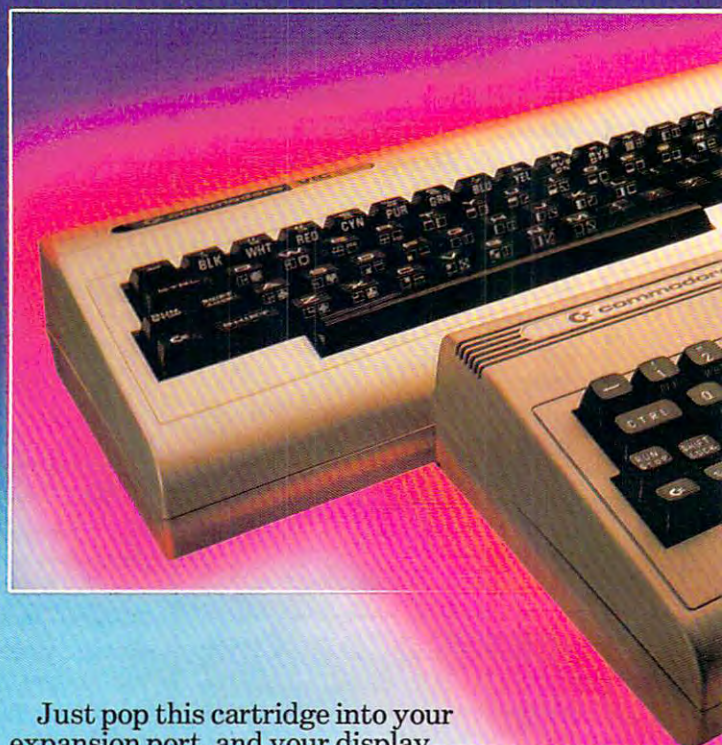
Free software with any VIDEO PAK. WORD MANAGER, our exclusive word processing package is full of advanced features. Combined with

our VIDEO PAK, it gives your VIC 20 or Commodore 64 capabilities found only in the most expensive word processing programs. Like full-function status display, and up and down scrolling, plus 13 advanced editing features including

merging and block move. In addition, we've included complementary mailing list programs. All are written in machine language for fast execution and minimal memory requirements. They're self-documenting and exceptionally easy to use. A self-adhesive strip for function keys makes most commands one-key simple. So simple, in fact, that we've eliminated the need for time-consuming menus and prompts. WORD MANAGER is provided on tape—and can be loaded to disk. It's yours free with any VIDEO PAK you pick.

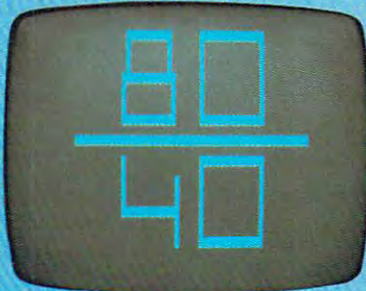
New! Our lowest priced VIC 20 VIDEO PAK ever.

We've just introduced a highly cost-effective 8K version. Price it out!



Just pop this cartridge into your expansion port, and your display instantly goes to the industry-standard 24 lines, with a choice of 40 or 80 characters. Displayed this way, you'll know exactly what you're going to get on the printout. And you really increase the amount of data you can see on the screen. You also increase memory in the process—to 12K to handle more sophisticated functions. Our package includes a terminal emulator and screen print feature. Plus the free WORD MANAGER software package!

VIDEO PAK 80 for Commodore 64. Move up to the industry-standard 80-column format, and you'll wonder how you ever did without it! Use software control to go from 40 to 80 characters in monochrome—and back to 40 characters in color. With VIDEO PAK 80, you can take full advantage of the



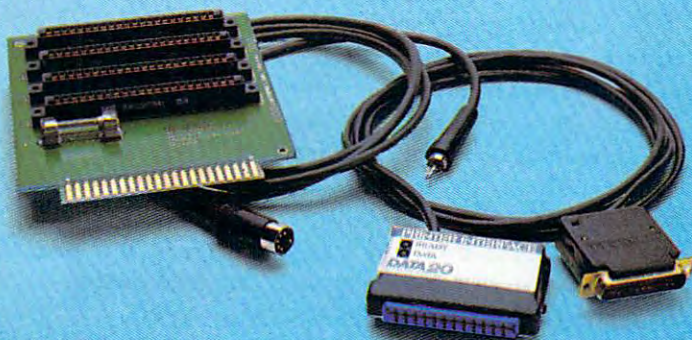
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terminal emulator mode and screen print feature with software we include. And this is a great package for word processing—particularly with our free WORD MANAGER software.

Z-80 VIDEO PAK brings complete CP/M® compatibility to your 64. This exciting peripheral gives you all the VIDEO PAK 80 features described above—plus! You see, our built-in microprocessor and software give you CP/M compatibility for any of the many programs formatted for the Commodore 1541® Disk Drive. The possibilities are truly awesome! And the WORD MANAGER software is free with your purchase.

VIDEO CABLE completes the installation. It's the easy way to connect your VIC 20 or Commodore 64 monitor to VIDEO PAK. And a must for 80-column use.



PRINTER INTERFACE in serial. Here's the perfect connection for your VIC 20 or Commodore 64. With our interface, you just plug in and go. We have a simple, yet sophisticated interface that offers flexible, continuous monitoring of data transfer functions—and virtually troubleshoots its own easy installation.

EXPANSION CHASSIS lets you use 4 cartridges at once. Run a series of compatible memory, software or game cartridges of any make on your VIC 20. Anything with the standard 22-pin edge connector. A built-in 500ma fuse protects your power supply.

MEMORY CARTRIDGE boosts VIC 20 brain-power to 20K. This super-reliable cartridge features the finest quality components, housed in a rugged plastic case.



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is not a problem in most cases; several computer manufacturers offer snap-on tractors at a fairly low cost. Nor is altering your interface capability generally much of a problem.

Many Choices

In the following printer descriptions, we will describe the specifications and special features of each machine. This should help you to compare these models to your needs and budget.



Epson MX-80

Epson MX-80

Of the Epson models in the MX Series, the MX-80 falls in our price category, retailing at \$494.

One standard feature of the MX Series is Graftrax Plus. Epson has upgraded this graphics chip from the original Graftrax included in earlier Epsons; the chip can be added to an older model. Graftrax Plus provides a considerable variety of graphics capabilities. It allows graphics configurations of up to 120 dots per inch horizontally and 72 dots per inch vertically. It also has an italics set and 66 possible variations of print characters, if you count all of the script variations.

The MX-80 can print a full 96-character ASCII set in upper- and lowercase. Characters are formed in its standard 9 x 9 matrix, though that can be emphasized and even double emphasized in a 9 x 18 or 18 x 18 matrix. Characters per inch (cpi) range from 5 to 17.16, depending on which mode you're using, and characters per line (cpl) run from 40 to 132. The print head operates bidirectionally at a speed of 80 characters per second (cps).

You can hook up an Epson MX-80 to several different models of home computers via its Centronics parallel interface. A one-line buffer is standard, but the optional RS-232 interface comes with a 2K buffer. An IEEE488 interface is also available. The adjustable, tractor-type pin feed will accommodate up to 10-inch fanfold paper.

*Epson America, Inc.
3415 Kashiwa Street
Torrance, CA 90505*

Radio Shack TRS-80 DMP-100 Dot-Matrix Printer

In December 1982, Radio Shack added a low-cost, dot-matrix printer to the growing list of TRS-80 microcomputer peripherals. Though Radio Shack has manufactured several printers for use with its personal computers, this is its first entry in the under-\$500 bracket.

The DMP-100's ability to print high-density, dot-addressable graphics is valuable for anyone interested in producing graphics on paper. Also, using an optional screen print program, the DMP-100 can produce detailed black and white graphics printouts similar to those on the TRS-80 Color Computer screen display. Its main character set can be expanded from 10 cpi to 5 cpi to create more readable copy.

The DMP-100's 80 upper- and lowercase 5 x 7 dot-matrix characters can be printed at a speed of 50 cpi. It has underline capacity and will take paper up to 9.5 inches wide. A buffer of 480 bytes is included with the printer, as is one ribbon cartridge. Selectable serial and parallel interfaces may be used to connect the DMP-100 to your Radio Shack computer.

The DMP-100 retails for \$499.

*Tandy Corporation
1800 One Tandy Center
Fort Worth, TX 76102*



Radio Shack TRS-80 DMP-100

Printelelex

About 2 inches high, 4 inches wide, and 8 inches long, the Printelelex manages to pack many features into that small space. It retails for \$145.

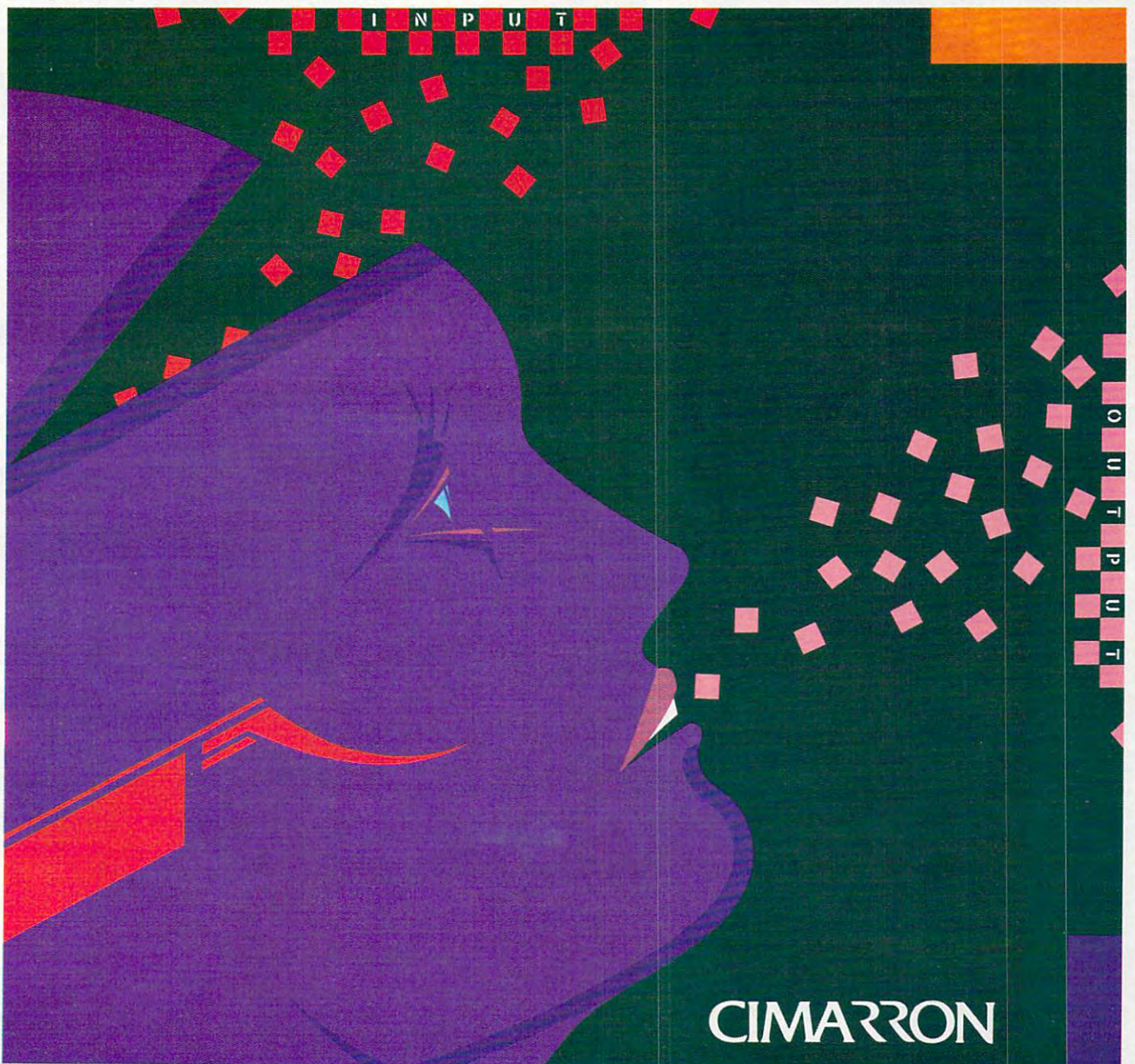
The Printelelex will not print on full-size paper. Its maximum paper width is 4.3 inches. And it's not an impact printer – it's *thermal*, so, although you won't have the noise of an impact printer, your paper costs will be higher.

The Printelelex prints characters in a 5 x 7 dot matrix at the rate of 160 cps. It prints a standard 10 cpi for a maximum of 40 cpl. It prints graphics. It prints upper- and lowercase characters. It is not logic-seeking, but it does have a one-line buffer. Both right and left margins can be justified.

The Printelelex has both a Centronics parallel

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Inside Apple

Apple Computer Inc., 20525 Mariani Avenue, Cupertino, California 95014

Vol. 1 No. 2

For the authorized Apple dealer nearest you, call 800-538-9696 (800-662-9238 in California.)

Fruitful Connections.

There are more people in more places making more accessories and peripherals for Apples than for any other personal computer in the world.

Thanks to those people — in hundreds of independent companies — you can make the humblest 1978 Apple II turn tricks that are still on IBM's Wish List for 1984.

But now we're coming out with our very own line of peripherals and accessories for Apple® Personal Computers.

For two very good reasons.

First, compatibility. We've created a totally kluge-free family of products designed to take full advantage of all the advantages built into every Apple.

Second, service and support.



Now the same kindly dealer who keeps your Apple PC in the pink can do the same competent job for your Apple hard-disk and your Apple daisywheel printer.

So if you're looking to expand the capabilities of your Apple II or III, remember:

Now you can add Apples to Apples.

A joy to behold.

The new Apple Joystick II is the ultimate hand control device for the Apple II.

Why is it such a joy to use?

With two firing buttons, it's the first ambidextrous joystick — just as comfortable for lefties as righties.

Of course, it gives you 360° cursor control (not just 8-way like some game-oriented devices) and full X/Y coordinate control.

And the Joystick II contains high-quality components and switches tested to over 1,000,000 life cycles.

Which makes it a thing of beauty. And a joystick forever.



Gutenberg would be proud.

Old Faithful Silentype® has now been joined by New Faithfuls, the Apple Dot Matrix Printer and the Apple Letter Quality Printer.

So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

The 7x9 Apple Dot Matrix Printer is redefining "correspondence quality" with exceptional legibility.

With 144x160 dots per square inch, it can also create high resolution graphics.

The Apple Letter Quality Printer, which gets the words out about 33% faster than other daisywheel printers in its price range, also offers graphics capabilities. See your authorized Apple dealer for more information and demonstrations. Because, unfortunately, all the news fit to print simply doesn't fit.





Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

Whatever your games, you'll be happy to know that someone has finally come out with game paddles built to hold up under blistering fire. Without giving you blisters.

Apple Hand Controller II game paddles were designed with one recent discovery in mind:

People playing games get excited and can squeeze very, very hard.

So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

So you'll never miss a shot.

A storehouse of knowledge.

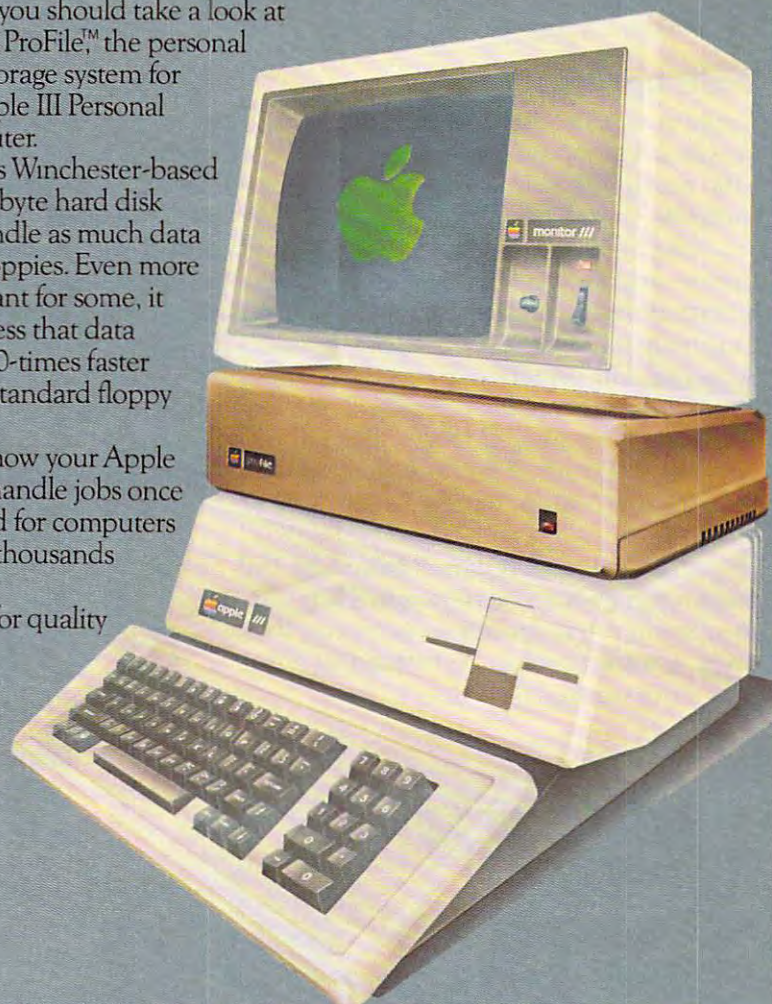
If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile™, the personal mass storage system for the Apple III Personal Computer.

This Winchester-based 5-megabyte hard disk can handle as much data as 35 floppies. Even more important for some, it can access that data about 10-times faster than a standard floppy drive.

So now your Apple III can handle jobs once reserved for computers costing thousands more.

As for quality

and reliability, you need only store one word of wisdom: Apple.



Launching pad for numeric data.

Good tidings for crunchers of numerous numbers:

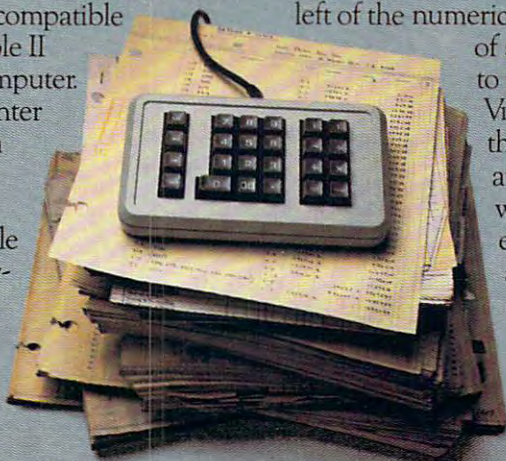
Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

The Apple Numeric Keypad II has a standard calculator-style layout. Appropriate,

because unlike some other keypads, it can actually function as a calculator.

The four function keys to the left of the numeric pad should be of special interest to people who use VisiCalc®. Because they let you zip around your work sheet more easily than ever, adding and deleting entries.

With one hand tied behind your back.



interface and an RS-232. Computer Peripherals, which manufactures the Printex, says that it is ideal for use with Sharp, Epson HX20, Atari, Texas Instruments, and Commodore computers.

Computer Peripherals
1117 Venice Boulevard
Los Angeles, CA 90015

Data Impact D-92

Data Impact Products offers several add-ons, all of which can be purchased separately for under \$100 each. The printer itself, the D-92, retails for \$399.

The D-92 is 100 cps, bidirectional. It can print upper- and lowercase, but has no graphics capabilities built in. A chip allowing dot-addressable graphics is available for \$30, and is easily installed. Another add-on will expand the standard 800-character buffer to 2K. The D-92 comes with a standard friction feed that will accommodate up to 8.5-inch paper. You may also purchase a tractor feed for up to 10-inch paper or a single sheet feeder as options.

Character pitch varies from 5 to 16.5 cpi; accordingly, cpl can be between 40 to 132. There are four more pitch variations between those boundaries. Characters can be formed in either a 7 x 9 or 11 x 9 dot matrix.



Data Impact D-92

The Data Impact D-92 can be interfaced with a number of popular personal computers via its Centronics parallel interface. An RS-232 serial interface is also available as an option for \$40.

Data Impact Products
745 Atlantic Avenue
Boston, MA 02111

Okidata Microline 80

Okidata manufactures a number of printers that cost more than \$500, but has recently come out with a machine that retails for \$449 – the Microline 80. The ML80 can be interfaced with the Radio Shack TRS-80, Apple, IBM, and several other popular home computers through its Centronics-compatible interface.

The ML80 can print its 7 x 9 dot matrix characters at 80 cpl for standard size print and 132 cpl

for condensed print. It can produce double-width characters at the rate of 5 cpi. Depending on the type of feed used (friction and pin are standard, a snap-on tractor is optional), up to 9.5-inch paper can be used. Up to 64 block shapes can be printed for graphics printing.



Okidata Microline 80

The manufacturer claims that the ML80's print head, operating at a speed of 80 cps unidirectional, will have a life of more than 200 million characters. Short, low-mass pins are used which are made of an extremely hard alloy.

The ML80 uses a spool ribbon. No buffer is included, but it is available through an interface.

Okidata
111 Gaither Drive
Mt. Laurel, NJ 08054

Timex/Sinclair 2040 Thermal Printer

In the first quarter of 1983, Timex Computer Corporation entered the personal computer printer market with its TS2040. This 32-column thermal printer is compatible only with Timex/Sinclair's two low-cost computers, the TS1000 and TS2000, and it retails for \$99.95.

Measuring 4.2 x 14.7 x 12 inches and weighing not much more than this magazine, the TS2040 can be hooked right up to your TS home computer by means of its Z-80 I/O port. It has graphics and text capabilities in two different modes: full-



Timex/Sinclair 2040

screen printing with single-key command, and a program-controlled printing mode which allows custom control of the printing format.

6 x 6 dot-matrix characters are printed at a rate of 64 cps; at a pitch of 10 cpi, a total of 32 cpl

"LOOK, MA, NO JOYSTICK!"

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"More than a game, COLORCRAFT is an educational toy." —George Barnes, Software City Stores, NJ

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INCOME	1500	1500	1500
SALARY	1000	1000	1000
COMMIT.	400	400	400
TOT INC.	1500	1500	1500
EXPENSES	500	500	500
RENT	200	200	200
FOOD	100	100	100
AUTO	100	100	100
MEDICAL	50	50	50
MISC.	50	50	50
TOT EXP.	500	500	500
SAVINGS	1000	1000	1000

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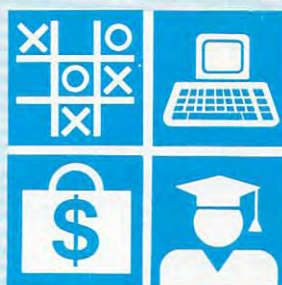
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can be printed on up to 4.3-inch wide paper. There is one character set that can be printed in upper-case only.

The TS2040 features a specially designed housing to achieve quiet operation.

*Timex Computer Corporation
Waterbury, CT 06720*

Commodore 1525P

Commodore offers two under-\$500 printers. Three, if you count the new four-color printer/plotter that retails for \$199.95 (see last month's **COMPUTE!**). The other printer, the 4022, is compatible with the Commodore CBM Series and retails for \$495.



Commodore 1525P

The VIC 1525P is compatible only with the VIC-20 and the Commodore 64 via a serial bus. It retails for \$395 and runs at a speed of 30 cps.

The 1525P can print ten 6 x 7 dot-matrix cpi, up to a maximum of 80 cpl. It is capable of printing upper- and lowercase characters, and graphics. The print head is unidirectional.

A one-line buffer is standard on the 1525P. The built-in tractor feed will take up to 9.5-inch wide paper.

*Commodore Business Machines
Consumer Products Division
487 Devon Park Drive
Wayne, PA 19087*

Mattel Aquarius Thermal Printer

One of the many peripherals designed for use with the new Mattel Aquarius home computer



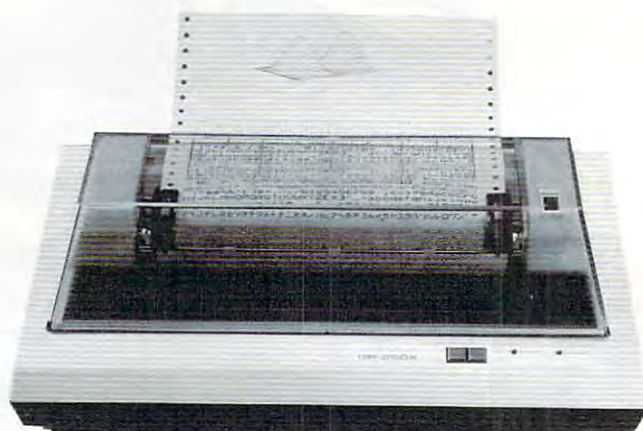
Mattel Aquarius Printer

system is its thermal printer. This is strictly a one-system printer; it connects directly to the Aquarius console without additional interfaces, as do the other Aquarius peripherals.

The Aquarius printer offers 40, 5 x 7 characters per line (10 cpi) at the rate of 80 cps. It is capable of printing 256 characters including upper- and lowercase letters, numerals, and special graphics characters. It also allows reproduction of graphics in the same configuration that appears on the computer screen. The printer will accept special thermal paper 4-3/8 inches wide.

Mattel is also planning to introduce a "master expander module" later this year that will allow the addition of up to eight more peripherals to the system (subject to FCC rules and certification).

*Mattel Electronics
5150 Rosecrans Avenue
Hawthorne, CA 90250*



Seikosha GP-250X

Seikosha GP Series

The Axiom Corporation manufactures a large line of low-cost printers. The IMP-4 offers Quad Density Graphics Resolution, which allows up to 19,008 individual dots to be printed bidirectionally within a square inch.

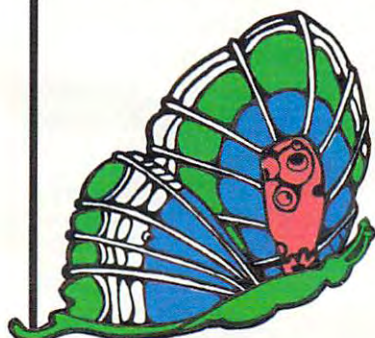
The GP-100A and 250X, retailing at \$389 and \$499 respectively, both have dot-addressable graphics, though the 250X has a more advanced graphics mode. Both print 10 cpi, 80 cpl, and they both have tractor feeds that can work with up to 10-inch wide paper. The 250X can print double-height characters in addition to the standard and double-width characters available on both, and character modes can be mixed on the same line. Multiple copies are possible on both machines, one additional on the 100A, two on the 250X Graphics.

The 250X is faster than the 100A – 50 cps compared to 30. Two interfaces are standard, Centronics parallel and RS-232, and several more are available. There are 64 user-definable characters (384 bytes) which may be stored in the

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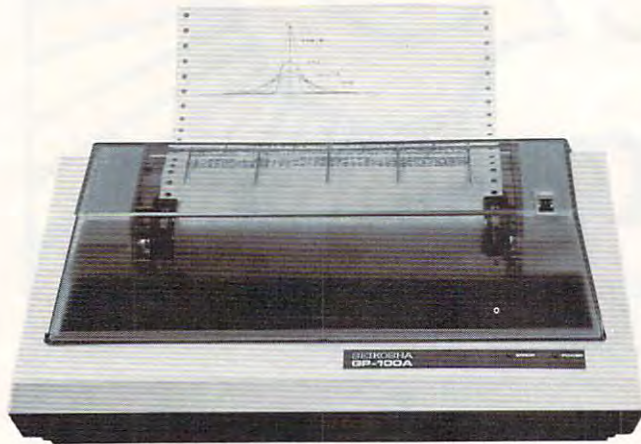
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printer's memory. That's in addition to the 80-byte standard buffer.

Both the GP100A and 250X will interface with several home computers, including the Apple, Atari, and Radio Shack.

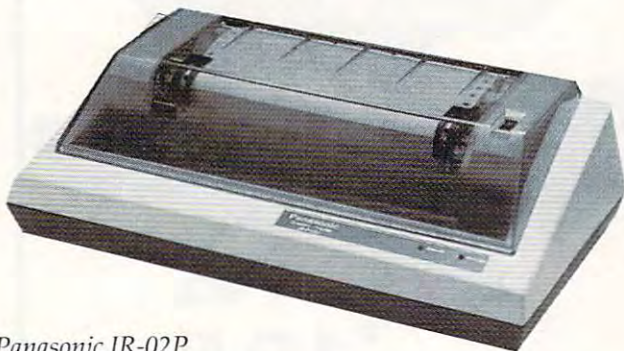
*Axiom Corporation
1014 Griswold Avenue
San Fernando, CA 91340*



Seikosha GP-100A

Panasonic JR-02P

One of the peripherals manufactured for the Panasonic JR-200U home computer is the JR-02P dot-matrix printer. It features ten 5 x 7 dot-matrix cpi, 80 cpl at the rate of 30 cps; and one character set that can print upper- and lowercase. It includes a Centronics parallel interface, allowing hook-ups to any compatible computer, the capability for both tractor and friction feed for up to 10-inch paper, and 90 bytes of memory.

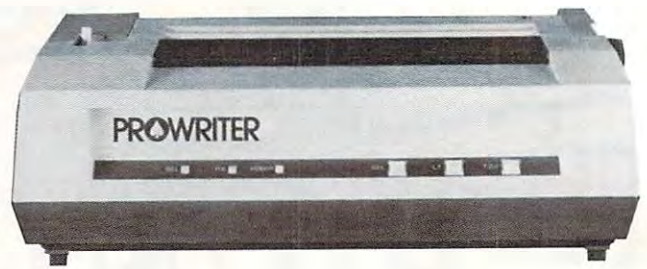


Panasonic JR-02P

There are also user-definable characters; the ability to repeat graphics or data patterns at the touch of a single button; same-line mix of characters, graphics, and double-width characters; and dot-addressable graphics.

The Panasonic JR-02P retails for \$369.

*Panasonic Company
One Panasonic Way
Secaucus, NJ 07094*



Prowriter 8510-AP

Prowriter 8510-AP

Retailing at \$495, the Prowriter offers a standard pitch of 10 cpi for a total of 80 cpl. Its dot-matrix characters measure 7 x 9 and can be printed in upper- and lowercase. The printhead is bidirectional, and its standard friction and tractor feeds will accommodate up to 10-inch wide paper; paper can be cut off less than 1 inch from the print line. A Centronics parallel interface is standard.

The Prowriter prints at 120 cps. A full kilobyte of buffer is included. It boasts a variety of character sets including Japanese, German, Swedish, Greek, or standard English. High resolution graphic printing is possible; each 1 square inch can hold up to 144 x 160 dots. There are eight different character sizes.

*C. Itoh Electronics
5301 Beethoven Street
Los Angeles, CA 90066*



NEC PC-6000

NEC PC-6021 Thermal Printer

Built to interface with NEC's PC-6000 home computer (though it does have a Centronics parallel interface), the NEC PC-6021 Thermal Printer provides printed copy of your programs and graphics. Its 5 x 7 dot matrix characters print at a speed of 40 cps; the maximum 4.5-inch thermal paper will accommodate 20 or 40 cpl. Upper- and lowercase printing is standard. It does have graphics capabilities, and has only one character set.

The NEC PC-6021 ("NEC TREK") is available at a retail price of \$249.95.

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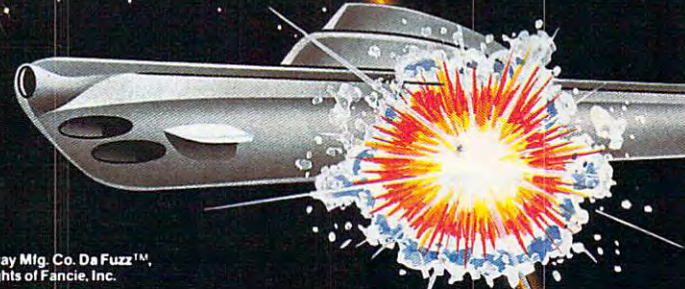
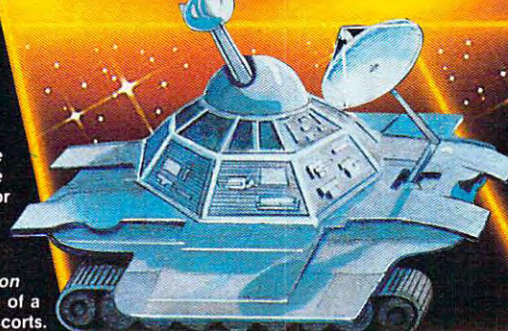
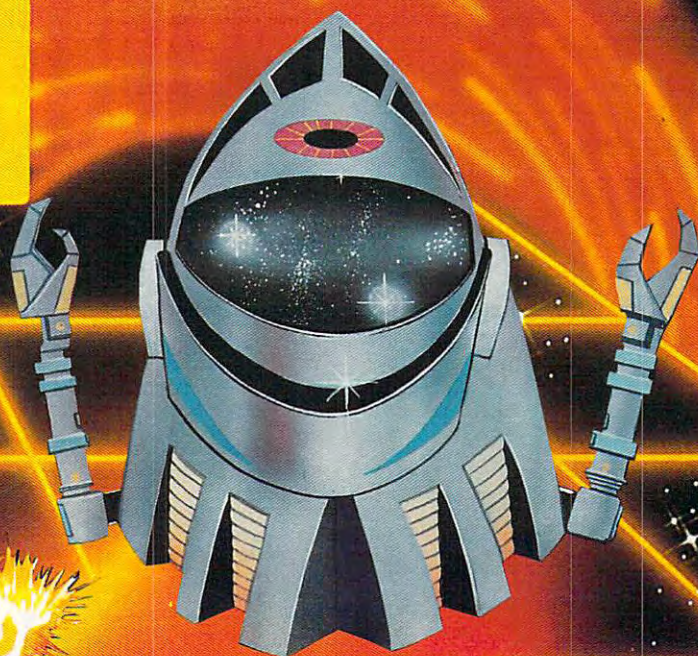
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Alphacom 42 Thermal Printer

The Alphacom 42 Thermal Printer is a recent upgrade of Alphacom's VP42 printer. Two features have been expanded: interface capability and graphics. Where the VP42 worked only with the Commodore VIC-20, this new model will be able to interface with the VIC-20 and the Commodore 64, Atari 400, 800, and 1200XL, and Texas Instruments 99/2 and 99/4A. Cartridge cables, sold separately, will be required to attach the printer to each manufacturer's line of microcomputer. The Alphacom 42 also has higher resolution graphics than its predecessor.

At a speed of 80 cps, the Alphacom 42 prints forty 5 x 8 characters per line on 4.5-inch paper. One set of upper- and lowercase characters is included, as is a one-line buffer.

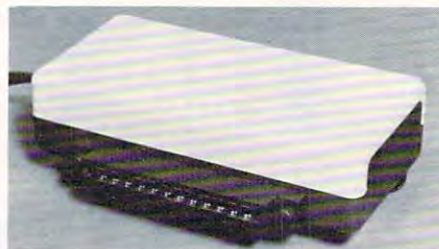
The printer and one cable will retail for slightly over \$200.

Alphacom
2323 South Bascom Avenue
Campbell, CA 95008

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120 PRINT (DN)SMART ASCII
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140 PRINT"NOW CONNECT PRINTER"
150 PRINT"AND PRESS RETURN."
160 REM
170 PRINT (RVS) READY ? (RVS)"
180 REM
190 WAIT198,1:GETC$
200 IFC$(1)CHR$(13)GOTO190
210 REM
220 PRINT"TEST"
230 SYS 253+096/34 red
240 PRINT (HM) (RED)OK"
250 PRINT*, "PRINTER
260 CLOSE4
270 :
280 FORX=1TO10
290 IF2=2(
300 PRIN
310 P
320

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Alphacom 42	5 x 8	10	40	80	Yes	One	Yes	Cartridge cable	—	No	One line	Under \$250	4.5	—
Commodore 1525P	6 x 7	10	80	30	Yes	One	Yes	Commodore serial bus	Spool	No	One Line	\$395	9.5	—
Data Impact D-92	7 x 9 11 x 9	10	80	100	(optional)	One	Yes	Centronics parallel	Cartridge	Yes	800 characters	\$399	8.5	RS-232 interface, 2K buffer, tractor feed, dot-addressable graphics chip
Epson MX-80	9 x 9	10	80	80	Yes	Two	Yes	Centronics parallel	Cartridge	Yes	One line	\$494	10	RS-232 interface with 2K buffer, IEEE488 interface
Mattel Aquarius Thermal Printer	5 x 7	10	40	80	Yes	One	Yes	None required	—	No	None	Under \$200	4 3/8	—
NEC PC-6021 Thermal Printer	5 x 7	10	40	40	Yes	One	Yes	Centronics parallel	—	No	No	\$249.95	4.5	—
Okidata Microline 80	7 x 9	10	80	80	Yes	One	No	Centronics parallel	Spool	No	None	\$449	9.5	Snap-on tractor
Panasonic JR-02P	5 x 7	10	80	30	Yes	One	Yes	Centronics parallel	Spool	No	90 bytes	\$369	10	—
Printelx	5 x 7	10	40	160	Yes	One	Yes	Centronics parallel RS-232	—	No	One line	\$145	4.3	—
Prowriter (8510-AP)	7 x 9	10	80	120	Yes	Five	Yes	Centronics parallel	Cartridge	Yes	1K	\$495	10	—
Radio Shack TRS-80 DMP-100	5 x 7	10	80	50	Yes	One	Yes	Selectable serial and parallel	Cartridge	No	480 bytes	\$399	9.5	—
Seikosha GP-250X	5 x 8	10	80	50	Yes	One	Yes	Centronics parallel RS-232	Cartridge	No	80 bytes	\$499	10	Interfaces: external RS-232 with 2K buffer, cables for TRS-80, Atari, IBM, Apple (with Graphax software)
Seikosha GP-100A	5 x 7	10	80	30	Yes	One	Yes	Centronics parallel	Cartridge	No	None	\$389	10	Same as 250X
Timex/Sinclair 2040	6 x 6	10	32	64	Yes	One	No	None required	—	Yes	None	\$99.95	4.33	—

* CPI = characters per inch;

CPL = characters per line;

CPS = characters per second

† Manufacturers' suggested list prices.

We have tried to be as comprehensive as possible. If any manufacturer has been left out, we regret the omission.

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Using A Printer With The TI-99/4A

C. Regena

These tips will give you a good start on adding a printer to the TI-99/4A. Here are the fundamentals from the RS-232 Interface to PRINT # statements.

Texas Instruments has a thermal printer which attaches to the side of the TI. It is a small unit which uses a special thermal printer paper and can print a 30-column line. A number of other printers may also be used with your TI. Prices range from about \$500 on up. The cost depends on whether the printing is dot-matrix or letter quality, on various options available, and on how the printer is built. (For definitions of these terms, see other articles in this issue.)

To connect your printer to your TI-99/4A, you will need the RS-232 Interface. You may use either the "old-style" individual RS-232 Interface peripheral or the RS-232 Interface Card which fits in the TI Peripheral Expansion Box. You will also need a cable to go from the interface to the printer, and the cable should be sold with the printer. If you want to wire your own cable, the plug is a standard DB-25, and the pin connections are given in the manual that comes with the RS-232 Interface.

Configurations

Manuals are important. The manual that comes with the RS-232 Interface describes how you list parameters for your "printer configuration" so you can give instructions to your computer to access the printer through the RS-232. The manual that comes with the printer should describe how to achieve various type styles (fonts) and how to set margins, line lengths, and the top of the form. Be prepared to spend some time experimenting with the different switches and features of your printer.

When you use the printer configuration in a command, it is set off in quotes. Parameters may be chosen for baud rate, stop bits, and number of nulls. Some examples are:

"RS232.TW.BA = 110" (teletype)
"RS232.BA = 600" (TI 825 or TI 840 printer)
"RS232.BA = 9600.DA = 8" (Epson MX 80)

One of the primary uses of a printer is to obtain a "hard copy" listing of a program. Using your own printer configuration in the quotes, the following commands may be used:

LIST "RS232.BA = 600"
Lists whole program
LIST "RS232.BA = 600": -250
Lists program lines up to line 250
LIST "RS232.BA = 600":300-330
Lists program lines 300 to 330
LIST "RS232.BA = 600":700-
Lists program from line 700 to end

Another valuable use for a printer is to print a report from your program. Before you print, an OPEN statement is necessary. The OPEN statement designates a device number and your printer configuration. You may have several devices, and you may number your devices in any order. An example statement is:

120 OPEN #1:"RS232.BA = 600"

After the OPEN statement, you may print to the printer by a statement such as:

130 PRINT #1:"MY NAME IS REGENA."

When you've finished printing or you're at the end of the program, you should close all devices. This can be done with the following statement:

550 CLOSE #1

Here is a short sample program that illustrates printing to a printer:

100 OPEN #1:"RS232.BA = 600"
Opens device #1 for printer.
110 OPEN #2:"SPEECH",OUTPUT
Opens device #2 for speech (Terminal Emulator II required)
120 PRINT "HERE IS A SAMPLE."
Prints message on screen.
130 PRINT #1:"TEST REPORT"
Prints on printer.


```

140 PRINT #2:"HELLO"
    Speaks the word using synthesizer.
150 CLOSE #1
    Closes device #1.
160 CLOSE #2
    Closes device #2.
170 END

```

The print list following the colon in a PRINT # statement follows the same rules as regular printing to the screen. Since the length of lines may be longer on the printer (the screen has 28 columns in a print line), you may use the TAB function to arrange your printing:

```

100 OPEN #1:"RS232.BA = 600"
110 PRINT #1:TAB(25):"MONTHLY PAYMENTS"

```

You may use a variable in the TAB function:

```
200 PRINT #1:TAB(T+A);MONTH$;X
```

You may also use colons to print blank lines:

```
220 PRINT #1::
```

If you have adjusted your printer properly for vertical tabs, you may go to the top of the next page by using:

```
300 PRINT #1:CHR$(12)
```

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Commodore To ASCII For Printers

Thomas Henry

Here's a utility program that will convert certain types of print programs to standard ASCII code format. It will work on all Commodore computers. The program is 109 bytes long. And even if you don't need this utility for your printer, you may want to examine the program anyway. It provides some insight into how a BASIC program is stored and how it may be changed by a machine language routine. On the other hand, you don't need to understand machine language to make use of it.

Before describing the program, I should point out what sort of print programs it may be used for. A good example is instruction printouts. For instance, not long ago I joined the Toronto PET Users Group, and thus was able to draw on their program library. One of the disks I got had "Micro-mon" and "Basic Aid" programs on it, along with some programs to print out instructions for both of these. When I sent the instructions to the screen, everything was fine. However, sending the output to the printer resulted in a mess. Lowercase became uppercase, and uppercase became Epson graphic symbols. I really wanted a hard copy. That need provided the inspiration to write this program.

Automatic Rewrite

This utility will automatically rewrite programs filled with PRINT statements (such as the ones mentioned above), so that anything between quotes will print out in standard ASCII. The total conversion time for a large program is less than one blink of the cursor. Note that this is not really a general-purpose program, but instead works only on programs of the sort just described. However, between this program and those in Brian Niessen's "PETASCII to ASCII Conversion" article (**COMPUTE!**, April 1982, pp. 126, 128), just about every type of program is covered.

Let's examine the program. Only two machine dependent locations are used, BASIC and POINTR. BASIC is the zero page pointer to the start of a BASIC program. This is at \$28 for all

PETs and CBMs and generally points to \$0401. For the VIC-20 and Commodore 64, the proper location is \$2B. Where it points to depends on the amount of extra memory added. The location called POINTR is the "start of variables" pointer, or, considered another way, it points to the end of a BASIC program. POINTR is used throughout the program, but will be restored to its initial value eventually, thus preserving the BASIC operating environment. POINTR is location \$2A for PETs and CBMs, and location \$2D for the VIC and 64.

At the entry of the program, POINTR is loaded with the start of BASIC. For a PET or CBM it points to \$0401. Next the accumulator is loaded with the first byte past the link addresses and line numbers. Indexing POINTR by Y, when Y equals \$04, will accomplish this. If a zero is found, then we must be at the end of a line. If the accumulator contains \$22, we have found a first quote and know that the conversion must start on the next character. To convert the string inside the quotes, we branch down to the label STRING.

Refer to that subroutine now. First we check if the end of a line has been found yet. If it hasn't, we check for an endquote. If that isn't found either, the character is ready to be converted. This conversion routine is very "hard-core" in the sense that it covers all 256 possible characters. This may be a bit more powerful than is actually needed here, but it's nice to be safe.

If the accumulator contains anything less than \$20, it is replaced with a \$01 which is a null character on my printer. It would be nice to use a \$00 as a null, but this upsets the program in general by confusing the BASIC operating system into thinking it has found an end of the line. Use any number you want, as long as your printer ignores it.

If the accumulator is less than \$41, the character must be punctuation or a numeral and can be printed as is. Next, if it lies between \$41 and \$5B, then \$20 must be added. This will change the lowercase from the PET to true ASCII lowercase.

If the character is less than or equal to \$61,

it's safe to print again. However, if it's less than \$81 but greater than \$61, it's an "artificial" punctuation, and hex \$40 must be subtracted to compensate.

The next test gets rid of all characters between \$81 and \$A0 by replacing them with a null symbol. Most of the characters in this range are cursor control symbols or system control symbols (like RUN and REVERSE OFF). We definitely don't want *these* going to the printer.

Next, graphic characters are replaced by blanks (as opposed to nulls), and finally capital letters are converted to true ASCII capitals by subtracting \$80.

This is a pretty hefty "compare and convert" routine, but it is foolproof in that your printer will never get a weird code and become confused. You may have to review the routine several times to really understand how it works, but it might help to keep in mind that some characters need no conversion, some (such as cursor control symbols) should be replaced by null symbols, and graphic characters should be replaced by blanks. Finally, upper- and lowercase letters must be accounted for. To confirm that the routine covers all cases, you can get a chart of true ASCII and compare it with a chart of PETASCII.

I've mentioned that at various times some numbers must be added or subtracted to perform the necessary conversion. Actually, since the numbers fall within a certain range, it is simpler and more efficient to use AND instead of subtraction, and OR instead of addition. The results are the same, and a few bytes may be saved.

A Popular Shortcut

If you look at locations 705A through 7069 in Program 3, you will see a trick commonly employed by 6502 software designers. The various conversion subroutines, such as BAD1, BAD2 and so on, are all separated by a \$2C. This is the BIT instruction which will have no effect on the operation of the program. Thus one master subroutine can have several entry points, all leading up to a common ending. For example, suppose the routine is entered at GOOD1 at address \$7060. The accumulator will be ORed with \$20. Next a BIT test is executed, but this has no effect other than setting some flags in the status register. Then another BIT is performed, and finally the routine concludes by storing the accumulator back in memory.

You may have to sit and stare at this a while to see why this works and why it saves some memory. Nevertheless, this technique of creating harmless op codes allows multiple entry points.

Resuming the analysis of the assembler listing, the STRING routine keeps looping around and around until every character has been con-

verted. Either an endquote byte or a zero indicates that the string is done. If an endquote is found, then the next string is searched for. If, however, a zero is found, the end of a line is indicated, and the program goes to ENDLIN. ENDLIN will direct POINTR to the start of the next line in memory by examining the forward link address of the previous line. If the forward link points to a zero byte, then the end of the program has been found, otherwise control is directed back up to the label LINE, and the next line is converted.

EXIT tidies things up before returning to BASIC. As you probably know, the end of a BASIC program is marked by three consecutive zeros. POINTR is left pointing at the second of these three zeros. Next, the number \$02 is added to it, so that it points to the start of variables. It is then safe to return to BASIC.

While back in BASIC, LIST the program and you will see a collection of nonsense between all the quote marks. It will look odd on the screen, but will turn out a perfectly printed hard copy on your ASCII printer. Depending on your needs, you may want to save the converted copy of your program, but in general this isn't necessary.

How To Load And Use The Program

For convenience, BASIC versions (Programs 1 and 2) will load the necessary machine language routine for you. Use Program 1 for all PET/CBM models. It locates the machine code at locations 28672 up. Use Program 2 for the VIC-20 and Commodore 64. It loads the code at the top of memory, protects it from BASIC, and indicates the proper SYS address to initiate the conversion. Once you have run the BASIC loader, you may want to save the machine language routine directly to tape or disk. This will enable you to use it in the future without having to run the BASIC loader program again. To save the machine code from memory on the PET/CBM, invoke the monitor (SYS 4), then type

```
S "CONVERT",01,7000,706d
```

to save to tape, or

```
S "CONVERT",08,7000,706d
```

to save to disk. For the VIC or 64, you will need VICMON, Supermon, Micromon, or one of the other available machine language monitors. Follow the directions for the PET/CBM, except that the beginning and ending addresses for the save will need to be adjusted depending on where in memory the routine is located.

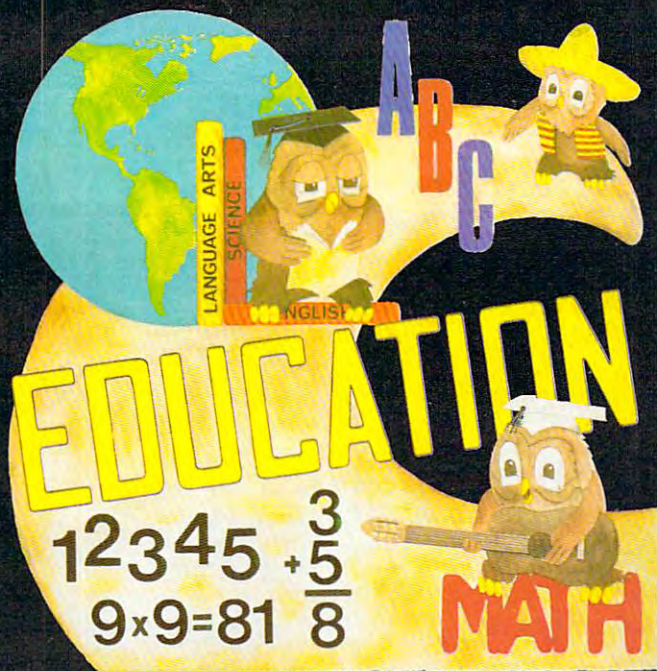
Here's how to use the program. First, load in the PETASCII to standard ASCII converter. Next type NEW. This will clear up some of the pointers in zero page. Now load in the program to be converted. At this point, type SYS 7*4096 (or whatever address the loader indicates). The program will

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be "instantly" rewritten. LIST it. See how odd it looks? But now RUN the program, and direct all output to the printer. The result will be perfect hard copy.

This isn't the sort of program you're likely to need on a daily basis. But, when you need it, you really need it. So type it in, save it, and play with it a little. Then, when you get some program documentation on disk, you can create a hard copy at a moment's notice.

One final note: if you have some old programs written for the original model PET, you probably have noticed that upper- and lowercase are reversed. You could go back and rewrite the program, but why not let the machine do it? Make a few alterations in the utility presented above, and you can have instant conversion of your old-style programs.

Program 1: BASIC Loader For All PET/CBM Models

```
100 REM BASIC LOADER FOR PETASCII TO ASCII
    CONVERTER
110 REM PET/CBM VERSION
120 HERE=7*4096
130 FOR ADRS=HERE TO HERE+108
140 READ DTA:POKE ADRS,DTA:CK=CK+DTA:NEXT
150 IF CK<>12485 THEN PRINT"CHECK FOR ERROR
    IN DATA STATEMENTS":STOP
160 PRINT"TYPE 'SYS";HERE;"{LEFT}" TO ACTI
    VATE."
170 END
200 DATA 165,40,166,41,133,42,134,43
210 DATA 160,4,177,42,240,7,201,34
220 DATA 240,31,200,208,245,160,0,177
```

```
230 DATA 42,170,200,177,42,240,6,134
240 DATA 42,133,43,208,227,24,165,42
250 DATA 105,2,133,42,144,2,230,43
260 DATA 96,200,177,42,240,223,201,34
270 DATA 240,216,201,32,144,31,201,65
280 DATA 144,38,201,91,144,26,201,97
290 DATA 144,30,201,129,144,21,201,160
300 DATA 144,11,201,193,144,4,201,219
310 DATA 144,12,169,32,44,169,1,44
320 DATA 9,32,44,41,63,44,41,127
330 DATA 145,42,24,144,196
```

Program 2: BASIC Loader For VIC-20 And Commodore 64

```
100 REM BASIC LOADER FOR PETASCII TO ASCII
    CONVERTER
110 REM VIC-20/C-64 VERSION
120 HERE=PEEK(56)-1:POKE 56,HERE:POKE 52,H
    ERE:HERE=HERE*256
130 FOR ADRS=HERE TO HERE+108
140 READ DTA:POKE ADRS,DTA:CK=CK+DTA:NEXT
150 IF CK<>12533 THEN PRINT"CHECK FOR ERRO
    R IN DATA STATEMENTS":STOP
160 PRINT"TYPE 'SYS";HERE;"{LEFT}" TO ACTI
    VATE."
170 END
200 DATA 165,43,166,44,133,45,134,46
210 DATA 160,4,177,45,240,7,201,34
220 DATA 240,31,200,208,245,160,0,177
230 DATA 45,170,200,177,45,240,6,134
240 DATA 45,133,46,208,227,24,165,45
250 DATA 105,2,133,45,144,2,230,46
260 DATA 96,200,177,45,240,223,201,34
270 DATA 240,216,201,32,144,31,201,65
280 DATA 144,38,201,91,144,26,201,97
290 DATA 144,30,201,129,144,21,201,160
300 DATA 144,11,201,193,144,4,201,219
310 DATA 144,12,169,32,44,169,1,44
320 DATA 9,32,44,44,63,44,44,127
330 DATA 145,45,24,144,196
```

Program 3: PETASCII To ASCII Converter For Print Programs

0000		BASIC = \$28		;START OF BASIC
0000		POINTR = \$2A		;START OF VARIABLES
0000		*=\$7000		
7000	A5 28	ENTRY	LDA BASIC	;INITIALIZE POINTR TO
7002	A6 29		LDX BASIC+1	;COINCIDE WITH THE START
7004	85 2A		STA POINTR	;OF BASIC.
7006	86 2B		STX POINTR+1	
7008	A0 04	LINE	LDY #\$04	;GO PAST LINK & LINE#.
700A	B1 2A	CHECK	LDA (POINTR),Y	;GET A PROGRAM CHARACTER.
700C	F0 07		BEQ ENDLIN	;ZERO MEANS END OF LINE.
700E	C9 22		CMP #\$22	;LOOK FOR FIRST QUOTE.
7010	F0 1F		BEQ STRING	;GO CONVERT THE STRING.
7012	C8	NEXT	INY	;NO STRING FOUND YET.
7013	D0 F5		BNE CHECK	;BRANCH ALWAYS.

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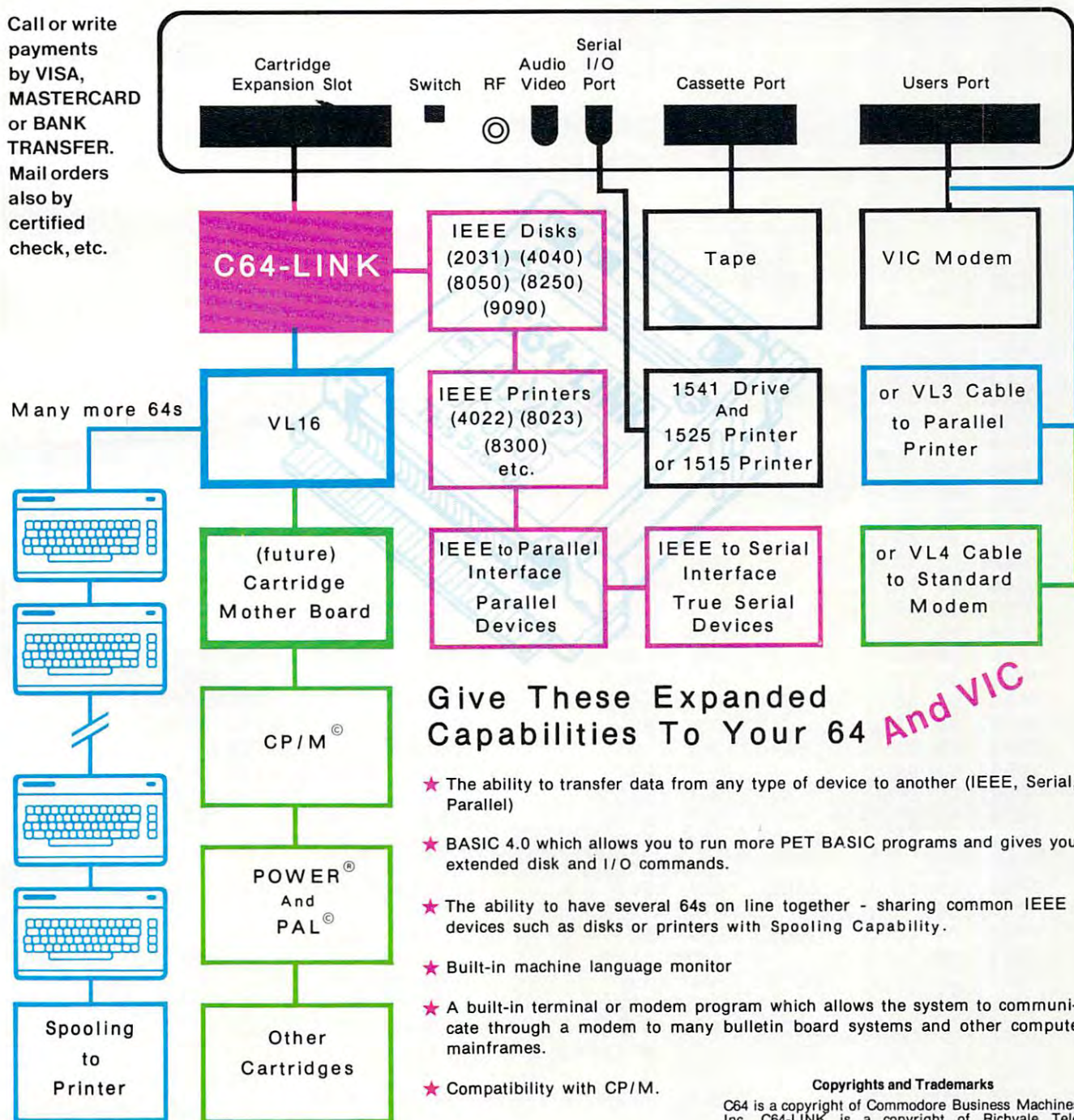
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```

7015 A0 00      ENDLIN LDY #$00          ;USING THE FORWARD
7017 B1 2A          LDA (POINTR),Y      ;LINK ADDRESS, DIRECT
7019 AA          TAX                    ;POINTR TO NEXT LINE
701A C8          INY                    ;IN BASIC PROGRAM.
701B B1 2A          LDA (POINTR),Y
701D F0 06          BEQ EXIT            ;ZERO MEANS END OF PROGRAM.
701F 86 2A          STX POINTR          ;OTHERWISE, UPDATE POINTR.
7021 85 2B          STA POINTR+1
7023 D0 E3          BNE LINE            ;BRANCH ALWAYS TO NEXT LINE.

7025 18          EXIT CLC              ;ADJUST POINTR BACK
7026 A5 2A          LDA POINTR          ;TO WHERE BASIC WOULD
7028 69 02          ADC #$02            ;LIKE IT, I.E.,
702A 85 2A          STA POINTR          ;START OF VARIABLES.
702C 90 02          BCC RETURN
702E E6 2B          INC POINTR+1
7030 60          RETURN RTS            ;RETURN TO BASIC.

7031          ; ROUTINE TO CONVERT A SINGLE CHARACTER:

7031          ; ENTER THE ROUTINE WITH THE ACCUMULATOR
7031          ; CONTAINING A PET-ASCII CHARACTER, LEAVE
7031          ; WITH IT REPLACED BY STANDARD ASCII

7031 C8          STRING INY
7032 B1 2A          LDA (POINTR),Y      ;GET NEXT CHARACTER.
7034 F0 DF          BEQ ENDLIN          ;ZERO MEANS END OF LINE.
7036 C9 22          CMP #$22            ;CHECK FOR SECOND QUOTE.
7038 F0 D8          BEQ NEXT
703A C9 20          CMP #$20            ;NON-PRINTABLE CHARACTER?
703C 90 1F          BCC BAD2            ;YES, REPLACE WITH NULL.
703E C9 41          CMP #$41            ;IS IT PUNCTUATION OR NUMERALS?
7040 90 26          BCC GOOD4           ;YES, KEEP INTACT.
7042 C9 5B          CMP #$5B            ;LOWER CASE LETTER?
7044 90 1A          BCC GOOD1           ;YES, GO ADD $20.
7046 C9 61          CMP #$61            ;BRACKETS, SLASHES, ETC.?
7048 90 1E          BCC GOOD4           ;YES, KEEP INTACT.
704A C9 81          CMP #$81            ;MORE PUNCTUATION?
704C 90 15          BCC GOOD2           ;YES, GO SUBTRACT $40
704E C9 A0          CMP #$A0            ;NON-PRINTABLE CHARACTER?
7050 90 0B          BCC BAD2            ;YES, REPLACE WITH A NULL.
7052 C9 C1          CMP #$C1            ;GRAPHIC CHARACTER?
7054 90 04          BCC BAD1            ;YES, REPLACE WITH A SPACE.
7056 C9 DB          CMP #$DB            ;IS IT A CAPITAL LETTER?
7058 90 0C          BCC GOOD3           ;YES, GO SUBTRACT $80.
705A A9 20          BAD1 LDA #$20        ;REPLACE WITH SPACE.
705C 2C          .BYTE $2C
705D A9 01          BAD2 LDA #$01        ;REPLACE WITH NULL CHARACTER.
705F 2C          .BYTE $2C
7060 09 20          GOOD1 ORA #$20       ;'ADD' $20.
7062 2C          .BYTE $2C
7063 29 3F          GOOD2 AND #$3F       ;'SUBTRACT' $40.
7065 2C          .BYTE $2C
7066 29 7F          GOOD3 AND #$7F       ;'SUBTRACT' $80.
7068 91 2A          GOOD4 STA (POINTR),Y
706A 18          CLC
706B 90 C4          BCC STRING          ;BRANCH ALWAYS.
706D          .END

```

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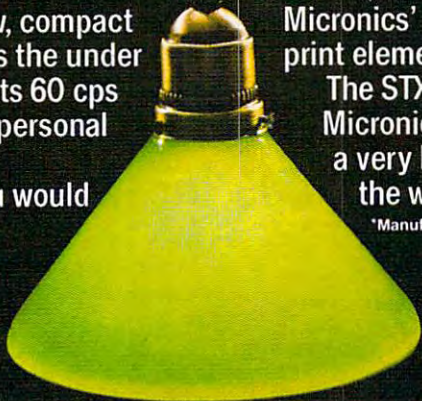
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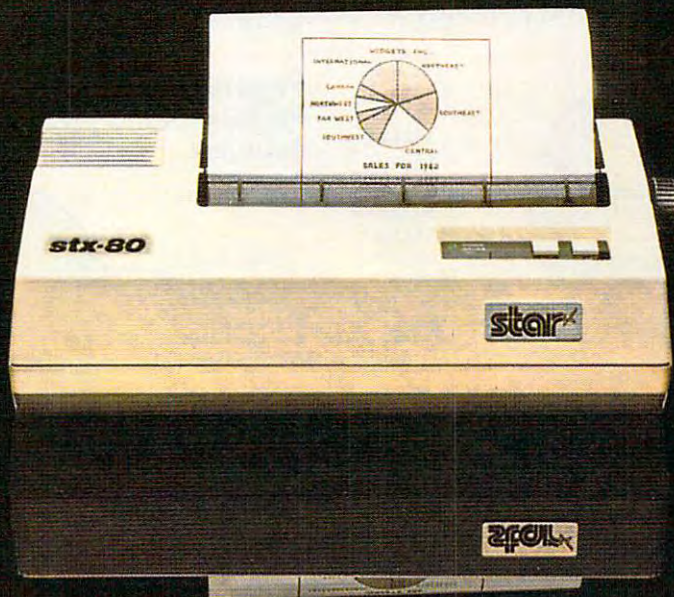
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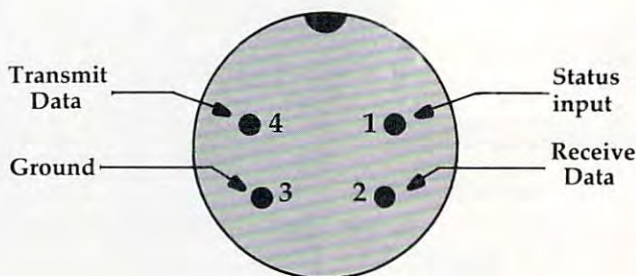
Connecting A Printer To The TRS-80 Color Computer

Ottis Cowper, Technical Editor

One of the special features of the TRS-80 Color Computer is the built-in RS-232 serial port interface. This makes connecting a printer pretty straightforward.

The four-pin RS-232 port on the Color Computer has only the so-called "minimum configuration" RS-232 signals (see Figure 1), but this is still more than most other computer manufacturers provide. You can therefore avoid many of the usual difficulties when interfacing a printer.

Figure 1:
Standard Designations For Serial Port Pins

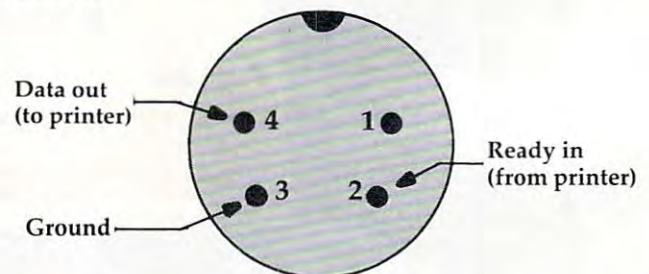


When you want to connect a printer to your TRS-80, the path of least resistance is to use one of the three Radio Shack printers which are directly compatible with the Color Computer. The DMP-100, DMP-200, and DMP-400 are dot-matrix printers which include a switch-selectable, four-pin serial interface in addition to the usual parallel interface. So, adding one of these models is as easy as connecting a four-pin (DIN) to four-pin cable between the printer and the Color Computer serial port. These cables are available at Radio Shack or, if you're a hardware hacker, you could pick up the parts at a local electronics supply store and easily construct your own.

One Bit At A Time

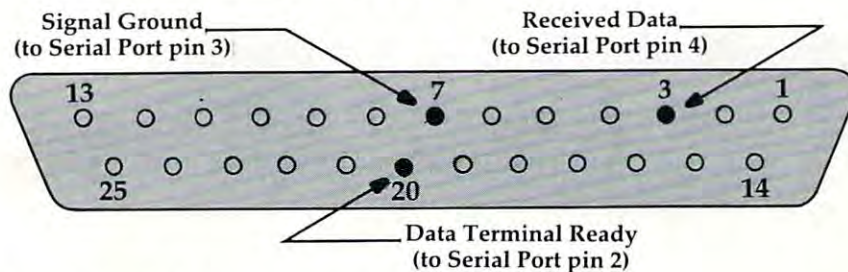
If you wish to attach another brand of printer, keep in mind that the Color Computer has only a serial (one bit at a time) interface. Many printers come equipped with parallel (eight bits at a time) interfaces. Before you spend several hundred dollars *make sure* that the printer you are buying has an RS-232 serial interface or that one is readily available for your particular model. Another thing to keep in mind when interfacing to other printers is that, for some reason, the Color Computer ROM printer output routines assign uses to the pins of the serial port that do not match their own stated standard designations (see Figure 2).

Figure 2:
Pin Designations For Use With ROM Output Routines



The printer's serial interface will most likely have the standard DB25 plug. This is the connector most commonly used in RS-232 communications, and a particular RS-232 signal is assigned to each of the pins on the plug. As an example, Figure 3 shows the connections necessary to connect an Epson MX-80 or MX-100 (with RS-232 serial interface) to the Color Computer. These same connections should work for other printers, but you should check the pin designations in the manual for your particular printer to be sure.

Figure 3:
DB25 Connector On Printer RS-232 Interface



How To Activate Your Printer

Now you have a printer attached to your computer. What do you do with it? The most obvious use is to make "hard copy" listings of your programs. This is simple; just type LLIST instead of LIST and the output will be routed to the printer. To send any other program output to the printer, just replace the PRINT statements with PRINT #-2. (On the Color Computer, the printer is designated as device -2.) For example, the following line will output a message to the printer:

```
10 PRINT #-2 "SEND THIS TO THE PRINTER PRONTO!"
```

If you have Extended BASIC on your Color Computer, you can format your output with the PRINT USING statement. For example, this line:

```
20 PRINT #-2, USING "$$###.##"; 293.687
```

should cause the printer to print

```
$293.69
```

Another Extended BASIC function you can use with your printer is POS. This returns the current print position. For example, PRINT POS(-2) will tell you the column in which the next character will be printed.

A number of the Radio Shack software packages support printer output. Naturally, the Color *SCRIPSIT* word processing program includes the capability to print out text. The *Speculator* electronic spreadsheet program enables you to print out your worksheets. Other programs which support printout include the *Personal Finance* and *Editor/Assembler* programs. The *Graphics Pack* program supports printout to the Radio Shack CGP-115 color graphics printer. This printer is good for multicolor graphics applications, but only marginally useful for printing text.

Matching Specifications

The routines in the ROMs which support output to the printer make certain assumptions about the printer hardware. In particular, the routines expect the data format to be one start bit (logic zero), seven (for Revision 1.0 ROMs) or eight (for Revision 1.1 ROMs) data bits beginning with the least significant bit (LSB), two stop bits (logic ones),

and no parity. The assumed transfer rate is 600 baud. The routines also assume that the printer will automatically provide a carriage return when it encounters a line feed, and that it will provide a busy signal to the computer if it is not ready to accept input. The expected print width is 132 columns.

You should consult the manual for your printer and set the appropriate DIP switches (or

whatever) to configure the printer to match these specifications. If your printer can't meet all the above conditions, several can be changed with POKES to Color Computer memory locations. For example, the value in location 155 controls the print width. If you're using an 80 column printer, you'll want to include the following statement before using the printer:

```
10 POKE 155,80
```

The comma field width (location 153) controls the amount of space left between variables separated by commas in PRINT #-2 statements. The default value for this location is 16. Thus, the line:

```
40 PRINT #-2 "FIRST", "SECOND"
```

will cause the word "FIRST" to be printed beginning at the left margin, and the word "SECOND" to be printed beginning in column 16. You can adjust the value in location 153 to change the format of your printed output. If you change the print width or comma field width (locations 155 or 153), you should also change the last comma field (location 154). This location should contain the value of the print width, minus the comma field width. You can achieve this with:

```
15 POKE 154, PEEK(155) - PEEK(153)
```

Adjusting the rate of data transfer from the default value of 600 baud requires changes to the data in locations 149 and 150. The table below provides the necessary POKES to location 150 for the given baud rates. (For all rates in the table, POKE 149,0.) This information comes from the *TRS-80 Color Computer Technical Reference Manual* (pages 38 and 39), which provides further details on interfacing printers to the Serial Port.

Adjusting The Rate Of Data Transfer

Desired baud rate	Value to POKE into location 150
300	180
600	87
1200	41
2400	18



Astrostorm

Peter Lear

Try to guide your spaceship, carrying emergency medical supplies, through a dangerous asteroid storm. A great deal depends on your skills as a navigator. Many times the success or failure of your mission will depend on your ability to make split-second decisions under pressure. Versions for the VIC, Atari, TI-99/4A, and Apple.

The mission: you are Captain Bosdiger of the interstellar tug *The Viccard*. While orbiting the fifth planet in the Benard system, you receive a distress call. The call comes from the Solarian system, in need of vital medical supplies. You are to pick them up from the sixth planet in the Benard system and then take them to the third planet in the Solarian system.

There is a time factor. The drugs have a short life. Your calculations indicate that it will be necessary to drop out of hyperspace between the fourth and fifth planets' orbits. There you will be in an asteroid field. You must cross this field in less than two minutes.

Looking At Astrostorm

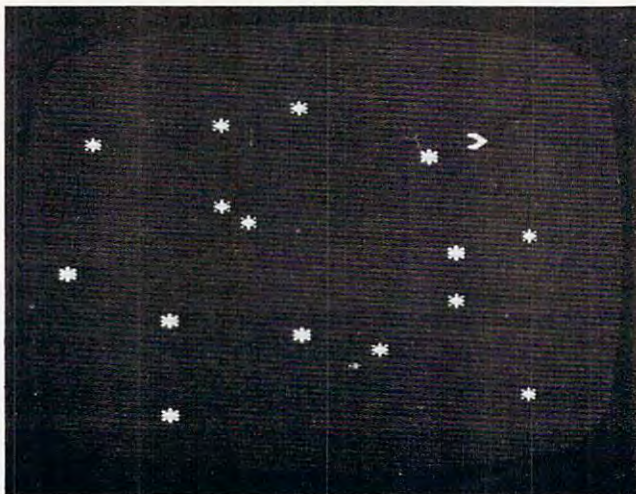
How does the VIC version work? Let's take a look.

In lines 5-230 the screen border is chosen and several variables for the joystick are defined. The player is given the choice of using a joystick or the keyboard. If you choose to use the keyboard, control the movement of the ship with the "Z" (left) or "C" (right) keys. The *VIC Programmers' Reference Guide* helped provide the joystick information necessary to use the first data statement.

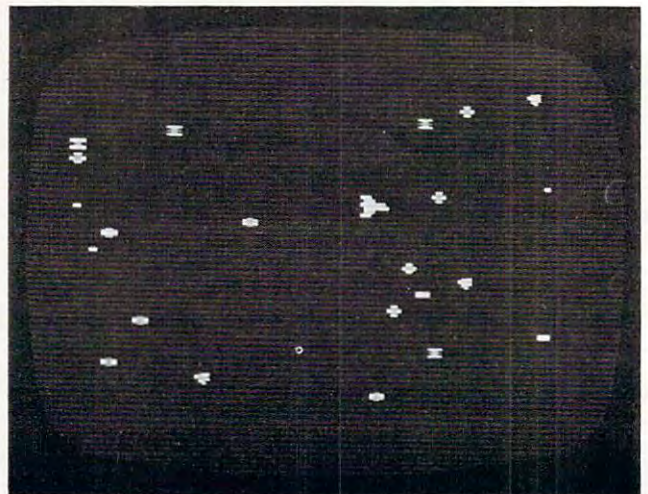
Then we are sent zooming up to line 5000 to make a bit of noise. Some more data is used here. Now we are off to line 910 to ask for the "asteroid depth" that is required. This simply determines where the ship is to be located on the screen. It can be placed between the fifth and eighteenth rows (always starting on the left side).

Line 1030 makes the program versatile enough to use with any VIC-20. For example, initially the VIC starts its screen memory at location 7680. When an extra 8K or more is added, the start of screen memory changes to location 4096. Since 3K cartridges do not change this location, any cartridges can remain inserted.

The game's main playing loop is in lines 2000-2240. It is enclosed in a FOR/NEXT loop and timed for two minutes. All it does is decide on a random color and column for the asteroid. The galactic or solarian credits are based on the position and

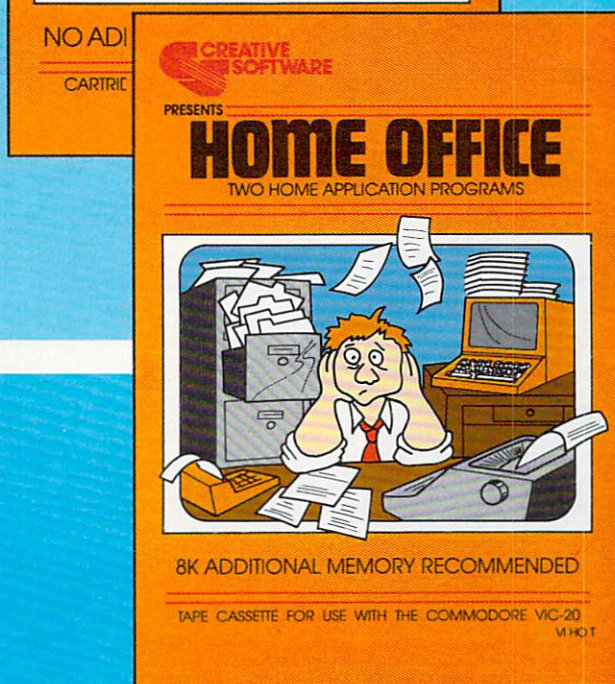
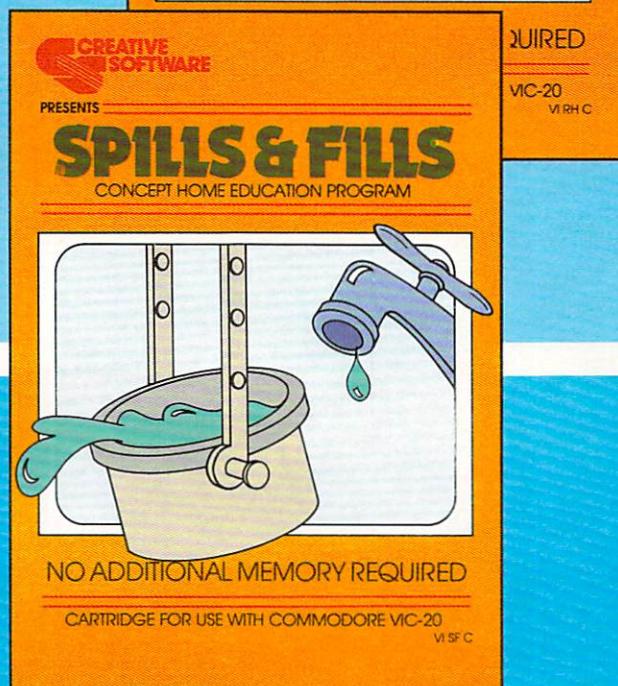
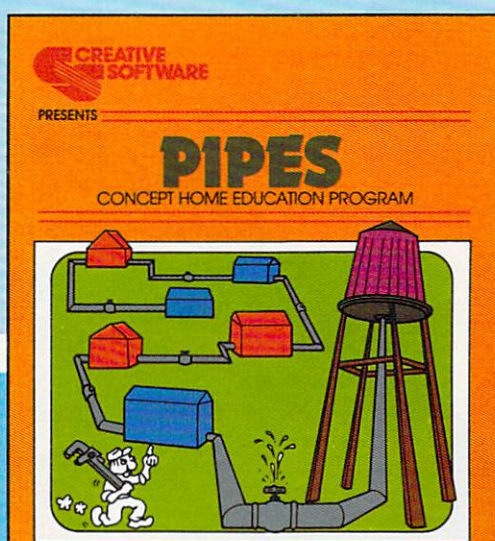
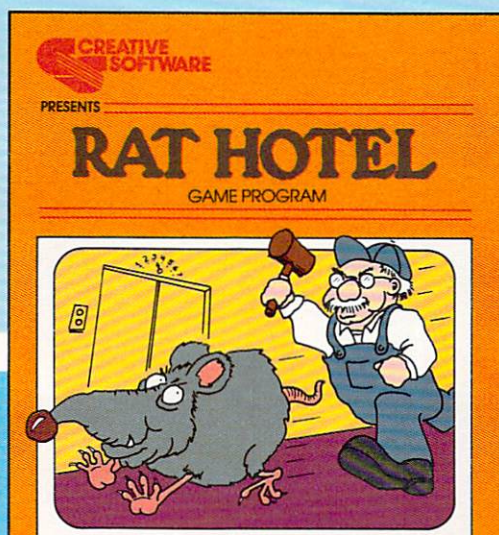


The player's spaceship (upper right) successfully negotiates the moving asteroids in "Astrostorm," VIC-20 version. (Apple and TI versions similar.)



A player's spaceship dodges space debris in the Atari version of "Astrostorm."

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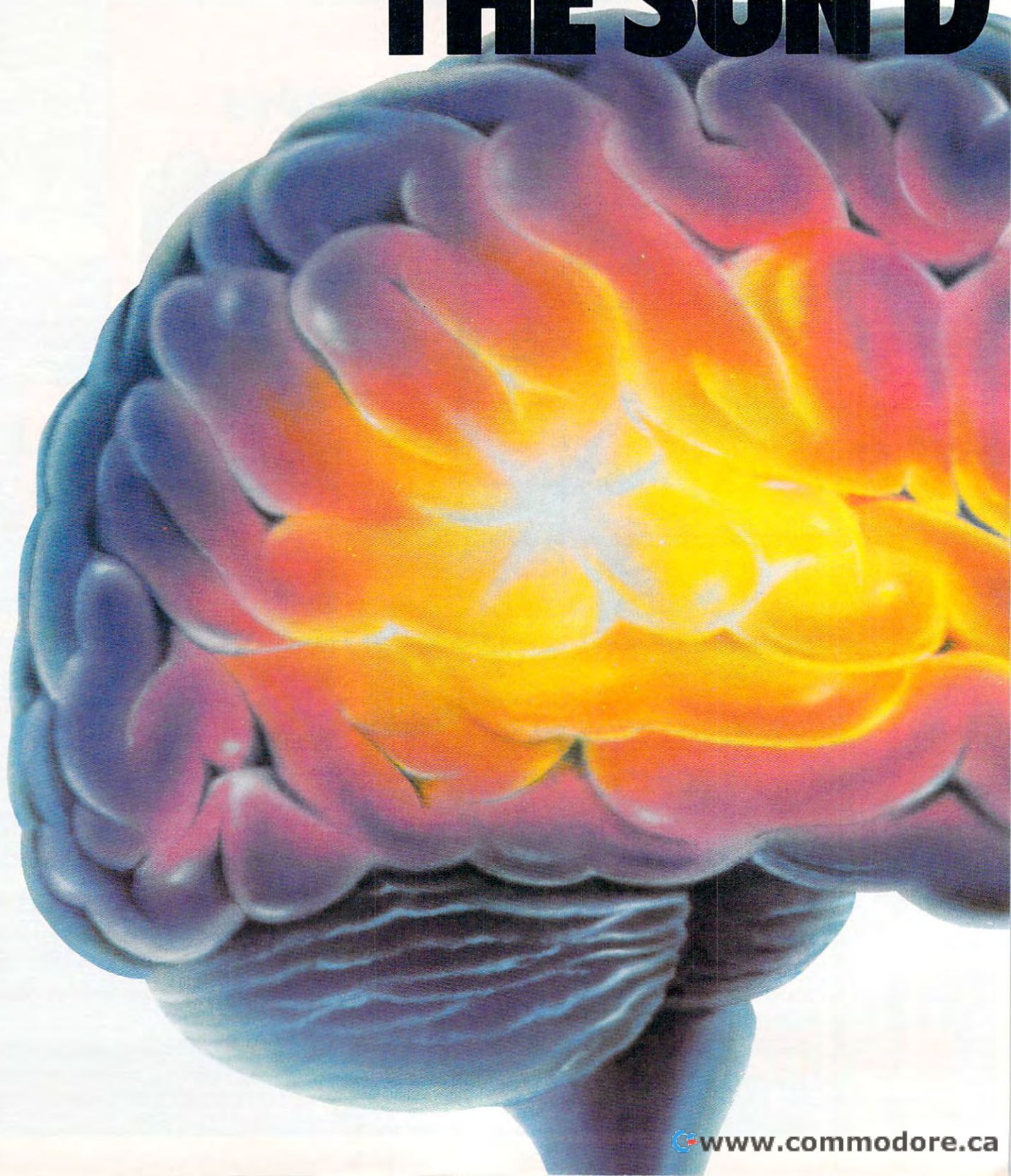
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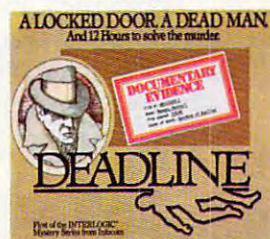
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color of the asteroid. The alarm sound is created by turning voice 36875 on and off with the variable CK. The first two IFs in the game loop check to see if the screen has been crossed. When the ship is moving forward, you gain points; going backward (left), you lose points. And if there is no movement, there is no loss or gain.

The movement of the asteroids is created by scrolling them off the screen. The ship is POKED on the screen. To prevent the ship from scrolling off every move, the program jumps to line 520. Here, with the variable OP (for old position), the

would-be scrolled ships are erased.

A check is made for every move to see if the ship has been hit. When this occurs, the program goes to 8170 to explode the ship. This is where the rest of the data is utilized. It then returns and offers a change in asteroid depth (this option is available for only seven seconds). Then an asteroid field is displayed in motion until either the fire button on the joystick or the keyboard's "H" key is pressed. To add to the excitement, you can think of this as dropping out of hyperspace.

Atari, TI-99/4A, And Apple Version Notes

Patrick Parrish, Programming Assistant

Atari Notes

The object of the Atari version of *Astrostorm* is to move your spaceship to the right across the asteroid field six times. The game is played with the keyboard or the joystick (in controller jack #1). In either case, movement of the spaceship is strictly horizontal. Once you start the spaceship moving left or right on the screen, it will continue until you cause a direction change.

With the joystick, left and right movement of the stick causes the spaceship to fly across the screen in the corresponding direction. Shifting the joystick position up or down will halt the spaceship. Under keyboard control, the "<" and ">" keys are used for left and right movement, and again, movement is continuous. If you choose the keyboard option, the spaceship's flight can be halted by pressing any key other than the "<" or ">" keys.

To achieve a high score on *Astrostorm*, avoid moving the spaceship to the left whenever possible, since penalty points are then deducted from your total. But bonus points are given for spaceship movement to the right. As an added incentive, you are awarded a thousand points each time you successfully maneuver the spaceship across the asteroid field.

TI-99/4A Notes

The object of *Astrostorm* on the TI-99/4A is to advance your spaceship across the asteroid field twelve times. Asteroids scroll from the bottom of the screen. Spaceship movement is horizontal. Control the movement of the ship by pressing the "<" and ">" keys.

This version of the game can be quite challenging since there are several skill levels. As the game begins, the vertical position of the spaceship can be set nearer the bottom of

the screen by specifying a greater "asteroid depth." A greater asteroid depth, of course, requires a faster reaction time. The difficulty of the game can be further increased by requesting a higher asteroid density (difficulty level).

The game loop (lines 500-830) is set to execute 1000 times. This means that you must finish your journey across the asteroid field before this loop is completed. You may find that this time limit is either too easy or too difficult, depending on the skill levels you choose. If so, vary the limit in line 500 as you see fit.

To achieve a high score on *Astrostorm*, avoid moving your spaceship backwards since points are deducted from your total.

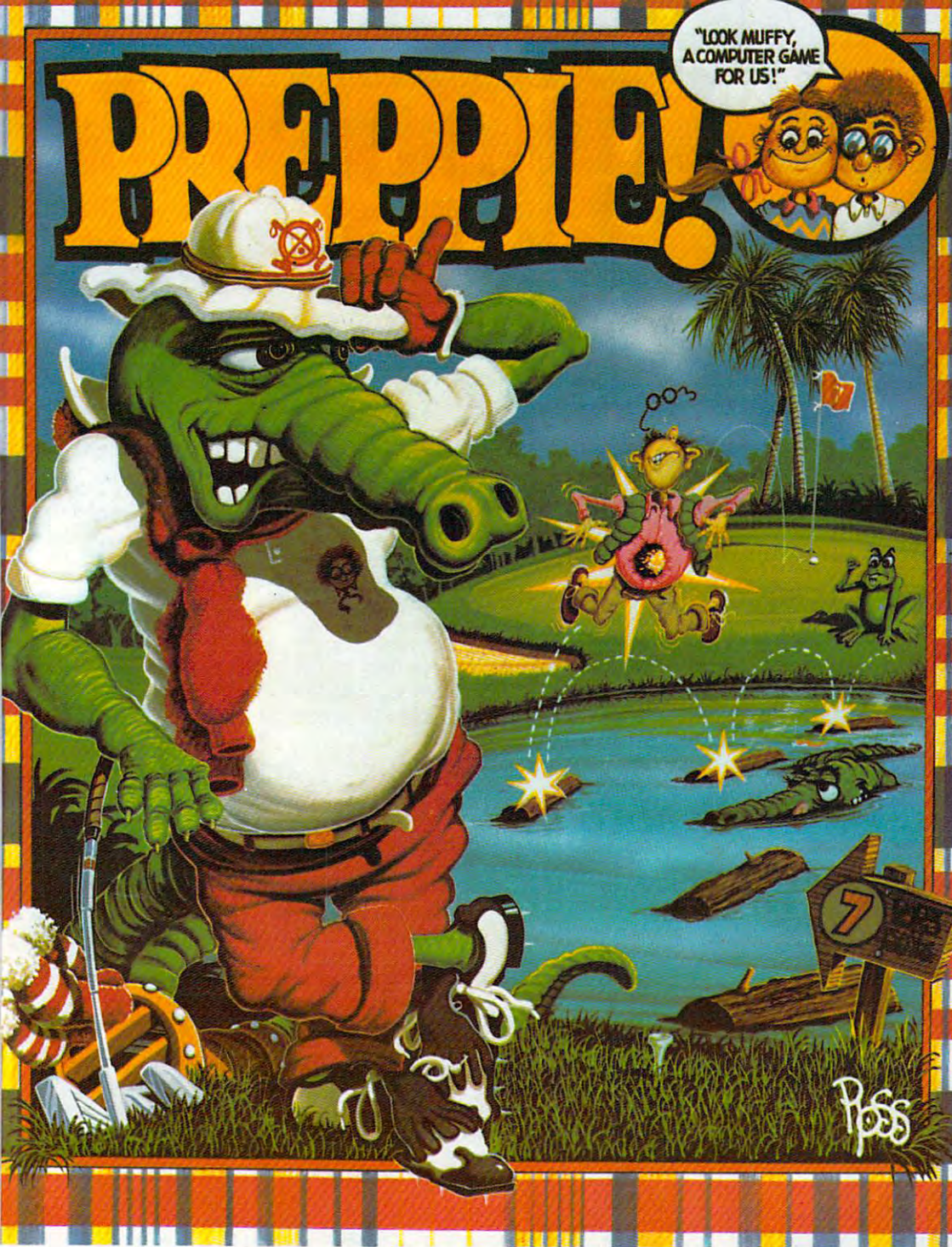
Apple Notes

With the Apple version of *Astrostorm*, you must move the spaceship across the astrofield six times to win. There is no time limit, and the game loop (lines 120-250) will execute until a crash is detected (line 230).

Asteroids scroll from the bottom of the screen. Only horizontal movement of the spaceship is allowed by the program. Movement, which is continuous, is accomplished with the SPACE bar while direction is controlled with the left and right arrow keys.

There are several skill levels. You can make the game more difficult by specifying a higher asteroid depth. This will place the spaceship closer to the bottom of the screen, and consequently, require a quicker reaction on your part to avoid a collision.

Scoring is based on the direction of spaceship movement and difficulty level. Of course, more points are given at greater asteroid depths. Points are awarded for movement of the spaceship to the right and deducted for movement to the left.



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—Martha Vineyard

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Program 1: VIC Version

```

5 POKE36879,8
10 PRINT"{CLEAR}{PUR}":POKE37139,0:DD=371
  54:PA=37137:PB=37152
45 IFLF=1THEN1000
47 PRINT"{05 RIGHT}{04 DOWN}ASTROSTORM"
50 PRINT"{DOWN}{05 RIGHT}JOYSTICK(1)":PRINT
  "{05 RIGHT}KEYBOARD(2)"
55 GETR$
60 IFR$="1"THENR=1:GOTO70
65 IFR$="2"THENR=2:GOTO70
68 GOTO55
70 FORJ=0TO2:READJS(J):NEXTJ:GOSUB5000
80 GOTO900
100 POKEDD,127:S3W=-((PEEK(PB)AND128)=0):P
  OKEDD,255
110 P=PEEK(PA):S2=((PAND16)=0)
120 FR=-((PAND32)=0):X=S2W+S3W
130 DN=JS(X+1):RETURN
200 IFPEEK(197)=33THENDN=-1:RETURN
210 IFPEEK(197)=34THENDN=1:RETURN
220 IFPEEK(197)=64THENDN=0:RETURN
230 RETURN
500 IFDN<>0ANDPEEK(S-DN)<>42THENPOKES-DN,32
505 FORI=1TO2
510 POKEOP,32:POKEOP-DN,32
520 OP=OP-22
530 NEXTI:RETURN
900 IFLF=1THEN1000
910 PRINT"THE A.D.[ASTEROID      DEPTH] DES
  IRED (5-18)":INPUTL
920 IFL<5THENPRINT"TOO EASY":GOTO900
930 IFL>18THENPRINT"TOO RISKY":GOTO910
940 LF=1:PRINT"{CLEAR}":GOSUB2200
1000 PRINT"{CLEAR}{18 DOWN}"
1020 POKE36878,15
1030 S=4*(PEEK(36866)AND128)+64*(PEEK(36869)
  )AND120:C=37888+4*(PEEK(36866)AND128)
1040 CK=1:S=S+22*(L+1):OP=S:SB=S-1:SE=S+23
2000 FORG=1TO418
2010 NA=INT(RND(TI)*22):CC=INT(RND(TI)*7)+1
2040 POKE646,CC:PRINTTAB(NA)"*";
2055 PT=PT+DN*(NA*CC*INT((L^.5)+.5))
2060 IFS=SBTHENPOKES,32:S=S+22:W=W-1
2065 IFS=SETHENPOKES,32:S=S-22:W=W+1
2070 IFPEEK(S)=42ORPEEK(S+22)=42THENPOKE646
  ,1:GOSUB8000:GOSUB7000:GOTO2200
2085 ONRGOSUB100,200:OP=S-22:S=S+DN
2090 CK=CK*-1:POKE36875,127+CK:GOSUB500:POK
  ES,61+DN:POKES+C,1:PRINT
2100 NEXTG
2110 PRINT"{YEL}":POKE36875,0:GOSUB6000
2200 PT=0:IFPEEK(197)=43THENRESTORE:LF=1:GO
  TO70
2210 POKE37139,0:IF(PEEK(PA)AND32)=0THENRES
  TORE:LF=1:POKE37139,128:GOTO70
2215 NA=INT(RND(TI)*22):CC=INT(RND(TI)*7)+1
2220 POKE646,CC:PRINTTAB(NA)"*";
2240 POKE37139,128:GOTO2200
5000 A=20:POKE36878,15
5010 READC,T,Z:T=T*A:Z=Z*A
5030 POKE36875,C:FORI=1TOZ:NEXTI:POKE36875,
  0:FORI=1TOZ:NEXTI
5050 IFZ>0THEN5010
5100 RETURN
6000 POKE36875,0
6005 IFW<6THENPRINT"YOU DID NOT COMPLETE Y
  OUR MISSION.":GOTO6200
6010 PRINT:PRINT"YOU COMPLETED YOUR  MISS
  ION.";
6020 PRINT"THE SOLARIAN SYSTEM  MINISTER ~
  HAS AWARDED YOU";PT
6030 PRINT"SOLARIAN CREDITS FOR  YOUR SERVI
  CES.";
6040 PRINT"DO YOU  WISH TO MAKE ANOTHER  DE
  LIVERY?"
6060 GETR$:IFR$="Y"ORR$="N"THEN6070
6065 GOTO6060
6070 IFR$="N"THENCLR:END
6080 PRINT"SAME ASTEROID DEPTH?"
6100 GETR$:IFR$="Y"ORR$="N"THEN6110
6105 GOTO6100
6110 IFR$="N"THENRUN
6120 RETURN
6200 PRINT"THE SOLARIAN GOVERN-  MENT HAS F
  INED YOU";PT;"  GALACTIC CREDITS"
6210 PRINT"THEY ARE ALSO HAVE  ANOTHER MI
  SSION FOR  YOU!":FORI=1TO7000:NE
  XT:RETURN
7000 POKE36875,0:PRINT"{CLEAR}YOU DIDN'T MA
  KE IT.THE SOLARIAN GOVERNMENT  HA
  S SENT";
7020 PRINT"  YOUR FAMILY":PRINTPT;"GALACTIC ~
  CREDITS"
7025 PRINT"HIT 'C' TO CHANGE A.D."
7030 FORI=1TO700:IFPEEK(197)=34THENFORJ=1TO
  10:GETR$:NEXTJ:RUN
7040 NEXTI:RETURN
8000 PRINT"{YEL}":POKE36875,0
8060 E(1)=S-23:E(2)=S-22:E(3)=S-1:E(4)=S:E(
  5)=S+23:E(6)=S+22:E(7)=S+1:E(8)=S
8090 FORI=1TO8:READA(I):POKEE(I),A(I):POKEE
  (I)+C,2:NEXTI
8110 A(4)=A(1):A(8)=A(5)
8130 A=2:IFL>17THENA=1
8150 FORI=1TOA:FORJ=1TO8:POKEE(J),32:POKEE(
  J)+C,0:NEXTJ:PRINT
8160 E(1)=E(1)-23-22*(I-1):E(2)=E(2)-22-22*
  (I-1):E(3)=E(3)-1-22*(I-1)
8165 E(4)=E(4)-23-22*(I-1):E(5)=E(1)+23+22*
  (I-1):E(6)=E(6)+22+22*(I-1)
8168 E(7)=E(7)+1+22*(I-1):E(8)=E(8)+23+22*(
  I-1)
8170 FORJ=1TO8:POKEE(J),A(J):POKEE(J)+C,2:N
  EXTJ
8180 FORJ=1TO100:POKE36877,220:NEXTJ:POKE36
  877,0:NEXTI
8200 FORI=1TO6:READA(I):NEXTI:POKE36877,220
8220 FORI=14TO0STEP-2
8235 POKE36878,I
8237 FORJ=1TO6:POKE36879,A(J):FORG=1TO25:NE
  XTG,J
8240 POKE36879,8:NEXTI:POKE36877,0:RETURN
9100 DATA-1,0,1,237,10,1,237,5,1,177,20,5,1
  77,20,5,237,10,1,177,5,1,140,20,5
9105 DATA237,10,1,177,5,1,140,15,2,237,10,1
  ,177,5,1,140,20,5,237,10,1,177,5,
  1,140,25,5
9110 DATA177,10,1,140,5,1,118,25,1,140,20,1
  ,177,15,1,237,25,1,237,20,1,237,1
  0,1,177,25,0
9200 DATA77,66,64,42,77,66,64,42,25,42,127,
  143,159,255

```

Program 2: Atari Version

```

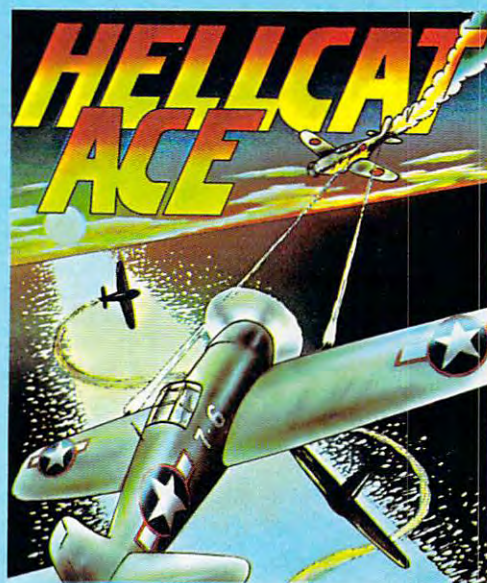
5 POKE 53248,0:GOSUB 3000:DIM N$(10)
  :N$="`{ } * . { ( , } X [ ] < > "
7 GRAPHICS 0:POKE 752,1:?:DL=PEEK(5
  60)+256*PEEK(561)+4:POKE DL-1,68:F
  OR I=2 TO 24:POKE DL+I,4:NEXT I
10 X=60:Y=50:W=0
20 A=PEEK(106)-8:POKE 54279,A:PMBASE
  =256*A
30 POKE 559,46:POKE 53277,3

```

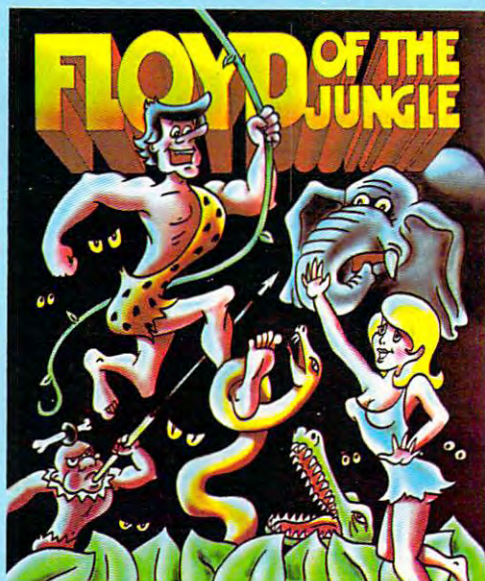

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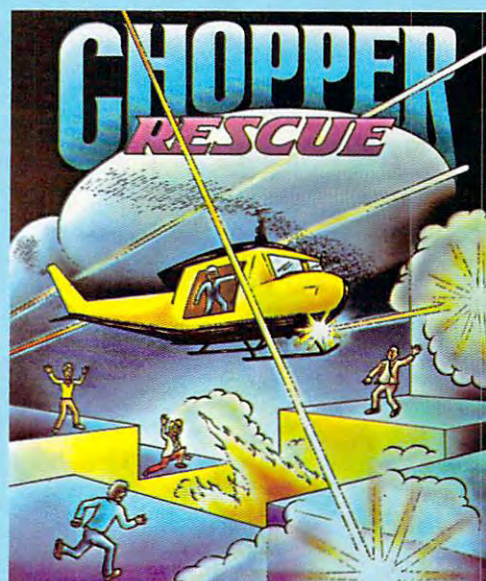
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```

40 FOR I=PMBASE+512 TO PMBASE+640:PO
KE I,0:NEXT I
50 POKE 53248,X
60 POKE 704,216:P0=PMBASE+512+Y
70 FOR I=PMBASE+512+Y TO PMBASE+517+
Y:READ A:POKE I,A:NEXT I
80 DATA 224,112,254,127,112,224
95 POKE 53278,0
97 IF R=2 THEN 500
104 B=STICK(0):IF B<>15 THEN A=B
110 X=X-4*(A=11)+4*(A=7):POKE 53248,
X:PT=PT+10-25*(A=11)
130 IF PEEK(53252) THEN POKE 764,255
:GOTO 2000
140 IF X>200 THEN POKE 53248,60:W=W+
1:PT=PT+1000:X=60
145 IF X<60 THEN POKE 53248,200:X=20
0:PT=PT-1000
150 IF W=6 THEN 1000
190 POSITION 17*(RND(0)*2)+4,23:Z=IN
T(LEN(N$)*RND(0)+1):? N$(Z,Z):PO
KE 710,PEEK(53770)
260 GOTO 97
500 I=PEEK(764)
520 IF I=54 THEN X=X-4:POKE 53248,X:
PT=PT-15:GOTO 130
530 IF I=55 THEN X=X+4:POKE 53248,X:
PT=PT+10:GOTO 130
540 GOTO 190
1000 POKE 764,255:GOSUB 2100:GRAPHIC
S 0:ON W GOTO 2000,1200,1005,10
05,1005,1020,1010
1005 IF W<6 THEN GRAPHICS 0:?"You d
id not complete your mission.":
GOTO 1020
1010 ? :? CHR$(125);"You completed y
our mission."
1020 ? "The Solarian System Minister
has":? "awarded you ";PT;" Sol
arian"
1025 ? "credits for your services.":
GOTO 2010
1200 ? CHR$(125);"The Solarian Gover
nment has fined":? "you ";PT;"
galactic credits."
1210 ? :? "but, they also have anothe
r mission":? "for you!":GOTO 2
010
2000 FOR W=15 TO 0 STEP -.3:SOUND 0
,20*RND(0),0,W:POKE 704,PEEK(53
770):POKE P0+6*RND(0),PEEK(5377
0):NEXT W
2005 GRAPHICS 0:?"You didn't make i
t. The Solarian":? "government
has sent your family ":? PT;" g
alactic credits."
2010 GOSUB 2100:POKE 764,255:?"Play
again? (Y/N)":? :GET #1,A:IF A<
>ASC("N") THEN RUN
2020 GRAPHICS 0:GOSUB 2100:END
2100 POKE 53277,0:POKE 53248,0:RETUR
N
3000 GRAPHICS 0:SETCOLOR 2,6,6
3010 ? "{2 TAB}ASTROSTORM"
3030 ? :? "1. Joystick":? :? "2. Key
board":? "{3 SPACES}Use < and >
for move"
3040 OPEN #1,4,0,"K:":? :? "Select:"
;
3050 GET #1,A:R=A-48:IF R<1 OR R>2 T
HEN 3050
3080 RETURN
3100 END

```

Program 3: TI-99/4A Version

```

100 RANDOMIZE
110 CALL CLEAR
120 FOR I=5 TO 8
130 CALL COLOR(I,16,1)
140 NEXT I
150 CALL CLEAR
160 PRINT " A S T R O S T O R M !!!
"
170 PRINT
180 PRINT
190 PRINT "POWER SHIP WITH < & > KE
YS"
200 FOR I=1 TO 9
210 PRINT
220 NEXT I
230 FOR I=14 TO 3 STEP -1
240 FOR J=1 TO 20
250 NEXT J
260 CALL SCREEN(1)
270 NEXT I
280 FOR I=1 TO 400
290 NEXT I
300 S=3
310 PT=0
320 RSHIP=10
330 CSHIP=1
340 SHIP=62
350 COL=2
360 RLSHIP=RSHIP
370 CLSHIP=CSHIP
380 CALL CLEAR
390 PRINT "WHAT ASTEROID DEPTH (1-1
0)";
400 INPUT X
410 IF (X>10)+(X<1) THEN 380
420 PRINT
430 PRINT "WHAT DIFFICULTY LEVEL (1
-10)"
440 INPUT DCULT
450 IF (DCULT>10)+(DCULT<1) THEN 380
460 CALL CLEAR
470 CALL SCREEN(S)
480 CALL COLOR(2,16,1)
490 REM VARY LIMIT OF LOOP IN THE N
EXT LINE IF THE GAME IS TOO HAR
D OR TOO EASY
500 FOR LOOP=1 TO 1000
510 FOR I=1 TO INT(RND*X)+1
520 COL=INT(RND*30)+2
530 CALL HCHAR(23,COL,42)
540 NEXT I
550 PRINT
560 CALL GCHAR(RSHIP+DCULT,CSHIP,LO
C)
570 CALL HCHAR(RLSHIP+DCULT-1,CLSHI
P,32)
580 IF LOC=42 THEN 1190
590 CALL SCREEN(S)
600 CALL HCHAR(RSHIP+DCULT,CSHIP,SH
IP)
610 CLSHIP=CSHIP
620 RLSHIP=RSHIP
630 CALL KEY(3,A,STATUS)
640 IF A<>ASC(".") THEN 730
650 CALL SOUND(-700,-5,3)
660 PT=PT+5*DCULT*X
670 CSHIP=CSHIP+1
680 IF CSHIP<>32 THEN 720
690 CSHIP=1
700 S=S+1
710 IF S=15 THEN 1030
720 SHIP=62

```




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```

730 IF A<>ASC(",") THEN 820
740 CALL SOUND(-700,-6,4)
750 SHIP=60
760 PT=PT-8*DCULT*X
770 CSHIP=CSHIP-1
780 IF CSHIP<>1 THEN 810
790 CSHIP=32
800 S=S-SGN(S-3)
810 SHIP=60
820 REM
830 NEXT LOOP
840 CALL CLEAR
850 PRINT " YOU DID NOT COMPLETE YO
UR"
860 PRINT
870 PRINT "MISSION. THE SOLARIAN"
880 PRINT
890 PRINT "GOVERNMENT HAS FINED YOU
"
900 PRINT
910 PRINT PT;"GALACTIC CREDITS."
920 PRINT
930 PRINT
940 PRINT
950 PRINT " BUT, THEY ALSO HAVE "
960 PRINT
970 PRINT "ANOTHER MISSION FOR YOU!
!!"
980 PRINT
990 PRINT
1000 INPUT "ARE YOU GAME (Y OR N)?"
:G$
1010 IF G$="Y" THEN 300
1020 GOTO 1500
1030 REM YOU WIN!!
1040 CALL CLEAR
1050 PRINT " YOU COMPLETED YOUR "
1060 PRINT
1070 PRINT "MISSION. THE SOLARIAN M
INI-"
1080 PRINT
1090 PRINT "STER HAS AWARDED YOU ";
PT
1100 PRINT
1110 PRINT "SOLARIAN CREDITS FOR YO
UR "
1120 PRINT
1130 PRINT "SERVICES AND WISHES YOU
"
1140 PRINT
1150 PRINT "TO MAKE ANOTHER DELIVER
Y!"
1160 PRINT
1170 PRINT
1180 GOTO 980
1190 CALL SCREEN(12)
1200 FOR I=1 TO 50
1210 NEXT I
1220 CALL SCREEN(9)
1230 FOR VOL=24 TO 1 STEP 4
1240 CALL SOUND(200,-7,VOL)
1250 NEXT VOL
1260 FOR VOL=1 TO 24 STEP 4
1270 CALL SOUND(200,-7,VOL)
1280 NEXT VOL
1290 CALL SCREEN(12)
1300 FOR I=1 TO 10
1310 NEXT I
1320 CALL SCREEN(8)
1330 CALL CLEAR
1340 CALL SCREEN(6)
1350 PRINT "{4 SPACES}TOO BAD! THE
SOLARIAN"

```

```

1360 PRINT " GOVERNMENT HAS SENT YO
UR"
1370 PRINT " FAMILY ";PT;" GALACTIC "
1380 PRINT " CREDITS."
1390 FOR I=1 TO 5
1400 PRINT
1410 NEXT I
1420 PRINT "{3 SPACES}HIT -P- TO PL
AY AGAIN"
1430 PRINT " OR -S- TO STOP."
1440 FOR I=1 TO 5
1450 PRINT
1460 NEXT I
1470 CALL KEY(3,K,ST)
1480 IF ST=0 THEN 1470
1490 IF (K=ASC("C"))+(K=ASC("P"))TH
EN 300
1500 END

```

Program 4: Apple Version

```

10 REM ASTEROID FIELD - APPLE II VERS
ION
20 FOR I = 770 TO 795: READ M: POKE I,
M: NEXT I
25 DATA 172,01,03,174,01,03,169,04,32
,168,252,173,48,192,232,208,253,13
6,208,239,206,0,03,208,231,96
30 GOTO 1000
100 TEXT : HOME : VTAB 1: PRINT "SCORE
: ": POKE 34,2
110 FOR I = 1 TO 15: SP = INT ( RND (1
) * 39) + 2: VTAB 24: HTAB (SP): PRINT
"*": NEXT I
115 FOR I = 10 TO 50 STEP 40: POKE 768
,10: POKE 769,I: CALL 770: NEXT I
120 POKE 0P,160: VTAB 24: SP = INT ( RND
(1) * 39) + 2
130 HTAB (SP): PRINT "*"
140 IF PEEK (CP) = 170 THEN GOTO 800
145 POKE CP,CC:OP = CP
146 FOR I = 1 TO 25: NEXT
149 VTAB 1: HTAB 7: CALL - 868: VTAB
1: HTAB 7: PRINT PT
170 M = PEEK ( - 16384): ON M < 128 GOTO
120
180 IF M - 128 = 8 THEN CC = 188: MV =
- 1: GOTO 120
190 IF M - 128 = 21 THEN CC = 190: MV =
+ 1: GOTO 120
200 IF M - 128 < > 32 THEN GOTO 120
210 IF CP < > BP OR MV > 0 THEN GOTO
215
212 ON SF GOTO 120
213 CP = BP + 39: SF = SF - 1: GOTO 230
215 CP = CP + MV
220 IF CP < > BP + 39 THEN GOTO 230
222 ON SF = 6 GOTO 600
225 CP = BP: SF = SF + 1
230 IF PEEK (CP) = 170 THEN GOTO 800
240 IF NOT MV THEN PT = PT + INT ((M
V * ( INT (DL * .2) * ((CP - BP) *
SF))) / 2): GOTO 250
245 PT = PT + (MV * ( INT (DL * .3) * (
(CP - BP) * SF)))
250 GOTO 120
600 REM WIN
610 TEXT : HOME : VTAB 2: HTAB 15: PRINT
"SCORE: ";PT
620 VTAB 8: HTAB 13: FLASH : PRINT "CO
NGRATULATIONS": NORMAL : VTAB 12: HTAB
14: PRINT "YOU MADE IT!"
640 POKE 768,15: POKE 769,50: CALL 770

```


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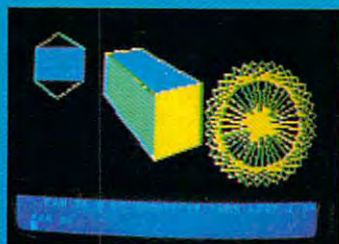
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```

: POKE 768,10: POKE 769,10: CALL 7
70: POKE 768,15: POKE 769,50: CALL 770
650 FOR I = 1 TO 500: NEXT I
660 POKE - 16368,0: GOTO 910
800 REM CRASH
810 V = DL + 2: H = CP - BP
820 IF H < = 1 THEN VTAB V - 1: HTAB
H: PRINT " / ": VTAB V: HTAB H: PRINT
" - ": VTAB V + 1: HTAB H: PRINT "
"; CHR$ (92): GOTO 850
830 IF H > = 39 THEN VTAB V - 1: HTAB
H: PRINT CHR$ (92); " ": VTAB V: HTAB
H: PRINT " - ": VTAB V + 1: HTAB H:
PRINT " / ": GOTO 850
840 VTAB V - 1: HTAB H: PRINT CHR$ (9
2); " / ": VTAB V: HTAB H: PRINT " -
- ": VTAB V + 1: HTAB H: PRINT " /
"; CHR$ (92);
850 FOR I = 1 TO 200: X = PEEK (-16336): NEXT I
890 POKE - 16368,0
900 TEXT : HOME : VTAB 2: HTAB 15: PRINT
"SCORE: "; PT
905 VTAB 10: HTAB 11: PRINT "YOU LOST
YOUR SHIP!"
910 VTAB 21: HTAB 6: PRINT "SAME GAME
? Y)ES, N)O, E)ND ";: GET A$
915 IF A$ = "E" THEN END
920 IF A$ = "Y" OR A$ = CHR$ (13) THEN
GOTO 1130
1000 TEXT : HOME
1010 VTAB 5: HTAB 15: PRINT "ASTROSTORM"
1050 VTAB 10: HTAB 1: INPUT "ENTER DIF
FICULTY LEVEL (5-18) "; DL$
1055 IF LEN (DL$) < 1 OR LEN (DL$) >
2 THEN GOTO 1050
1060 E = 0: FOR I = 1 TO LEN (DL$): CH$

```

```

= MID$ (DL$, I, 1): IF ASC (CH$) <
48 OR ASC (CH$) > 57 THEN E = 1
1070 NEXT I: ON E GOTO 1050
1080 DL = VAL (DL$)
1090 IF DL < 5 THEN VTAB 18: PRINT "T
OO EASY": FOR I = 1 TO 1000: NEXT
I: VTAB 18: CALL - 868: GOTO 1050
1100 IF DL > 18 THEN VTAB 18: PRINT "
TOO HARD": FOR I = 1 TO 1000: NEXT
I: VTAB 18: CALL - 868: GOTO 1050
1110 VTAB 15: HTAB 10: INPUT "INSTRUCT
IONS (Y/N) "; A$: IF A$ = "Y" THEN
GOTO 1200
1130 J = 0: FOR I = 1024 TO 1920 STEP 128
1140 J = J + 1
1150 IF J = DL + 2 THEN CP = I: I = 192
1: GOTO 1180
1160 IF J + 8 = DL + 2 THEN CP = I + 4
0: I = 1921: GOTO 1180
1170 IF J + 16 = DL + 2 THEN CP = I +
80: I = 1921
1180 NEXT I
1190 BP = CP: SF = 1: CC = 190: MV = + 1:
PT = 0: GOTO 100
1200 TEXT : HOME
1210 VTAB 3: HTAB 14: PRINT "INSTRUCTI
1220 VTAB 6: PRINT "THE LEFT AND RIGHT
ARROW KEYS CONTROL ": PRINT "THE
DIRECTION OF MOVEMENT OF THE ROCKE
T. ";: PRINT "PRESS THE SPACE BAR T
O MOVE THE ROCKET."
1230 PRINT : PRINT : HTAB 4: PRINT "PR
ESS SPACE BAR TO BEGIN THE GAME"
1240 VTAB 20: HTAB 8: PRINT "PRESS ANY
KEY WHEN READY": WAIT - 16384, 128
1250 GOTO 1130

```

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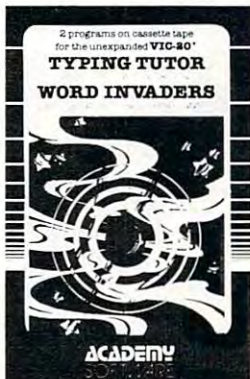
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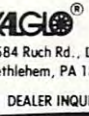
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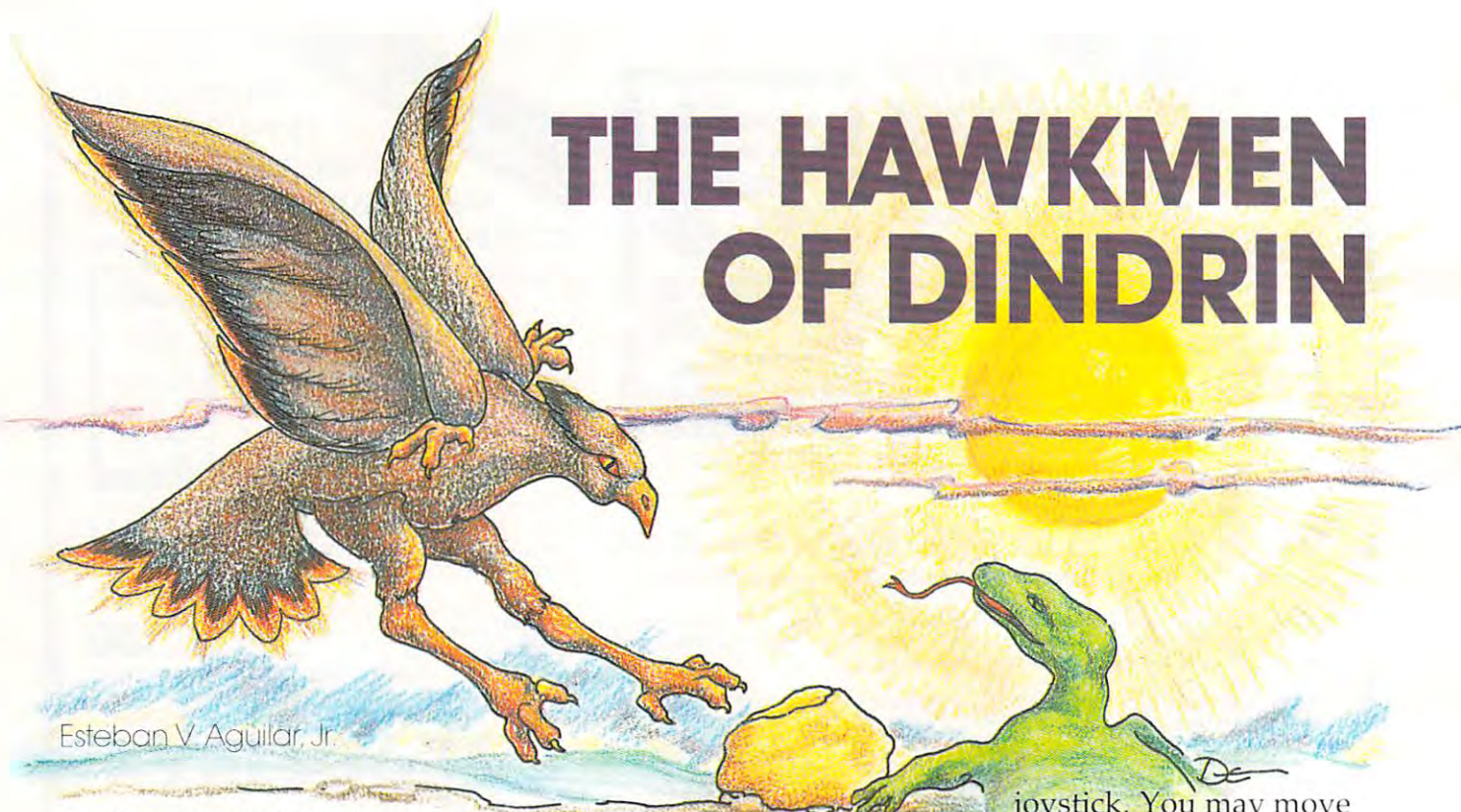
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THE HAWKMEN OF DINDRIN



Esteban V. Aguilar, Jr.

Fly down through the dangerous skies of the planet Dindrin to collect golden stones. Retrieve enough of them and you can win the game, but beware of the floaters, skimmers, and lizards. There are versions here for VIC, 64, and Atari. Several special Atari and 64 animation, multicolor sprite, and sound effects techniques are described in the accompanying notes.

There's a strange planet named Dindrin where multicolored floaters and a giant sky skimmer drift through the daytime skies. On the surface of the planet, vicious land hunters come up from the ground and set polished, golden stones in the sun. It's a form of worship too obscure, too alien to describe.

Suddenly a strange looking hawk-like creature dives down and snatches a stone. With this program and your VIC, you can experience what it's like to be one of the Hawkmen of Dindrin.

The "Hawkmen of Dindrin" is divided into two programs. The first program makes custom characters and automatically loads the main game program. When the game begins, you (the hawkman) start off on the upper left corner of the screen under the cloud layer. You will move across the screen and move lower after every line.

Maneuvering is accomplished with your

joystick. You may move backwards by pulling left on the joystick. Whenever you want to go into a dive or fly upwards, you must pull down or up (respectively) on the joystick. One thing to keep in mind when ascending or descending is that you will move diagonally rather than straight up or down. The winds are powerful on Dindrin. Flying is an art form there.

Once in a while, an obstacle such as the sky skimmer (moving above the surface) or a floater (dominating the skies) will get in your way. When this happens, you can press the red button on the joystick to extend the hawkman's tongue to snap up its prey. You can also do this to obtain points and energy. The skimmer is worth 5 points and 10 energy credits. The floaters are worth 15 points and 20 energy credits.

There are a couple of things to consider before playing the game. As time passes, you will lose energy. If your energy gets too low, the screen border will disappear. If your energy runs out, the game will end. If you have sufficient energy, the border will remain on screen. Second, when you're flying don't run into anything or you'll lose one of your lives. Third, when the game starts after the program is loaded from tape, press the stop button on the cassette player. Otherwise, the joystick will not respond to your commands. To win, you must obtain 10,000 points.

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Atari And Commodore 64 Notes

Charles Brannon, Program Editor

Several special programming tricks went into the making of the Atari and 64 versions of "The Hawkmen of Dindrin." Most striking is that the Atari and 64 program listings are very similar. The same basic program was used on both machines, but lines specific to each machine's graphics are of course modified. The joystick values returned by STICK(0) (Atari) and PEEK(56321) AND 15 (64) are identical, making the game easier to translate.

Animated Characters

Take a look at the screen photos for Hawkmen. A "patrol snake" sweeps across the bottom of the screen. Airborne "floaters" pop up all over the screen, grinning (as well they might). The hawkman's wings flap. The luminous stones at the bottom of the screen are protected by menacing lizards whose tongues wiggle venomously at you.

To play the game, use a joystick plugged into the first port. Follow the general instructions in the VIC article. The joystick response will be strange and difficult to master, but it is predictable. Your hawkman cannot stick out his tongue, but if you hold down fire, you can safely bump into the smirking floaters (and get points for them!).

How It's Done

Multicolored characters are used on both the Atari and 64 for the stones and the lizards. The patrol snake is a multicolored sprite on the 64 and is formed on the Atari by overlaying two players to get three colors.

The animation (wing flapping, tongue wiggling) is done by switching between two custom character sets. Every object to be animated has two alternate "views." The same image is copied into both character sets for shapes that should not move, such as the stones or the score line.

Special Machine Language

A machine language routine is used for smooth, even horizontal motion for the patrol snake. Instead of being called when needed by BASIC, the machine language routine runs continuously "in the background." The machine language routine also flips the character set and, on the Atari, produces a variable sound effect.

Countdown Timers

On the Atari, the machine language is called automatically by Countdown Timer Two. To use the countdown timer, store the address of your routine in CDTMA2 (\$0228). To start the automatic execution, store a clock value into CDTMV2 (\$021A). The clock value is measured in sixtieths of a second. The time value is decremented every vertical blank, and when it hits zero, your routine is called by an indirect JSR through CDTMA2. After your routine executes, it should store a new timer value so that it will be called again, and then return with RTS.

The beauty of using the countdown timers instead of a vertical blank is twofold: it's easier to set up and disable (to disable, just store a zero into CDTMV2), and you can control how often it's called by the timer value. The routine was being called every sixtieth of a second (value of one), but the character set flipping was so fast it blurred. So a higher value was used, and the snake was speeded up by additional increments of its horizontal position.

Interrupting The Commodore 64

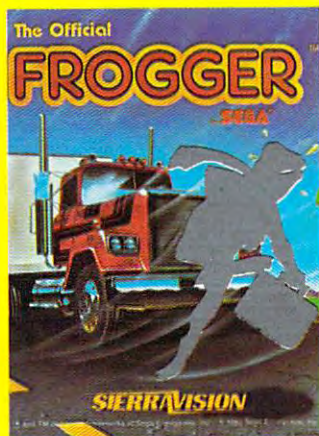
We used the hardware interrupt request (IRQ) on the Commodore 64. To place a machine language routine so that it automatically executes every sixtieth of a second, you change the IRQ vector at \$0314 (it normally points to the ROM interrupt routines) to point to your machine language routine. After your routine executes, it exits with a JMP to the normal ROM routine.

The setup is a little tricky. While you're storing the new IRQ value, you have to use SEI (SEt Interrupt disable bit) to prevent any interrupts from happening. If you don't, an interrupt *could* occur after you had stored the first byte of the vector value but before you changed the second. The interrupt would then vector through a "half baked" value,

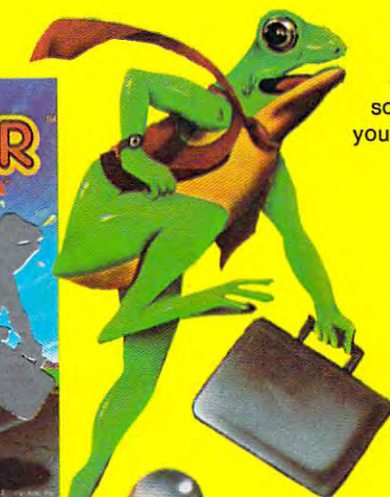
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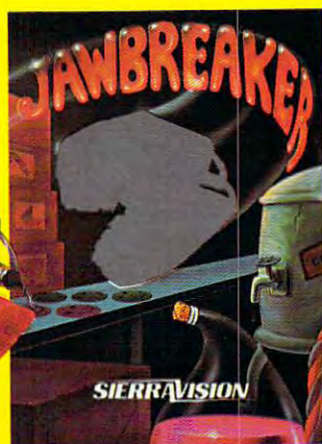
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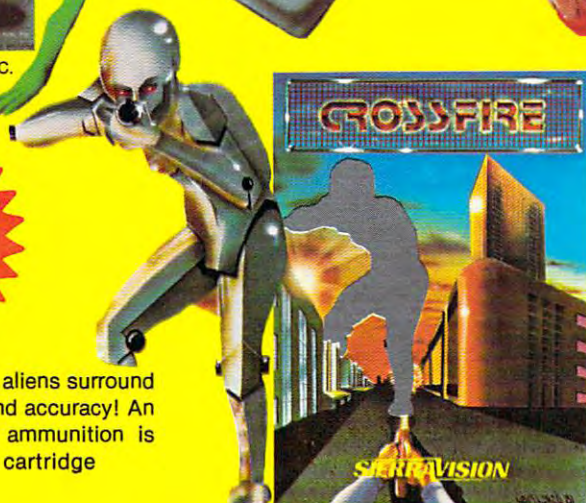
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and end up in limbo.

After you've changed the IRQ vector, you clear the interrupt disable bit (CLI) and return with RTS to BASIC. The machine language routine will then be running continuously in the background, flipping the character set and moving the sprite.

More On Multicolor

The now famous IRG mode 4 is used on the Atari for multicolored characters. See the Atari Notes for Thunderbird (**COMPUTE!**, January 1983) for more information on multicolored characters. Interestingly, the same character set used on the Atari was used on the 64, even for multicolor. It turns out that both machines use the same format for storing multicolor patterns.

Commodore 64 Multicolor

Multicolor graphics are really important for good arcade effects. A few years ago, graphic objects (such as a tank or plane) were always a single color. But increasing realism has been a feature of arcade graphics, and multicolored objects are an important aspect of this realism.

Normally, when you define a custom character set on the 64, you create eight rows of pixels (picture elements, dots). Each row is eight dots (or bits) wide. With multicolor, each row is divided up into four two-bit pairs. Each pair of bits can hold a number from 0-3: 00,01,10,11. You use a different number for each color. This reduces the resolution to four multicolor pixels per row, so the lizards and stones are composed of two characters each. You also have to tell the VIC-II chip that you are using multicolor. Do this with:

```
POKE 53270,PEEK(53270) OR 16
```

Disable multicolor with:

```
POKE 53270,PEEK(53270) AND 239
```

Here is a sample multicolor shape:

```
rrrr    r = red  (arbitrary colors)
rbbb    b = blue
rbgg    g = green
rbgg
```

Let's say the binary codes for red, green, and blue are (respectively) 01, 10, and 11. Substituting gives:

```
01 01 01 01    01010101
01 10 10 10    01101010
01 10 11 11    01101111
```

```
01 10 11 11    01101111
```

You can change the colors according to this key:

```
00 Background #0 color register - 53281
01 Background #1 color register - 53282
10 Background #2 color register - 53283
11 Color in lower 3 bits in color memory.
```

That last line needs explaining. You know that to get variously colored characters, you POKE a number from 0-15 into the corresponding color memory location. However, colors 8-15 (accessed by the Commodore key) are really multicolors. Multicolor characters always are displayed with a color from 8-15. You won't get the eight alternate colors (such as grey), but the normal color on the key (15 = yellow). Just add eight to the "normal" color number. So, a bit value of 11 will take on the value in color memory. The other colors will come from the color registers (00 is transparent).

Multicolored sprites are similar. Instead of the normal 24-bit resolution, the bits are grouped into 12 bit pairs. The colors come from:

```
00 - Transparent, screen color
01 - Sprite multicolor register #0 53285
10 - Normal sprite color register
11 - Sprite multicolor register #1 53286
```

You tell the VIC-II chip that you are using a multicolored sprite by:

```
POKE 53276,PEEK(53276) OR (2↑X)
```

"x" is the sprite number, from 0 to 7. You can mix multicolored and regular sprites on the same screen. But all multicolored sprites will share the same two multicolor registers.

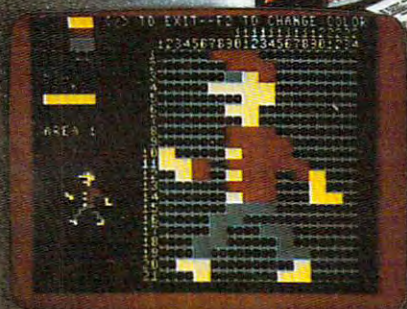
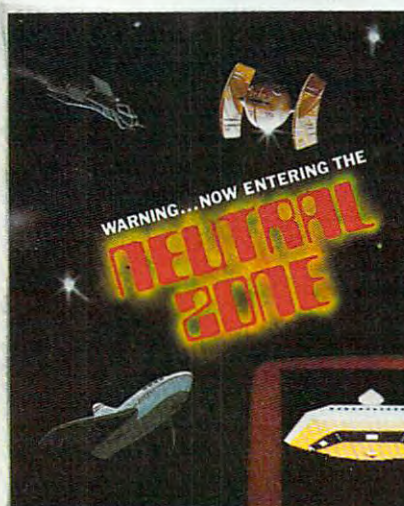
Simple SID Chip Sound

We were able to get some nice sound effects on the Atari version (such as the thrumming made by a lizard) by experimenting. But with the 24 registers of Commodore's sound synthesis chip, SID, trial and error would take far too long. The "thrumming" noise is made by playing a low-pitched tone through the SID using the variable pulse wave and a fairly long (one second) decay. Another sound effect (I can't really describe it) is made with white noise and a medium decay. The high byte of the pitch is changed as the note is played. There is also another sound effect created by the sawtooth waveform affecting the low byte of the pitch.

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Hawkmen – VIC Version Part 1. Save this first on tape.

```

10 POKE 36879,93:REM PART ONE OF TWO PART
PROGRAM
20 PRINT"[CLEAR] {REV}HAWKMEN OF DINDRIN
{OFF}"

50000 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE5
1,PEEK(55):CLR
50010 CS=256*PEEK(52)+PEEK(51)
50020 FORI=CSTOCS+511:POKEI,PEEK(I+32768-C
S):NEXT
50030 READX:IFX<0THEN50090
50040 FORI=XTOX+7:READJ:POKEI,J:NEXT
50050 GOTO50030
50090 DATA7512,0,28,54,255,48,30,0,0
50091 DATA7504,35,85,91,192,109,41,101,26
50092 DATA7496,255,126,60,60,60,60,255,255
50093 DATA7168,134,205,207,252,255,96,96,2
4
50094 DATA7432,0,0,0,255,0,0,0,0
50095 DATA7440,0,90,60,90,126,24,36,66
50096 DATA7448,0,24,36,66,66,66,36,255
50097 DATA7456,24,135,133,199,71,103,103,2
55
50098 DATA7464,24,207,141,239,255,255,255,
255
50099 DATA7472,0,0,0,170,85,0,0,0
50100 DATA7488,255,255,255,255,255,255,255
,255
50101 DATA-1
63000 POKE198,5:POKE631,78:POKE632,69:POKE
633,87:POKE634,13:POKE635,131:END

```

Program 2:

Hawkmen – VIC Version Part 2

```

1 REM PART TWO. SAVE AFTER PART 1 ON TAP
   E
6 TI$="000000"
7 POKE36869,255
8 CLR:S1=36876:S2=36875:S3=36874:S4=3687
  7
9 E=200:FC=38554
10 PRINT"{CLEAR}":POKE36879,122:SC=0:Y=78
    13:V=36878:YC=38533:SK=8080:MKC=3
    8800:TN=4:FL=7834
20 PRINT"{HOME}{04 DOWN}&&&&&&&&&&&&&&
&&&&" ;
21 PRINT"{HOME}{DOWN}SCORE:" :PRINT"ENERGY
  :"
22 FORA=0TO21:POKE8164+A,40:POKE38884+A,6
  :NEXTA
30 FORA=0TO21:POKE8142+A,35:POKE38862+A,5
  :NEXTA
35 PRINT"{HOME}{18 DOWN} !!!+"
40 POKE36878,15
50 POKEYC,0:POKEY,0
51 J=PEEK(37151):E=E-1:GOSUB600
52 IFJ=94THENGOSUB100
53 IFJ=110THENQ=-1
54 IFJ=126THENQ=1
55 IFJ=118THENQ=23:POKES2,130
56 IFJ=122THENQ=-21:POKES2,210
57 POKEY,32:POKES2,0:IFY+Q<7790ORY+Q>=816
  3THEN500
58 PRINT"{HOME}LIFE:";TN:PRINT"{HOME}{
  DOWN}{06 RIGHT}";SC:PRINT"{07
  RIGHT}{06 LEFT}";E:IFE<=0THEN1000

```

```

59 IFPEEK(Y+Q)=35THEN90
60 IFPEEK(Y+Q)=32THEN75
71 IFPEEK(Y+Q)<>32THEN500
75 Y=Y+Q:YC=YC+Q:POKEYC,0:POKEY,0
76 IFPEEK(Y+22)=36THEN300
80 GOTO51
90 Y=Y+Q:YC=YC+Q:POKEYC,0:POKEY,0:SC=SC+1
   00:E=E+100
92 FORI=1TO20:POKES1,220+I:NEXTI:POKES1,0
93 POKEY,32:Y=Y-22:YC=YC-22:POKEYC,0:POKE
   Y,0
96 GOTO51
100 IFY>=8138THENRETURN
101 E=E-3:IFE<=0THEN500
102 G=250
105 FORX=1TO3
110 IFPEEK(Y+X)<>32THEN135
115 POKEY+X,33:POKES3,G:G=G+1:NEXTX
119 B=3
120 FORX=BTO1STEP-1
125 POKEY+X,32:POKES3,G:G=G-1
129 POKES3,0
130 NEXTX:RETURN
135 IFPEEK(Y+X)=34THENE=E+20:SC=SC+15
140 IFPEEK(Y+X)=33ORPEEK(Y+X)=43THENE=E+10
   :SC=SC+5
145 POKES1,195:POKEY+X,42:B=X:FORJ=0TO60:N
   EXTJ
149 POKES1,0
150 GOTO120
300 POKEY,0
305 POKEYC+22,2:POKEYC,2:POKEY+22,41:POKEY
   ,36
310 FORB=1TO100
315 POKEY,36
320 POKES4,187
325 POKEY,37
330 POKES4,127
335 NEXTB:POKES4,0
345 POKEY,32:POKEY+22,35
346 E=INT(E*.5)
350 TN=TN-1:IFTN=0THEN1000
351 Y=7813:YC=38533:GOTO50
500 IFPEEK(Y+Q)=36THENPOKEY+23,35:POKEY+22
   ,36:GOTO300
501 Y=Y+Q:YC=YC+Q:POKEYC,2:POKEY,42
502 FORH=240TO220STEP-1
503 POKES3,H:NEXTH:POKES3,0
505 POKEY,32
506 TN=TN-1:IFTN=0THEN550
507 YC=38533:Y=7813:GOTO50
550 GOTO1000
600 O=INT(RND(1)*22)+1:IFO=22THENO=0
601 O=INT(RND(1)*22)+1:IFO=22THENO=0
602 D=INT(RND(1)*2)+1
603 IFD=1THENPOKE38862+O,4:POKE8142+O,36
604 IFD=2THENPOKE38862+O,5:POKE8142+O,35
605 POKE(SK-3),32:POKESK,33
606 IFPEEK(SK+1)=0THENY=Y+1:GOTO500
608 MKC=MKC+1:SK=SK+1
609 IFSK=8098THENSK=8076:MKC=38796:POKE809
   6,32:POKE8097,32:POKE8095,32
610 POKEMKC,8:POKESK,43
611 Z=INT(RND(1)*10)+1:IFZ<>5THEN650
612 F=INT(RND(1)*242)+1:IFPEEK(FL+F)<>32TH
   EN612

614 W=INT(RND(1)*7)+1
615 IFW=7THEN614
616 POKEFC+F,W:POKEFL+F,34
625 IFE<100THENPOKE36879,127
626 IFE>100THENPOKE36879,122
650 RETURN

```


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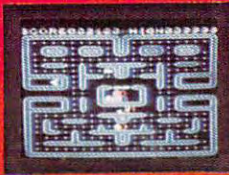
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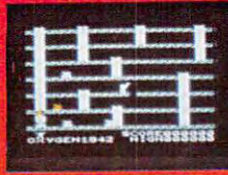
VICMEN

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METEOR

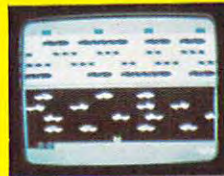
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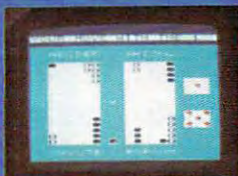
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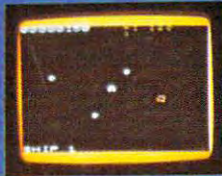
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```

1000 PRINT "{CLEAR}"
1005 PRINT "IF YOU WISH TO PLAY":PRINT "AGAIN
, PRESS THE FIRE BUTTON."
1010 PRINT "{PUR}IF NOT, THEN PRESS THE":PRIN
T "JOYSTICK DOWN."
1015 PRINT "YOUR SCORE: "; SC
1020 PRINT "YOUR TIME: "; VAL(TI$)
1023 IF SC=10000 THEN PRINT "{REV}{RED}YOU HAV
E WON!{OFF}"
1025 J=0
1030 J=PEEK(37151)
1035 IF J=94 THEN RUN
1040 IF J=118 THEN POKE 36869, 240:PRINT "{REV}
HAWKMEN OF DINDRIN      GAME TER
MINATED  {OFF}":END
1050 GOTO 1025

```



"Hawkmen Of Dindrin," Atari version.

Program 3: Hawkmen – Atari Version

```

100 REM HAWKMEN OF DINDRIN
110 REM ATARI VERSION
120 REM
130 REM Enter INVERSE VIDEO with Ata
ri logo key
140 GOSUB 530:ENERGY=500:GOTO 180
150 POSITION 1,1: ? #6;ENERGY;" ";:PO
SITION 13-LEN(STR$(SCORE)),1: ? #
6;SCORE;
160 IF ENERGY<=0 THEN 440
170 RETURN
180 IF STICK(0)<>15 THEN ST=STICK(0)
:POKE 77,0
190 IF RND(0)>0.95 THEN POSITION 19*
RND(0),10*RND(0)+3:PUT #6,ASC(FO
OL$(INT(4*RND(0)+1)))
200 IF RND(0)<0.7 THEN 220
210 POSITION INT(10*RND(0))*2,20+(RN
D(0)>0.5):C=33+2*(RND(0)>0.7): ?
#6;CHR$(C);CHR$(C+1);
220 IF PEEK(53252) OR PEEK(53253) TH
EN 440
230 COLOR PC:PLOT PX,PY:ENERGY=ENERG
Y-1-9*(1-STRIG(0))
240 POSITION 1,1: ? #6;ENERGY*(ENERGY
>0);" ";:IF ENERGY<=0 THEN 440
250 NX=PX+1-2*(STICK(0)=11):NY=PY-(N
X<0)+(NX>19):NX=NX*(NX<20)+20*(N
X<0)
260 NY=NY+(ST=13)-(ST=14):IF NY<3 OR

```

```

NY>20 THEN ST=27-ST:NY=PY
270 LOCATE NX,NY,WHATSIT
280 IF NY>19 THEN Z=PX*2-20*(PX>9):L
OCATE Z,NY+(PX>9),WHATSIT:GOTO 3
30
290 IF WHATSIT=32 THEN COLOR 32:PLOT
PX,PY:PX=NX:PY=NY:GOTO 180
300 IF STRIG(0) THEN 440
310 COLOR 32:PLOT PX,PY:FOR W=15 TO
0 STEP -0.5:SOUND 0,W,12,8:SOUND
1,W,0,8:NEXT W
320 SOUND 0,0,0,0:SOUND 1,0,0,0:WHAT
SIT=32:SCORE=SCORE+10:ENERGY=ENE
RGY-50:GOSUB 150:GOTO 280
330 ST=27-ST:IF WHATSIT<33 OR WHATSI
T>34 THEN 360
340 POSITION Z,NY+(PX>9):PUT #6,32:P
UT #6,32:SCORE=SCORE+10:ENERGY=E
NERGY+50
350 COLOR 32:PLOT PX,PY:PX=NX:SCORE=
SCORE+50:GOSUB 150:GOTO 180
360 IF WHATSIT=32 THEN 180
370 REM GRAB 'EM AND EAT 'EM UP!
380 POKE DL+19,112:POKE DL+20,4:COLO
R 32:PLOT PX,PY
390 POSITION Z,NY+(PX>9):PUT #6,37:P
UT #6,38:POSITION Z,NY-2+(PX>9):
PUT #6,42:PUT #6,36
400 SOUND 0,255,2,15:FOR W=1 TO 500:
NEXT W:SOUND 0,0,0,0
410 POSITION Z,NY+(PX>9):PUT #6,35:P
UT #6,36:POSITION Z,NY-2+(PX>9):
PUT #6,32:PUT #6,32
420 POKE DL+19,6:POKE DL+20,6:GOTO 4
60
430 REM PLAYER MEETS HIS DEMISE
440 FOR I=60 TO 0 STEP -4:SOUND 0,I,
12,1/4:POKE 53274,PEEK(53770):SO
UND 1,1,2,1/4:POKE 53274,PEEK(53
770)
450 COLOR ASC(EXPL$(16-I/4)):PLOT PX
,PY:POKE 53274,PEEK(53770):NEXT
I
460 COLOR 32:IF LIFE<3 THEN PLOT 15+
LIFE*2,1
470 PLOT PX,PY:LIFE=LIFE+1:IF LIFE<4
THEN ENERGY=500:GOSUB 770:GOTO
180
480 POKE 538,0:POKE 53248,0:POKE 532
49,0:SOUND 2,0,0,0:SOUND 3,0,0,0
490 COLOR 32:PLOT 0,5:DRAWTO 19,5:PL
OT 0,7:DRAWTO 19,7:POSITION 5,5:
 ? #6;"GGGGGGGGGG"
500 POSITION 5,7: ? #6;"press START":
POKE 53279,8
510 IF PEEK(53279)<>6 THEN 510
520 RUN
530 REM INITIALIZATION
540 CHSET=(PEEK(106)-12)*256:IF PEEK
(CHSET+8)=2 THEN 600
550 POKE 88,0:POKE 89,CHSET/256-4: ?
CHR$(125):REM clear memory
560 GRAPHICS 18:SETCOLOR 4,0,10:POS
ITION 4,5: ? #6;"THE HAWKMEN":POS
ITION 5,7: ? #6;"OF Dindrin":SETC
OLOR 1,4,4
570 DL=PEEK(560)+256*PEEK(561)+4
580 POKE DL+12,6:POSITION 1,11: ? #6;
"ready in 15 seconds";
590 GOSUB 890:GOSUB 800
600 GRAPHICS 17:DL=PEEK(560)+256*PEE
K(561)+4:DIM FOOL$(4),PC$(4),EXP

```


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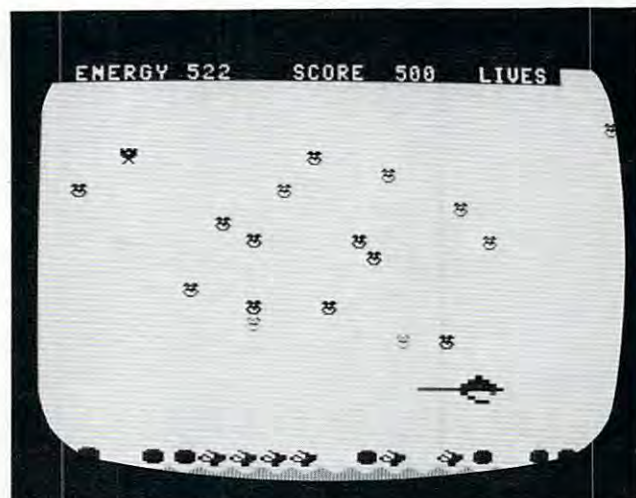
L$(16):RESTORE 630
610 FOR I=1 TO 4:READ A:FOOL$(I)=CHR
$(A):NEXT I:FOR I=1 TO 4:READ A:
PC$(I)=CHR$(A):NEXT I
620 FOR I=1 TO 16:READ A:EXPL$(I)=CH
R$(A):NEXT I
630 DATA 41,169,9,137,43,171,11,139,
44,172,12,140,45,173,13,141,46,1
74,14,142,47,175,15,143
640 POKE DL-1,71:POKE DL+2,7:POKE DL
+21,4:POKE DL+22,4:POKE DL+23,4:
POKE DL+24,4:POKE 756,CHSET/256
650 SETCOLOR 0,13,14:SETCOLOR 1,7,12
:SETCOLOR 2,12,8:SETCOLOR 3,4,14
:SETCOLOR 4,5,4
660 POSITION 0,0:PRINT #6;"ENERGY score
lives"
670 POSITION 0,1:PRINT #6;" 500
(8 SPACES)0 ";PC$(2,2);" ";PC$(
3,3);" ";PC$(4,4);
680 POSITION 0,22:FOR I=0 TO 19:PUT
#6,39:PUT #6,40:NEXT I
690 POSITION 0,20:FOR I=0 TO 19:PUT
#6,33:PUT #6,34:NEXT I
700 POSITION 10,20:PUT #6,35:PUT #6,
36
710 PMBASE=CHSET-1024:P0=PMBASE+512:
P1=P0+128:POKE 54279,PMBASE/256:
POKE 559,46:POKE 53277,3:POKE 62
3,32
720 POKE 704,4*16+8:POKE 705,14:POKE
53256,1:POKE 53257,1
730 RESTORE 740:FOR I=0 TO 4:READ A:
POKE P0+90+I,A:NEXT I:FOR I=0 TO
2:READ A:POKE P1+91+I,A:NEXT I
740 DATA 12,30,255,8,6,4,240,2
750 FOR I=1 TO 5:POSITION 19*RND(0),
10*RND(0)+3:R=INT(4*RND(0)+1):?
#6;FOOL$(R,R):NEXT I
760 SOUND 2,0,12,2:SOUND 3,0,12,2:A=
USR(1664)
770 PX=5:PY=5:PC=ASC(PC$(LIFE+1,LIFE
+1)):COLOR PC:PLOT PX,PY:POKE 53
278,0
780 IF STICK(0)=15 THEN 780
790 RETURN
800 RESTORE 810:FOR I=1664 TO 1710:R
EAD A:POKE I,A:NEXT I:RETURN
810 DATA 104,169,139,141,40,2
820 DATA 169,6,141,41,2,230,203,230,
203
830 DATA 230,203,165,203,141,0
840 DATA 208,141,1,208,141,6,210
850 DATA 73,255,141,4,210,173,244,2
860 DATA 73,12,141,244,2,169
870 DATA 2,141,26,2,96
880 GOTO 880
890 FOR I=128 TO 471:Z=PEEK(57344+I)
:POKE CHSET+I,Z:POKE CHSET+I+102
4,Z:NEXT I
900 RESTORE 940
910 READ A:IF A=-1 THEN RETURN
920 FOR J=0 TO 7:READ B:POKE CHSET+A
*8+J,B:NEXT J:GOTO 910
930 DATA 0,0,0,0,0,0,0,0,0
940 DATA 1,2,9,9,9,9,9,2,0
950 DATA 2,160,88,88,88,88,88,160,0
960 DATA 3,12,3,16,196,195,63,3,3
970 DATA 4,0,192,252,236,252,240,192
,192
980 DATA 5,3,35,131,139,139,171,35,3
990 DATA 6,192,192,224,232,202,194,1
94,200

```

```

1000 DATA 7,64,80,84,85,85,85,85,85
1010 DATA 8,1,5,21,85,85,85,85,85
1020 DATA 9,0,102,219,36,126,137,66,
60
1030 DATA 10,0,15,0,51,63,15,15,3
1040 DATA 128,0,0,0,0,0,0,0,0
1050 DATA 129,2,9,9,9,9,9,2,0
1060 DATA 130,160,88,88,88,88,88,160
,0
1070 DATA 131,12,3,0,192,195,63,3,3
1080 DATA 132,0,192,252,204,252,240,
192,192
1090 DATA 133,3,3,35,171,139,139,131
,35
1100 DATA 134,192,200,194,194,202,23
2,224,192
1110 DATA 135,64,80,84,85,85,85,85,8
5
1120 DATA 136,1,5,21,85,85,85,85,85
1130 DATA 137,129,102,90,36,126,82,3
6,24
1140 DATA 138,0,15,0,48,63,3,15,15
1150 DATA 11,153,219,231,255,90,24,3
6,66
1160 DATA 139,24,90,231,255,219,153,
36,66
1170 DATA 12,217,219,231,75,2,24,36,
66
1180 DATA 13,216,225,235,69,7,2,40,6
6
1190 DATA 14,192,192,145,3,67,1,72,1
30
1200 DATA 15,192,128,8,1,1,0,16,128
1210 DATA 140,217,219,247,99,22,24,3
6,68
1220 DATA 141,216,225,227,71,23,130,
32,66
1230 DATA 142,192,200,129,3,131,1,64
,130
1240 DATA 143,192,144,0,1,1,0,8,128
1250 DATA -1

```



"Hawkmen Of Dindrin," Commodore 64 version.

Program 4: Hawkmen – Commodore 64 Version

```

100 REM HAWKMEN OF DINDRIN
110 REM COMMODORE 64 VERSION
120 POKE52,48:POKE56,48:CLR:GOSUB500:EN=50
0:GOTO160

```



```

130 PRINT "{HOME}{REV}{RED}"; TAB(9) "{LEFT}"
;EN; "{BLU}"; TAB(26-LEN(STR$(SC)))
;SC;
140 IF EN<=0 THEN 410
150 RETURN
160 IF (PEEK(56321) AND 15) <> 15 THEN JS=PEEK(56321) AND 15
170 IFRND(1) > .9 THEN Q=LL*RND(1)+(15*RND(1)+2)*LL:POKET+Q,FOOL:POKEC+Q,6*RND(1)+2
180 IFRND(1) < .7 THEN 200
190 Q=920+INT(20*RND(1))*2:Z=33-2*(RND(1)>.7):POKET+Q,Z:POKET+Q+1,Z+1
200 IF PEEK(V+31) THEN 410
210 Q=PX+LL*PY:POKET+Q,PC:POKEC+Q,6:EN=EN-1-9*(1-(PEEK(56321) AND 16)/16)
215 PRINT "{HOME}{REV}{RED} TAB(9); "{LEFT}"
;-EN*(EN>0); "{LEFT} "; :IF EN<=0 THEN 410
220 NX=PX+1+2*(JS=11):NY=PY+(NX<0)-(NX>39):NX=-NX*(NX<0)-40*(NX<0)
230 NY=NY-(JS=13)+(JS=14):IF NY<2 OR NY>23 THEN JS=27-JS:NY=PY
240 WHATSIT=PEEK(T+NX+LL*NY)
250 IF NY>22 THEN 300
260 IF WHATSIT=32 THEN POKET+PX+LL*PY,32:PX=NX:PY=NY:GOTO 160
270 IF PEEK(56321) AND 16 THEN 410
280 POKET+PX+LL*PY,32:POKES+24,15:POKES+5,9:POKES+6,0:POKES+1,10
281 FOR I=0 TO 10:POKES,I*20:POKES+4,32:POKES+4,33:NEXT:POKES+24,0
290 WHATSIT=32:SC=SC+10:EN=EN-50:GOSUB 130:GOTO 250
300 JS=27-JS:IF WHATSIT<33 OR WHATSIT>34 THEN 300
305 Q=(NX AND 254)+LL*NY:POKET+Q,32:POKET+Q+1,32:EN=EN+50
310 GOTO 320
288 POKET+PX+LL*PY,32:Q=LL*NY+NX:POKET+Q,37:POKET+Q+1,38:POKET+Q-LL,42
320 POKET+PX+LL*PY,32:PX=NX:SC=SC+50:GOSUB 130:GOTO 160
330 IF WH=32 THEN 160
340 REM GRAB 'EM AND EAT 'EM UP!
350 POKET+PX+LL*PY,32:Q=LL*NY+(NX AND 254):POKET+Q,37:POKET+Q+1,38:POKET+Q-LL,42
360 POKET+Q-LL+1,36:POKEC+Q-LL,13:POKEC+Q-LL+1,13
370 POKES+24,15:POKES+1,0:POKES,255:POKES+3,8:POKES+2,0:POKES+5,12:POKES+6,0
375 POKES+4,64:POKES+4,65:FOR W=1 TO 1500:NEXT:POKES+4,64:FOR L=STOS+24:POKEL,0:NEXT
380 POKE T+Q,33:POKET+Q+1,34:POKET+Q-LL,32:POKET+Q-LL+1,32
390 GOTO 430
400 REM PLAYER MEETS HIS DEMISE
410 POKES+24,15:POKES+5,9:POKES+6,0:POKES,200
420 FOR I=0 TO 90 STEP 6:Q=PX+LL*PY:POKET+Q,44+I/30:POKEC+Q,8*RND(1)
425 POKE 53280,16*RND(1):POKES+1,I:POKES+4,128:POKES+4,129:NEXT
427 FOR L=STOS+24:POKEL,0:NEXT
430 POKE 53280,0:IF LI<3 THEN POKET+35+LI*2,32
440 POKET+PX+LL*PY,32:Z=PEEK(V+31):LI=LI+1:IF LI<4 THEN EN=500:GOSUB 720:GOTO 160
450 SYS 52992:REM TURN OFF ML
460 PRINT "{HOME}{03 DOWN}{REV}"; TAB(15); "{BLK}G{RED}A{CYN}M{PUR}E{RIGHT}{GRN}O{BLU}V{YEL}E{RED}R{BLU}"
470 PRINT TAB(7) "{DOWN}{REV}PRESS {RED}FIRE {BLU} TO PLAY AGAIN"
480 IF (PEEK(56321) AND 16) THEN 480
490 RUN
500 REM INITIALIZATION
510 POKE 53280,0:POKE 53281,1
515 T=1024:C=55296:S=54272:LL=40
520 CHSET=12288:IF PEEK(CHSET+264)=2 THEN 570
530 PRINT "{CLEAR}"; C$="{BLK}{RED}{CYN}{PUR}{GRN}{YEL}{BLU}"; FOR I=1 TO 7:PRINT "{HOME}{DOWN}"; MID$(C$,I,1);:GOSUB 2000:NEXT
550 PRINT TAB(10) "{03 DOWN}{02 RIGHT}{BLK}READY IN {RED}22{BLK} SECONDS";
560 GOSUB 750:GOSUB 840
570 PRINT "{CLEAR}";:FOOL=41
575 FOR L=STOS+24:POKEL,0:NEXT
580 PC=43:POKE 53282,10:POKE 53283,2
590 POKE 53272,(PEEK(53272) AND 240) OR 12:REM ENABLE NEW CHARACTER SET
600 POKE 53270,PEEK(53270) OR 16:REM SET MULTICOLOR MODE
610 PRINT "{HOME}{RED}{REV} ENERGY 500 {BLU} SCORE 0 {GRN} LIVES {OFF}{PUR}+ + +"
630 FOR I=0 TO 39 STEP 2:Q=24*LL+I:POKET+Q,39:POKET+Q+1,40:POKEC+Q,7:POKEC+Q+1,7:NEXT
640 FOR I=0 TO 39 STEP 2:Q=23*LL+I:POKET+Q,33:POKET+Q+1,34:POKEC+Q,13:POKEC+Q+1,13:NEXT
650 Q=10+23*LL:POKET+Q,35:POKET+Q+1,36
660 V=53248:REM START OF VIC-II CHIP REGISTERS
670 POKEV,220:POKEV+1,194:POKEV+21,1:POKEV+39,7:POKE 2040,13
680 POKEV+23,1:POKEV+29,1:POKE 53285,3:POKE 53286,4:POKE 53276,PEEK(53276) OR 1
681 FOR I=0 TO 63:POKE 832+I,0:NEXT:RESTORE
685 FOR I=0 TO 18:READ A:POKE 832+8+I,A:NEXT
690 DATA 192,0,3,240,0,15,124,85,95,255,0,12,8,0,3,0,0,0,240
700 FOR I=1 TO 5:Q=40*RND(1)+(10*RND(1)+3)*LL:POKET+Q,FOOL:POKEC+Q,6*RND(1)+2:NEXT
710 SYS 52992:REM START ML ROUTINE
720 PX=5:PY=5:PC=43:POKET+PX+LL*PY,PC:POKEC+PX+LL*PY,6
730 IF (PEEK(56321) AND 15)=15 THEN 730
740 RETURN
750 RESTORE:FOR I=0 TO 18:READ A:NEXT:FOR I=0 TO 96:READ A:POKE 52992+I,A:NEXT:RETURN
760 DATA 120,173,21,3,201,234,208,19
770 DATA 169,39,141,20,3,169,207,141
780 DATA 21,3,169,0,133,251,133,252
790 DATA 76,37,207,169,49,141,20,3
802 DATA 169,234,141,21,3,88,96,165
804 DATA 251,141,0,208,173,16,208,41
806 DATA 254,5,252,141,16,208,24,165
808 DATA 251,105,4,133,251,165,252,105
810 DATA 0,133,252,240,12,165,251,201
812 DATA 91,144,6,169,0,133,251,133
814 DATA 252,165,162,74,144,8,173,24
816 DATA 208,73,2,141,24,208,76,49
818 DATA 234
840 POKE 56334,PEEK(56334) AND 254:POKE 1,PEEK(1) AND 251
841 FOR I=0 TO 511:POKE 13312+I,PEEK(54272+I):POKE 15360+I,PEEK(54272+I):NEXT
842 POKE 1,PEEK(1) OR 4:POKE 56334,PEEK(56334) OR 1
860 READ A:IFA=-1 THEN RETURN
870 FOR J=0 TO 7:READ B:POKE CHSET+A*8+J,B:NEXT J:GOTO 860

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