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Apple II / Macintosh



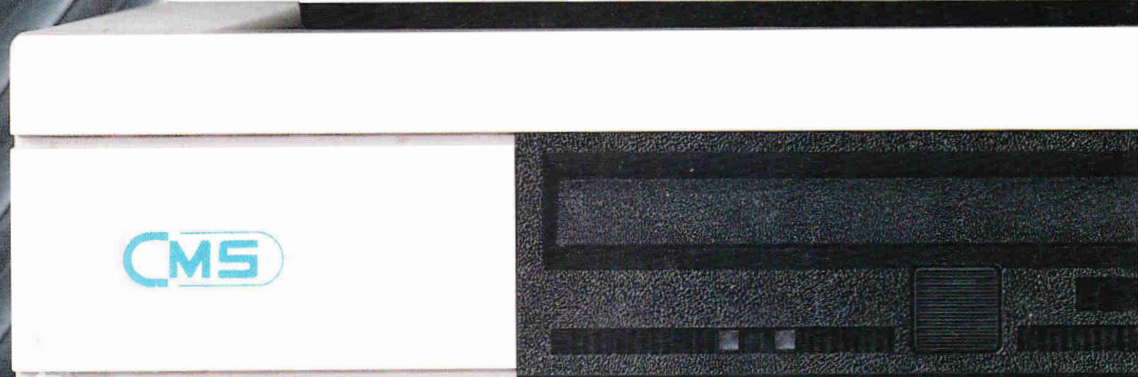
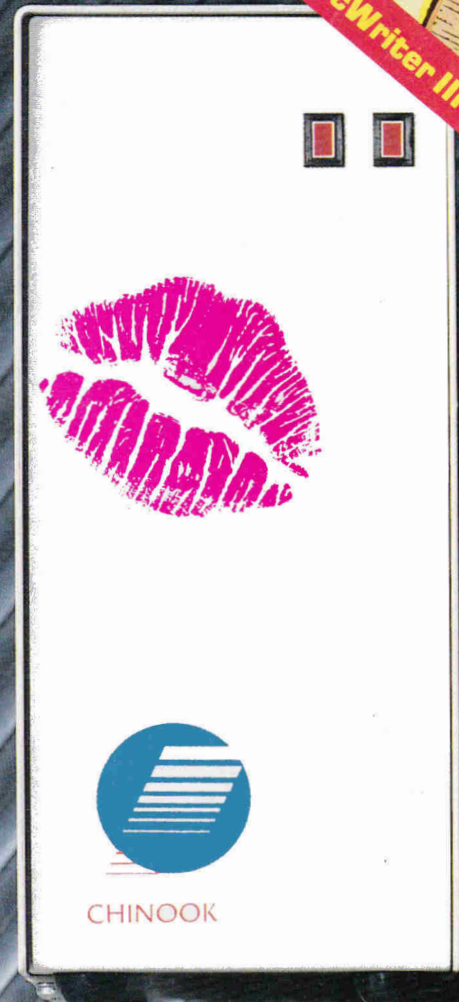
A Good Drive Is Hard to Find. . .

The Inside Story Vulcan, InnerDrive, InSyder Compared, p. 49

Programming Choosing a Language, p. 56

Reviews:

- Softdisk G-S
- Once Upon a Time II
- Program Writer vs. MD-BASIC
- Alge-Blaster Plus
- Jack Nicklaus Course Disk Volume II: The International Course Disk
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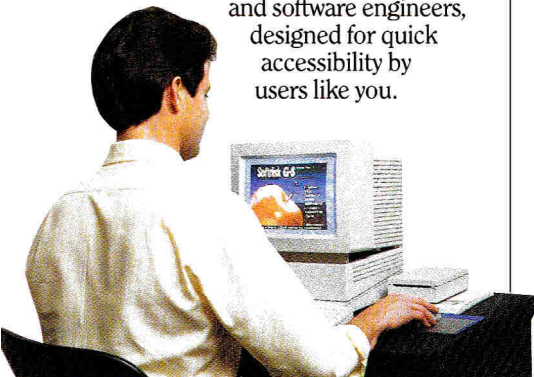
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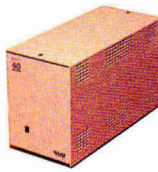
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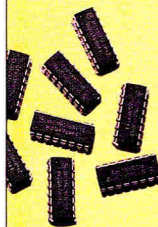
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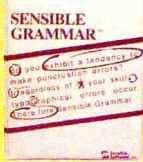
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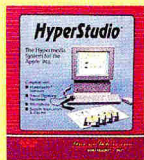
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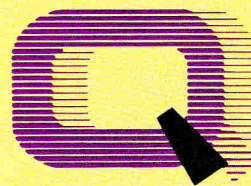
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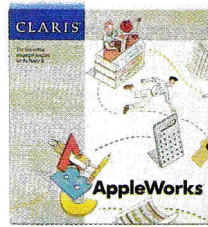
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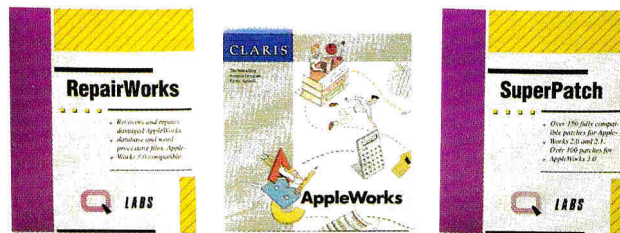
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JULY

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ARTICLES

42 . . . A Hard Drive Is Good to Find

Looking for extra speed and storage space? How much is enough — and how much is too much? What should you watch for in terms of position, noise, and parking problems? What's the going price of support? The test results are in — if you're in the market for a hard-disk drive, *inCider* has the answers.

49 Battle of the Internal Hard Drives

Space-saving internal hard-disk drives face off in a stiff competition for first place in *inCider's* benchmark tests. Compare the InnerDrive, the Vulcan, and the InSyder for cost, speed, reliability, and extra features, and find out which model fits your storage needs best.

56 Programming: Part II

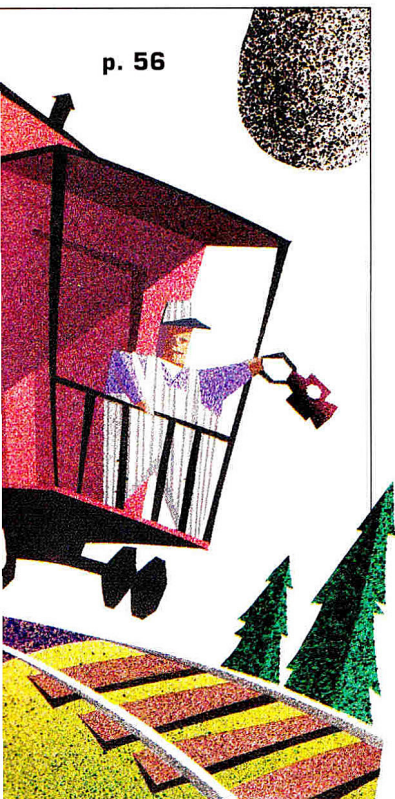
Thanks to a wide range of languages and tools for every level of expertise, Apple II programmers help keep America moving in business, science, the arts, and education.

COLUMNS

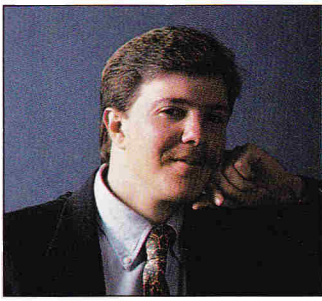
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**INCIDER'S
VIEW**

THE GOOD LIFE

By **DAN MUSE** * EDITOR IN CHIEF

This is the high-tech generation, folks — and most of us have bought in hook, line, and VISA.

YOU KNOW HOW IT IS THESE DAYS. Unless you want to be hopelessly out of style, you have to have a VCR, a compact-disc player, a microwave oven. . . . It wouldn't surprise me if many of you own two VCRs — don't forget the one for the television set in the bedroom. And how many of you can't wait for a shot at high-definition TV? This is the high-tech generation, folks — and most of us have bought in hook, line, and VISA.

Since you already own a personal computer, you may be a step ahead of the Joneses — the family across the street that thinks its Nintendo machine is so cool. But owning a computer isn't enough. The accessory that every trendy Apple II owner simply must have is a hard-disk drive.

Why? Because, like the microwave oven, a hard-disk drive makes your life easier. With leisure time at an all-time low, anything that saves time is fashionable. If I had to choose between my microwave and my hard drive, I'd probably go with the drive. Pizza Haven is only a minute down the road, so I could get by without the oven — but I couldn't deal with booting a program like AppleWorks GS or GraphicWriter III from floppies. And it's not only those big GS applications. I haven't used AppleWorks 3.0 or Publish It! from floppies for so long, I'm not sure how I'd react. (Probably the same way millions of video-renting Americans would react to going back to watching *The Love Boat* on Saturday nights.)

I hear you. A hard-disk drive costs more than a VCR, a compact-disc player, and a microwave oven combined. Prices are finally beginning to drop, though. Besides, how can you put a price tag on your quality of life? I'll bet if you stop shuffling floppies you'll add years to your life.

The tough part about buying a drive is that it's hard to know which one to choose. Internal or external? SCSI or proprietary? Fixed or removable? How much storage capacity?

This month, we try to answer those questions, and they're not easy, as Senior Technical

Editor Bill "Benchmark" Kennedy will attest. We offer our recommendations on the best buy in three hard-drive categories: external, internal, and removable. Kennedy, writer Bob Consorti, and Contributing Editor Owen Linzmayer (who tested 101 hard drives for *MacUser* magazine and lived to tell about it) designed a series of benchmark tests that will give you an idea of how these drives perform in a real-world environment. The tests are objective and easy to duplicate in case you want to perform your own benchmarks on a drive we didn't evaluate (or in case you don't believe our results).

Speed is easy to measure, but it shouldn't be the only criterion you use to make your decision. The most important hard-drive feature, reliability, is almost impossible to test, for a number of reasons.

First, to do it accurately, we'd have to set up the drives and use them all the same way for a year. Second, just because our drive works flawlessly doesn't mean the drive you buy will do the same. If a manufacturer's failure rate is 40 percent, for example, maybe we just got lucky. Third, it's tough enough to get companies to part with drives for just 30 days, let alone a year.

While our tests are as accurate as possible and, we think, informative, don't stop there. Ask friends and user-group members to share their experiences. Call tech-support numbers before you buy to get a taste of how helpful a company's customer-service representatives are. If you're buying mail-order, stick with companies you know. It's your money, of course, but I'd never order an item as expensive as a hard-disk drive from a company I'd never done business with. Order something small first.

Hard-disk drives are expensive, and making the decision can be a complex process. We still think you should have a hard drive — just shop around and ask a lot of questions.

If you still think all you need is a 3.5- and a 5.25-inch disk drive, what can I say? You probably still think Perrier is trendy, too. □



The Ultimate 3.5 Drive

Introducing the new AE 3.5 Drive — setting a new standard for basic Apple II storage. All the reliability and performance of Apple's 3.5 drive at a price approaching that of the cheapest import. Our design incorporates the same top-quality Sony mechanism that Apple uses, but instead of Apple's \$429, our drive is \$279.

Just to make your decision easier, we added a couple of performance features like upgradeability to 1.4 MEG of capacity or higher — an upgrade we'll make available in the future.

High density capacity means you can stop playing diskette roulette. Simply store your large 2-disk application programs on one high-density disk and forget about fumbling for clumsy "sets" of disks. And storing files just became twice as easy too, because you'll only need half the previous number of disks.

Our exclusive 2-way LED indicator shows green for reading, red for writing. Now you can monitor the drive's progress and know that a disk is actually being copied, instead of being confronted with an ambiguous "on" light.

We're even making available a low-cost optional controller card for the IIe. The card

(not required for IIgs), allows the IIe to accept data from the 3.5 format. The AE drive is also Macintosh compatible and you will be able to separately upgrade to 1.44 MEG in the Macintosh format.

Aesthetically, the AE Drive is every bit as handsome as the Apple Drive. We designed a thick, high-impact plastic case to stack with and exactly match the footprint of Apple's drive. Naturally, the AE Drive is Conserver compatible, snuggling neatly inside the drive port.

We also added features like auto eject, complete daisy-chain capacity (from AE to another drive or vice versa) and a full one-year warranty.

Features

- 800K, upgradeable to 1.4 MEG or higher
- 2-way LED indicator, green for read, red for write
- Auto eject
- Daisy chain port — works both ways, connect a drive to it, or connect it to another drive
- 1 year warranty
- Apple compatible, works with IIe, IIc Plus, IIgs, Mac and PC Transporter

- Stack and footprint compatible with Apple Drive
- Conserver compatible
- FDHD compatible (upgrade to 1.4 MEG or higher on Apple II)
- FDHD SuperDrive compatible (upgrade to 1.44 MEG on Macintosh)

AE 3.5 Drive \$279

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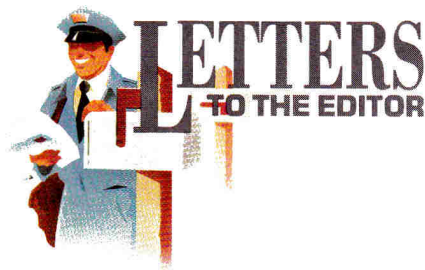
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SPELL IT RIGHT

HAS INCIDER REVIEWED SPELLING programs? I have a IIC, and I mostly use Magic Window, a word processor from ArtSci (now discontinued), in addition to AppleWorks. Is there a spelling program that works with Magic Window?

Dan Mueller
6888 East Bender Road
Bloomington, IN 47401

Try Sensible Speller IV (\$125), from Sensible Software, 335 East Big Beaver, Suite 207, Troy, MI 48083, (313) 528-1950. — eds.

WARRANTY QUESTIONS

I'M THINKING ABOUT MODIFYING my IIC with the Zip Chip; the Zip ad states that installing the chip doesn't take very long.

I was looking through my computer manual and in the "Ask Apple" appendix saw the question, "Do you recommend opening up the Apple IIC so I can see how it works?"

In the answer, Apple warned that opening the IIC's external cover would void the warranty. Does that mean I can't install the Zip Chip without voiding my warranty unless I ask a licensed Apple dealer to do it for me?

Randy Curfiss
278 East Division Street
Fond du Lac, WI 54935

Your Apple warranty expired 90 days after you bought the computer — nobody has an Apple IIC that's under warranty.

The 90-day warranty on the Apple IIC Plus, however, isn't voided by opening the case, according to Apple, if an authorized Apple dealer

installs a peripheral. Of course, the Apple IIC Plus already has an accelerator, so it won't need a Zip Chip.

By the way, any Apple computer bought after January 1, 1990, is now covered by a one-year limited warranty. (See "It's Guaranteed," What's New, June 1990, p. 14, for details.) — eds.

THE LINEUP

IN INCIDER'S MARCH 1990 PRESS Room column ("Buon Appetito," p. 72), Cynthia Field has a problem making decimals line up when typing columns of numbers. Her solution is to insert a zero as a place holder in the dollars position (0.75, for example) and use white-out to remove the zero after printing.

Publish It! offers a better solution. After tabbing to the column, type Open apple-0 (zero) to skip over the dollars position, rather than press the spacebar. You'll still get a space, but it's a numeric space that will keep decimals lined up.

Note that this option may not function in early versions of Publish It! 2; version 2.04 works okay, and later versions probably work, too.

I use Publish It! 2 at work on an Apple IIC Plus, connected to an Apple Laser-Writer IINT, to get great-looking documents. Who says you need a Mac?

Gary Scott
96 River Street
Sidney, NY 13838

MACRO TRICKS

I JUST WANTED TO DROP YOU A note regarding the article "Make the ADB Connection" (February 1990, p. 51). It states that the function keys on

extended keyboards aren't too useful, since MacroMate is the only program that can use them, and that requires pressing an additional modifier key as well.

AppleWorks 3.0 owners can use Beagle Bros' TimeOut UltraMacros to program the extended keys to perform any set of keystrokes they want, and you don't need a modifier.

Just press Home, Page Up, Help, or whatever, and UltraMacros sends the necessary keystroke to AppleWorks.

Hit F12 to type in your return address, or F13 (Print Screen) to perform an Open apple-H.

Accessing this feature is as easy as pressing Open apple-X to record a macro, followed by the function key you want and the associated keystrokes.

Press Open apple-X again to stop recording, and your new one-key command is ready to go to work for you.

Randy Brandt
Beagle Bros
6251 Ferris Square
Suite 100
San Diego, CA 92121

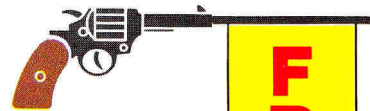
UPDATE

In our review of telecommunications software ("Link Up," May 1990, p. 50), we inadvertently omitted the program Modem MGR. Version 1.6 is available from MGR Software, 305 South State College Boulevard, Suite 101, Anaheim, CA 92806, (714) 993-0294.

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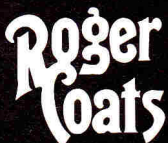
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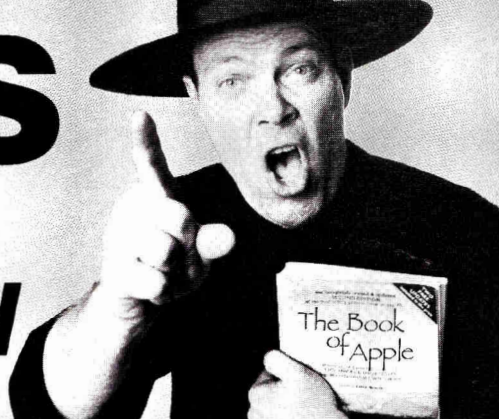
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2 Speakers & 15 watt amp
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Pack (8 HR, UPS) & Case
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RamFast/SCSI //c-GS SCSI Controller)
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SuperWriter 924 (GS 24 Pin Parallel Int)
\$69

Kurta ADB Graphics Tablet
\$249

Stay tuned next
month for Part III of:
**The Case of the
Kidnapped Canine.**

WHAT'S NEW

edited by Paul Statt

GUIDE FOR THE PERPLEXED

With tips on updates and maintenance, plus product recommendations and lists of suppliers, *Your IIGS Guide* is a complete reference and teaching aid that will help you better understand your GS system—its central processing unit, its peripherals, and its software. The book goes beyond the basics of GS computing. Its publishers believe that “understanding helps to alleviate frustration, prevent costly mistakes, automate decisions, and increase personal performance,” which “stimulates creativity and delivers an organized approach to computing.”

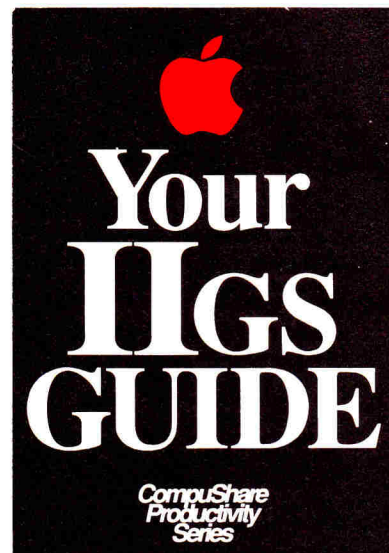


RESOURCES

The guide includes chapters on updating the Apple GS and taking care of it, as well as full, easy-to-understand

descriptions of how all the various parts work. *Your IIGS Guide* takes Apple's motto seriously—“The power to be your best”—and tries to bring the power of the GS to everyone. *Your IIGS Guide* is available from CompuShare, 1800 North Road, Bothell, WA 98012-6217, (206) 776-9890, for only \$21.95 plus \$2 shipping.

—P.S.



NETWORKS MADE EASY

It's been “the year of the educational computer network” for a decade now and you're still confused. What's a file server? Who's a token ring? Scholastic Software, a company that makes education programs that run on many networks, has taken the mystery out



RESOURCES

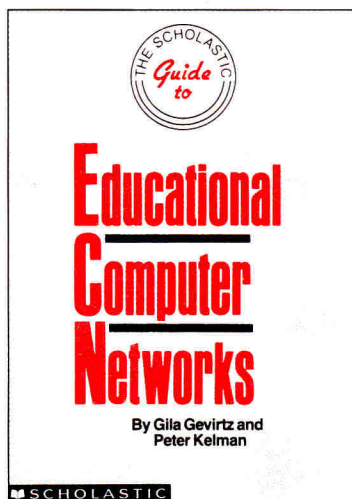
of it with an informative free booklet called *The Scholastic Guide to Educational Computer Networks*.

“As more school districts utilize the technology of networking, we are committed to assisting educators in creating the best possible networking environment,” says Peter Kelman, publisher of Scholastic Software. “Networks offer

numerous educational benefits and can provide more flexible and interactive instruction for students. However, the process of setting up and administering a network, as well as determining the appropriate educational applications, can be confusing and time-consuming. *The Scholastic Guide* was created to help educators not only understand this technology, but more importantly, to help them determine how it can best be used in education.”

The Scholastic Guide explains network vocabulary and concepts, includes tips on how to purchase and install a network, and features firsthand accounts by educators who are using networks in their classrooms.

Scholastic Software currently offers more than 50 network software products for AppleTalk, Corvus/Apple, DIGCARD, VELAN, and other systems. *The Scholastic Guide to Educational Computer Networks* is available free of charge to educators by calling Scholastic's Inquiry Department at (800) 541-5513, or circle number 353 for more information.





CALLBOX PROGRAMMERS ASSOCIATION

Need a little help from your friends? In an effort to provide better support for users of the company's GS programming utilities, So What Software recently announced the formation of the **CallBox Programmers Association** (CBPA).

For \$25 the CBPA provides a broad assortment of support materials for the Apple IIGS CallBox TPS programming system—

including a quarterly newsletter, technical notes, and sampler disks containing CallBox TPS-related templates, utilities, and code.

According to Bill Stevens, author of CallBox, the first CBPA mailing will consist of the newsletter, in which a standardized line-numbering system is proposed, among other items; some 12 technical notes, including descriptions of how to use GS/OS class 1 calls from BASIC and how to

allocate your own memory blocks; and a sampler disk containing CallBox templates for GS/OS version 5.0.2, sound, and the GS desktop, plus an ampersand (&) editor/interpreter for BASIC and a renumber/append utility for merging BASIC code fragments (including the aforementioned templates) with your own code. Accompanying hardcopy documentation is designed to clamp into your CallBox

manual binder.

For further information, send in your CallBox warranty card, or contact the CallBox Programmers Association, c/o So What Software, 10221 Slater Avenue, Suite 103, Fountain Valley, CA 92708, (714) 964-4298. —*W.K.*

RAM CARD



HARDWARE

Chinook's new **RAM 4000** board adds as much as 4 megabytes of random-access memory to your Apple IIGs. It uses standard 1-megabyte RAM chips and can be configured for 1, 2, or 4 megabytes.

The RAM 4000 follows Apple standards exactly. That means that it works on either ROM 01 or ROM 03 machines, and that it's compatible with direct memory access (DMA) devices such as Apple's new Apple II High-Speed SCSI Card. (See "New SCSI Card," What's New, June 1990, p. 14.)

The RAM 4000, like Apple's 1-megabyte memory-expansion board, is constructed using multilayer circuit-board technology, which provides an electronically quiet environment inside the GS. Chinook is confident that the RAM 4000 is "the most reliable memory board," and is backing it with a 30-day money-back offer and a five-year warranty. A RAM 4000 board with no memory is priced at \$74.95; 1 megabyte, \$159; 2 megabytes, \$245; 4 megabytes, \$417. For details, circle number 354 on the Reader Service card or contact Chinook Technology, 1811 Lefthand Circle, Suite B, Longmont, CO 80501, (303) 678-5544. —*P.S.*

DOUBLE YOUR DATA

AppleWorks 3.0 still has one small limitation—each database record can hold only 30 categories. But **DoubleData** from JEM Software overcomes that hitch handily, allowing as many as 60 categories per record. DoubleData even allows for importing text files using all 60 categories into database records, and exporting to spreadsheet files.

Hard-core AppleWorks database freaks will recognize the name Dan Verkade, author of DoubleData for JEM. He also created TimeOut ReportWriter, the relational report generator, for Beagle Bros.

DoubleData cost \$30 (that's only 50 cents per category), from JEM Software, P.O. Box 20920, El Cajon, CA 92921. Circle number 350 on the Reader Service card for more information.



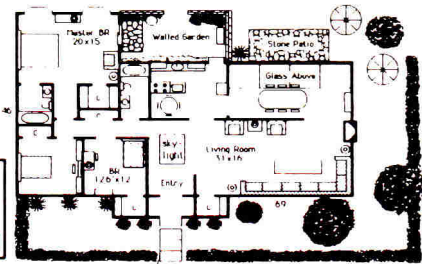
SOFTWARE



—*P.S.* ▶

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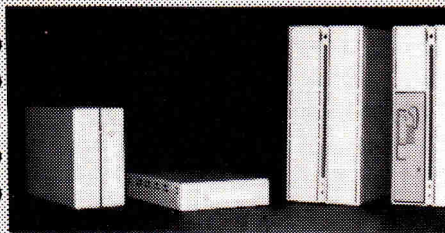
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WHAT'S NEW

GRAPHICWRITER III UPDATE

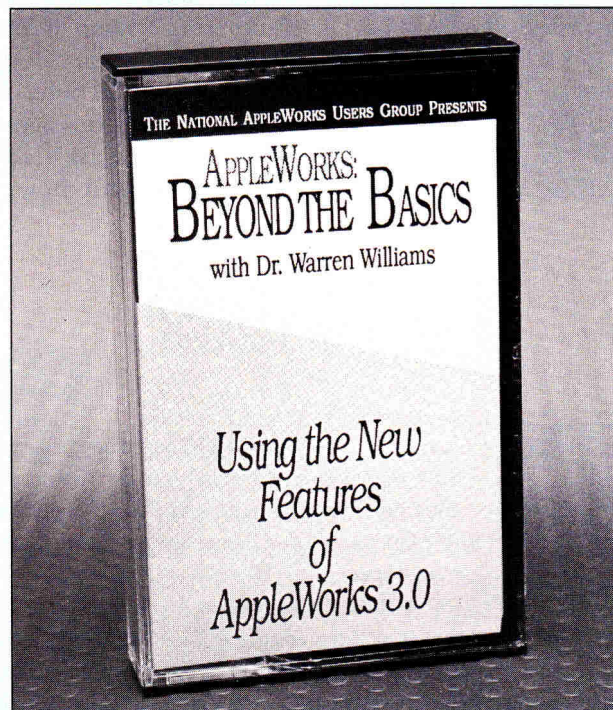


SOFTWARE

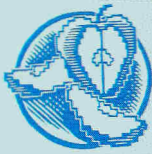
Now that **GraphicWriter III** is shipping (see Editors' Choice in this issue, p. 100), Seven Hills Software has been keeping busy filling back orders for the long-awaited Apple IIGS desktop-publishing program. If you have a copy of **GraphicWriter II** or even the original **GraphicWriter** from Datapak Software, you can upgrade to the latest and greatest: Simply return your original master disk along with \$25 to Seven Hills Software, 2310 Oxford Road, Tallahassee, FL 32304. Circle number 352 on the Reader Service card or call Seven Hills at (904) 575-0566 for more information. If you do want to upgrade, do it soon—the deadline is August 31, 1990.

—L.L.

LISTEN UP



Using the New Features of AppleWorks 3.0 is the latest hit release from Dr. Warren Williams and the National AppleWorks Users Group. Dr. Williams' easy, relaxed style on this audio tape makes it simple for you to learn to use more than 50 new functions of AppleWorks 3.0 as you sit at the keyboard or even as you drive to work. (Just keep your eyes on the road.) Ninety minutes of AppleWorks audio for only \$9.95, from NAUG, Box 87453, Canton, MI 48187, (313) 454-1115.



APPLE BITS

■ **II Infinitum**, a letter-writing campaign to "save the Apple II," is the brainchild of Jerry Fellows of Kentwood, MI. "I would like to see Apple actively promote the Apple II line," says Fellows, who first bought an Apple II in 1980. Fellows urges Apple II users to write to John Sculley at Apple Computer and to *The Wall Street Journal* and *inCider*, among others, "to let Apple know they're out there." But *inCider* already knows you're out there.

■ **Seven Hills Software** (Tallahassee, FL) is finally shipping **GraphicWriter III**. (See the accompanying story on the previous page, plus Editors' Choice in this issue, p. 100.) Also in development are an "information organizer" akin to an electronic notepad, and a **secret project** that will "directly affect any Apple IIgs-specific desktop-publishing or painting program—such as AppleWorks GS, GraphicWriter, or Medley," according to a company insider.

■ **Chinook** (Aurora, CO) hopes to build a **hard-disk drive** the size of a floppy drive.

■ **Randy Brandt** at **JEM Software** (El Cajon, CA) says he's hard at work on an **outliner** that works within **AppleWorks** on word-processing files.

■ **Will Beagle Bros** (San Diego, CA) ever release **Platinum Paint**, the killer GS paint program that grew out of Rob Renstrom's MiniPaint?

THE CRYLLAN MISSION



GAMES

Somewhere on the planet Crylla, the crew of the space ship *USS Houston* is lost. It's the year 2088, and your **Cryllan Mission** is to find them.

The **Cryllan Mission** is fantasy role-playing science fiction that uses the power of the Apple IIgs to let you just play the game—you don't have to worry about the details. You move effortlessly over Crylla by mouse and fight with Cryllan monsters by pull-down menu. All action takes place in screen windows, which move fast because Victory Software's **Cryllan Mission** uses the speedier 16-bit operating system GS/OS 5.0.

The **Cryllan Mission** comes on four 800K disks and requires a 1.25-megabyte GS. You can copy it to a hard-disk drive. The **Cryllan Mission** is available for \$69.95 from Victory Software, P.O. Box 821381, Houston, TX 77282, (800) 232-3828. For more information, circle number 351 on the Reader Service card. —P.S.

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- NEW GS157 100 color pictures of animals of every kind!* . . . \$9
- NEW GS158 100 color pictures of symbols, emblems, & logos* \$9
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*Requires Print Shop™ IIgs to use.

Graphics/Graphic Utilities

- GS63 Cheap Paint—full-featured color painting program (768K REQ.) (SHAREWARE†) . . . \$9
- GS121 DT Painter: fully-functional color pnt prog as desk access. (EDITOR'S CHOICE) \$9

Adult Graphics

- GS136, GS137 Adults-only slide show of 44 beautiful ladies (2 DISK SET) . . . \$18
- NEW GS154 Treasures In The Sand—adults-only, 24 lovely poses . . . \$9

Desk Accessories

- GS131, GS132 84 fonts San Francisco, Manhattan, symbols, pics, (2 DISK SET) . . . \$18
- NEW GS155 Find.It: searches disks for files, Screensaver, Write It, Sci. Calc, etc (SW†) \$9

Hyperstudio Stacks

- NEW GS168 Animations: Mickey Mouse, planets in orbit, + more (REQ HYPERSTUDIO™ TO USE) . . . \$9

Games

- GS27 Bounce-It!: IIgs adaptation of the Little BrickOut™ game (SHAREWARE†) . . . \$9
- GS86 Solitaire plus Wheel: Vanna's game on the IIgs! ★Best Seller . . . \$9
- GS89 Video Poker, Backgammon, and much more . . . \$9
- GS99 Pyramid: Solitaire card game from Ancient Egypt . . . \$9
- GS104 Monte Carlo, Poker, and Lotto.GS number generator . . . \$9
- GS116 Follower.GS, Miniature Golf, Metacrus adventure game . . . \$9
- GS117 Flight Simulator, Pinball, Galaxy, plus more games (SHAREWARE†) . . . \$9
- GS149 Senseless Violence, Lunar Lander arcade (SYS 5.02 OR NEWER) (SHAREWARE†) \$9
- GS150 Romulan.GS: 18 games, Worm, Shooting Gallery, more! (SHAREWARE†) . . . \$9
- GS151 Orbizone—like Asteroid™, and Othello, (REQ SYSTEM 5.02) (SHAREWARE†) . . . \$9
- NEW GS162 Gamble w/One.Arm.Battle or fight Rush.Hour traffic (NEEDS SYS 5.02 OR NEWER) \$9

Utilities

- NEW GS160 Virus.MD—scan your disks for known IIgs specific viruses + more . \$9
- ANY 10 DISKS FOR ONLY . . . \$59.95

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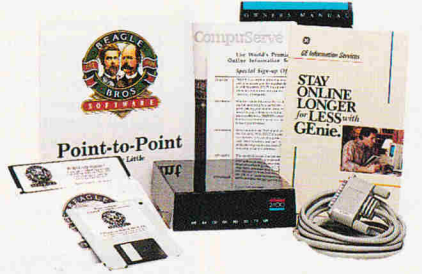
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**STATUS
REPORT**

REAL SCIENCE

By **PAUL STATT** * SENIOR EDITOR

Put your boat in
the water and
see where it floats,
then use your
computer to keep
track of your
findings.

THOR HEYERDAHL, NORWEGIAN explorer, ethnologist, and hero of my youth, once thought he had proven that the mysterious stone faces of Easter Island, the loneliest inhabited spot on earth, might have been carved by ancient South Americans who floated westward in tiny wooden boats. He built a raft and sailed it 2000 miles across the Pacific in 1947. The raft, and the book he wrote about it, were called *Kon-Tiki*.

Heyerdahl's work is controversial — but it's hard to argue against his method. Heyerdahl tested his theory by trying it. Direct experiment isn't, or wasn't then, controversial. But today a computer can replace an experiment.

Scientists no longer need to get dirty — or wet. A computer simulation I saw on the PBS television show *Nova* helped refute Heyerdahl's thesis about the origins of the Easter Island rock carvings. Taking into account information about weather, climate, and currents in the South Seas, as well as the navigational skills of the ancient Polynesians, it showed the routes they might have taken eastward to Easter Island.

Computer simulations are common these days. They certainly look convincing — pictures can't lie. But are they science? Science, according to the dictionary, is "knowledge gained through experience." What's gained from the experience of watching a computer simulation?

Some young people use simulations to study science; for instance, Operation Frog, from Scholastic Software, simulates dissection on the computer screen. It's bloodless and clean, and every student reaches the same conclusions. Is it science, or just an electronic way to look up the answer? Used effectively, however, the power of personal computers to interpret and communicate raw information can make real scientists even of grade-school kids.

The National Geographic Kids' Network is real science. In the 1989-1990 school year, each of some 3000 elementary-school classes around the world has been building rain collectors,

measuring the acidity of local rainfall, testing the effects of acidity on the environment, and, most importantly, sharing data with the other 2999 classes, from Argentina to the U.S.S.R.

Dr. John Miller, deputy director of the Air Resources Laboratory at the National Oceanic and Atmospheric Administration, thinks the acid-rain project is real science: "The network's data could supplement field projects the government will be running in the next few years to help determine the nation's strategy on acid rain." The Kids' Network may study land use, health, biological diversity, weather, and the water supply in the years to come.

The Kids' Network is funded by the National Geographic Society, the National Science Foundation, and (bravo!) Apple Computer. The project was developed by Technical Education Research Centers, a nonprofit organization in Cambridge, Massachusetts, that has quietly been changing the classroom in response to technology for 25 years.

Scientists gather facts and reach conclusions from those facts — they don't memorize somebody else's conclusions, no matter how impeccable the source. Scientists are as skeptical as journalists. But many citizens believe that global warming, for instance, is a scientific problem because they read about it in a magazine or saw it on TV. Some scientists believe global warming is a fact because their computer models prove it. And by using programs like Operation Frog, members of the next generation of scientists, now students, are learning that a computer simulation is reality. Teachers may think looking up the answers on a computer is "more scientific" than consulting an encyclopedia, but it's not.

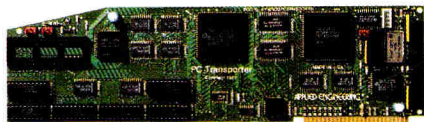
"Books must follow sciences," wrote Francis Bacon, "and not sciences books." Computers must follow science, too. Put your boat in the water and see where it floats, then use your computer to keep track of your findings and communicate them. Put your trust in the world, not in your computer. □



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DRIVING CRAZY

Disk IIs may be old, but they're not tired.

**Save yours if you can — it's worth it,
given the quality of "newer" drives.**

By WILLIAM P. KENNEDY, Ph.D.

DISK II SHIELDING

I HAVE AN APPLE IIE WITH TWO Apple Disk II drives purchased in 1983. Everything seemed to work fine — until recently. Now some of the new software either won't boot or, if it boots, won't operate properly: When it accesses the disk later, the drive makes an awful chatter and then the system "hangs."

I've had the biggest problems with copy-protected software (Reader Rabbit and Sticky Bear Math I, for instance), although I don't think copy protection is the problem, because I have several titles that have worked for years without a hitch.

I've tried interchanging my drives, and I've used a utility to set the proper speeds, all to no avail. Are disks made differently now, or is my system just too old and tired?

**Joseph Olinchak
Newark, Delaware**

Old and tired? Sounds familiar — but I don't think that's the problem, Joseph. Your Disk IIs can still come "up to speed" okay. At least, that's true according to your utility.

The only changes in the newer software titles I can think of are the copy-protection schemes. They often require that your drives be in tip-top condition — heads clean and properly aligned

and the disk speed set to or near 300 rpm. Cleaning and realignment by a service technician who can tell the difference between a read/write head and the pressure pad (some can't) solves most floppy-disk drive problems. That's if you can avoid the salespeople who'll try to convince you to purchase a new one.

The only other possibility, and this one's a bit remote, involves very old Disk II drives — ones usually manufactured before 1983 — but you never know how long yours might have sat on the shelf before you bought the Iie system.

Those ancient drives lacked proper shielding between the interface card and the rest of the mechanism. Some, mostly copy-protected, software is apparently sensitive to electrical interference and, as you've described, won't boot or will "hang up" shortly thereafter.

Try this to see if improper shielding is a problem with your drives. Expose the Disk II interface card by removing the four screws in the base and sliding the drive forward and out of its case. Then, carefully, free the interface from its mounts without disturbing the wire connectors: Remove the two fastening screws at the front and slide the printed circuit card out of the back clips.

Now insert a disk that has been giving you consistent problems and start up your Iie. If the program boots correctly while the interface card is lifted away from the drive, but not if the card is correctly mounted, you've found the fix.

What I've done in the past is glue a square of

aluminum foil to the back of a thin cardboard sheet that's been cut to the approximate shape of the Disk II interface card.

Insert that shield, with the foil face-down, on the bottom of the interface and reassemble the drive. Note that you don't have to "ground" the foil or connect it in any way to the drive — its presence is sufficient to disrupt any electrical interference among the interface, heads, and drive motor.

By the way, I have several Disk IIs that have been in consistent and reliable service for more than eight years, including some I've modified with the foil shield. Those drives have required only periodic cleaning and realignment. Save yours if you can — I think it's worth it, given the quality of more recent drives.

MONOCHROME GS TEXT

I IN A RECENT APPLE CLINIC column (October 1989, p. 24) you explained how to change the text and background colors on the GS. The procedure doesn't work for me — in fact, all my BASIC programs display text only in black-and-white, never in color. What gives?

**Meyer Slingsor
Knolland, WA**

You're not using an RGB monitor with your GS, are you, Meyer? Apple's user and technical manuals aren't clear on this point, clouded by the fact that the GS treats RGB versus composite video differently.

So let's part the clouds: The GS, in "emulation," or Iie, mode, won't display colored text on a "composite" (non-RGB) monitor. Conversely, you can't turn off the color when displaying text on an RGB monitor.

The reason is simple: Colored text, particularly 80 columns of it, is nearly unreadable on a ►

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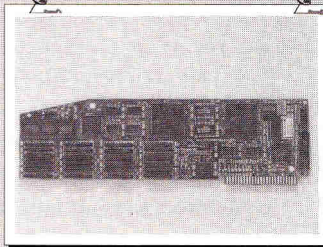
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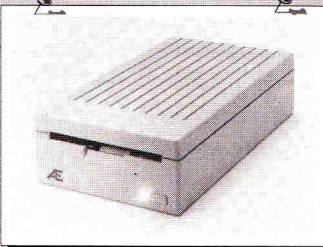
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composite or "NTSC"-compatible monitor.

The GS, therefore, and all the other IIs as well, automatically strip the color information, or "burst," from the composite video signal when displaying text.

All modes of GS graphics are also displayed only in color when using an RGB monitor. But you have the option of turning off that color when using a composite monitor: Simply set the display type to monochrome in your GS' Control Panel.

Thereafter, graphics displays appear in

shades of grey, eliminating the "spotty" patterns that color graphics generates on a black-and-white monitor.

CONTROL-PANEL UPDATE

IN THE AUGUST 1989 CLINIC (P. 24) you published an Applesoft program that disables access to the classic desk-accessory programs in the GS, ostensibly so that schools can keep students from chang-

ing the Control Panel settings. We're having problems using it as the "boot" program for AppleShare-networked Apple IIs. Do you have any other solutions?

Sam Morse
Fort Worth, TX

I should mention right away, Sam, that those fortunate enough to have purchased the newest 1-megabyte version of the GS needn't bother

Table. Modify the last two data values in the original Disable.CP program (August 1989, p. 24), line 110, according to your GS' ROM version.

Version	Data Values
original GS	156,180
ROM 01	224,181
ROM 03	26,186


with Disable.CP or CDALock (discussed below). They can use a simple hardware jumper to specifically disable access to the Control Panel without restricting access to other classic desk accessories.

Look for a pair of bare pins on an orange base, marked S1, located on the GS' motherboard center right as you face the front of the GS, and just to the right of a bank of chips marked Fast RAM. Use a commercially available jumper block to short those pins, or simply bend them together; just be careful you don't snap the jumper pins off. Thereafter, the Control Panel CDA won't appear in the menu when you press Open apple-Control-Escape.

And don't forget to remove or inactivate the Control Panel NDA (CtlPanel.NDA) in the System/Desk.Accs directory of your GS/OS boot volume. Neither the hardware modification nor CDALock (below) restricts Control Panel modifications by that NDA or by any other program.

Disable.CP, the program published in the Clinic you mentioned, actually suffers from a few disabilities: It can't launch a GS/OS application directly; it doesn't work with any GS desktop programs such as the Finder; and the ROM address of the "do-nothing" routine to which the Open apple-Control-Escape interrupt vector is redirected has been changed in each new GS ROM version.

In its defense, however, let's point out that Disable.CP is still a good method for restricting access to the Control Panels of older GSes if you



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don't want to boot GS/OS from a System Disk or network before you launch a ProDOS application. You'll probably have to update *Disable.CP* for your machine, however: Replace the last two data values in line 110 of the original *Disable.CP* program with those values in the accompanying **Table** that correspond to your GS' ROM version. The new 1-megabyte GS uses ROM 03; the rest of you probably have ROM 01 unless you bought your GSes when they were first introduced and haven't taken advantage of Apple's free ROM-upgrade offer.

For all other GS/OS-based applications, such as the GS' Finder and *AppleWorks GS*, use the routine *CDALock*, shown in the accompanying **Program listing**, to restrict access to the GS Control Panel and other CDAs. *CDALock* is a permanent initialization program (filetype \$B6) that, when found in the /System/System.Setup directory of your boot volume, loads and executes during GS/OS startup and remains active in memory, even in the presence of other GS/OS applications.

CDALock works similarly to *Disable.CP* by redirecting the Open apple-Control-Escape interrupt vector away from the ROM CDA handler to a "do-nothing" (CLC, RTL) routine. It differs from *Disable.CP* in that the do-nothing routine is part of *CDALock* and, hence, doesn't depend on the particular ROM version. Moreover, *CDALock* is set up as a "HeartBeat" task, and, therefore, your GS executes it automatically once every second. If it finds that an application has changed the CDA handler's interrupt vector (that's why *Disable.CP* doesn't work with the Finder, and so on), *CDALock* "steals" it back, thereby ensuring that Control Panel access is continually disabled.

CDALock worked with all the ProDOS and GS/OS applications I tested, including the Finder, *AppleWorks Classic*, *AppleWorks GS*, BASIC, and a couple of games — but I can't guarantee it'll work with everything. In fact, in

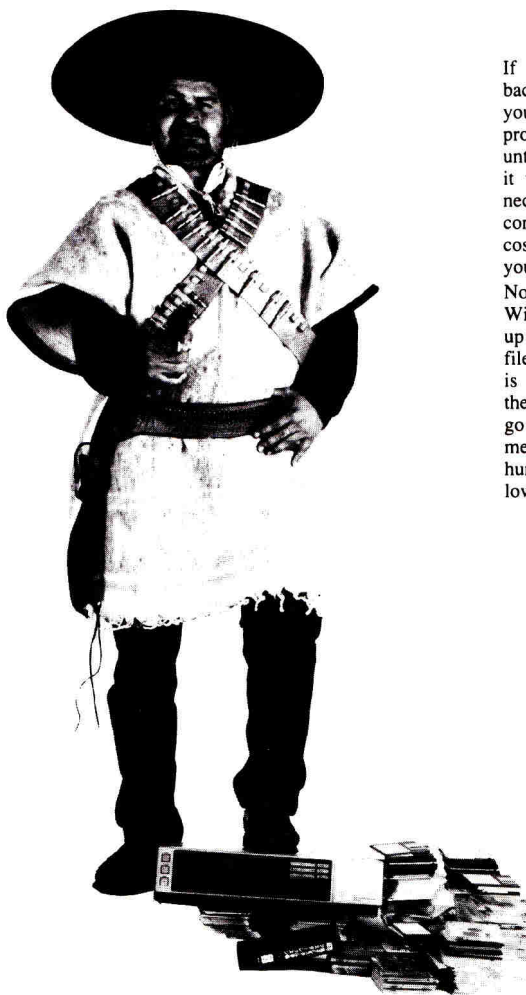
some cases it may cause an invisible version of "vector wars" and lock up your GS. If that happens, inactivate *CDALock* by either removing it from the System.Setup folder or "x-ing" the Inactive box when you select Icon Info from the Special menu in the Finder. Thereafter it won't load or execute when you restart your GS system.

Special thanks to Matt Deatherage at Apple's Apple II Developer Technical Services and Joe Abernathy, an inCider contributing editor, for their assistance in disabling the Control Panel.

Apple Clinic continues on page 26 with the initialization program listing *CDALock*.

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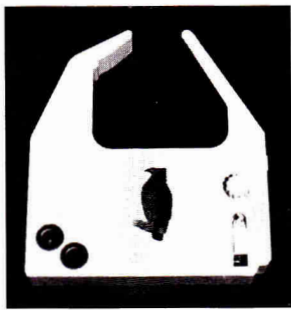
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QUICKIES

Special GS font characters from *AppleWorks GS*: Press and hold the option key, or the option and shift keys, together with another letter key. For instance, Option-S displays the Greek symbol beta; Option-Shift-K displays an apple.

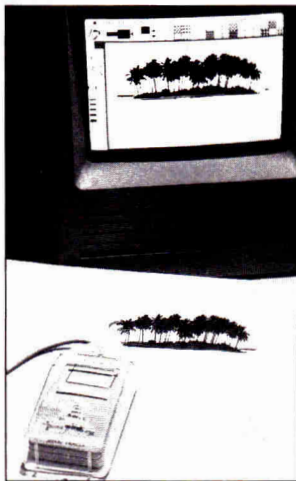
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Program listing. CDALock disables access to all GS Classic Desk Accessories (OA-Control-Escape menu), including the Control Panel.

```

;
;
; CDALock
;
; Locks out OA-control-esc access to GS's CDA's
; by Dr. Bill Kennedy
; Copyright 1990, inCider
; Compile with ORCA/M GS Macro Assembler,
; change filetype to $B6 (permanent GS/OS
; initialization file), and transfer to
; System/System.Setup of GS/OS boot volume.
; keep CDALock
; mcopy macros/ml6.tools1
; mcopy macros/ml6.msc
; mcopy macros/ml6.i.o
; gen on ;Expand macros
;
; LockInit installs the CDA lock as a VBL Heartbeat task.
; This portion executed only during GS/OS boot.
;
LockInit start
    using LockHdr
    phk
    plb
    putcr ;Print version message
    puts #'CDALock (inCider) v01.00',CR=T
    PH4 #LockHdr
    _SetHeartBeat
    rtl
    end
;
; CDA Lock Heartbeat task manager
;
LockHdr data ;Required task parms
    dc i4'0' ;Task pointer space
TskCount dc i2'1'
    dc h'5AA5' ;Req'd signature
    end
CDALock start ;CDA lock handler
    using LockHdr
CDAVNum equ $12 ;IRQ.DSKAccs vector id
    phk ;Current bank
    plb
    rep #$30 ;Use 16-bit m,x
    longa on
    lda #60 ;Execute once per second
    sta TskCount
    PH4 #0 ;Get current IRQ vector
    pea CDAVNum
    _GetVector
    pla ;Ptr to LockVect below?
    cmp #LockVect
    bne ResetLV
    pla ;LSW is; how about bank?
    cmp #^LockVect
    bne ResetLV2
    beq LockDone
ResetLV pla ;Clear stack
ResetLV2 pea CDAVNum
    PH4 #LockVect ;Change IRQ vector
    _SetVector
LockDone sep #$30 ;Restore to 8-bit m,x
LockVect clc ;Double-duty: Exit for task
    rtl ;and do-nothing CDA vector
    end
;

```


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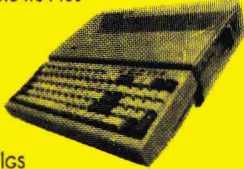
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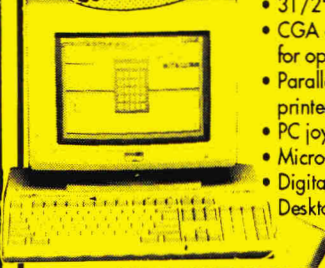
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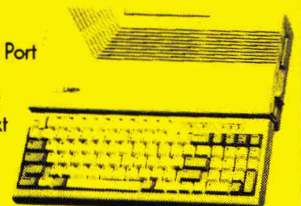
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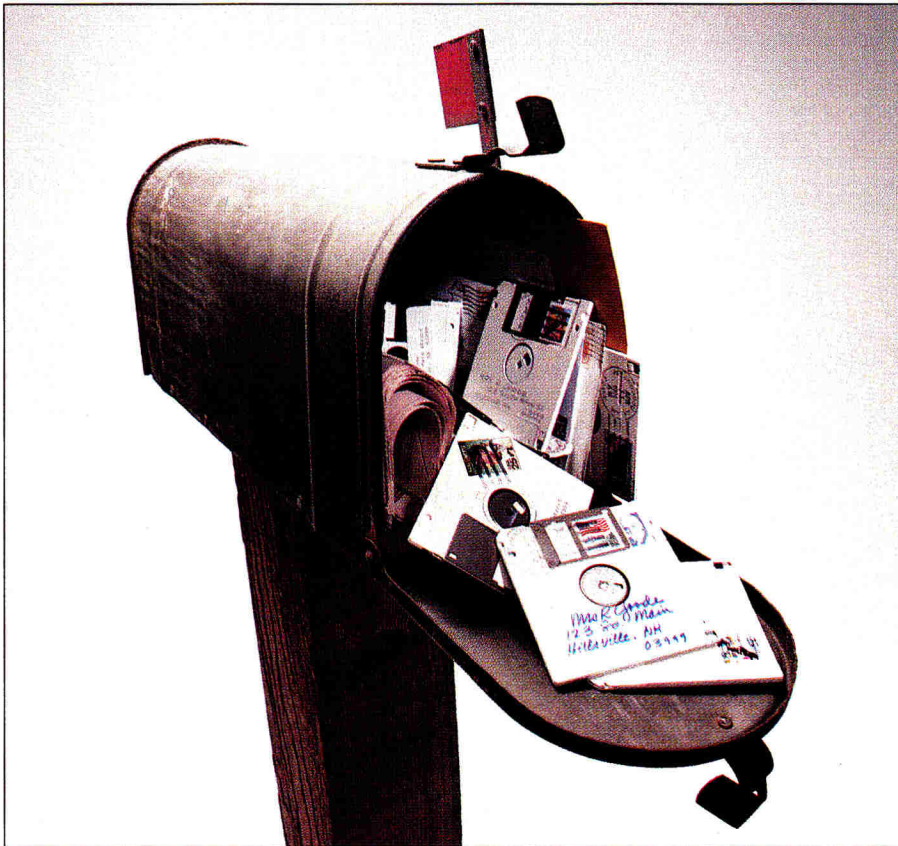
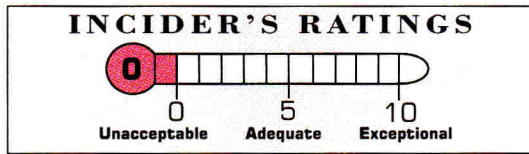
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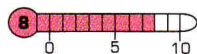
REVIEWS



SOFTDISK G-S

**SOFTDISK PUBLISHING,
P.O. Box 30008, SHREVEPORT, LA 72230-0008,
(318) 221-8718**

Productivity and entertainment software collections:
768K Apple IIgs; no copy protection; three-month subscription \$29.95,
six months \$49.95, one year \$89.95



Are you a real bargain hunter? Do you watch ads like a hawk for the best buys? Do you prowl the bulletin boards in search of discount treasure? Wait 'til you hear about this one.

Imagine buying a word processor, a full-featured paint program, an adventure-game authoring system, and a couple of arcade games for less than \$50. Think about adding to this assortment with a

collection of clip art, AppleWorks GS templates, and an on-screen jukebox. Throw in some new system fonts, Print Shop GS fonts, software reviews, technical advice, and a few desk accessories, too — that's what Softdisk G-S offers you.

Softdisk G-S is best described as a magazine on disk — and then some. In each issue, you'll find a magazine-type letters column, regular features, software reviews, and the main attraction — Softdisk G-S software. A new subscriber receives the current issue plus a system disk with the latest GS/OS. When you boot the disk, you're greeted with fabulous graphics. Even menu browsing is a treat because Softdisk's icons are all animated by a clever team of computer artists.

The Jukebox is one of Softdisk's regular features. You can choose from one of three musical selections, drop a quarter in the slot, and listen to an old-time jukebox — complete with bubbling lights — as it plays your choice of Music Studio tunes performed by musical wizard Gene Koh. It's a wonderful way to show off your computer — especially if you hook it up to stereo speakers. If you already have a collection of Music Studio songs, you can play them on the jukebox, too.

Each issue of Softdisk G-S features either a game or an application. A recent entry in the game department was the Softdisk Adventure Machine — a text-adventure authoring system complete with a sample adventure called Harry Ho.

If you're content to simply play the game, Harry Ho is a beginner's-level adventure that casts you as a private eye. Your nephew has been murdered, and in your quest for justice you'll brave the wilds of a local radio station, tackle a pit bull, and end up in a secret passageway. The game is completely mouse driven and ►



“Elegant, innovative, flexible and in all aspects the leader of the field.” — Incider Magazine

Accolades continue to pour in. Vulcan hard drives were recently awarded FIVE stars by Incider Magazine, a rating reserved for products judged “excellent and remarkable”. Incider went on to say, *“The Vulcan sets a new performance standard for hard drives . . . Applied Engineering has done it again.”*

Hard drives tremendously boost your productivity. The Apple II’s operating system, hardware and memory-gobbling software take on a new agility and finesse with the addition of a hard drive.

Speed? The IIGS Buyer’s Guide put it this way, *“Everything this drive does is fast. TimeOut modules, installed in AppleWorks and configured as disk-based, came up as fast as if they were memory-based. Graphics load almost immediately. Even that damnable lie, ‘One Moment Please’ suddenly delivers its promise. We recommend the Vulcan wholeheartedly.”*

And Incider said, *“The Vulcan walks all over the competition. Twelve seconds to the GS Finder; 10 seconds to AppleWorks GS. Sounds good doesn’t it? It is. That sizzling speed is achieved thanks to a high-quality internal tracking unit.”* Vulcan incorporates an ultra-fast 16-bit data bus controller, not the less expensive 8-bit others use.

Features? As Nibble Magazine said, *“AE drives support more operating systems and have more features in the supporting software.”* And Incider added, *“Applied Engineering has put together the most complete set of utilities to date for an internal hard drive that leads the market.”* And since Vulcan’s made by Applied Engineering, you’re assured of full compatibility with current and future AE products.

Power? Vulcan’s high-efficiency power supply is rated in excess of 70 watts, *nearly double* the capacity of other hard drives. The power supply components are heatsinked to the aluminum case for cool operation and long life. To harness all that power, Vulcan incorporates an ultra-quiet, flush mounted cooling fan, keeping the temperature inside the Vulcan, and inside your Apple lower than before.

Flexibility? Choose a Vulcan from 20, 40, 100 — all the way to 200 MEGs. Upgradeable Vulcan grows as your needs grow. And we don’t mean by daisy-chaining additional hard drives. When you upgrade Vulcan, you pop one out and *replace* it with another.

Only Vulcan lets you use virtually any operating system: GS/OS (v5.0 is included), ProDOS 8, DOS 3.3, CP/AM or Pascal 1.3. Vulcan supports them all with sixteen partitions

(access four simultaneously). Choose slot 1, 2 4, 5, 6 or 7. Even pseudo-slot to slot 7 from elsewhere. Vulcan works on 110/220 VAC, even European 115/230 VAC at 50-60 Hz.

Ease of Use? Incider says, *“The true test of a hard drive lies in its ease of use and maintenance. In that respect, the Vulcan brings together a more complete package that any of its current competitors.”* Vulcan simply pops in; replacing the Apple power supply under your computer’s hood. Our built-in firmware automatically installs itself as a Desk Accessory for write protection and partitioning. The software we provide lets you easily park heads, back up and reformat.

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requires no keyboard input. It's nice, undemanding fun that you can complete in a single sitting.

If you have enough patience, however, you can rework Harry Ho into your own original adventure. If you come up with a winner, send it along to the folks at Softdisk and they may just publish it. They also promise a game editor in a future edition.

Another Softdisk G-S game from a previous issue is Zappa Roidz — a mouse-driven addictive arcade game similar to



A good read, plus colorful software.

the classic Asteroids, but decked out with GS sound and graphics. You're at the helm of a spaceship, and your mission is to destroy deadly asteroids and alien ships.

All Softdisk G-S programs, including Zappa Roidz, are noncopy-protected, so you can install them on a hard drive and run them in seconds. Zappa Roidz is particularly fast, so if you're using Applied Engineering's TransWarp GS, expect a challenging workout unless you change your computer's speed.

GET TO WORK

Softdisk G-S also offers applications such as Soft Palette — a full-featured, professional-quality paint program that lets you see 256 colors on screen at one time. Soft Palette features a complete assortment of paint tools, such as lasso, fill, cycling, stencils, and so on. The module's multiple-color palette function is impressive and very easy to use. You can mix palettes, copy colors, and assign palettes to various horizontal segments of your picture. Like the other Softdisk G-S programs, Soft Palette has on-disk documentation, which you can print at the touch of a key.

Soft Palette is responsive and fast. Its only drawback is that it can load and save only screen files: You can't use Apple

Preferred or other picture files. For those of you with a large collection of clip art in other formats, or for those who want to print full-page graphics, it could be a serious flaw.

WordWorks, another application, is a nifty WYSIWYG (what you see is what you get) word processor that packs an amazing amount of power into a tiny package that loads in seconds. Although it takes up only 14K on disk, it offers most of the features included in high-priced commercial packages — all at a fraction of the cost. This little word processor, however, has some limitations. It offers no headers or footers, nor does it have a speller or thesaurus on board. Also, justification is global; that is, it centers or justifies all text in the file.

WordWorks' strong points, however more than compensate for its shortcomings. For example, with this application you can use all those fancy fonts you've been collecting — and you see them in color. (Unfortunately, Apple's ImageWriter driver doesn't translate these colors very well to paper.) On-screen text handling is smooth and fast, cursor movement is enhanced, and editing is similar to that in AppleWorks GS, with the usual cut, copy, paste, and numerous control commands. Find-and-replace also works well.

WordWorks does windows, too. It lets you keep several documents open at the same time, and the stack-windows feature lets you layer them automatically on screen. Selecting *Edit Next Doc* moves you quickly to the next open file.

To export files easily to other programs, you can save files either in proprietary format or as unformatted ASCII text. You can also add or delete files. A reversion feature calls up the most recently saved version of your file. If you need word, character, paragraph, or line counts, or if you keep tabs on system memory, you'll get your data by calling up *Information* from the menu bar.

You'll find no steep learning curve with WordWorks. Although its on-disk documentation is complete in just four pages, you probably won't even need to read it before you're off and running.

UNIVERSAL APPEAL

Softdisk truly offers something for everyone. Its help features and clear

documentation make it particularly easy for the neophyte to use. Even loading fonts and desk accessories to another disk — an operation that usually requires familiarity with system subdirectories — is simplified by an on-board file-transfer program.

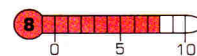
Yet Softdisk isn't just for the new owner. Its applications, clip art, AppleWorks GS templates, and desk accessories for programmers attract the serious user as well — and you'll have to go a long way to beat the price.

Sharon Webb
Blairsville, GA

ONCE UPON A TIME II

**COMPU-TEACH,
78 OLIVE STREET, NEW HAVEN, CT 06511,
(203) 777-7738**

Illustrated storybook-design program
for ages 6-12;
512K Apple IIgs, single 3.5-inch drive;
printer recommended; no copy protection;
\$59.95



Ask young children to choose between drawing pictures or reading stories and you may end up waiting for their decisions. It stands to reason, then, that if one program were to incorporate both activities, it would be quite popular with the younger set and represent a valuable addition to your software library. With that in mind, make room for Once Upon a Time II.

In just a few simple steps, kids design illustrated pages, write text to go along with the pictures, and link the pages together into a book. They can see their story in color on screen, and print it in either color or black-and-white. If they print in black-and-white, budding authors create not only a storybook but a coloring book as well. The package even includes pre-sharpened colored pencils.

EASY PIECES

Creating a storybook page is elegant in its simplicity. First, you select a suitable scene from the Background menu at the top of the screen and then choose the underwater, dinosaur, or forest motif. The background appears on screen along with a list of options you can select with a

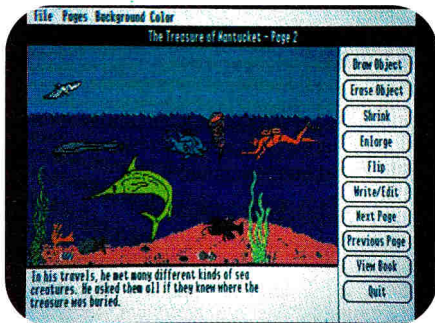
mouse. To “draw” pictures on your background, select the *Draw Object* button and a window opens to display the names of the available images. Type in a word and the picture appears on screen. You can add as many graphics images to your page as you like. It’s that easy.

Once you have a picture on your screen, you can manipulate it. Click on any object to activate it. Hold down the mouse button and drag the picture to change its position; pull down the Color menu to select a hue; click on the *Shrink* or *Enlarge* option to change size; use the *Flip* command to change the picture’s direction; or employ the *Erase* command to remove the object.

After you finish the illustrated portion of your page, select the *Write/Edit* option and you can add up to four lines of text. Page one of your masterpiece will be finished; to continue, select *Next Page* and a screen with your previously chosen background appears. You’re now ready to embellish it with pictures and words.

THE PLOT THICKENS

Now that you have an overview of how *Once Upon a Time II* works, a closer look will help you appreciate both the power and the educational value of this fine product. Good educational software, such



Fairy tales and storybooks. . . .

as *Once Upon a Time II*, usually employs several basic concepts to meet more than one educational objective.

To begin with, *Once Upon a Time II* “talks.” Making good use of the GS’ sound capabilities, the program clearly pronounces the word corresponding to each picture you select before adding it to the screen. In one stroke, a child receives practice in spelling (by typing the word), pronunciation (by hearing the word spoken), and keyboard usage.

Once Upon a Time II emphasizes another subtle concept with its *Shrink* and *Enlarge* commands. The program introduces the concepts of perspective and spatial relationships subliminally as children decide that “the fish looks farther away from the diver when the fish is smaller” or that “the man has to be bigger when he stands next to the squirrel.”

Kids also learn to discern and to create aesthetically pleasing color combinations when they manipulate pictures on a page. Changing the colors of each picture is so easy that children are encouraged to experiment.

IT’S ADAPTABLE

The creators of *Once Upon a Time II* recognize that as children grow and develop they change the way they play with the program.

While younger children rely more on illustrations to tell a story, older children use mostly words, adding pictures only to highlight the tale. Your 10-year-old might write an entire page of text, add an illustration to the next page, and continue with another page of text.

Other sophisticated options make *Once Upon a Time II* both easy and flexible. The *Copy Page* command is a great time saver because it lets youngsters duplicate the preceding page when they plan to create a similar new page.

In addition, global editing features such as *Insert Page*, *Delete Page*, *Swap Pages*, and *Clear Page* also attest to the power of this relatively simple-looking program. *Insert Page* is especially useful because gaps in the story line typically don’t appear until after much of it is written. With *Once Upon a Time II*, revising a story is no problem at all.

Another useful feature is the ability to change backgrounds on the fly. Although *Once Upon a Time II* includes only three themes, each one contains two or three backgrounds. For instance, a child can use those options to show the passage of time by switching from a day scene to a night setting.

PICTURE THIS

Once Upon a Time II does have two minor flaws, but neither detracts greatly from the program. For a picture to appear

on a background, a child **must** type the word from the displayed list. While this task can be beneficial for older kids, it can be frustrating for youngsters. The program should include an option to click on a word to select that picture. After all, the program emphasizes the creative design of a picture storybook, not typing skills.

The second drawback is that the program fails to make full use of its excellent speech generator. Although advertised as a talking version, the program takes advantage of this feature only when you type or click on a word. It would be more impressive if the program read the story page by page as it appeared on screen.

All in all, *Once Upon a Time II* is an excellent educational package. It would be nice to see additional background or art disks to enhance the overall value of the software, but the package includes enough graphics images as it stands to make *Once Upon a Time II* a program that your kids will use over and over again.

Jim Trunzo
Leechburg, PA

PROGRAM WRITER

BEAGLE BROS.,
6215 FERRIS SQUARE, SUITE 100, SAN DIEGO,
CA 92121, (619) 452-5500

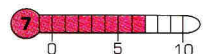
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any Apple II with either DOS 3.3 or ProDOS 8;
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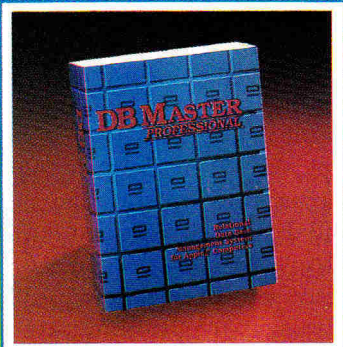
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Continued on p. 82

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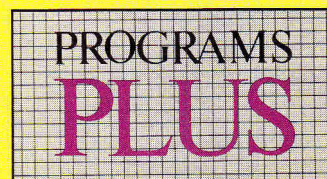


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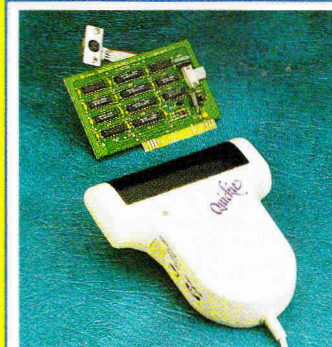
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Alpha Check v3.0..... 29.
- Addison-Wesley**
Wordbench (AP & GS)..... 95.
- Beagle Bros.**
Timeout MacroTools
or MacroTools II..... 19.
Beagle Write Desk Accessories
or Font Pack 1 or 2..... 29.
Beagle Write Picture Manager..... 29.
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or Timeout MacroEase. SPECIAL 29.
Beagle Bros. Clip Art 1(GS)..... 35.
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or DeskTools..... 35.
Timeout Thesaurus, DeskTools II
or PowerPack..... 35.
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Timeout TextTools..... 35.
Timeout UltraMacros
or SpreadTools..... 45.
Beagle Bros. Desk Accessories(GS)..... 45.
Timeout SuperFonts or QuickSpell.. 49.
Timeout ReportWriter
or Beagle Write..... 59.
Timeout Graph..... 65.
Beagle Write(GS)..... 69.
Timeout Performance Pak
(DeskTools, II & PowerPack)..... 75.
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- Timeout Decision Pak(Graph,
SpreadTools & SideSpread)..... 99.
- Broderbund**
On Balance..... 39.
Bank Street Writer Plus (AP or C+). 50.
- Claris**
Apple Works v3.0..... 175.
Apple Works(GS) v1.1..... 209.
- Dac Software**
Dac-Easy Accounting..... 65.
- Intuit**
Quicken..... 39.
- Manzanita**
BusinessWorks Payroll (AP & GS)..... 109.
BusinessWorks Bundle AP & GS
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A/R, Inventory)..... SPECIAL 269.
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v4.0 (AP & GS)..... 95.
- Mecc**
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Tracking/Inventory..... 139.
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Dollars and Sense..... 79.
- Nolo Press**
Will Maker v3.0..... 39.
- Sensible Software**
Sensible Grammar
ProDods (AP & GS)..... 55.

Seven Hills Software

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- Disk Access..... 32.
- Graphicwriter III(GS)..... 85.

SoftSpoken

- Cross-Works v2.0..... 69.

Stone Edge

- DB Master Professional
(AP & GS)..... SPECIAL 195.

Timeworks

- People, Places and Things,
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Education Graphics, Font Pack 1
or 2 (AP & GS)..... 27.
- Graph It!..... 45.
- Art Portfolio 4 in 1..... 74.
- Publish-It v3.0(AP & GS)..... SPECIAL 74.

Word Perfect Corporation

- WordPerfect (AP or GS)..... 109.

Modems

Anchor Automation

- 2400E..... 155.

Applied Engineering

- DataLink Modem 2400B
(Int AP & GS)..... 175.
- DataLink Express Modem..... 199.

Practical Peripherals

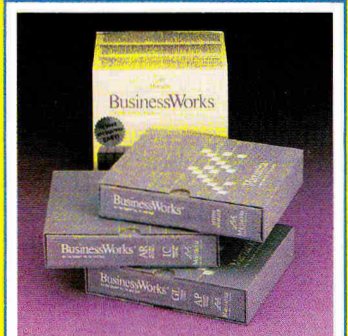
- Practical Modem 2400 SA..... 179.

Prometheus

- Pro Modem 2400A (Single Card).. 129.

Supra Corporation

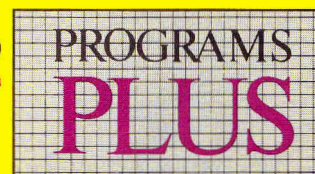
- SupraModem 2400
(Hayes Compatible)..... 119.



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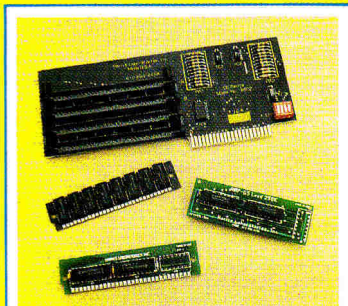
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A.E.C.	
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Barron's	
Computer SAT Revised Version.....	34.
Britannica	
Designasaurus(GS) or Revolution '76(GS).....	29.
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Algebra 1: 1st & 2nd Semester.....	48.
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Playroom.....	27.
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Where in the World is Carmen Sandiego?(GS).....	29.
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Science Tool Kit Master Module.....	55.
Geometry(GS).....	55.
ByteWorks	
Ugly Duckling(GS).....	32.
Compu-Teach	
Joshua's Reading Machine (AP or GS & C+).....	27.



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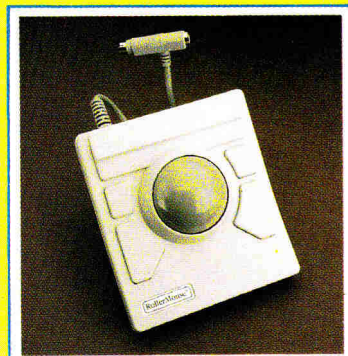
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Davidson & Associates	
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Alge-BlasterPlus(AP or GS).....	34.
Read 'N' Roll or Word Attack Plus(AP or GS).....	34.
Spell-It Plus(AP or GS) or Math Blaster Mystery(AP or C+).....	34.
Talking Math & Me(GS) or Talking Reading & Me(GS).....	34.
Word Attack Plus Spanish or French.....	34.
First Byte/Electronic Arts	
The Rhyming Notebook.....	29.
Grade Busters Corporation	
Grade Busters 4,5,6.....	42.
Grade Busters 1,2,3.....	75.
Great Wave	
Kidstime II (GS).....	24.
Lawrence Productions, Inc.	
McGee(GS) or Katie's Farm(GS).....	SPECIAL 29.
Learning Company	
Magic Spells(AP or GS) or Gertrudes Secrets(GS).....	24.
Reader Rabbit or Math Rabbit(AP or GS).....	24.
Think Quick(AP or GS) or Writer Rabbit(AP or GS).....	30.
Reader Rabbit(GS).....	36.
Writing and Publishing Center(AP or GS).....	36.
Mindscape	
Crossword Magic.....	34.

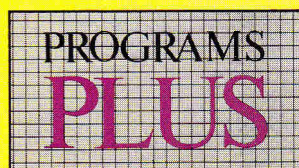
Orange Cherry	
GS Talking Series:	
Animals, Dinosaurs, Numbers, First Write, First Reader, School Bus, Alpha Chimp, Colors & Shapes, Reading Railroad, Addition & Subtraction, ABC's, Speller, Clock or Money.....	42.
Pelican Software	
Dinosaur Days.....	24.
Monsters & Make Believe Plus.....	29.
POW! ZAP! KER-PLUNK!.....	35.
Roger Wagner	
HyperStudio(GS).....	89.
Sensible Software	
Report Card II(AP & GS).....	37.
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Typing Tutor IV Plus(AP or GS).....	27.
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Mavis Beacon Typing.....	28.
Mavis Beacon Typing(GS).....	33.
Spinnaker	
Facemaker: Golden Edition or Kidwriter.....	27.
Atlas Explorer or Kidwriter Gold(GS).....	35.
Terrapin	
Terrapin Logo Plus.....	79.
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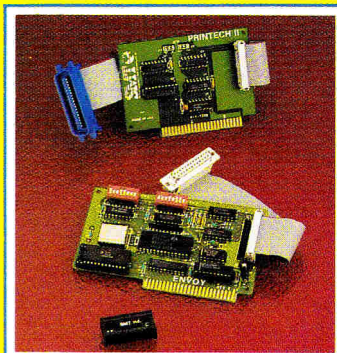
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w/Serial Interface..... 235.
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Laser 128 Computer..... 349.
Laser 128EX Computer..... 389.
Laser 128EX II Computer (5¼)..... 429.
Laser 128EX II Computer (3½)..... 469.

Printers

Apple
ImageWriter II.....459.
Brother
M-1109AP
(ImageWriter Compatible).....225.
Laser Computer, Inc.
Laser 190A w/ Serial Interface.....235.
Seikosha
Seikosha SP 1000
(ImageWriter Compatible).....229.

Printer Interface Cards

Apple
SCSI Card..... 109.
Apple Super Serial Card..... 119.
Applied Engineering
Parallel Pro..... 79.
Serial Pro..... 109.
Orange Micro
Grappler Plus (AP & GS).....75.
Grappler 9 pin.....78.
SMT
No Slot Clock.....SPECIAL 30.
Print Tech II.....SPECIAL 33.
Envoy.....SPECIAL 59.

Backup Utilities

Alpha Logic
Locksmith v6.0..... 36.
Apple
GS/OS v5 (GS)..... 45.
Central Point
Copy II Plus v9.0..... 25.
Glen Bredon
Dos.Master or Pro.Cmd..... 25.
ProSel 8 (5¼)..... 37.
ProSel 16 (3½)..... 57.
Vitesse, Inc.
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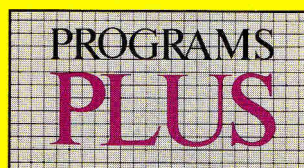
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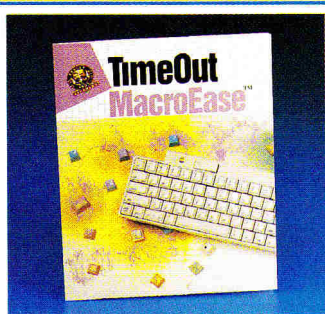
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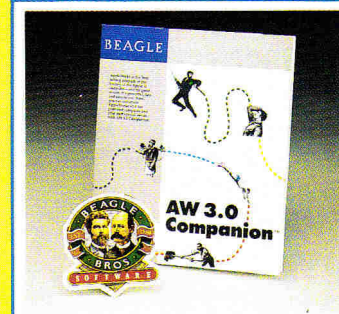
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Datasoft
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Micro Revelations
 Xenocide(GS).....30.
Mindscape
 Hostage(GS).....29.
 Captain Blood(GS).....29.
 Deja Vu II(GS) or Balance of Power 1990(GS)....32.
New World Computing
 Might & Magic or Might & Magic II. 36.
Origin Systems
 Times of Lore(AP & GS) or WindWalker.....27.
 Space Rogue, Knights of Legend or Omega(AP or GS).....34.
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 Mother Goose(AP or GS).....19.
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 Test Drive.....27.
 Mean 18(GS) or Hardball(GS).....29.
 4th & Inches(GS) or FastBreak(GS). 29.
 Heatwave(GS) or Grand Prix Circuit(GS).....29.
 Jack Nicklaus Golf(GS) or Blue Angels(GS).....34.
 Third Courier(GS) or Test Drive II(GS).....34.
Activision
 Blackjack Academy(GS).....17.
 Sky Travel(AP & GS).....34.
Artworx
 KaleidoKubes(GS).....14.
 Bridge 6.0(AP or GS) or Strip Poker II(GS).....27.
BlueLion
 Ticket to Hollywood or London.....27.
 Ticket to Paris or Spain.....27.
 Ticket to Washington D.C.....32.
Britannica
 Laser Force(GS) or Gnarly Golf(GS). 18.
 Great Western Shoot-Out(GS).....18.
 JigSaw(GS) or Task Force(GS).....24.
Broderbund
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 Wings of Fury(AP & GS) or Prince of Persia.....24.
 Ancient Art of War or Ancient Land of Ys(GS).....30.



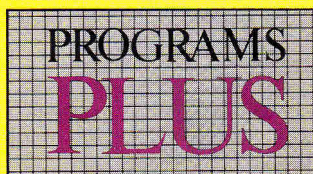
Electronic Arts
 Marble Madness(GS) or World Tour Golf(GS).....15.
 Music Construction Set(GS) or Skate or Die(GS).....15.
 Bards Tale II.....18.
 Cartooners(GS), Bards Tale II(GS) or Pipe Dream.....22.
 Zany Golf(GS) or King's Bounty.....26.
 Earl Weaver Baseball.....26.
 Bards Tale III or Madden Football... 32.
 Instant Synthesizer(GS).....35.
FTL
 Dungeon Master(GS).....27.
Infocom
 Zork Trilogy or Leather Goddesses of Phobos.....14.
 Beyond Zork(AP or GS) or Battle Tech.....34.
 Zork Zero, Journey or ShoGun.....34.
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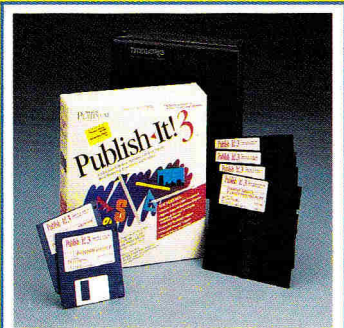
Gold Rush(AP or GS) or Black Cauldron(GS).....26.
 Kings Quest IV(AP or GS).....32.
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 ManHunter New York(AP or GS) or Police Quest(AP or GS).....32.
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Sublogic
 Jet.....15.
 Flight Simulator II.....32.
Taito
 Arkanoid, Bubble Bobble(AP & GS) or Renegade(AP & GS).....10.
 Arkanoid II(GS) or Rastan(GS).....24.
 Qix(AP or GS).....24.
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 Warlock(GS) or Dark Castle(GS).....33.
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Xetec Inc.

Superwriter 924 (GS,C+,C).....	SPECIAL 79.
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Accessories

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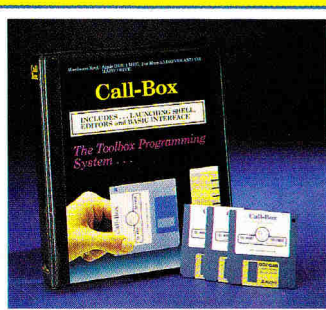
Advanced Gravis' JoyStick(AP & GS).....	39.
MouseStick ADB(GS).....	69.

Apple Computer

Apple Mouse //c.....	85.
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Digital Vision

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RC Systems

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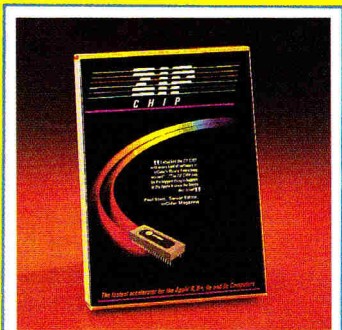
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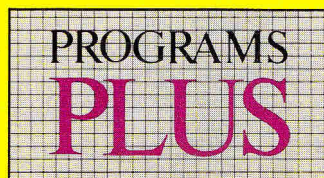
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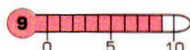
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Add-on disk for Jack Nicklaus' Greatest 18 Holes of Major Championship Golf; 512K Apple IIgs, Jack Nicklaus program disk; off-disk copy protection; \$21.95



If I were a rich man — or a professional golfer — I'd travel around the world playing championship golf courses. Since I'm neither of those, the closest I'll ever come is the local country club and the courses of Jack Nicklaus' Greatest 18 Holes of Major Championship Golf.

This latest addition to the world of Jack's Greatest, the International disk, gives you a choice of three championship courses in Australia, England, and Japan, all designed or redesigned by Jack Nicklaus himself.

The Australian Golf Club in Kensington

is the most scenic — and the most difficult. The long, rolling fairways are lined with trees just waiting to snatch your ball from flight. The Saint Creek Golf Club in Nagoya resembles an artistically crafted Japanese garden with winding brooks and rolling hills. (When you're playing the course, however, you'll find it considerably less serene.) The St. Mellion Golf & Country Club in Cornwall is another long course, but it's more a links-type layout, with few killer trees. I liked this one a lot.

A digitized shot of the Golden Bear himself appears between holes to offer a bit of advice. It would be nice if you could just click through these interludes and get right to the tee — because more often than not, Jack's bit of Zen golf wisdom is something like the advice he offers before the first hole at St. Mellion: "Drive straight, and as long as you can." Hmm, I probably wouldn't have thought of that. Thanks, Jack.

If the folks at Accolade really wanted to spice up the between-hole screens, they could have thrown in some true golf jargon: "Shoot a banana ball for a good approach, but make sure it holds its head. Don't chili-dip the second shot or you'll have a real tester once you get on the dance floor." Translation: Try to get your drive to arc to the right for good position on your second shot, but don't slice too much. Don't blow your second shot, or you'll have a difficult time when you reach the green.

That complaint aside, there's nothing else that detracts from the truly world-class experience of the golf courses on the International disk. Come in at or under par on any of them, and you deserve congratulations. Tee it high and let it fly. ▶

Lafe Low
inCider staff

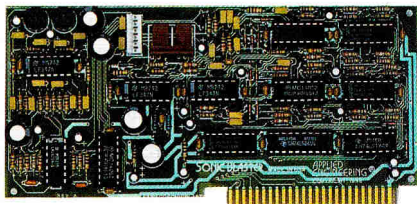


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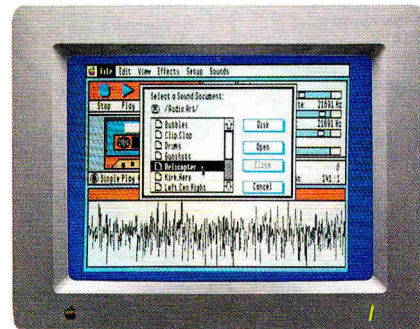
We designed Sonic Blaster to be complete. Here's a quick tour of part of the software screen:

The Buttons

Stop, Play, Pause and Record buttons, perform the same functions they do on a tape recorder. Also included are Single and Continuous Play buttons and a VU Meter to visually represent input levels.

The Sound Graph

The Sound Graph is the waveform at the bottom of the screen. Portions of the Sound Graph are selected with the mouse and then edited using the cut, copy and paste options within the Edit menu.



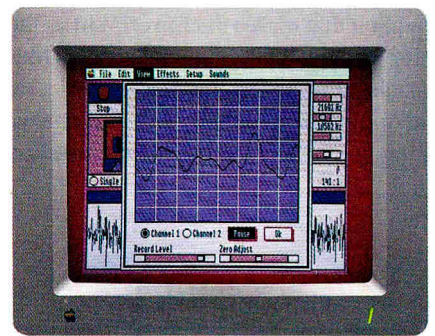
Seventeen sound effects to get you started. Add your own collection of sounds.

The Bars

The Volume bar controls amplitude of the playback. Playback and Record mode sample rates are adjusted with the next pair of bars and the Record Level bar adjusts the level from the source connected to the Sonic Blaster's input connector.

The Blocks

Three blocks give readouts of file length, available memory, bytes selected and resolution ratio.



"See" the sound on the oscilloscope.

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Sonic Blaster

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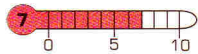
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MINES OF TITAN

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Adventure game;
128K Apple IIc/IIe, GS in IIe emulation mode;
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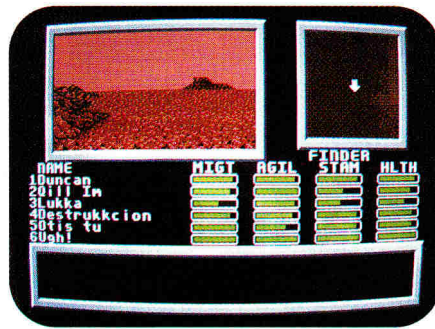


Nobody could accuse you of lacking an adventurous spirit, but this may be taking things a bit too far. Here you are, a working stiff delivering cargo to the moons of Jupiter, when you have a little trouble landing and find yourself in hock to the company store.

To get out of this tangle, you'll have to fight your way through the riffraff of the solar system, best the bizarre denizens of Titan, and penetrate a web of corporate bungling that makes the Exxon Valdez disaster of the late 20th century look like harmless fun. Infocom's newest game for the Apple II combines a story line worthy of the publisher's name with an interface

as good as any in the adventure world.

The universe of Mines of Titan is nearly as extensive as a Bard's Tale. Combat can be entirely manual, entirely computerized, or a combination of both; on-screen maps are built as you explore; and party maintenance is convenient. You spend your



The hunter becomes the hunted.

time exploring, rather than mapping and doing housekeeping chores.

The story line is exceptional — every devious twist and turn of it. It looks as though you'll have to hire yourself out as a bounty hunter to get off this rock. The

native inhabitants of Titan — not to mention the mutant gangs of humans who live on the outposts of society — don't care much for you and your kind, and the rule of law and order is breaking down. There's a good reason the Titanians despise you, although it won't become apparent for some time. If you conduct a careful investigation (and snoop in your secret information packet), you can gain a lot of insight as to why you're so universally loathed. The answer to their antagonism is incisive, if you'll excuse the pun.

Ultimately, your mission is to determine why the company has lost contact with Proscenium, the newest and most promising of Titan's mines. Negotiation may be the key to gathering the resources you'll need to get off this desolate moon alive.

Mines of Titan is good fun — a solid return on your entertainment dollar, taking weeks to complete without growing painfully dull. It's captivating — another winning game in the Infocom tradition.

**Joe Abernathy
Houston, TX**

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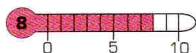
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DARK CASTLE

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Arcade action;
768K Apple IIGs; no copy protection; \$44.95



Who (or what) else would live in the Dark Castle but the Black Knight? Plenty, but please don't let that stand in your way.

If you're ever going to find and defeat the Black Knight, you'll first have to work your way through some of the most bizarre caverns and dungeons you've ever encountered — filled with all sorts of devilish beings you'd imagine only in your worst nightmares.

Already a popular game for the Macintosh, Dark Castle for the Apple IIGs is essentially the same, but now all the dungeons and their creepy, crawly inhabitants are in color.

You'll fight off bats, rats, mutants, evil rock-

throwing and whip-bearing henchmen, and a whole slew of other outrageous denizens.

You're armed only with a pile of rocks, although you can pick up other helpful things along the way, such as a health elixir, a mace (which you'll need to get by the jailer in the dungeon level), and a



Things that go bump in the night . . .

variety of other things I haven't found yet.

As if that weren't tough enough, you'll have to hop, leap, jump, and climb at just the right moments to get where you have to go.

At the Fireball 2 level, for instance, watch out: You'll have to descend through an icy,

bat-infested cave by jumping — at precisely the right time — from floating rock to floating rock.

Miss a jump, and you end up in the water. Wait too long, and a stalactite will fall on your head.

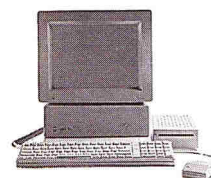
Dark Castle has three difficulty levels, plus a practice option, which gives you an unlimited number of lives.

Exploring as many of Dark Castle's levels as I could reach was a blast in practice mode at the beginner level. I couldn't imagine getting anywhere at the advanced level. You'd have to log some serious hours to become that proficient.

In that respect, Dark Castle is great. Be prepared — it's one of those games that are relatively simple to learn, yet extremely difficult to master.

Dark Castle will keep you going long after you said you were going to quit — long after the lights go out and the things that go bump in the night start coming out to bump you. □

Lafe Low
inCider staff



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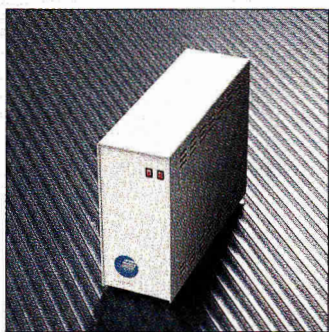
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... A HARD DRIVE IS GOOD TO FIND



CMS SD45RM/A2S

ANOTHER *INCIDER* ARTICLE ABOUT hard-disk drives? You bet. We're not beating a dead horse — several new drives have appeared on the market recently, most notably the removable-cartridge variety. In addition, the new **Apple II High-Speed SCSI Card** not only leaps tall buildings in speed and performance, but also makes all those Macintosh-bound SCSI (small-computer-systems interface) hard-disk drives even more attractive as additions to your Apple II. (See "New SCSI Card," *What's New*, June 1990, p. 14, for details.)

There's no point in belaboring the many reasons why you should think seriously about purchasing a hard-disk drive. The primary reason is simple, if not blatantly obvious: You want to avoid the floppy-disk shuffle. Instead of starting up your computer with a different disk for each program and storing your letters, spreadsheets, databases, and so on on a pile of floppies, you can put most of your applications as well as your data in one place — a hard disk. Centralized storage helps you organize your computing time and resources better so that your productivity software can make you even more productive.

WHAT'S IT ALL ABOUT?

In this article, we'll discuss what goes into a hard-disk drive and what to consider when purchasing a mass-storage device. To better help you make your decision, we've tested a selection of popular 40- to 50-megabyte drives connected to both an Apple IIe and a GS. The results of those hard-disk labors are discussed later in this article. (See the accompanying **Table**, as well.)

Size, speed, and price are the usual considerations when purchasing a hard-disk drive; those areas are a good place to start, but after we cover the basics we'll complicate matters with some

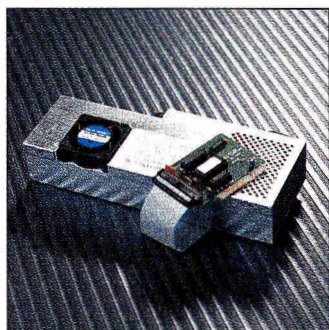
other considerations that are just as important.

The phrase *hard disk* is simply descriptive: The platter inside the drive's housing on which your computer programs and data are stored is inflexible. That rigidity is necessary to hold the fine magnetic medium in near-perfect proximity to read/write heads so that the density of stored information is greatly increased compared to that on floppy disks. A solid platter is also necessary to withstand the high speeds at which the disk spins; the increased speed lets the device handle and store data much faster than a floppy-disk drive can.

A hard-disk drive's data-storage capacity is measured in *megabytes*. One megabyte (M) is 1024 *kilobytes* (K), or 1024 times 1024 bytes. ProDOS and GS/OS typically use *blocks* as a storage measure. One block is 512 bytes, or .5K; so 1M is equal to 2048 blocks, for example. In comparison, 3.5-inch and 5.25-inch floppy disks hold 800K and 140K bytes, respectively. You can store literally hundreds of floppies' worth of data or programs on a single hard disk.

The most popular hard-disk drives these days hold about 40M, although you can find some that hold as little as 5M or more than 100M. A rough way to measure your storage needs is to count the program and data floppy disks you use, multiply the sum by their storage capacity (either 140 or 800), and multiply that by 5.

Careful, though: Without special utilities, ProDOS, the disk-operating system used most often with 8-bit Apples (IIe, IIc, IIc Plus, and II Plus), can access only up to two 32M "volumes" or "partitions" (64M total) on your hard disk. GS/OS, the operating system of choice for the 16-bit GS, has no such limitation. However, most software written for the older, 8-bit machines, such as AppleWorks Classic, retain that 64M



Ingenuity InnerDrive

Looking for extra speed and storage space?

How much is enough — and how much is too much?

What should you watch for in terms of position, noise, and

parking problems? What's the going price of support?

The test results are in — if you're in the market

for a hard-disk drive, *inCider* has the answers.

barrier because they use ProDOS even when executed from a GS.

Don't get obsessed with size, however. Choose only those programs and data you use often to calculate your needs. Remember that drive maintenance — backing up your hard disk and so on — is a necessary evil for hard-disk owners. (See "Do You Know Where Your Data Are?" May 1989, p. 54, for details.) The larger the drive, the more laborious the maintenance and the bigger the disaster should your drive develop problems.

Speed — how fast you can retrieve data and programs or write to disk — is perhaps the most complicated and misleading issue to resolve when shopping for a hard drive. Advertisements often tout speed in terms of "access" times; average access is the time it takes for the disk to move its read/write head from one section of the disk to another. The lower the average access time the faster the drive will execute a disk-intensive operation, such as a database search.

Access times, however, are only one part of the story. Manufacturers use similar, sometimes identical, hard-disk mechanisms in their drives. Where the drives differ is in the speed of the interface card and the unit's internal circuitry, in the utility software that formats and maintains the drive, and, in the case of the GS, in the GS/OS driver — a collection of disk-handling software. A drive's speed depends not only on mechanical operation, but on a number of other factors that add up to a more revealing and accurate measure of speed: the data-transfer rate. That's why we've performed our "real world" benchmark tests of a number of hard-disk drives.

THE PRICE OF TECHNOLOGY

Any purchasing decision, of course, involves price. As you'd expect, lower-capacity drives do

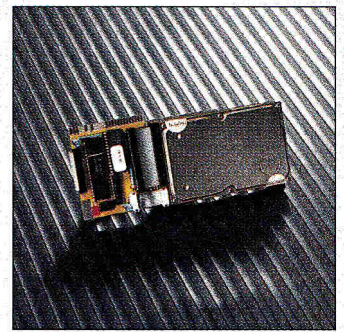
typically cost less than larger ones. Also, mass-storage technology advances every year; you may find that the drive you purchase today will be obsolete in five years. Accordingly, make sure you choose a size that realistically fits your current and short-term future needs. And don't hesitate to purchase a more expensive drive if it provides you with better support. An established reputation for quality and Apple II-specific support software are just two of the many factors that overshadow price.

One type of drive that carries a bigger price tag and that you may not have considered before is the *removable-cartridge hard disk*. Similar to a floppy, the hard disk itself is encased in a protective cartridge you can remove and replace with another disk. The entire mechanism represents a greater cost per megabyte than that of comparable "fixed" hard-disk drives. Additional disk cartridges, which typically have a capacity of about 45 megabytes, cost a fraction of what you would pay for a second hard-disk drive, however. If you own both an Apple II and a Macintosh, a removable-cartridge drive can serve double duty: Because it's Apple SCSI-compatible, you can switch it between the two computers. Just format one cartridge (or more) for the Apple and another for the Mac.

COMPLICATING CONCERNS

If choosing a hard-disk drive were simply a matter of finding the fastest and largest to fit your budget, things would be easy. For the Apple IIc owner, it's that simple. Chinook Technologies is currently the only manufacturer that makes hard-disk drives (the CTxc series) that plug into the external disk-drive port on the back of that machine.

Apple II owners who want to share a hard-



Cirtech InSyder

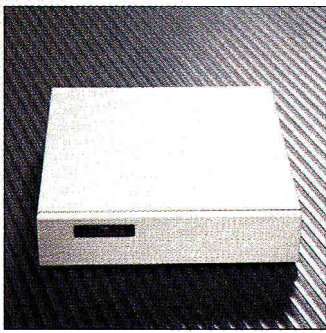


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HARD-DISK DRIVES



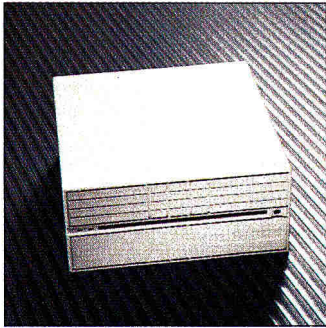
First Class Sider DF4

disk drive but don't want to invest in a network and its dedicated file server (another computer) also have only two options: You can share some of CMS' hard drives using additional interfaces, and Johnson & Associates' **MicroMUX** system lets several Apples share the same First Class **Sider** hard disk (Multi-OS model D2 only).

If you own an Apple II Plus, you also have a somewhat limited range of options. The new and improved high-speed version of Apple's SCSI card for the Apple II won't work in a II Plus. And the earlier versions of the Apple II SCSI card were s-l-o-w compared to other proprietary interfaces. II Plus folks should look to these proprietary drives, which are still available from a few manufacturers.

If you own an Apple IIe or a GS, though, the hard-disk marketplace rivals any of the fanciest bazaars: It's got everything from different interface cable lengths to multiple operating systems. Size, speed, and price aren't the only purchasing factors.

The various Apple II-compatible hard-disk drives on the market have some things in common: They come complete with an interface connecting cable and a power cord. Other factors, however, may tip the balance in favor of one drive over another: For example, if your Apple II computing needs dictate that you use a combination of DOS 3.3, Pascal, CP/M, and/or ProDOS (GS/OS), your choice is limited to the internal **Vulcan** from Applied Engineering or an external Sider from First Class Peripherals.



Tulin TL48GSH

IN OR OUT

Another factor to consider when selecting a hard-disk drive is where you're going to put it after you buy it. You might want to put it inside your Apple II. Three internally mounted drives are now available. Applied Engineering's **Vulcan** and Ingenuity's **InnerDrive** both replace the II's power supply with a heftier, fan-cooled hard-disk/power system. Cirtech's **InSyder** plugs directly into one of the II's expansion slots and fits nicely. (See the accompanying comparison of these three drives in this issue, p. 49.)

If you don't like the idea of putting your drive inside your Apple, you could try putting it between your computer and the screen. "Twixt" drives with thin profiles and wide footprints fit solidly between the Apple II's CPU (central processing unit) and the monitor. Many Macintosh-ready hard drives are designed to fit under a Mac Plus or SE. They may or may not be solid or wide or long enough to hold your GS' RGB (red-green-blue) monitor, however. In addition, none of the "twixt" drives attempts to distinguish itself

from the competition by providing a whole-system fan or conveniently switched power outlets, such as those offered by Kensington's **System Saver** or the **Conserver** from Applied Engineering, which you'll probably have to abandon if you plan on using a twixt drive. That prospect is even less attractive because you must start and warm most drives before you switch on the power to your Apple II. You can place any of the rest of the external drives nearly anywhere in the general vicinity of your Apple II. Beside it, under the desk, in a closet, out the window? Well, that is... as far as the connecting cable will reach. The standard connecting-cable length appears to be a whopping 2.5 feet, tip to tip — so out the window is probably not a realistic option, although you can purchase longer cables at no small expense.

Another important feature to note is the way you "park" a drive before shutting off the power after a work session. Parking protects the drive's sensitive mechanics. Failure to park your drive properly may damage the disk permanently. Some drives expect you to execute a special "parking" program; the GS Finder's "shutdown" sequence usually works as well. Other drives have an "auto-park" feature; the heads are protected whenever you remove power, thereby removing concern and extra trouble on your part.

WHAT WAS THAT?

Noise and cooling are two other areas to consider. Most hard-disk drives have their own internal fans. But it's important to note whether or not convection holes are punched at the top of the drive's case to let heat escape by a more natural route.

Noise is generated both by the whirring, whining hard disk and by the fan. Some drives are louder than others. Quantifying noise requires complicated equipment, but the best noise-detecting instrument is your ear. If possible, listen to the drive you're interested in purchasing. (Maybe out the window isn't such an unreasonable place after all.)

NAME YOUR INTERFACE

Your final hard-disk-drive consideration centers around the issues of interfaces and supporting software. All hard-disk drives require an interface that plugs into one of your Apple II's expansion slots, preferably slot 7 if you intend to start up your II from the hard drive. Some hard-disk drives are designed to use a proprietary interface and won't work with any other. Others include a proprietary interface, but will also operate with some others (at extra cost), most



DMA 181-ES

HARD-DISK DRIVES

notably the Apple II High-Speed SCSI Card. Some drives, particularly those designed for use with Macintosh computers, don't include an interface, but are Apple SCSI-compatible — so add \$129 to the cost of the drive. Not all Apple SCSI-compatible drives will work with your Apple II. Most do, but consult your dealer, or, because many dealers don't even know Mac drives can work with the II, call the manufacturer.

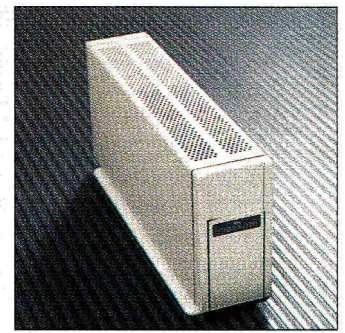
Ideally, support software for your hard-disk drive should include formatting, partitioning, defragmentation, parking, backup, file maintenance (copy, delete, and so on), and application launch utilities, as well as a GS/OS driver for the GS. (See the sidebar below for a discussion of some of these features, as well as "Do You Know Where Your Data Are?" May 1989, p. 54.)

Drives that operate from a proprietary inter-

face should include their own support software on floppies as well as on the drive. Most do, but to varying degrees; we'll leave that comparison to your shopping acuity. The Apple SCSI interface comes with the formatting, partitioning, and backup utilities you'll need for compatible drives. For all hard-disk drives, GS owners can use Apple's GS/OS 5.0.2 System Disk and System Tools for additional support software. Other Apple II owners can use the Apple ProDOS System Disk or a variety of other commercially available file maintenance programs, such as Glen Bredon's **ProSel**, Central Point Software's **Copy II Plus**, or Quality Computers' **Easy Drive**.

THE WINNERS

Let's cut right to the awards. (No, the UniDisk 3.5 isn't the drive of choice.) According to our ►



First Class Sider D4T



Format, Initialize, Interleave, Defragment, and Partition

Ever watch a child write his or her first story? Lined paper helps children keep the words from running together. While a child can eventually forego lines, however, your hard disk, or any type of disk for that matter, needs them to keep its stored data from running amok. In fact, your hard disk needs a well-organized form — something like an insurance claim or a tax document. That's what "formatting" and "initialization" are all about.

Formatting "lines" the hard disk electronically into concentric tracks and subdivides those tracks into blocks. And, much like the fill-in boxes that run across a paper form, initialization labels each block so that your system can locate it quickly. Access speed is particularly important for hard-disk drives: Formatting creates tens of thousands of blocks; it's faster and easier to find a numbered box on a form than to count from the beginning each time.

"Interleaving" takes into account that your disk spins much faster than your interface and your Apple can read and digest data. In the time it takes to decode and put a block's worth of data into your Apple's memory and then figure out where to read next, the drive's read/write head will have spun beyond several physically adjacent blocks. Rather than make a time-consuming complete revolution of the disk, the block order is skewed electronically during formatting and initialization so that the next block is positioned properly when the drive is ready to read it.

The actual interleave you should use for your hard disk depends on your drive, the

interface, and which Apple model you're using. An illustration of these effects is shown in the benchmarks for the First Class Sider model D4T in the **Table** accompanying this article. A 1:1 block interleave works well when connected to a IIe, but an 8:1 interleave is best with a GS, particularly when using the GS/OS driver. Don't be surprised if your drive suddenly starts operating as though it were immersed in molasses if you change your system by adding an accelerated processor.

Fortunately, First Class and most other manufacturers, including Apple, provide formatting utilities that let you select the optimum interleave for your system manually. In fact, we recommend that you format your new hard disk unless you're absolutely sure a preformatted one fits your particular system and needs.

Still wondering why your files are broken down and saved as so many small blocks? This technique allows for efficient use of the disk's storage space. Like a mosaic, small pieces permit greater detail and diversity than large ones.

Storage efficiency comes at a price, however. Initially, your files are arranged end to end in continuous blocks. Then when you erase a file from disk ("replace" erases first, then writes the new data), its blocks are "freed" for use by another file, thereby creating a gap. The next saved file might be smaller than that gap and, hence, will again fill the space using consecutive blocks. A larger file, however, will fill that gap and then look elsewhere for more.

Because like all computer users you erase

and save data constantly, gaps of varying sizes and locations exist. Eventually, data for a particular file can be scattered all over the disk. That's known as "fragmentation," and it slows down your disk significantly because your disk and the interface are optimized to read data linearly. "Random-type" access of a fragmented file is quite slow in comparison, as the linear- versus random-read benchmarks for any drive in the **Table** demonstrate.

When you notice your hard disk operating more slowly than usual, try defragmenting it. Defragmentation utilities, such as Pro-Sel's Beach.Comber for the IIe/IIc and Optimizer for the GS, to name just two, are available. Or simply copy (don't use backup) every file on the disk, erase it, then copy the files back. The process can be time-consuming, but you'll make up that lost time as the drive operates noticeably faster.

While you're bothering to back up and reformat your disk, "partition" it as well to suit your needs. Partitioning simply divides your disk into separate volumes, much like books in a library. Each volume maintains its own table of contents (directories) and doesn't use other volumes' tracks or blocks. Most often, it's best to create at least one volume containing your applications. Because you'll rarely delete and resave these files, they tend not to become fragmented. Create at least one other volume for those data files you change often and that therefore become fragmented quickly. That way you need to back up and defragment only the data volume(s) on a regular basis, saving time and trouble. — **W.K.**

Testing the Drives

Before you write out a check for a hard drive, consult our benchmark results shown in the accompanying **Table** to get the best buy. While the drives listed represent the variety of units marketed for both the II and the Mac, the list is by no means comprehensive. Some manufacturers couldn't supply a test drive in time for this writing; we'll report our benchmark findings for those in later issues. Others refused to participate because they didn't feel they could provide adequate service to the II market in addition to the Macintosh.

We ran the hard disks through eight performance tests. Each test measures one of the many operations a hard-disk drive and its interface must perform to save and retrieve your stored programs and data. We used both an Apple IIgs and a IIe for the tests. Each had the hard-disk drive's interface card installed in slot 7, the default boot slot for the IIe and the GS. The GS' Control Panel slot assignment was set to "your card" and the boot slot to "scan."

The GS contained the standard ROM 01 and 1.25 megabytes of RAM. Cache RAM and the /RAM5 disk were deactivated. A 5.25-inch drive was attached to slot 6 in both computers; a 3.5-inch drive and a Uni-

Disk 3.5 were connected to slot 5 in the GS and the IIe, respectively. The Apple IIe was "enhanced," as required by the Apple SCSI card, and contained an Applied Engineering RamWorks memory-expansion card.

Each drive was formatted before testing with either the manufacturer's software for proprietary interfaces, or the SCSI Utilities provided with the Apple II High-Speed SCSI Card. The block interleave for each drive indicated in the **Table** was used with the GS; a 1:1 interleave is best for most drives, particularly those connected to the Apple SCSI card. The most efficient IIe interleave was either set by the manufacturer's software or by the Apple SCSI utilities. When allowed, the hard disk was also partitioned into a 32-megabyte (32M) boot volume; the remaining 8M to 15M segment was used as a data volume. For comparison, we've also performed some of the benchmark tests on an Apple 3.5-inch drive connected to a GS and a UniDisk 3.5 connected to a IIe.

Test 1 (Warmup) gives you an idea of how long you must wait after turning on your hard drive before it's "up to speed" and ready for access, regardless of the particular Apple II model to which it's connected.

What complicates this measurement is that you can turn on some drives simultaneously with the computer; the interface will wait until the drive is ready. Other interfaces, including Apple's SCSI card, don't wait; if the drive isn't ready, your Apple moves on to another potential boot device. If it finds one, it will ignore your hard drive; if it doesn't, it will crash into a system error such as "Check the Boot Drive." You must turn on these latter hard-disk systems sometime before the computer.

To perform Test 1, we had to do some "hand waving," because some drives' only indication of readiness was the cessation of audible startup clicks and shuffles. The actual times measured are therefore in some cases a few seconds longer than the minimum warmup time.

The remaining benchmarks measure the rates at which an Apple IIe or GS accesses data from the hard-disk drive through the interface indicated in the **Table** and, if used, the GS/OS driver. The reported numbers are the mean of three evaluations; no individual test varied from the others by more than 5 percent of that mean.

Tests 2 through 4 evaluate "real world" operations: the time it takes to start up

Benchmark Test Results

Model	Manufacturer	Size ¹	Price ²	Placement	Interface	OS Format	Auto-Park?
CT-40	Chinook Technologies	40	\$718. ³	side	Apple-SCSI	GS/OS	yes
40SC	Apple Computer	41	\$1,508. ³	side ⁷	Apple-SCSI	GS/OS	yes
UltraDrive	GCC Technologies	47	\$828. ³	side ⁷	Apple-SCSI	GS/OS	yes
TL48GSH	Tulin Corporation	47	\$589. ³	side ⁷	Apple-SCSI	GS/OS	yes
GS-Partner	American Micro Research	40	\$799. ³	twixt	Apple-SCSI	GS/OS	yes
Sider DF4	First Class Peripherals	47	\$895.	twixt	proprietary	GS/OS	yes
Sider DF4	First Class Peripherals	47	\$1,024. ³	twixt	Apple-SCSI	GS/OS	yes
Sider D4T	First Class Peripherals	38	\$849.	side	proprietary	multi-OS	yes
Sider D4T	First Class Peripherals	38	\$914. ⁴	side	proprietary	multi-OS	yes
TLT44GSH	Tulin Corporation	43	\$785. ^{3,5}	side ⁷	Apple-SCSI	GS/OS	yes
181-ES	DMA Technologies	47	\$1574. ^{3,6}	side ⁷	Apple-SCSI	GS/OS	yes
SD45RM/A2S	CMS	43	\$1399.	side ⁷	proprietary	GS/OS	yes
Vulcan-GS/e	Applied Engineering	40	\$899.	inside	proprietary	multi-OS	yes
InnerDrive	Ingenuity	40	\$575.	inside	proprietary	GS/OS	yes
Apple 3.5	Apple Computer	0.8	\$429.	side	SmartPort	GS/OS	yes

1. Total capacity according to the GS Finder Get Info rounded to the nearest megabyte (M).

2. Manufacturer's suggested retail price.

3. Includes cost of the Apple High Speed SCSI card (\$129); card not included with drive.

4. ProDOS-only ROM and GS/OS driver (\$65) sold as extra accessory.



and launch applications. For GS applications, GS/OS version 5.0.2 was installed on each drive with the System.Disk and the System.Tools Installer program. The GS/OS drivers SCSIHD.Driver and SCSI.Manager, as found on the SCSI.Utilities disk, were also installed. Otherwise, the appropriate GS/OS driver, if available, was installed for the proprietary interfaces.

Test 2 (Boot to Finder) measures the time taken from the point when the familiar "Welcome to the lIgs" screen appears during bootup to that when the mouse pointer (not the watch) appears in the upper left-hand corner of the Finder desktop. Note that the time required to initialize the Apple systems as well as the interface card isn't represented in this value, and that the GS/OS drivers that make disk accesses more efficient aren't activated until late in the boot process. This test measures what might be called the drive's "raw" speed.

Test 3 measures the time it takes to launch AppleWorks GS (version 1.1 ExpressLoad program) and is a good indicator of a drive's "real world" operation when all its faculties are active: The drive's warmed up, the GS/OS driver is active, and so on. The AWGS program was copied to

the hard-disk boot volume and its icon moved to the desktop in preparation for launch. The file AWGS.Config was also installed on the boot volume and programmed so that all AWGS program modules were loaded during launch.

Test 4 (AppleWorks 3.0 launch) measures the time taken from bootup directly into AppleWorks 3.0 (AW 3.0). Each hard-disk drive was prewarmed. Launch time was measured from startup (using the familiar Open apple-Control-Reset "warm" boot) to the appearance of the AW 3.0 main menu on the Apple IIe screen. Note that this time includes interface initialization times, which, for the Apple II High Speed SCSI Card, added about five seconds to the overall boot time.

Tests 5 through 8 were performed on the GS to evaluate the hard-disk drives' individual operations more closely and vigorously. Test 5 (Verify) measures the time taken by the GS Finder's disk-verification utility to read each block of the hard-disk drive's boot partition and to ensure their integrity. It measures the mean data-access rates for the entire volume. For comparison, because not all boot volumes were partitioned as 32M (65,536 blocks),

the reported values in the **Table** are normalized by dividing the total time for verification by the number of verified blocks.

Tests 6 through 8 were performed using Glen Bredon's ProSel Volume Repair Utilities, which provide statistical benchmarks for a disk drive's linear- and random-read and operating-system overhead operations. The listed times are the mean rates required to perform the operation on selected portions of the disk.

Similar to the verification benchmark (Test 5), Test 6 (Linear Read) is the mean time taken to read adjacent blocks from the disk. Linear reading is the fastest rate at which the drive and interface can transfer data, as the necessary "search" for the next block is kept to a minimum.

Test 7 (Random Read), on the other hand, measures the rate for data transfer when the read blocks aren't adjacent, but randomly selected, as when your data files are "fragmented." (See the accompanying sidebar.) The benchmark evaluates the drive's and interface's search efficiency.

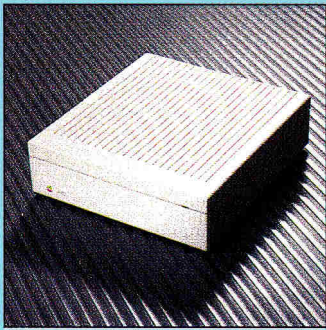
Finally, Test 8 (OS Overhead) isolates the drive and interface from the operating-system software, in this case GS/OS and the GS/OS driver, if present. —W.K.

Interleave (GS/OS)	GS/OS Driver	Warm-up (sec)	Welcome to Finder (sec)	Launch AWGS (sec)	Boot AW V.3.0 (sec)	Verify (K/sec)	Linear Read (msec/block)	Random Read (msec/block)	OS Overhead (msec/block)
1:1	SCSIHD	7	25	23	11	390	1.2	27.5	10.7
1:1	SCSIHD	9	29	26	14	287	1.6	32.4	13.4
1:1	SCSIHD	18	32	26	16	237	2.1	31.9	13.8
1:1	SCSIHD	21	33	26	16	234	2.1	33.1	13.8
1:1	SCSIHD	12	38	27	14	216	2.2	33.0	15.2
1:1	Sider. DF4. 157N1	20	25	29	11	88	5.5	26.2	33.3
1:1	SCSIHD	20	33	26	10	232	2.1	33.4	13.8
1:1	none	12	32	50	9	28	17.9	33.1	2.2
8:1	Sider 4.0	12	28	33	12	59	8.3	27.5	2.0
1:1	SCSIHD	22	35	28	16	334	1.4	38.1	13.2
1:1	SCSIHD	23	33	29	15	282	1.6	46.6	15.1
1:1	none	14	35	52	10	25	19.5	32.2	4.3
1:1	Vulcan	11	19	25	8 ⁸	137	3.6	21.7	1.0
1:1	InnerDrive	11	27	31	9	96	4.9	18.6	1.3
2:1	Apple 3.5	<1	58	82	27	27	16.2	151.3	6.9

5. Cartridges (44M) cost an additional \$95 each.
 6. Cartridges (50M) cost an additional \$160 each.

7. Case designed to fit under Macintosh Plus- or SE-series computers and may be installed "twixt" GS and RGB monitor.
 8. Benchmark performed with IIe version of Vulcan drive.

HARD-DISK DRIVES



Apple 40SC

benchmark results, Chinook's **CT-40** connected to the Apple II High Speed SCSI Card is the best performer of the lot — that is, if you want a compact, competitively priced, fast, quiet, fixed, external hard-disk drive.

The two top performers in the removable hard-disk line are the Tulin **TLT44GSH** and DMA Technologies' **181-ES**, which are difficult to separate except in price. The Tulin drive outperformed DMA's slightly, although the differences are negligible, particularly when compared to the other hard drives.

The internal drives from Applied Engineering and Ingenuity operate well compared to other drives, and run virtually neck-and-neck when compared directly. The Vulcan outperformed the InnerDrive, however — particularly when launching applications. (For a more definitive look at a selection of internal hard drives, see the accompanying feature article on p. 49.)

Everything outperformed CMS' removable hard disk when used with the the GS. It did a little better when working with a Iie. Even the Apple 3.5-inch floppy drive came close to the **SD45RM/A2S'** performance on a GS. Now perhaps if the manufacturer would abandon its proprietary SCSI for Apple's and produce a GS/OS driver. . . .

LOOKING AHEAD

It isn't surprising that the Apple II High Speed SCSI Card makes just about any compatible hard-disk drive competitive with, if not superior to, drives that use proprietary interfaces. The

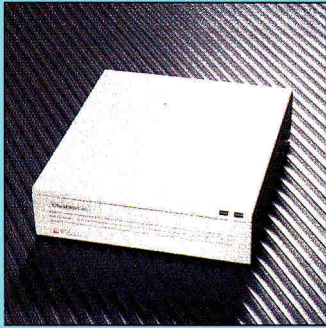
Apple SCSI card uses what's known as *DMA* (direct memory access) to put data directly into your Apple's memory.

That's faster than having to move the data through a temporary buffer, as earlier, slower versions of the Apple SCSI card did, and as drives with proprietary interfaces still do today. In fact, direct memory access is such an asset that the competitive speeds of some of the proprietary drives is a tribute to the efforts of the engineers who developed them.

But the biggest effect of Apple's new SCSI card is that Apple II owners can now efficiently use hard-disk drives that in the past have been marketed almost exclusively to the Macintosh market. With the ensuing flood of competition among the various manufacturers of hard-disk drives, you can expect to see distinguishing innovations; particularly built-in accessories, as companies attempt to gain a marketing advantage — and that will be good for all of us.

We'll keep you posted on the changing marketplace and provide benchmark results for additional hard-disk drives in upcoming issues. If you're ready to buy now, however, just about any one of the hard disks evaluated here sure beats the floppy-disk shuffle hands down. □

BOB CONSORTI IS PRESIDENT OF ON THREE, A HARDWARE AND SOFTWARE DEVELOPMENT COMPANY. HE HAS EXTENSIVE EXPERIENCE IN HARD-DRIVE RESEARCH AND TESTING. WILLIAM P. KENNEDY IS *INCIDER'S* SENIOR TECHNICAL EDITOR AND WRITES OUR APPLE CLINIC COLUMN EACH MONTH. ADDRESS YOUR CORRESPONDENCE *C/O INCIDER*, 80 ELM STREET, PETERBOROUGH, NH 03458.



GCC UltraDrive 45

PRODUCT INFORMATION

181-ES

DMA Technologies
801 Pine Ave.
Goleta, GA 93117
(805) 964-0733
\$1574

Apple II High-Speed

SCSI Card, \$129
Apple 3.5 Drive, \$429
Apple 40SC, \$1508
Apple Computer
20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Conserver

Applied Engineering
P.O. Box 5100
Carrollton, TX 75011
(214) 241-6060
\$99

Copy II Plus

Central Point Software
15220 N.W. Greenbrier
Pkwy. #200
Beaverton, OR 97006
(503) 690-8090
\$39.95

CT-40

Chinook Technologies
601 Main St., # 635
Longmont, CO 80501
(303) 678-5544
\$718

Easy Drive

Quality Computers
15102 Charlevoix
Grosse Pointe, MI
48230
\$59.95

GS-Partner

Amer. Micro Research
1305 Yorba Ave. Unit A
Chino, CA 91710
(714) 590-3900
\$799

MicroMUX

Johnson & Associates
P.O. Box 42073
Phoenix, AZ 85080
(602) 542-2203
\$695 base unit
\$150/interface card

ProSel 8, \$40

ProSel 16, \$60
Glen Bredon
521 State St.
Princeton, NJ 08540

SD45RM/A2S

CMS
1372 Valencia Ave.
Tustin, CA 92680
(714) 259-4352
\$1399

Sider DF4, \$895

Sider D4T, \$849
First Class Peripherals
3579 Highway 50E
Carson City, NV 89701
(800) 982-3232

System Saver

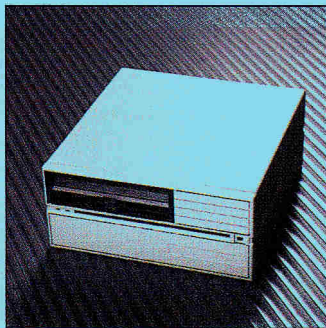
Kensington Microware
251 Park Ave. South
New York, NY 10010
(212) 475-5200
\$89.95 Iie, \$99.95 GS

TLT44GSH, \$785

TL48GSH, \$589
Tulin Corp.
2156H O'Toole Ave.
San Jose, CA 95131
(408) 432-9025
\$785

UltraDrive 45

GCC Technologies
580 Winter St.
Waltham, MA 02154
(800) 422-7777
\$828



Tulin TLT44GSH



BATTLE OF THE INTERNAL HARD DRIVES



Space-saving internal hard-disk drives face off in a stiff competition for first place in *inCider*'s benchmark tests. Read on for a report on this fierce three-way struggle.

By OWEN W. LINZMAYER ✦ CONTRIBUTING EDITOR

InnerDrive? Vulcan? The new InSyder? It's time to finally settle the issue. What's the best internal hard-disk drive for the Apple II?

We rounded up the three internal models on the market — the **InnerDrive** from Ingenuity, the **InSyder** from Cirtech, and the **Vulcan** from Applied Engineering — and put them through a series of rigorous benchmark tests designed to simulate real-world use. (See the accompanying **Table**.) We found more similarities than differences among the competing products, but each drive excels in certain areas.

THE INTERNAL DEBATE

Before you can decide which internal drive to buy, it's important to decide whether you really want one at all. Aside from the gee-whiz factor of actually having a hard-disk drive inside your computer case, there are few substantive benefits to internal drives. Sure, you save a little desk space and eliminate some cabling confusion. Internal drives also make it easy to pack up your system and move it to another location. But do those benefits outweigh the disadvantages?

On a cost-per-megabyte basis, internal drives are more expensive than external models; the large market for external drives has led to intense competition and low prices. Also, most external drives are SCSI (small-computer-systems interface) devices you can use with an Apple IIe or GS (with an appropriate interface card) or attached directly to a Mac Plus, SE, or II; the custom interfaces internal drives use can cause compatibility problems. Internal drives also can't match the data-transfer rate of the new Apple II

High Speed SCSI Card, which uses *DMA* (direct memory access). And even though they may contain built-in fans, internal drives raise the temperature inside your computer, increasing the likelihood of mechanical failure for both the drive and your other peripheral cards.

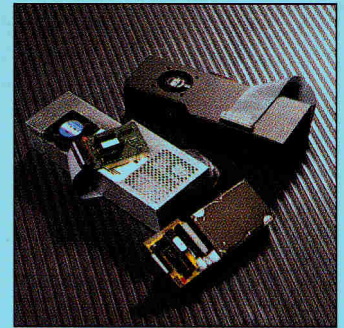
Lastly, it's important to look to the future. If you want to add more disk storage later, can you upgrade to a larger internal model, or will you have to buy an external drive after all? And what if you buy a Macintosh? If you have an external drive, chances are you can reformat it for use with your next system. You'd probably have to sell your internal drive at fire-sale prices, however.

SURVEYING THE MARKET

Although there were some early aborted attempts to market internal hard-disk drives for the Apple II, the concept didn't really catch on until Ingenuity (then Applied Ingenuity) released its InnerDrive series. Applied Engineering followed suit with a similarly designed line called the Vulcan. The two firms offer 20-, 40-, and 100-megabyte (M) versions of their hard drives.

Both the InnerDrive and the Vulcan are combination hard drives and power supplies. To install the drives, you must remove your Apple's existing power supply and replace it with the slightly larger drive/power-supply combo. Then you insert a proprietary interface card into one of your II's empty expansion slots and run a cable between the board and the hard drive. You can use the Vulcan in a II Plus, IIe, or GS; the InnerDrive works only with the IIe and the GS.

Cirtech took a different approach with its



The inside story —
internal hard-disk drives
from Ingenuity (left),
Applied Engineering
(top right), and Cirtech
(bottom).



Everyone wants his or her computer to work faster. Aside from an accelerator, the best thing you can add to your slow computer is a hard-disk drive.

InSyder drive (nice name, by the way). Currently available only in a 20M configuration (Cirtech promises to have a 40M drive by the time you read this), the InSyder is a 2.5-inch disk drive mounted directly on a SCSI interface card. The InSyder card's cable terminates in a DB-25 connector you attach to the back panel of the computer. You can plug an external SCSI drive into this connector or, with an optional adapter, a parallel printer. According to its U.S. distributor, A2-Central, the InSyder works with an Apple II, II Plus, IIe, or GS; we tested it on a GS.

OPERATING ROOM

You can format all internal drives tested here as either ProDOS or GS/OS volumes. Under GS/OS, these models use custom device drivers. Under ProDOS, you can segment the larger drives into several partitions to bypass the 32M limit. The InSyder comes with a program that patches ProDOS to bypass this limitation.

The Vulcan and the InSyder also come with partitioning software that lets you create DOS 3.3, Pascal, and CP/M sections on disk. With the InSyder, you can specify up to two 400K DOS 3.3 partitions, a 16M Pascal 1.3 partition, an 8-gigabyte CP/M Plus partition, and an 1.5M SoftCard CP/M 2.23 partition. These operating-system partitions exist as ProDOS files on the hard drive. To boot into the new operating system, you launch that particular file. You can't exchange programs and data files among the different operating-system partitions.

The Vulcan comes with a program called the Partition Manager, which lets you format up to 16 segments with different operating systems. Under ProDOS 8, the largest partition can be only 32M, but the Vulcan comes with a modified version of ProDOS 8 that lets it recognize more than two partitions. DOS 3.3 allows any number of 140K or 400K volumes. With Pascal you have a maximum partition size of 16M, and under CP/M you can define a partition as large as 8M.

SPEED DEMONS

When it comes to hard-disk drives, the three most important things to consider are cost per

megabyte (easy to calculate), long-term reliability (almost impossible to test), and access speed (a little tricky to measure accurately). Sure, the bundled software is important, too, but most people are interested in speed, speed, and more speed. It's hard to argue with that point of view: Everyone wants his or her computer to work faster. Aside from an accelerator such as the TransWarp or the Zip Chip, the best thing you can add to a slow computer is a hard-disk drive.

Even the slowest hard-disk drive is much faster than the fastest 3.5- or 5.25-inch floppy-disk drive. Applications that take minutes to load from floppy disk are available in seconds from a hard disk. The point is that if you're used to a floppy-disk drive, any hard drive is going to be a great improvement. How well it performs relative to other hard drives isn't really important. That said, let's see how the internal drives stack up.

FINDING THE FASTEST

To test drive speed, we devised a number of benchmarks designed to simulate real-world uses of hard disks with a GS. The tests are also revealing, however, if you own an 8-bit Apple. (For more details on our test system and methods, see the sidebar "Testing the Drives" in our cover story, "A Hard Drive Is Good to Find," p. 46.)

First we booted each drive and timed how long it took for the mouse pointer to appear on the Finder's desktop. This tells you how long you can expect to wait each time you restart or cold-boot your computer. The Vulcan performed best in this test, requiring a half minute from flipping the switch to being able to go to work. That's about a third faster than either the InnerDrive and InSyder. One reason the InSyder didn't do as well in this test is because the drive doesn't spin on power-up, but rather only on first access (when your system polls the slots for devices). Although you sacrifice some speed, there's less demand on the power supply.

The second test verifies the boot partition of each drive from the Finder's Disk menu. To arrive at a fair unit of measure, the total number of blocks verified was divided by the time required. This tells you how fast the drive can

	\$/M	Boot to Finder	Verify (blocks/sec)	Launch AWGS (sec)	Random Read
InnerDrive	\$14	38	187	31	18ms
InSyder	\$35	41	190	33	28ms
Vulcan	\$22	30	325	25	21ms

INTERNAL HARD DRIVES

read each spot on the disk in a linear fashion. Once again, the Vulcan proved the fastest of the lot, able to verify 325 blocks per second. That's more than 40 percent faster than the InnerDrive and the InSyder, both of which verified about 190 blocks per second.

Our third speed test was to launch AppleWorks GS version 1.1 with all modules preloaded. This real-world test gives you some idea as to how much time you'll spend staring at the watch icon as opposed to actually getting down to business. By now it should come as no surprise that the Vulcan beat the competition, taking only 25 seconds to launch the integrated program. The InnerDrive was in second place with 31 seconds, followed closely by the InSyder at 33 seconds.

The Vulcan outperformed its internal competition in every category but one: It took second place in the random-access race. The InnerDrive's winning time of 18 milliseconds is about 15 percent faster than the Vulcan's, and 35 percent faster than the InSyder's. (For more results, see the **Table** in "A Hard Drive Is Good to Find," p. 46.)

Overall, the test numbers tell us that the Vulcan is clearly faster than its competitors when reading and writing files on a freshly formatted drive with wide-open spaces. But the InnerDrive is a bit faster at random access, arguably a more important specification. The InSyder was the slowest of the lot, but not by much. When nitty meets gritty, keep in mind that although one drive may be 30 percent faster than another, the absolute difference between them is measured in seconds and milliseconds.

COMPARING COST

You'll have to decide for yourself just how much you're prepared to pay for shaving a few seconds off normal disk access. In most of our tests, the Vulcan proved the fastest drive, but it also carries the highest cost per megabyte. On average, its list price is 45 percent higher than similarly sized InnerDrives. That's a gap that's hard to ignore. When you compare street prices offered by dealers and mail-order houses, however, the Vulcan is only marginally more expensive than the InnerDrive.

The InSyder, on the other hand, is currently distributed only by A2-Central and carries a rather high price tag given its capacity. Keep in mind, however, that it includes the cost of a SCSI card (a \$129 value) as well as some unique programming: Its multi-user software lets you share an external SCSI hard drive with another user, provided you both have InSyder cards. The software correctly handles SCSI arbitration so that you can both access the drive at the same time. You can even lock out other users from certain partitions of the shared drive.

LIVE LONG AND PROSPER

The InSyder is the only drive that works with the original Apple II. If that's what you own and you have your heart set on an internal drive, the InSyder is the way to go. If you have an Apple II Plus, you can choose between the InSyder and the Vulcan. They both cost about the same and run virtually every major operating system. In general, I'd stick with the faster, proven Vulcan technology, unless you want to take advantage of the InSyder's SCSI interface for an external drive or multi-user capability.

The InnerDrive can't handle DOS 3.3, Pascal, or CP/M partitions, so if you need those operating systems, you must again choose between the InSyder and the Vulcan. If you have an IIe or a GS running ProDOS or GS/OS, you can use any one of the three internal drives. The Vulcan, however, is generally the fastest, reasonably discounted, covered by a one-year warranty, thoroughly documented, and guaranteed to be compatible with all other Applied Engineering products. The InnerDrive and the InSyder are fine alternatives with unique features that might sway you to consider them. For most people, though, the Vulcan is the way to go. □

BETWEEN OVERSEEING A REPORT ON 101 EXTERNAL HARD-DISK DRIVES FOR THE FEBRUARY 1990 ISSUE OF *MACUSER* MAGAZINE AND REVIEWING THE THREE INTERNAL MODELS THIS MONTH FOR *INCIDER*, CONTRIBUTING EDITOR OWEN W. LINZMAYER NOW KNOWS HARD-DISK DRIVES INSIDE AND OUT. WRITE TO HIM C/O *INCIDER*, 80 ELM STREET, PETERBOROUGH, NH 03458.

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(913) 469-6502

Vulcan 20, \$699

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If you're used to a floppy-disk drive, any hard drive is a great improvement. How well it performs relative to other drives isn't really important.





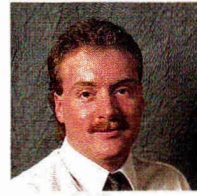
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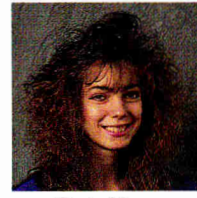
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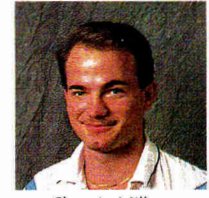
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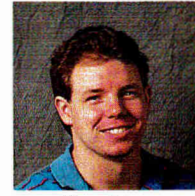
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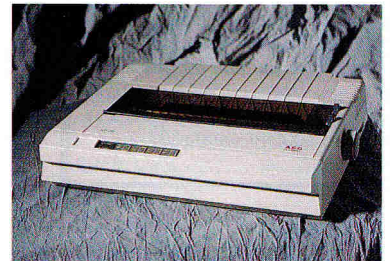
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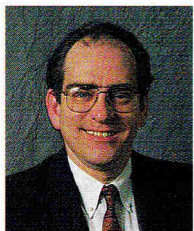
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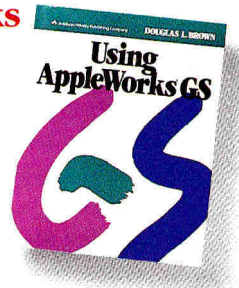
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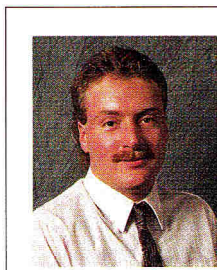


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CDA Computer Sales

Thanks to a wide range of languages and tools for every level of expertise, Apple II programmers help keep America moving in business, science, the arts, and education.



By **JOE ABERNATHY** * CONTRIBUTING EDITOR

THE LESSONS WE TEACH OUR CHILDREN, the music, art, and entertainment we create, the data analysis that leads to scientific advances, the accounting and recordkeeping that keep our businesses on track — Apple IIs and the programs that run them are a big part of the American style of work and play. As we saw in part 1 of this article last month (June 1990, p. 50), a wide range of languages, environments, and utilities make programming available to computerists at all levels of experience, with supplementary tools designed to tailor your code writing to your individual goals and abilities. Part 2 presents *inCider's* survey of brand-name Apple II languages and programming utilities. In every area, from graphics and sound to games and productivity, you'll find a language and accompanying software ideally suited to your needs and interests.

ASSEMBLY LANGUAGE

Merlin, from Roger Wagner Publishing, is perhaps the fastest, most accessible way to write assembly-language programs — and a version of Merlin is available for every Apple II model. The newest release, **Merlin 16+**, includes well-designed examples of source code, on-line help for ProDOS and GS/OS functions, a GS Toolbox quick reference, and an extended version of Glen Bredon's **ProSel** utility set. You also can add your own utilities to the Merlin shell, and export its output files to The Byte Works' **ORCA/M** or Apple Computer's **Apple Programmer's Workshop** (APW) version of assembly, allowing easier mixing of languages.

APW (available through the Apple Programmers and Developers Association, or APDA) and The Byte Works' **ORCA/M**, functionally the same, include some features Merlin doesn't — in particular, support of high-level projects. They're more development environments than languages; they include assembly compilers as the standard language. You can add Pascal and C compilers, and mix these languages in a single program to get the best from each.

The strength of the APW and **ORCA/M** assemblers lies in their ability to manage complex projects professionally. Their Unix-style development shells include 50-plus utilities to support such functions as partial recompilation. A single programmer can manage a project of 25,000 or more lines with APW or **ORCA/M**. The shell itself takes some learning, but the time is well spent if you want to write big applications or use C or Pascal for the GS.

APW costs a bit more than **ORCA/M**, but it's maintained by Apple and so is the best the way to stay abreast of the latest developments in assembly programming. For instance, APW has supported *resources* (a type of complex data structure) for months, while **ORCA** owners are still waiting for that capability.

ProDOS 8 Assembly Tools is an 8-bit II-series assembly-language system from Apple through APDA. It includes an editor, assembler, debugger, and relocating loader. **ORCA/M 4.1** is The Byte Works' 8-bit (IIe) assembler. Source code developed on this system is compatible with **ORCA/M** for the GS. You can mix code from **ORCA/Small C** with **ORCA 4.1** assembly code, as well.

Additional assembly-language utilities and source-code listings are available from The Byte Works, including **ORCA/Desktop**, **ORCA/Decompiler**, **ORCA/M 4.1 Floating Point Libraries**, **MON+ Symbolic Debugger**, and **ORCA/M 4.1 O/S Source**. **Desktop** is an option for **ORCA's** standard Unix-style shell; it lets you write, test, and debug your programs in the standard desktop

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environment. Desktop's multiple-window environment is essential if you expect to develop a large library of source code. Disassembler is a product now under development; it will be able to change any OMF (object module format), ROM (read-only memory), BIN (binary), or SYS (system) file into understandable assembly language. Stay tuned for details in upcoming issues of *inCider*.

Floating Point Libraries add extended numerics capabilities; source code for these functions is included. MON+ allows step-by-step debugging of ORCA 4.1 assembly, plus disassembly and on-the-fly editing of problems. O/S Source is composed of four disks of source code from the ORCA 4.1 system, so you can learn by example or write customizations such as device drivers for the compiler itself.

Micol Macro Assembler for the GS, from Micol Systems, easy to learn and easy to use, is primarily a companion product for Micol's popular **Advanced BASIC**, which can't use subroutines produced by other assemblers. In light of the competition, Micol Macro isn't the place to turn for dedicated assembly programming, even though it's more efficient in some regards than APW.

APPLESOFT BASIC

Applesoft is a language you don't have to buy — it's built into every Apple II. Applesoft hasn't changed much over the years, so you'll want to check into products that make it easier to write and

more powerful. Scores of Applesoft utilities have been written over the last 12 years; we'll review here only products that are actively supported.

The first thing to purchase is a real code editor. Several are available; the best are **Program Writer** from Beagle Bros for the IIe and **MD-BASIC** from Morgan Davis for the GS. (For details, see our comparative review in this issue, p. 31.)

Moving on to more sophisticated applications, **Supergraphix II**, from El Kassir Software, is one of a new breed of Applesoft enhancements for the GS. It adds various commands for dealing with the machine's advanced graphics, including color cycling, animation, a custom palette editor, a shape editor, and a font editor. A companion product, **Supermusic**, adds similar commands with which you can access GS sound through Applesoft.

Iconix and **Sonix**, from So What Software, are two products that compete with Supergraphix and Supermusic. (See March 1989, p. 80, for a review of Iconix.) They add various commands to allow use of sound and graphics in Applesoft — everything you need to do slick music and screen manipulation.

Is it easier to use Applesoft with enhancements for GS programming or just learn a language that's better suited to the task? Only advanced Applesoft programmers can make full use of those enhancements, and even they will run into limitations. Instead, Iconix, Sonix, Supergraphix, and Supermusic are probably best ►



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sued for renewing or updating your existing Applesoft programs.

A wealth of Applesoft enhancement utilities exist for non-GS Apple II owners. For instance, **Filecard Menus**, from Northeast Micro Systems, adds AppleWorks-style menus to any BASIC program. It supports 40- and 80-column screens, ProDOS clocks, and the mouse. Its nine commands include Box, for drawing boxes; Card, for drawing file cards; Line, for drawing repeated text; Menus, for composing numbered menus of up to nine items; and List, for menus of up to 255 items; plus one-key input, edit line input, and a file-card controller.

Perspective View by Mark Munson, from Imaging System Software, is a three-dimensional graphics toolkit for Applesoft and assembly language. Features include fast animation of up to 15 shapes simultaneously, 16 colors on the hi-res screen, true 3-D, nondestructive animation (for use with background pictures), a shape editor/viewer, and animation demonstration programs in BASIC and assembly.

One surefire way to tune up Applesoft is with the Toolbox series from Roger Wagner Publishing. All Toolbox programs are intercompatible, limited only by your II's memory, and are accessed with the Applesoft ampersand command. **Video Toolbox** manages text and hi-res screen functions, including menu generation and the mouse interface. **Wizard's Toolbox** helps you manage data and arrays, but also includes assorted shapes utilities, sound effects, and turtle graphics. **Invisible Tricks Toolbox** is a potpourri of memory management, Boolean arithmetic, in/out and conversion functions, BASIC command enhancement, and a slew of other useful utilities. **Database Toolbox** commands manage a myriad of array operations, including disk-file management, array conversions, and math functions, plus several fixes for Applesoft and a basic set of math tools. **Chart 'n Graph Toolbox** is a complete graphics-management package, including double-hi-res plotting and Easy Chart, a full-featured menu-driven graphing program.

Beagle Compiler (Beagle Bros) transforms your Applesoft programs into assembly language. The result is code that runs up to 15 times faster. It also lets your BASIC programs use auxiliary memory, including GS memory. This one's a must for serious Applesoft authors. (See our review in May 1987, p. 92.)

Beagle Bros, a company perhaps best known for its AppleWorks enhancements, started as a purveyor of utilities and Applesoft enhancements, tricks, and techniques. Rather than let these classics fade away, Beagle now offers a number of them free for the price of a long-distance call to its bulletin board, **ProBeagle**. Available titles include Alpha Plot, Beagle Bag, Beagle Basic, DOS Boss, Big U, D Code, Double Take, Extra K, Fat Cat, Flex Type, Font Mechanic, Frame-Up, Pro-Byter, Pronto DOS, Shape Mechanic, Silicon Salad, Tip Disk #1, and Utility City. If you want to write in Applesoft, this offer is worth the cost of a modem.

The Tabler, from Michael Black, is a traditional shape-table editor for Applesoft BASIC or 6502 assembly. Creating shapes is a nasty process, and a number of utilities have been written to make it more palatable. The Tabler is one of the better efforts.

ModemWorks, from Morgan Davis, is a set of ampersand-added

commands that make programming telecommunications easy. Besides helping you design custom terminal programs and even bulletin boards, ModemWorks also includes the **AmpersandWorks** utility set, a comprehensive set of disk-access routines.

Glen Bredon's **Applesoft FPE** lets you use Innovative Systems' **Floating Point Engine** from Applesoft to dramatically increase the speed at which the math coprocessor performs its operations. (See our review in December 1989, p. 118, for more information on this expansion card.)

Also from Glen Bredon is **ProCMD**, a standardized Applesoft command installation program, with examples. Type, Copy, Print Using, and a set of double-hi-res utilities are included. **UniRAM**, from Steven Humpage, is a companion package for RAM disks. It offers several useful BASIC commands, including Type and Type with prompting, Copy, Concatenate, Extract, Format and Unformat, and Filter.

BASIC Programmer's Utility, from Sir Cain Software, is designed to assist professional software designers by adding elements of structure, such as replacing line numbers with labels, and support for external libraries of source-code modules. Programs can be ported among Apple, IBM, and CP/M machines.

ENHANCED BASICS

AC/BASIC, from Absoft, is a structured high-level language that almost eliminates the difficult aspects of programming the GS' complicated environments, especially the Desktop. You can implement menus, windows, buttons, fonts, sound, animation, mouse support, and event trapping with simple commands and no knowledge of the underlying Toolbox. This is unquestionably the fastest way to get a desktop program up and running, but you'll sacrifice performance and flexibility. AC/BASIC is compatible with GS/OS 5.0.2, although it doesn't implement the operating system's new features. This compiler appears to have a limited future, although it's fine for light tasks.

Micol Advanced BASIC, from Micol Systems, on the other hand, could pass for an Applesoft-compatible Pascal. It offers structure and program control of sufficient quality to teach programming style, and it acts as a superset of Applesoft (although somewhat obscurely). The GS version supports direct Toolbox calls and offers various Toolbox shortcuts. As a compiled BASIC, Micol features stunning support of graphics, including more screen resolutions than any other IIe language. It's the only BASIC for either the IIe or the GS that's supported aggressively. In contrast, **TML BASIC** from TML Systems and Apple's **GS BASIC** are both largely dysfunctional and shouldn't be used.

ZBASIC, from Zedcor, is an easy-to-use, compiled BASIC, producing programs that are compatible across several brands of computers, including IBM, CP/M, TRS-80, Apple II, and Macintosh. ZBASIC uses a line-based editing environment similar to Applesoft's, including syntax. Its features 54-digit precision for mathematics, with integer, single-, and double-precision numeric formats. You can use ZBASIC as an unstructured language — in which you deal with line numbers and convoluted source code — or with full structure for clean code. Program control statements



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such as WHILE/WEND and DO/UNTIL are also provided here.

From Ross W. Lambert and Jay Jennings comes **ProTools 2.0**, a source-code function library for ZBASIC that supports the desktop user interface, windows, buttons, and a pop-up text editor styled after AppleWorks. Advanced input and disk operations are also included.

PASCAL

ORCA/Pascal, another in the language series from The Byte Works, runs under the APW and ORCA/M environments on the GS. It's an ANSI-standard (American National Standards Institute) Pascal with extensions for the GS. You can generate launchable GS programs, classic desk accessories (CDAs), new desk accessories (NDAs), or programs to run under the Unix-style APW shell. ORCA/Pascal can make direct use of the Floating Point Engine math coprocessor, as well.

TML Pascal II, from TML Systems, is a stand-alone language that provides a full implementation of the new GS/OS features, including a resource editor to make desktop programming easier. The compiler is a nice, fast desktop development environment, but the language itself is plagued by bugs. (See Reviews, May 1990, p. 24, for details.)

Apple II Pascal 1.3 is the official UCSD (University of California at San Diego) Pascal for the II. Even though Apple doesn't seem to be supporting it in the language's later years, Pascal was once the darling of that company, so the product is highly evolved. It includes a complete development environment, with compiler, linker, filer, editor, assembler, interpreter, sample programs, an its own operating system.

The Apple II Desktop Toolkit is a library of Pascal routines from APDA to manage the Desktop environment, mousetext, and double-hi-res graphics. Capabilities include pull-down menus, windows, cursors, and event handling, all in graphics or text mode. Also from APDA is the **Apple II Filecard Toolkit**, which provides an AppleWorks-like user interface for Apple Pascal, along with console and keyboard tools. APDA's **Apple II Pascal Device Support Tools** provide assistance in writing and attaching device drivers to programs written under Apple Pascal.

C DIALECTS

APDA's **APW C** is one of two Cs you can use with APW and ORCA/M. While providing an important extension to the APW environment, this compiler is marketed strictly toward those who already understand programming in general and the architecture of the GS in particular. APW C has also taken a beating because it produces relatively cumbersome programs — and that's not supposed to happen with C.

ORCA/C, from The Byte Works (reviewed in March 1990, p. 90), seeks to be the successor to APW C. It generates faster programs, may be more accessible to those with intermediate skills, and is more compatible with C compilers on other computer lines. It offers function prototyping and a subset of the emerging ANSI C standard. Currently, ORCA/C has a problem with bugs and doesn't fully support the GS/OS operating system, a situation we can

expect will change with the upcoming release of version 2.0.

ORCA/M 4.1 Small C, also from The Byte Works, is a subset of C for the IIe. All full C statements are included, with most operators, but only short and long integers are implemented. The full source code of the compiler is included by way of example. You can mix Small C with assembly in the ORCA/M environment; the language also supports libraries and partial compilation.

Aztec C, from Manx, is the choice for full-powered C programming on earlier IIs (64K required). It offers the full power of C, and your programs are readily portable to versions of Aztec C for the Macintosh, Amiga, IBM, Atari ST, CP/M-80, CP/M-86, and TRS-80 lines.

FORTH

GSF's **GS16FORTH II** is an exciting programming language. It retains backward compatibility with FIGForth and Forth-79, two dialects of the language, but includes a full set of enhancements to support GS programming. In fact, it's one of the most accessible GS languages. It supports all GS/OS 5.0.2 features, including resources, with directions and source-code examples. One of Forth's advantages is the ability to build a reusable "vocabulary" as you write an application; in this compiler, that means you can borrow the user interface of the Forth programming shell itself to create nearly instant desktop programs.

Another feature of the language is incremental compiling, which lets you create and test small fragments of source code and then move on to the next part of your program with confidence. In the GS16Forth II desktop environment, you can use this feature in the traditional way or as a method for designing individual tool calls that otherwise would require the presence of a full supporting framework for testing. GS16Forth II generates fast 16-bit native code, and best of all, it's one of the most affordable products on the market.

Allen Anway's **FORTH-83** for the GS is favored by many teachers because it boots into self-instruction mode. It doesn't offer Toolbox extensions, but the package does include an example disk.

RavenFORTH/GS, from RavenWare Software, is a 16-bit implementation of Forth-79 for the GS. It includes all standard Forth-79 commands, plus an interface to the GS' built-in programmer's Toolbox. The package includes a text editor, Forth screen editor Toolbox interface files, demo programs, and sample source code.

Isys FORTH-83, from Illyes Systems, is fast and optimized, and includes separate versions for the IIe, the GS, and older IIs enhanced with a 65802 or 65816 microprocessor. Its features include turtle and Cartesian graphics, with support of double-hi-res and GS super-hi-res graphics, single- and double-precision floating-point math with transcendentals, double-precision integer math, and a macro assembler.

LOGO

Terrapin's **Logo Plus** is the latest version of an old favorite. It includes turtle graphics, a shape editor for replacing the default turtle, math functions, debugging tools, shared text and graphics, a procedure editor, words and lists, interactive programs, and tools ►

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for advanced programmers. Its newest feature is the ability to control robotic devices. A generous supply of ideas and support materials from Terrapin are included to let you quickly integrate this language into the classroom.

Add-on products from Terrapin provide further curriculum support. **TSI Robotics** lets you use Terrapin Logo to control robotics kits, including those from Fischertechnik, Capsella, Robotix, Erector, and Lego, for skill development in science, mathematics, problem solving, and logic. The appeal of Logo to children and other beginners is fully preserved. (See Reviews in November 1987, p. 37, and June 1988, p. 32, for more information.)

LogoWorks: Lessons in Logo is a set of curriculum materials for teaching geometry in 4th through 8th grades. The result of a state-funded project in North Carolina, it includes hundreds of student activities, lessons, and a teacher's manual. *The Logo Project Book: Exploring Words and Lists* delves into the language arts. The presentation is attractive, with horoscopes, anagrams, secret codes, and palindromes. **Logo Probability** provides 12 activities to encourage students to examine that mathematical concept. Besides encouraging development of clear perception, this product may help provide early protection against innumeracy. **Logo Data Toolkit** teaches planning and data organization. It includes a

surveying tool, a database system, and a charting tool, as well.

Logo comes to the GS with a new version of **LogoWriter** from LCSi. This language, which is still available for earlier IIs, combines traditional Logo programming with word processing. It opens up a second level of creativity by letting students write stories and games on the same screen with the turtle. The home edition comes with an activity book that lets you start using the language on the second page and leads you through a variety of projects. It's written for ages 7 and up; supporting materials for teachers are available. LogoWriter offers full graphics-based word processing, four turtles, music, math, programmable word processing, and the full Logo language. The Apple IIGS version is for those with intermediate-level skills.

TC Logo, from Lego Systems (reviewed in June 1988, p. 32), combines one of the most creative languages for students with one of the more enduring play sets. If Jack's really a Lego maniac as the ads say, he has an Apple II and TC Logo at home with which to explore the physical sciences, although he probably doesn't look at it that way. This product uses an extended version of the Logo language to provide control over a Lego construction set you can use to build various mechanical devices with motors, touch sensors, and light sensors. Seven projects are described in the directions,

PRODUCT INFORMATION

AC/BASIC

Absoft Corp.
2781 Bond St.
Auburn Hills, MI 48057
(313) 853-0050
\$125

AmperWorks, included w/ MW
ModemWorks, \$59.95
MD-BASIC, \$49.95
Morgan Davis Group
10079 Nuerto Rancho
San Diego, CA 92078-1736
(619) 670-0563

APW, \$100
APW C, \$100
Apple II Desktop Toolkit, \$30
Apple II Filecard Toolkit, \$35
Apple II Pascal 1.3, \$100
Apple II Pascal
Device Support Tools, \$20
Apple IIes BASIC, \$50
ProDOS 8 Assembly Tools, \$35
Apple Programmers and
Developers Association
Apple Computer Inc.
20525 Mariani Ave.
MS 33-G
Cupertino, CA 95014-6299
(800) 282-2732

Applesoft FPE, included w/ FPE
ProCMD, \$25
ProSel, \$40 (8), \$60 (16)
Glen Bredon
521 State Road
Princeton, NJ 08540

APW Make

DEMCO Electronics
10516 Grevillea Ave.
Inglewood, CA 90304
(213) 677-0801
\$50

Aztec C

Manx Software
1 Industrial Way
Eatontown, NJ 07724
(201) 542-2121
(800) 221-0440
\$299

BASIC Programmer's Pak

\$129
DB Master Professional, \$295
DB Master Version Five,
\$45 shareware
Electronic Service & Repair,
\$50

Medical Office Management

\$150
Simple Accounting System, \$25
Stone Edge Technologies
P.O. Box 3200
Maple Glen, PA 19002
(215) 641-1825

BASIC Programmer's Utility

Sir Cain Software
7516 Marathon Drive
Biloxi, MS 39532
(601) 392-8444
\$15

Beagle Compiler

\$74.95
Program Writer, \$49
Beagle Bros
6215 Ferris Square, Suite 100
San Diego, CA 92121
(800) 345-1750
(800) 992-4022 (CA)
(619) 452-5500
(619) 558-6151 **ProBeagle BBS**

CDA Power: Volume I

Desk Accessories, \$59.95

File Utilities

\$34.95
360 Text Toolkit, \$64.95
360 Microsystems
12272 Fox Hound Lane
Orlando, FL 32826
(407) 365-6714

Chart 'n Graph Toolbox

\$39.95

Database Toolbox

\$39.95

The Graphic Exchange

\$49.95

HyperStudio 2.0

\$149.95

Invisible Tricks Toolbox

\$39.95

Merlin 16+

\$124.95

Softswitch

\$59.95

Video Toolbox

\$39.95

Wizard's Toolbox

\$39.95
Roger Wagner Publishing
1050 Pioneer Way
Suite P
El Cajon, CA 92020
(619) 442-0522

Filecard Menus

Northeast Micro Systems
5C Kensington
London Square
Clifton Park, NY 12065
(518) 383-2858
\$15

Floating Point Engine

Innovative Systems
P.O. Box 444
Seyern, MD 21144-0444
(301) 987-8688
\$229

FORTH-83

Allen Anway
1219 North 21st St.
Superior, WI 54880
(715) 394-4061
freeware (send 2 disks)

Graphics Supermarket

Abracadaba
P.O. Box 2440
Eugene, OR 97402
(503) 342-3030
\$49.95
\$149.95 with source code

GS16FORTH II

GSF
1049 Shady Lakes Circle South
Palm Beach Gardens, FL 33418
\$49.95

Hyperscreen

Scholastic Software
2931 East McCarty St.
P.O. Box 7501
Jefferson City, MO 65101
(800) 541-5513
(800) 392-2179 (MO)
\$99.95 educators
\$124.95 consumers

Iconix

\$59.95

Sonix

\$59.95
So What Software
10221 Slater Ave.
Suite 103
Fountain Valley, CA 92708
(714) 964-4298

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including traffic lights, a turtle, a merry-go-round, a washing machine, an assembly line, an automobile, and logic gates.

RELATIONAL DATABASE DESIGN

DB Master Professional, from Stone Edge Technologies Inc., is a business alternative to traditional programming. You may think it's fancy AppleWorks, but it isn't. DB Master is the management tool every business needs if it finds itself at odds with standard accounting packages. It lets you design a tracking, forecasting, accounting, and reporting system unique to your type of business. You can take the full dose, or use it simply to manage cash flow, customer contacts, or tax liabilities.

DB Master Professional combines the traditional information-management capabilities of a database with extended numeric capabilities, relational associations, and made-to-order reporting (printouts). It's designed to handle the most demanding tasks, supporting single files of up to 10 megabytes in size, across 50 disks. Advanced searching and sorting, required fields, inclusion of extended text, instant report generation, and dozens of other features put this product in a class by itself. Relational capabilities let you automatically associate operations on a given piece of information with other fields and other files. To give a simple example,

invoices can automatically look up customer names, product prices, or availability, and tell you when to reorder.

Stone Edge also markets **DB Master Version Five**, a somewhat less powerful version of the product, as shareware. Version Five lets you create records with up to 200 fields of 250 characters each. It can work with files as large as 10 megabytes in size and includes most of the report-generation features of Professional. (For details, see "DB Master for Everyone," What's New, June 1990, p. 17; "In a Class by Itself," March 1989, p. 39; and "On the Pole in the Database Derby," Editors' Choice, July 1988, p. 96.)

A number of Stone Edge enhancements are marketed for use with DB Master, including the **BASIC Programmer's Pak** for accessing DB Master files, the **Medical Office Management** template, the **Electronic Service & Repair** template, and the **Simple Accounting System**, which lets you design a custom system of your own.

AUTHORING SYSTEMS

Authoring systems let Apple II users with little or no programming knowledge design interactive presentations utilizing graphics, sound, speech, and so on. This is the first evidence of *object-oriented* programming for the II, which many experts predict will

Isys FORTH-83

Ilyes Systems
P.O. Box 2516
Station A
Champaign, IL 61820
(217) 359-6039
\$99

Logo Data Toolkit, \$39.95

Logo Plus, \$119.95

Logo Probability, \$19.95

**The Logo Project Book:
Exploring Words and Lists**,
\$29.95

LogoWorks: Lessons in Logo,
\$29.95

TSI-1 Robotics Kit, \$225

TSI-2 Robotics Kit, \$270

Terrapin Software
400 Riverside St.
Portland, ME 04103
(207) 878-8200

LogoWriter

LCSI
3300 Cote Vertu
201 Montreal, Quebec
Canada H4R 2B7
(800) 321-5646

Micol Advanced BASIC,

\$145 GS, \$89.95 Ile/Ilc

Micol Macro Assembler,

\$89.95

Micol Systems
9 Lynch Road
Willowdale, ON
Canada M2J 2V6
(416) 495-6864

MON+ Symbolic Debugger,

\$29.95

ORCA/C, \$150

ORCA/Desktop, \$60

ORCA/Disassembler, \$49.95

ORCA/M, \$69.95

ORCA/M 4.1, \$99.95

ORCA/M 4.1 Floating Point

Libraries, \$39.95

ORCA/M 4.1 O/S Source, \$39.95

ORCA/M 4.1 Small C, \$39.95

ORCA/Pascal, \$150

The Byte Works
4700 Irving Blvd. NW
Suite 207
Albuquerque, NM 87114
(505) 898-8183

Perspective View

Imaging System Software
6521 East Paradise Drive
Scottsdale, AZ 85254

Programmer's Online Companion

Addison-Wesley
Consumer Software Support
Route 128
Reading, MA 01867-9984
(617) 944-3700
\$49.95

ProTools 2.0

Ariel Publishing
P.O. Box 398
Pateros, WA 98846
(509) 923-2249
\$29.95

RavenFORTH/GS

RavenWare Software
23930 Ocean Ave. #201
Torrance, CA 90505
price unavailable

Rose Editor

JEM Software
24812 Celtic Court
Ramona, CA 92065
\$15

StoryWorks

Teachers' Idea & Information
Exchange
P.O. Box 6229
Lincoln, NE 68506
(402) 483-6987
\$49.95

Supergraphix II, \$89.95

Supermusic, \$39.95

El Kassir Software
232 Thorne St.
Suite C
Los Angeles, CA 90042
(213) 257-6882

The Tabler

Michael Black
213 Iroquois
Laurium, MI 49913
\$5 shareware

TC Logo

Lego Systems
555 Taylor Road
Enfield, CT 06082
(800) 243-4870
(203) 749-2291
\$485

TML BASIC, \$125

TML Pascal II, \$125

TML Pascal II

Source Code Library, \$49.95

TML Pascal II Speech Toolkit,

\$69.95

TML Systems
8837-B Goodby's Executive
Drive
Jacksonville, FL 32217
(904) 636-8592

Tutor-Tech 2.2

Techware Corp.
P.O. Box 151085
Altamonte Springs, FL 32715
(407) 695-9000
\$195

\$290 with gradebook manager

UniRAM

Steven Humpage
2427 Northeast 24th Ave.
Portland, OR 97212
\$20

ZBASIC

Zedcor
4500 East Speedway
Suite 22
Tucson, AZ 85712
(800) 482-4567
\$69.95



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revolutionize the way computers are regarded and used. There's a lot of power and promise in today's authoring systems, but make no mistake: This type of programming still takes effort.

HyperStudio for the IIGs, from Roger Wagner Publishing, includes a text editor, paint program, sound editor, sound digitizing hardware, microphone, graphics and sound-effects libraries, the ability to import from most GS paint and sound programs, and generous examples. It's a well-designed, reliable product with everything you need to create significant presentations.

The idea of a complete authoring system is betrayed somewhat by the absence of a video digitizer, which you must have if you're going to create high-quality original *stacks*, or topic modules. But many people won't feel the need for such a digitizer, which would add \$200 to \$300 to the price of the product. Thousands of existing pictures and compatible clip-art images are available.

HyperStudio lets you lay out a series of interrelated screens through which users can progress in an intuitive, rather than sequential, fashion. You start with a standard or custom card background and add pictures, or *buttons*, that can be associated with sounds, text files, other pictures, stacks, or cards, or traditional application software. For instance, a teacher might establish a relationship between a test-giving stack and a gradebook program. (For more information, see "Exploring HyperStudio," March 1990, p. 56; "In the Cards," *Speaking of Graphics*, October 1989, p. 94; "Does HyperStudio Stack Up?" September 1989, p. 44; and "Hypertext for Your GS," *Editors' Choice*, August 1989, p. 108.)

Tutor-Tech, from Techware, is a IIe multimedia tool that lets you combine writing, drawing, custom fonts, sound effects, speech, and video in an interactive application. A number of educational extensions facilitate the design of tests and lessons. Tutor-Tech reportedly is being enhanced to provide scripting, plus the ability to convert Macintosh HyperCard stacks. **HyperScreen**, from Scholastic Software, and **StoryWorks**, from the Teachers' Idea & Information Exchange, are two other authoring systems for 8-bit Apples. (See "Curing the 8-Bit Blues," September 1989, p. 48; "More Hypertext," *What's New*, April 1990, p. 20; "On the Button," *Editors' Choice*, May 1990, p. 96; and *Reviews*, April 1990, p. 32, for more information.)

UTILITIES

Abacadata's **Graphics Supermarket** is a planning and design tool for the GS that includes such advanced internal graphics tools that most people don't know where to start. Graphics Supermarket is kind of like a modern-day shape editor, such as those used with Applesoft. You can create or edit shapes of any size, icons, patterns, or entire pictures, and translate them into C or assembly language. Examples show you how to use them in your own programs in C, assembly, and BASIC. A tutorial teaches the fundamentals of GS shapes. You can import shapes from any standard GS picture, and a number of shapes are included. Other features include animation, all super-hi-res screens, full color, seven levels of zoom, a clipboard that can hold 15 images, color printing, full drawing tools, and custom color palettes. The source code for Graphics Supermarket itself is available.

Rose Editor, from JEM Software, replaces the one that comes with ORCA/M and APW. Rose can edit two files at once, with cut-and-paste between them. It allows multiple tab settings for various languages and comes with both AppleWorks and ORCA command sets. It supports the mouse and macros and can scroll through a 64K file in about four seconds.

Martin Peckham's **APW Make**, from DEMCO Electronics, automates application design. It lets you write a script of interdependent filenames corresponding to the modules of your program; Make examines the date of last modification and recompiles a module if the dates of its interdependent files indicate it has become obsolete.

The Graphic Exchange by John MacLean, from Roger Wagner Publishing, allows the conversion of any graphics screen file from any Apple II type to any other type, including GS super hi-res. You'll find this useful with any hypermedia product or in game programming. **Softswitch** by Ken Kashmarek, also from Roger Wagner Publishing, lets you switch instantly among as many as nine ProDOS programs, but only on the GS. (It works as a CDA.) It's especially useful when doing Applesoft programming or when using a language that doesn't have its own editor.

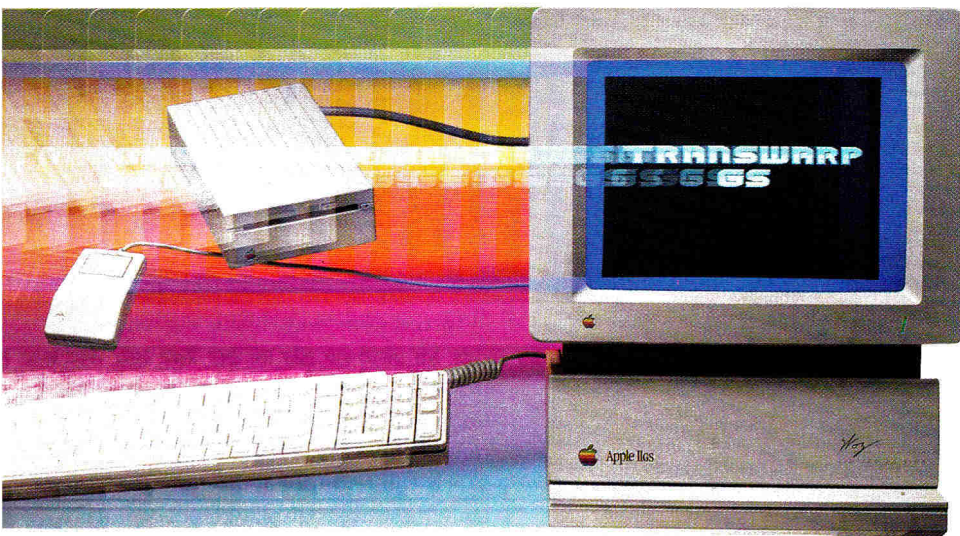
The Programmer's Online Companion, published by Addison-Wesley, is a CDA for the GS that provides a generic quick reference to the built-in Toolbox calls. To date, it hasn't been updated to support the latest features of the GS or to run under the current operating system.

CDA Power: Volume I Desk Accessories, from 360 Microsystems, offers some indispensable CDAs for use on the GS: an ASCII table, a 65816 command reference, and a scientific calculator, among other things. Also from 360 comes **Text Toolkit**, a library for GS APW and ORCA/M that extends the screen text-handling capabilities of your languages. The Text Toolkit comes with an assembly-language interface; you can add ORCA Pascal and APW C interfaces separately. **File Utilities I** is an expanded set of shell utilities for APW and ORCA for the GS.

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"Do-it-yourself" has always been the hallmark of Apple II users. Need to keep more accurate records for income-tax purposes? Designing a new kind of adventure game? Want to plan your kids' next history or geography lesson? Whether you're dabbling on the weekend or making programming your life's work, decide what you want to say, plan the best way to say it, and then choose the environment that matches your goals. Examine all the alternatives. No language is automatically better than others — each is a specialist to one degree or another. With Apple II languages and tools available for every type of endeavor that can be computerized, the best software is the expression of your individual ideas. □

JOE ABERNATHY IS A JOURNALIST WITH *THE HOUSTON CHRONICLE*. HE IS A CERTIFIED APPLE DEVELOPER AND THE AUTHOR OF *INCIDER'S* BIMONTHLY PROGRAMMING COLUMN APPLE IIGS BASICS. WRITE TO HIM AT P.O. BOX 66046, HOUSTON, TX 77098. ENCLOSE A SELF-ADDRESSED, STAMPED ENVELOPE IF YOU'D LIKE A PERSONAL REPLY.



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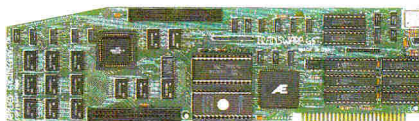
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HIT THE ROAD 2

How much do you spend on your car? Customize last month's spreadsheet with your own expense figures, and take your budget in for repairs.

By **RUTH K. WITKIN**

SUMMERTIME, AND THE LIVING IS more than just easy. For me, it's downright exhilarating, especially when I can put pedal to the metal.

But owning a car can be expensive, even more expensive than many of us think. Finding out what your car costs for each mile you run it can be an eye-opening experience.

Last month, you created the spreadsheet in the accompanying **Figure**, which keeps track of gas costs, repairs and maintenance, licenses, insurance, and other related expenses (June 1990, p. 60). In this session, you'll learn how to use and update the spreadsheet.

Now load AppleWorks and display the spreadsheet named *CAR COST*. And here's the *Review/Add/Change* screen.

USING YOUR SPREADSHEET

Before you can start using the car-cost calculator, you need to make a few preparations. To keep the original intact, first save it to disk under another name: Press Open apple-N (OA-N), type **MY** and hit the spacebar (so that the filename becomes *MY CAR COST*), and hit Return. Press OA-S to save it to disk.

Now blank out the existing entries, starting with car description, original

price, and market value: With the cursor on C3, press OA-B, type **B**, highlight the block of cells to D5, and hit Return. Blank out H3 and H4 the same way.

You're about to work in the entry area, which contains many formulas. Though protected against change, you can still blank out formulas inadvertently, so be sure the cursor is on the correct cell at all times. First, blank out the dates in column A: With the cursor on A9, press OA-B, type **B**, move the cursor to A13, and hit Return.

Next, blank out the ending-mileage entries in column C: With the cursor on C9, press OA-B, type **B**, move the cursor to C12, and hit Return. Because these cells are in standard-value format, blanking leaves their format unaffected. As you work, formula results start to disappear.

And finally, blank out the gallons and cost entries in columns E and F: Place the cursor on E9, press OA-B, type **B**, move the cursor to F12, and hit Return. These cells are in a nonstandard format (column E cells are in *Commas* with one decimal place, and column F cells are in *Commas* with two decimal places), so blanking their contents also blanks their formats.

Though the entry area looks eerily empty now, the formulas are still there. As you move the cursor around, the cell-contents line shows them safe and secure in their cells.

In the same way, blank out entries in the following cells: C24 through H24 (*PRIOR PERIODS*), A29 through D34 (*MAINT & REPAIRS*), H29 through H34 (*FIXED COSTS*), and H48 (*Years in Use*). When you're finished, most of the formulas in these areas display zero. Formulas in H41 and H42 contain "historical" amounts, so that's what they display, as do other formulas relating to those formulas. *ERROR* messages appear in H49, H50, and H51 merely because you're asking these formulas to divide by zero, which they can't do.

To give the labels in row 27 (anniversary year and current year) the proper time frame, edit (OA-U) them, overtype them, or blank them out and type from scratch.

This completes the preparations, so press OA-S to store the spreadsheet on disk.

FORMATTING CONSIDERATIONS

At this point, it's important to understand two things about AppleWorks and this spreadsheet:

1. Certain entries are in cells with a nonstandard format. When you blank out these entries, you also blank out the cell formats. Cells so affected are *Gallons* in column E and *Cost* in column F.
2. Any "disappearing" IF formula (one with quotation marks in the Else statement) in a cell with a nonstandard format blanks out the cell format when the Else statement makes the cell look empty. (This is an unfortunate AppleWorks trait that I hope Claris corrects.) Cells so affected include *CPG* in column G and *MPG* in column H.

What all this means is that you'll have to reformat as you go along—with input cells, before or after you make the entry—and with formula cells, after they display ►

AE Update...

AppleWorks 3.0 Expander for AppleWorks 3.0 is now shipping as an update for all AE memory board owners. The expander offers Apple IIGS, IIe, IIc Plus, and IIc AppleWorks enhancement for AppleWorks 2.0, 2.1 and the latest version, 3.0. New features include increased record limits in the data base, more lines in the word processor, multiple disk saving, time and date display, print buffering (for most AE memory boards), and enhanced RAM disk handling. Now available from AE for \$29.

Applied Engineering expands technical support. In a continuing effort to improve customer service, AE recently hired a new manager of technical services with more than 15 years experience in technical services management. In addition, AE's telephone support staff has been doubled in size and the number of incoming phone lines has increased.

Applied Engineering installs multi-line technical support bulletin board. All types of product information is now available 24 hours a day, 7 days a week - no busy signal. The AE technical support staff is on-line to support our entire product line. Over the next several months, we'll develop a comprehensive question and answer data base. A directory will also be developed for often asked questions so customers can go directly to an appropriate section. The modem number is (214) 241-6677 and supports any Hayes compatible modem with speeds up to 2400 bps.

ReadyLink updated to version 1.3.1. The interface has been improved and is now more intuitive than ever. The macro command language has been expanded to be more powerful, and there are more terminal emulations to increase connectivity. Just to name a few of the many improvements. ReadyLink is ready now and available to existing ReadyLink customers from AE for \$15.

Applied Engineering developing the first heavy duty power supply for the Apple IIGS. Ample power for even the most decked-out GS's. Expected to be available some time in the third quarter. Ask your dealer or call Applied Engineering for more information.

PC Transporter gets a System Disk facelift to version 1.3. The update contains increased hard disk support for storage up to 64 Meg, support for ADB extended keyboards, better GSOS support including the elimination of drive polling, easier program launching, additional modem support, improved printing with the ImageWriter II, and more. Available now from Applied Engineering for \$25.

The AE 3.5 Drive is now shipping. Our new drive is packaged in a high-quality plastic case and has the same aesthetic look, footprint and dimensions as the Apple drive. Incorporates same top-quality Sony mechanism used in Apple's drive. The AE drive features a daisy-chain port, red/green L.E.D. indicators for disk read/write, auto eject and a full year warranty. A user installable High Density Upgrade is soon to follow. AE 3.5 Drive \$279. 3.5 Disk Controller for IIe and II Plus \$79. High Density Upgrade \$49.

GS-RAM and GS-RAM Plus DMA upgrade available for "Rev A" owners. "Rev A" owners can send in their GS-RAM or GS-RAM Plus to be swapped for a current Rev which is DMA compatible, even with Apple's new SCSI card. Call AE for information on how to upgrade. GS-RAM upgrade \$99. GS-RAM Plus upgrade \$109.

the calculation produced by this spreadsheet's Then statement.

MAKING YOUR FIRST ENTRIES

Pull out the mountain of documents you've amassed since last month, so that you can make your entries. Lacking those, practice with the sample entries in the **Figure** and make up others as you go along, so that you'll become familiar with the routine of ending one period and starting another. Here's how to get going:

- Enter your car description in C3, C4, and C5, and the original price and market value in H3 and H4.
- Enter gas fill-up dates in A9 through A18, ending mileage at each fill-up in C9 through C18, number of gallons in E9 through E18, gas cost in E9 through E18, maintenance and repair dates in A29 and below, what was done in B29 and below, maintenance and repair costs in D29 and below, and fixed costs in H29 through H34. Don't bother to fill every cell in the maintenance-and-repair section. Just a few will do.

As you work, the formulas will produce starting mileage in B9 through B18, number of miles between fill-ups in D9 through D18, cost per gallon in G9 through G18, number of miles per gallon in H9 through H18, and totals in row 20. They also calculate annual fixed costs in H36, depreciation in H45, and operating cost since you bought your car in H44, and show you the operating costs per year, per month, and per mile in H49 through H51. In D54, the formula adds up the total maintenance and repair costs for the year. Whew!

The formulas in H41 and H42 still contain sample historical costs. If you want to change these numbers, either blank out the formulas (press OA-B, type Y to remove protected cells, and hit Return) or edit (OA-U) the formulas. Now press OA-S to store the spreadsheet on disk.

STARTING ANEW

When rows 9 through 18 are filled, Formula 21 (H5) reminds you to *START ANEW*. At this point, you can either blank out old entries or insert entry rows. Here's how to blank out old entries:

1. Turn off automatic recalculation (OA-V, then **RFM**). Now enter the formula results

Figure. Car-cost spreadsheet with sample entries.

CAR COST CALCULATOR								
3	DESCRIPTION:	1989 Marlin Mystic			ORIGINAL PRICE:	\$14,500		
4	PURCHASE DATE:	March 23 1988			MARKET VALUE:	\$6,200		
5	BOUGHT FROM:	Abner Motors			PERIOD STATUS:	OKAY		
7	DATE	START	END	MILES	GALLONS	COST	CPG	MPG
9	May 2 90	21,320	21,671	351	16.0	16.60	1.04	21.9
10	May 11	21,671	21,948	277	15.0	15.50	1.03	18.5
11	May 19	21,948	22,288	340	17.5	18.00	1.03	19.4
12	May 27	22,288	22,571	283	15.0	15.35	1.02	18.9
13	Jun 3	22,571						
20	CURRENT PERIOD	4	1,251	63.5	65.45	1.03		19.7
22	LIFE-TO-DATE							
24	PRIOR PERIODS	120	21,320	960.0	1,286.40	.94		22.2
25	PRIOR+CURRENT	124	22,571	1,023.5	1,351.85	.99		21.0
27	MAINT & REPAIRS (3/23/90 to 3/22/91)				FIXED COSTS FOR 1990			
29	Mar 30 90	Tune-up		65.83	Driver's License 8.00			
30	Mar 30	Oil change & lube		32.66	Car Registration 46.75			
31	Apr 21	Wash and wax		12.00	Insurance 658.00			
32	May 23	New tires (2)		202.00	Inspection 12.50			
33	May 23	Brakes relined		83.42	Auto Club 45.00			
34	Jun 3	Oil-1 quart		2.23	Loan Interest 587.00			
36					Total Fixed Costs 1,357.25			
39					LIFE-TO-DATE CAR COSTS			
40					Gas Costs 1,351.85			
41					Fixed Costs 3,702.25			
42					Maint & Repairs 1,632.14			
43								
44					Operating Cost 6,686.24			
45					Depreciation 8,300.00			
46								
47					Adjusted Cost 14,986.24			
48					Years in Use 2.25			
49					Cost per Year 6,660.55			
50					Cost per Month 555.05			
51					Cost per Mile .66			
54	Year-To-Date			398.14				

2. You want to start with a clean sheet, so use OA-B to blank out the dates in column A, ending-mileage entries in column C, and gallons and cost entries in columns E and F. Reformat as necessary.
3. Press OA-K to recalculate. The formula cells in rows 9 through 18 should now look empty, except B9, which copies the prior-period mileage from D24. Your spreadsheet is now ready for the start of a new

period. As you make your new entries, press OA-K to recalculate the formulas and reformat as necessary.

Now remove this blanked-out version from the Desktop and load the earlier, complete version stored on disk.

INSERTING ENTRY ROWS

Adding entry rows is a good way to cut down on the number of times you need to blank out old information. It's best to insert these rows when input cells are formatted, because you can copy formulas and formats in one step. It doesn't matter if the cells are empty or contain entries at the time. Here's how to do it:

1. With the cursor on A19, press OA-I to start the *Insert* command. Confirm *Rows*, type **2** as the number of rows to insert, and press Return.

2. Copy the formulas and any input formats into the inserted rows: With the cursor on B18, start the *Copy* (OA-C) command and confirm *Within worksheet*. Press OA-Right Arrow to identify B18 through H18 as the source, and hit Return. To identify the destination, move the cursor to A19, type a period, move the cursor to A20, and hit Return. Type **Y** to clear the protected cells (it doesn't mean anything here), then press OA-R once to tell AppleWorks every cell reference in every formula is *relative*.

3. AppleWorks will adjust the SUM formulas to include the new rows, but you'll have to edit in a new ending cell in H5. To do this, place the cursor on H5 and press OA-U. Press Right Arrow five times to move the cursor to the *I* in H18, press OA-E to switch to the otype cursor (the blinking rectangle), and type **20** (the new cell for the formula to check).

You can insert rows in the maintenance-and-repair area the same way. Start with the cursor on A53 (or whichever row contains the short line after you insert rows in the entry area), and press OA-I. AppleWorks will adjust the SUM formula, now in D54, to account for the new rows.

If you insert more rows than can fit on one sheet of paper, AppleWorks will print leftover rows on a second page. Reducing the top margin from its current .3 inches to zero lets you keep a few more rows on the page.

It's easy to keep track of a second car. Simply use OA-N to make a copy of this spreadsheet under still another filename. Blank out the irrelevant entries, enter new information, and save the spreadsheet.

If you'd like a reprint of part 1 of our "Hit the Road" series, send a self-addressed, stamped envelope to "Car-Cost Spreadsheet," Editorial Department, *inCider*, 80 Elm Street, Peterborough, NH 03458. Next month, in response to many requests, you'll be creating a database to keep track of your stock holdings. □

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BUSINESS TYPES

Drowning in office forms? Publish It! comes to the rescue with templates for billing, contracts, memos, and order forms to help you stay organized.

By CYNTHIA E. FIELD, Ph.D.

IF YOUR BUSINESS OR NONPROFIT enterprise is like most, you could spend more time being productive if it weren't for one perennial problem: a sea of paperwork. Page-layout software won't exactly throw you a life preserver, but this month we'll show you how a program like **Publish It! 2** can help you lay out purchase orders, invoices, and statements that excel in both appearance and efficiency.

One businessperson who's revamped her office procedures thanks to desktop publishing is Jean Crosby, of Wedgwood Studio (2522 North 52nd Street, Phoenix, AZ 85008). For 27 years Crosby has been involved in the restoration of art objects, including Oriental treasures, Sevres vases, and Cybus porcelains. The work can be painstaking and slow. As Crosby chuckles, "A little humor makes the [client's] long wait more acceptable."

When Crosby began thinking about designing custom business forms for Wedgwood Studio, she did what comes naturally to perhaps thousands of other Apple II users: She loaded **The Print Shop** into her Apple IIc. Initial attempts were, by Crosby's own admission, "very flat and uninteresting." But from these experiments Crosby discovered three things. First, she needed a higher-level desktop-

publishing program. Second, she wanted a jump-start from a more experienced desktop publisher. And third, the cute turtle illustration she discovered on The Print Shop art disk would be perfect for her business logo.

Enter Mollie Ann Matlaf (P.O. Box 1934, Port Hueneme, CA 93041-6934), formerly a teacher and now a computer-graphics artist. She imported Crosby's Print Shop turtle into **The Print Shop Companion** and flipped the right-facing illustration horizontally to have a left-facing turtle.

To prepare Crosby's logo-in-progress for later embellishment, Matlaf converted the Print Shop turtles from DOS 3.3 format to ProDOS with the System Utilities disk that came with her Apple IIe.

Next Matlaf put **TimeOut SuperFonts** and **TimeOut Paint** to work drafting a couple of versions of the Wedgwood Studio logo and slogan, shown in **Figure 1**. She used SuperFonts' London.18 for the Wedgwood Studio name, Geneva.14 for the company's address and phone number, and Sanfrancisco.18 for the "Slow but Sure!" slogan. Matlaf saved Crosby's logos to a data disk in Publish It!-compatible, double-high-resolution graphics format.

DRAWING-BOARD BASICS

Wedgwood Studio's invoice is composed of some 39 objects, including text frames,

graphics frames, and graphics objects, such as rules (horizontal and vertical lines) and a round rectangle. (See **Figure 2** for a screen dump of the final publication.) But don't let sheer numbers discourage you. This month's project is a piece of cake as long as you take it one bite at a time.

First, start up Publish It!, and, if you're not already in *Size to Fit* mode, switch to it now by pressing Open apple-4 (OA-4) or by selecting *Size to Fit* from the Special menu. Click on the text tool in the toolbox and "rubber-band" (press the mouse button, drag, and release) a text frame about 7.5 inches wide and 9.5 inches high.

In the paragraph above we chose the word *about* purposely. Thanks to Publish It!'s *Show Specifications* feature, you can draw an object rather carelessly, then fine-tune it automatically to thousandths-of-an-inch precision. Just select the object by clicking on it with the pointer. When the object's four corner handles appear, press OA-M or pull down the Objects menu and click on *Show Specifications*. Type precise values, such as those in **Table 1**, into the *Show Specifications* dialog.

Take a moment now to match your first text frame with the background text frame drawn by Mollie Matlaf for Crosby's Wedgwood Studio. Press the return key (or click on the OK button in the dialog) when you're finished.

This background text frame serves a dual purpose. First, it's a layout board that delineates your work area and cordons off enough white space (unused territory) to make the ultimate printout more appealing (**Figure 3**). Second, if you prefer to fill in forms on the computer, this background text frame theoretically lets you do just that. If you're like most businesspeople, though, you'll probably use your desktop-publishing program to create a blank ►

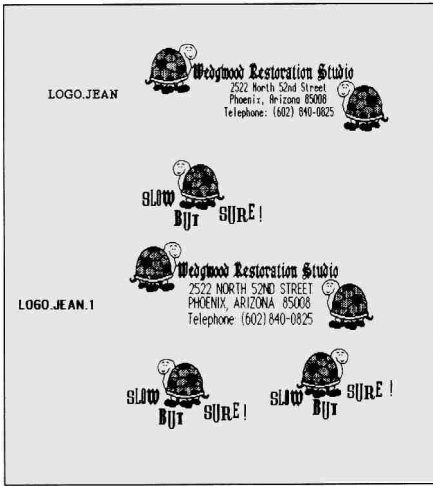


Figure 1. Logos by Mollie Matlaf.

master, which you'll photocopy. That way, when it's time to bill clients, you can fill in invoices by hand or typewriter. Better still, configure an AppleWorks 3.0 database report to generate invoices that "fit" your desktop-published version.

FORM AND FUNCTION

Once you've mastered the technique of drawing "sloppy" objects and then using *Show Specifications* to perfect them, you're well on your way to creating virtually any kind of desktop-published product, including an invoice like Wedgwood Studio's. For now, simply duplicate the objects listed in **Table 1**.

Use the text tool and *Show Specifications* to lay out the remaining seven text frames. Put a border around the column-heading text frames by clicking on the *Frame Border* radio button in each frame's dialog.

Select the I-beam tool from the Publish It! toolbox and position it inside the *Hours* text frame. Click the mouse button. Press OA-W (or click on the *Select* option from the Font menu) to pick the typeface and style you want. For consistency, Wedgwood Studio's invoice uses *Desplaines.12 bold* for all text areas.

Now type the days and hours of operation. Keep going until you've completed the customer-information area, the invoice-number box, the three column headings (ITEMS, DESCRIPTION, and PRICE), and the total-price box.

Drawing rules in these areas is a snap with Publish It!'s line tool. Click on it now. Before using the tool, however, pull down

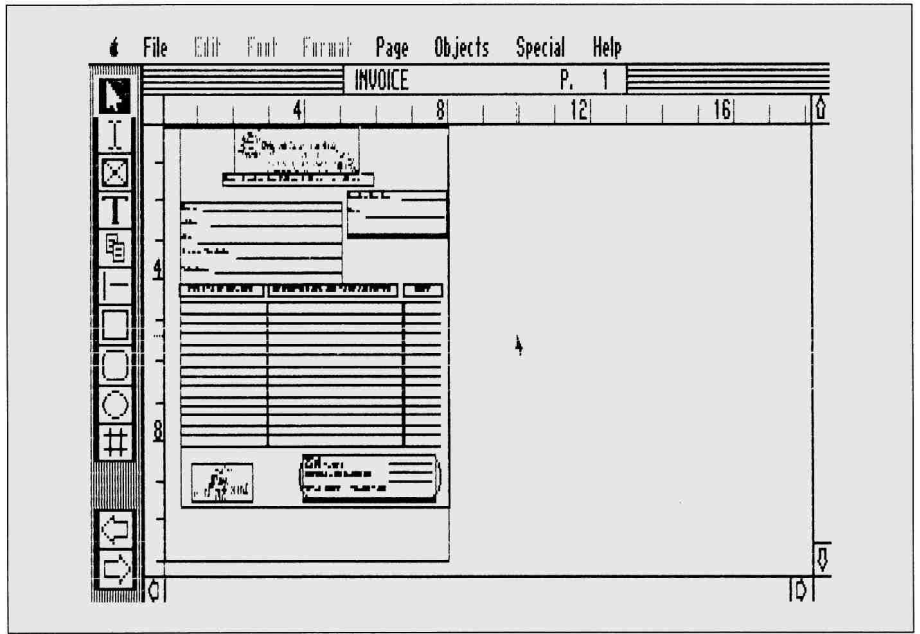


Figure 2. Screen dump with invoice layout.

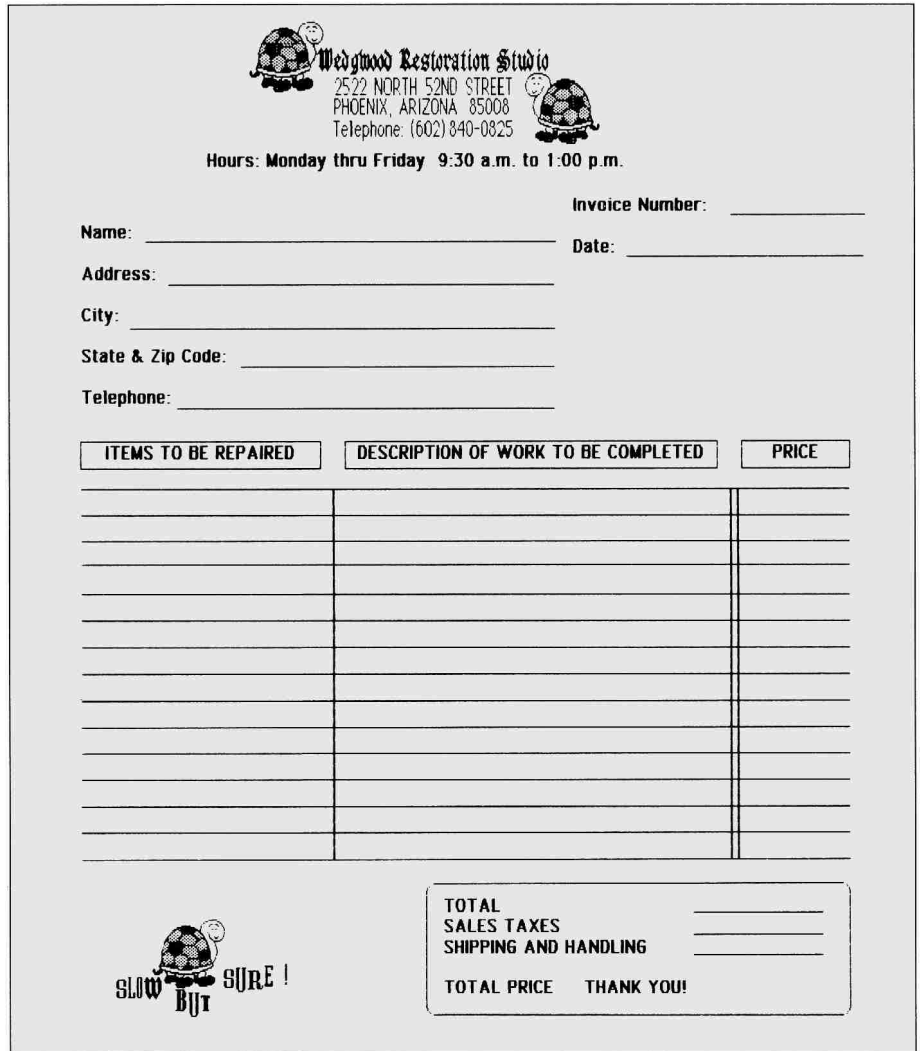


Figure 3. Wedgwood Studio invoice.

Figure 4. Wedgwood Studio work order.

Figure 5. Wedgwood contract.

the Objects menu and select the *Set Line Weight* option. If the thinnest line weight isn't already chosen, click on its radio button. Pull down the Objects menu again; choose *Set Pen Pattern* and solid black.

Place the line-tool cursor just after the word *Name*: in the customer-information box. Press the mouse button and hold it. Drag the mouse horizontally about 3.5 inches before letting go. The straight line that results is probably not accurately placed, so use *Show Specifications* and the values in **Table 1** to size and position it.

Use the same method to draw the remaining four rules in the customer-information box, the two rules in the invoice-number box, and the three rules in the total-price box.

Table 1. Specifications for invoice form (dimensions in inches; n/a = not applicable).

Object	Left Start	Top Start	Width	Height	Frame Border?
TEXT FRAMES					
Background	0.500	0.093	7.500	9.500	N
Hours	1.690	1.331	4.195	0.222	N
Name etc.	0.500	2.000	4.500	2.000	N
Invoice #	5.150	1.750	2.750	1.000	N
Headings					
Col. 1	0.500	4.075	2.250	0.225	Y
Col. 2	3.000	4.075	3.500	0.225	Y
Col. 3	6.750	4.075	1.000	0.225	Y
Total	3.916	8.334	3.662	1.033	N
GRAPHICS FRAMES					
Logo with Company Name	2.000	0.050	3.500	1.250	N
Logo with Company Motto	0.750	8.500	1.733	1.013	N
SHAPES					
Round Rectangle	3.750	8.225	4.000	1.250	n/a
RULES					
Name Box					
H. Line 1	1.109	2.177	3.869	n/a	n/a
H. Line 2	1.320	2.586	3.648	n/a	n/a
H. Line 3	0.958	2.993	4.018	n/a	n/a
H. Line 4	2.004	3.363	2.963	n/a	n/a
H. Line 5	1.411	3.752	3.556	n/a	n/a
Invoice # Box					
H. Line 1	6.637	1.925	1.268	n/a	n/a
H. Line 2	5.655	2.313	2.231	n/a	n/a
Work Sheet					
H. Line 1	0.500	4.500	7.250	n/a	n/a
H. Line 2	0.500	4.750	7.250	n/a	n/a
H. Line 3	0.500	5.000	7.250	n/a	n/a
H. Line 4	0.500	5.250	7.250	n/a	n/a
H. Line 5	0.500	5.500	7.250	n/a	n/a
H. Line 6	0.500	5.750	7.250	n/a	n/a
H. Line 7	0.500	6.000	7.250	n/a	n/a
H. Line 8	0.500	6.250	7.250	n/a	n/a
H. Line 9	0.500	6.500	7.250	n/a	n/a
H. Line 10	0.500	6.750	7.250	n/a	n/a
H. Line 11	0.500	7.000	7.250	n/a	n/a
H. Line 12	0.500	7.250	7.250	n/a	n/a
H. Line 13	0.500	7.500	7.250	n/a	n/a
H. Line 14	0.500	7.750	7.250	n/a	n/a
H. Line 15	0.500	8.000	7.250	n/a	n/a
V. Line 1	2.872	4.500	n/a	3.500	n/a
V. Line 2	6.630	4.500	n/a	3.500	n/a
V. Line 3	6.695	4.500	n/a	3.500	n/a
Total Box					
H. Line 1	6.277	8.488	1.212	n/a	n/a
H. Line 2	6.277	8.688	1.212	n/a	n/a
H. Line 3	6.277	8.888	1.212	n/a	n/a

Table 2. Specifications for work order (dimensions in inches; n/a = not applicable).

	Left Start	Top Start	Width	Height	Frame Border?
TEXT FRAMES					
Hours	1.690	1.331	4.195	0.222	N
Name etc.	0.500	2.000	4.500	2.000	N
Date	5.108	1.591	2.777	0.519	N
Headings					
Work Order	2.016	4.111	3.370	0.369	N
Description	0.508	4.534	2.556	0.236	N
Estimate	6.055	4.511	1.652	0.259	N
Total	3.916	8.334	3.662	1.033	N
Thank You	3.073	9.662	3.815	0.666	N
GRAPHICS FRAMES					
Logo with Company Name	2.000	0.075	3.500	1.250	N
Logo with Company Motto	0.694	8.166	1.500	1.000	N
SHAPES					
Round Rectangle	3.750	8.225	4.000	1.250	n/a
RULES					
Name Box					
H. Line 1	1.109	2.177	3.869	n/a	n/a
H. Line 2	1.320	2.586	3.648	n/a	n/a
H. Line 3	0.958	2.993	4.018	n/a	n/a
H. Line 4	2.004	3.363	2.963	n/a	n/a
H. Line 5	1.411	3.752	3.556	n/a	n/a
Date Box	5.690	1.876	2.130	n/a	n/a
Work Sheet					
H. Line 1	0.500	4.500	7.250	n/a	n/a
H. Line 2	0.500	5.000	7.250	n/a	n/a
H. Line 3	0.500	5.250	7.250	n/a	n/a
H. Line 4	0.500	5.500	7.250	n/a	n/a
H. Line 5	0.500	5.750	7.250	n/a	n/a
H. Line 6	0.500	6.000	7.250	n/a	n/a
H. Line 7	0.500	6.250	7.250	n/a	n/a
H. Line 8	0.500	6.500	7.250	n/a	n/a
H. Line 9	0.500	6.750	7.250	n/a	n/a
H. Line 10	0.500	7.000	7.250	n/a	n/a
H. Line 11	0.500	7.250	7.250	n/a	n/a
H. Line 12	0.500	7.500	7.250	n/a	n/a
H. Line 13	0.500	7.750	7.250	n/a	n/a
H. Line 14	0.500	8.000	7.250	n/a	n/a
V. Line	6.031	5.000	n/a	3.000	n/a
Total Box					
H. Line 1	6.091	8.556	1.444	n/a	n/a
H. Line 2	6.091	8.958	1.444	n/a	n/a

While the invoice's worksheet area, with its 15 horizontal rules and three vertical ones, looks complicated, it's not. Draw the first horizontal rule and fine-tune its specifications. With this first rule selected, press OA-C. This command copies the rule into your computer's memory. Now press

OA-V to display a duplicate of the rule.

Instead of trying to drag the second horizontal line into place — a very "trying" experience — use *Show Specifications* (press OA-M) instead. The line will snap into position automatically after you type in its precise orientation and press Return.

Continue this way for the remaining 13 horizontal lines in the worksheet area. Use the sequence OA-V and OA-M. You don't have to press OA-C each time you want a new line, because the image of the original rule stays in memory until it's replaced by something else you copy.

FINISHING TOUCHES

Crosby's invoice has a prominent total-price box surrounded by a round rectangle. If you want a square-corner border, click on the *Frame Border* radio button in the text frame's *Show Specifications* dialog. Creating fancier borders may require one or more of Publish It!'s shape tools.

For a round-rectangle border, click on the rounded-corner box tool. Pull down the Objects menu; select *Set Fill Pattern* and solid white. Use *Show Specifications* and the values in **Table 1** to fine-tune the size and placement of the round rectangle.

Because Publish It!'s page-layout method is considered "object-oriented," you've unwittingly drawn a white-filled round rectangle on top of the text frame and rules, blocking them from view. The situation is easily fixed. Select the round rectangle, pull down the Objects menu, and select *Move to Back*. This action puts the round rectangle where you want it: behind the text and rules.

The Wedgwood Studio invoice incorporates a logo created outside Publish It!, as described above. If you don't want to design a custom logo, however, you can still design a stylish invoice.

Create a text frame for your company's name, address, and phone number, and select an appropriate typeface, style, and size (Font menu). If your company has a slogan, create another text frame where you'd like the slogan to appear.

If you like, draw one or more graphics frames with that function's tool. Depending on the source and type of clip art, choose *Import Picture* or *Import Print Shop* from the File menu. Cut the clip art to size in the cropping screen. Press the return key to add the artwork to your layout.

With later versions of Publish It! you can enlarge or shrink artwork by selecting it and tugging on one of its handles. And don't forget that clip-art disks bulging with illustrations are available at nominal cost from public-domain software libraries and

Table 3. Specifications for Wedgwood Studio contract form (dimensions in inches).

	Left Start	Top Start	Width	Height	Frame Border?
TEXT FRAMES					
Hours	1.690	1.331	4.195	0.222	N
Name etc.	0.500	2.000	4.500	2.000	N
Terms Heading	2.013	4.108	3.368	0.250	Y
Contract Text	0.629	4.450	6.776	3.518	N
GRAPHICS FRAMES					
Logo with Company Name	2.000	0.075	3.500	1.250	N
Logo with Company Motto	0.694	8.166	1.500	1.000	N

from user groups. (In our June 1990 issue, see "Pick a Winner: The Best of Public-Domain Software," p. 36, and "Take My Software — Please!" p. 42, for more information on obtaining free or low-cost programs and accessories.)

Kudos from Wedgwood Studio clients prompted owner Jean Crosby to create a whole family of forms on her IIc: among them, a work order (Figure 4 and Table 2)

and a contract (Figure 5 and Table 3). For these forms, Crosby worked smarter, not harder. She eliminated some objects from the invoice form, shifted the position of other objects slightly, and added a few new objects.

Follow Crosby's lead and create the most object-filled form you need. Then adjust this complex form to create a simpler one. Continue until all you're left with

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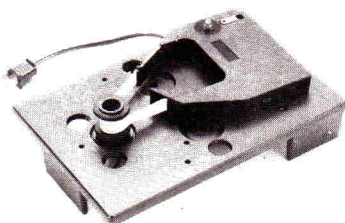
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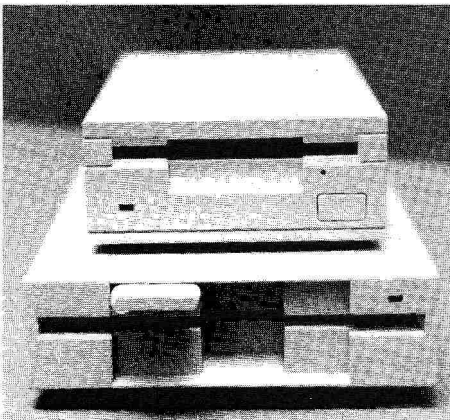
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is letterhead stationery and memo paper.

To eliminate an unwanted object, select it and press OA-X. To "zap" a series, select the first object, then press the open-apple key while clicking the mouse on the second one. "Open apple-click" on the third, and so on. When you press Delete, the whole group disappears. Publish It! routinely presents a warning about losing "an article's text" when you delete a text frame; just click on the OK button.

With good reason, Jean Crosby refers to Mollie Matlaf as "a national treasure" and adds, "I don't think I would be sitting at the computer today if not for her." Best of all, Crosby says she receives continual feedback from clients who like her new forms. While Crosby has as much paperwork as ever, at least she enjoys it more now — thanks to Apple II desktop publishing. □

CYNTHIA E. FIELD IS A CONTRIBUTING EDITOR FOR *INCIDER*. SHE IS A FREE-LANCE JOURNALIST SPECIALIZING IN COMPUTER-RELATED TOPICS. WRITE TO HER AT 60 BORDER DRIVE, WAKEFIELD, RI 02879. ENCLOSE A SELF-ADDRESSED, STAMPED ENVELOPE IF YOU'D LIKE A PERSONAL REPLY.



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GRAPHICS ALIVE!

Wake up your programs with color and animation — catch your audience's eye. A few basic commands will get you started — but don't be afraid to play!

By **DAN BISHOP**

EXCITING GRAPHICS ARE *LIVELY* graphics. Add movement to those images, and title screens come alive, boring old cursors are a thing of the past, game characters seem to jump out at you.

In my last column ("Draw It in BASIC," May 1990, p. 72), I introduced the Applesoft commands for low-resolution (lo-res) graphics and described the way your Apple handles graphics information in memory; I also demonstrated the importance of a well-designed graphics subroutine in making your programming tasks easier while increasing the versatility of your code. Let's review those concepts, then discuss the addition of *animation*, or the illusion of movement, to your graphics displays. We'll also tackle the creation of lo-res images by POKEing code directly into video RAM (random-access memory).

Note that if you're testing a graphics program and it ends, leaving you in graphics mode, you can just enter the TEXT command followed by HOME to get back into standard text mode.

LO-RES MAPPING

Applesoft reserves 1024 bytes of RAM between addresses 1024 and 2047 to store

information for display on your computer screen. This block of RAM is called *page 1 of text* or *page 1 of lo-res graphics*, depending on whether the program is in text mode or graphics mode. When in text mode, your Apple interprets a value in that area of RAM as a text character and displays that character on screen. When in graphics mode, it interprets the value as two vertically stacked points, or square blocks.

In graphics mode, the value stored in each byte is a combination of the two color codes (zero to 15) for the two blocks represented by that byte. If byte 1024 contains the value 193 (the letter *A* in text mode), two blocks appear, stacked vertically in the top left corner of the screen. Your Apple displays the top block in color 1 (red) and the block beneath it in color 4 (green).

Note that each screen byte is composed of 8 bits, or binary digits. The letter *A*, for example, is binary encoded as 1100 0001. The colored graphics blocks are specified by the first and last four binary digits of that screen value. By convention, the lower block is represented by the first 4 (or *high-order*) bits (*most-significant nybble*); the upper block by the *least-significant nybble*.

Your lo-res graphics screen is divided into 40 vertical columns and either 40 or 48 horizontal rows. The GR command

places you in lo-res page 1 graphics mode with a 40-row screen. The bottom eight graphics rows remain in text mode as four rows of text, which let you PRINT instructions, prompts, and so on below your graphics display. To get a full-screen (48-row) graphics display, follow the GR command with POKE -16302,0. POKE -16301,0 switches back to 40-row graphics.

In RAM, 960 of the 1024 bytes between addresses 1024 and 2047 correspond to, or "map to," 960 pairs of locations on your computer screen. RAM location 1024 maps to the upper left corner of the screen, rows 0 and 1. Address 1025 maps

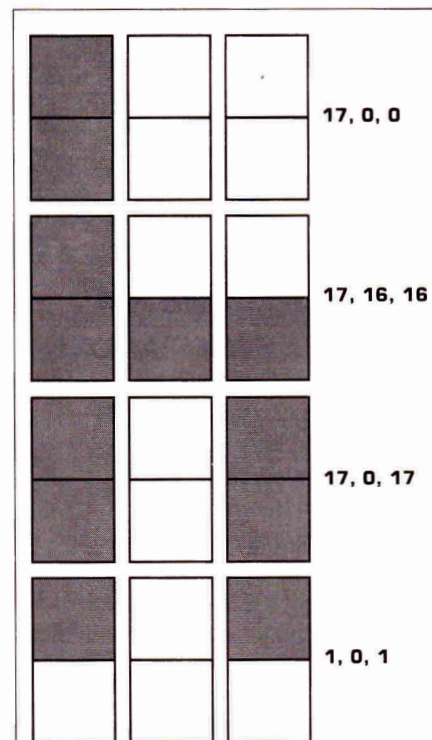


Figure. Lowercase "h" blocked out in a four-row by three-column matrix, subdivided into vertically stacked square blocks.

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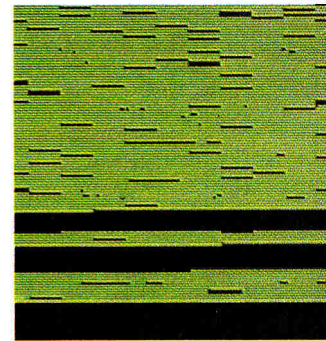
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Listing 1. Target Practice, a simple example of computer animation.

```

1 REM TARGET PRACTICE [2945]
2 REM D. BISHOP, INCIDER [4038]
3 REM ***** [3832]
4 REM [186]
10 GR [140]
15 SC = 0:Y = 15 [1226]
20 C = INT ( RND (1) * 15 + 1) [1833]
25 HT = 0: GOSUB 550 [1183]
30 FOR I = 1 TO 35 [1147]
35 COLOR= 0:X = I - 1: GOSUB 500 [1358]
40 COLOR= C:X = I [958]
45 IF SCRN( X + 4,Y) = 15 THEN HT = 4: GOTO 60 [3135]
50 IF SCRN( X + 4,Y) = 13 THEN HT = 2: GOTO 60 [3090]
55 IF SCRN( X + 3,Y + 1) = 13 OR SCRN( X + 3,Y - 1) = 15
    THEN HT = 1 [3882]
60 IF HT > 1 THEN GOSUB 520:X = X + 2: GOSUB 520:I = 35 [2743]
65 GOSUB 500 [942]
70 NEXT I [407]
75 GOSUB 580 [976]
80 IF HT < 2 THEN GOSUB 520 [1350]
85 HOME [279]
90 SC = SC + HT [836]
95 PRINT "SCORE: "SC [2291]
100 INPUT "ENTER ROW (2 TO 37) OR 0 TO QUIT...";Y [8201]
105 IF Y = 0 THEN TEXT : HOME : END [1266]
110 IF Y < 2 OR Y > 37 THEN 100 [2029]
115 GOTO 20 [783]
495 REM [306]
496 REM ***** [2028]
497 REM DRAW ARROW [927]
498 REM ***** [2028]
499 REM [314]
500 HLINE X,X + 4 AT Y [1000]
505 PLOT X + 3,Y - 1 [1461]
510 PLOT X + 3,Y + 1 [1464]
515 RETURN [185]
516 REM [186]
517 REM ***** [3747]
518 REM SPLAT ARROW & ERASE [3908]
519 REM ***** [3661]
520 COLOR= 0: PLOT X,Y: PLOT X + 1,Y: PLOT X + 2,Y [2163]
525 COLOR= C: PLOT X + 4,Y - 1: PLOT X + 4,Y + 1 [2884]
530 PLOT X + 4,Y - 2: PLOT X + 4,Y + 2 [1803]
535 COLOR= 0: VLINE Y - 2,Y + 2 AT X + 3 [2021]
540 VLINE Y - 2,Y + 2 AT X + 4 [1466]
545 RETURN [181]
546 REM [186]
547 REM ***** [3777]
548 REM DRAW SHIP [1865]
549 REM ***** [3779]
550 XT = INT ( RND (1) * 20 + 15) [2367]
555 YT = INT ( RND (1) * 36 + 2) [2170]
556 YT = 6 [640]
560 COLOR= 15: HLINE XT,XT + 4 AT YT [1652]
565 COLOR= 13: PLOT XT + 1,YT - 1 [2079]
570 PLOT XT + 3,YT - 1 [1439]
575 RETURN [305]
576 REM [306]
577 REM ***** [5368]
578 REM ERASE SHIP [2135]
579 REM ***** [5464]
580 COLOR= 0: HLINE XT,XT + 4 AT YT - 1 [2094]
585 HLINE XT,XT + 4 AT YT [1901]
590 RETURN [305]

```

to the two vertically stacked points to the right of that first pair. Each row contains 40 points. Addresses 1024 to 1063 map directly to the first two rows of graphics points; addresses 1064 to 1103 map to rows 17 and 18; addresses 1104 to 1143 map to rows 33 and 34. If you fill the first 120 RAM addresses with graphics codes,

your Apple displays those codes as graphics points in three distinct bands of two rows each, separated by one-third of the screen. Bytes 1144 to 1151, the remaining 8 bytes in a 128-byte sequence, aren't used for the display.

The next 128 bytes of RAM, addresses 1152 to 1279, map to your screen as three more pairs of rows, each directly beneath those produced by bytes 1024 to 2047. Again, the last 8 bytes of that segment are unused. This pattern of memory mapping continues through byte 2039, which maps to the bottom right corner of the screen, rows 46 and 47. The display circuitry ignores bytes 2040 to 2047, the last 8 bytes in this final segment.

LO-RES COMMANDS

GR switches your display to page 1 of lo-res graphics mode, with 40 columns and 40 rows, each numbered 0 to 39. The upper left corner point is at column 0, row 0 (or simply 0,0). GR also fills the RAM block with zeros, so all the graphics blocks on the display are black. The TEXT command reverses this process, returning the display to text mode. All graphics code is left in place, but your computer now interprets it as text, sometimes producing a very strange display. Follow the TEXT command with HOME to fill the video RAM with spaces that clear the display.

GR also sets the value for color to black. The first thing you must do before drawing is set a value for color between 0 (zero) and 15 with the COLOR = ## command, where ## is the selected value. That color value can be a number, a variable, or an expression. You can use the COLOR command as often as you like. Points already drawn keep their original colors; only subsequent points will have the new color definition.

Now you can plot individual points (actually square blocks in lo-res mode) with the PLOT X,Y command. X and Y may be numbers, variables, or expressions that evaluate to numbers. X specifies the column (0 to 39), and Y specifies the row (0 to 39 or 0 to 47) for the point you want to display, in whatever value you've assigned currently to COLOR.

You can also plot horizontal lines with the statement HLINE X1,X2 AT Y, and vertical lines with VLINE Y1,Y2 AT X. X1 and X2 are the starting and ending columns for the horizontal line drawn along row Y. Y1 and Y2 are the starting and ending rows for the vertical line drawn along column X. For diagonal lines, you must use the PLOT X,Y command within a loop that calculates new values for X and Y before each PLOT.

MOVING OBJECTS

And what about animation? First, an Applesoft subroutine that draws the moving object is essential. You must also define the color and drawing location as variables, then use GOSUB to call the subroutine.

You create the illusion of movement by drawing the object in a given color at the starting location, then redrawing it in the color of the background, usually black (COLOR = 0), effectively erasing the first image. You then draw the object in color at a slightly different location, and erase it again. Continuing the process creates an object that appears to move across the screen.

For this effect to work in BASIC, which is rather slow, keep your moving objects small and simple. Use a loop that erases the old

image, calculates the object's new position automatically, then draws the new image.

Listing 1, Target Practice, provides a simple example of animation, shooting an arrow across the screen in whatever row you select. The program places a target on screen at a random location; if your arrow strikes the target, you score points. The SCRN command tests the arrow's new position before your Apple draws it. If the squares it tests aren't black, SCRN returns a value other than zero to indicate that your arrow has hit the target.

Lines 500 through 515 contain the arrow subroutine; lines 520 through 545 contain the subroutine that erases the last arrow image and mashes it flat against the wall (or the target). Note that both subroutines use variables (X and Y) to define drawing location and variable C to define the current (randomly selected) color. The program assigns values to each of these variables before the GOSUB 500 and GOSUB 520 commands.

LO-RES ALPHABET

If you often need to display text in large block letters with lo-res graphics, you should invest a little time creating short subroutines for each letter of the alphabet. Block the letters out on graph paper, then use HLIN, VLIN, and PLOT to fill in the squares for a given letter. Use variables for color and location, and be sure to include a REMark with each subroutine telling which letter it produces. Start the definition for each letter at the same location (upper left corner, for example).

Include an X increment within the subroutine to reset the value of X to the starting location of the next letter. That'll save you the trouble of figuring a new value for X each time you draw a letter on screen. It's especially helpful if your letters have different widths.

Listing 2, Friendly Hello, provides a short example to get you started. In this program, the word *HELLO* flashes diagonally down the screen, each time in a randomly chosen color (still another kind of animation). Each letter in the word *HELLO* occupies five rows and three columns. If you want to define the color of each letter separately, include a COLOR = C command at the beginning of each subroutine, and define C before calling that letter's subroutine.

POKING INTO GRAPHICS

Listing 3, Alphabet Polka, also displays block letters on screen, but it uses an entirely different method to create them. Rather than draw the letters on screen with HLIN, VLIN, and PLOT, this program POKEs the appropriate code values for each pair of stacked squares into RAM. The program initially reads the codes for each letter from DATA statements and stores them in a large integer array (subroutine 200).

The percentage sign (%) after the array name, L, tells your Apple that all values stored in the array are integers. Because Applesoft uses 4 bytes to store real numbers, but only 2 to store integers, this trick cuts in half the memory required to store the codes.

L% is a two-dimensional array, with 36 rows (one for each letter) and 20 columns (allowing a maximum of 20 code values per letter). The letters defined in this program occupy eight rows and

Listing 2. Friendly Hello: Spice up your program titles with simple block-character graphics and an active screen display.

```

1  REM  A FRIENDLY HELLO  [3293]
2  REM  BY DAN BISHOP, INCIDER  [4569]
3  REM  ***** [3832]
4  REM  [186]
10 GR  [140]
15 FOR I = 0 TO 20 [1088]
20 X = I:Y = I: COLOR= INT ( RND (1) * 15 + 1) [2868]
25 GOSUB 100 [666]
30 X = I:Y = I: COLOR= 0 [1400]
35 GOSUB 100 [652]
40 NEXT I [437]
45 TEXT : HOME [376]
50 END [228]
95 REM [332]
96 REM ***** [4886]
97 REM DISPLAY "HELLO" [2942]
98 REM ***** [4886]
99 REM [308]
100 GOSUB 500 [971]
105 GOSUB 510 [1016]
110 GOSUB 520: GOSUB 520 [1597]
115 GOSUB 530 [998]
120 RETURN [321]
498 REM [308]
499 REM ***** [1738]
500 REM "H" [477]
501 VLIN Y,Y + 4 AT X [982]
502 VLIN Y,Y + 4 AT X + 2 [1443]
503 PLOT X + 1,Y + 2 [1456]
504 X = X + 4: RETURN [1335]
508 REM [332]
509 REM ***** [1754]
510 REM "E" [493]
511 VLIN Y,Y + 4 AT X [1576]
512 HLIN X + 1,X + 2 AT Y [990]
513 HLIN X + 1,X + 2 AT Y + 4 [1429]
514 PLOT X + 1,Y + 2 [828]
515 X = X + 4: RETURN [703]
518 REM [194]
519 REM ***** [2852]
520 REM "L" [806]
521 VLIN Y,Y + 4 AT X [1299]
522 HLIN X + 1,X + 2 AT Y + 4 [1454]
523 X = X + 4: RETURN [703]
528 REM [178]
529 REM ***** [2580]
530 REM "O" [754]
531 VLIN Y,Y + 4 AT X [1349]
532 VLIN Y,Y + 4 AT X + 2 [1408]
533 PLOT X + 1,Y: PLOT X + 1,Y + 4 [1859]
534 X = X + 4: RETURN [689]

```

one (letters *i* and *l*) to five (letters *m* and *w*) columns. The largest block required for a letter contains $8 \times 5 = 40$ colored squares and requires 20 code values.

The first number in the DATA statement for each letter corresponds to the width (number of columns) for that letter. A typical DATA statement looks like this:

```
DATA 2,0,16,0,16,0,17,16,17: REM "J"
```

Line 210 reads the letter's width (2 in this example) into L%(I,0), where I = 10 for the letter *J*. This value times the letter height (4 in this program) tells your Apple the number of values it must read for that particular letter (line 215). The program also uses width when the letter is displayed to calculate where to place the next pair of blocks on screen (lines 110, 115, 120, and 130).

Listing 3 produces lowercase letters and numbers. To calculate ►

the codes for the DATA statements, block out the object on graph paper. Divide this picture into pairs of vertically stacked squares. Reading from left to right, two rows at a time, write the pair of decimal values for the colors you want in each vertically stacked pair of squares. If you want to use the same definition with different colors, use color 1 for your DATA definitions. That way, each pair of blocks has one of four values: 0, 1, 16, or 17. For example, the **Figure** shows the letter *h*. The color-code sequence looks like this for the nine pairs of squares:

1,1; 0,0; 0,0
 1,1; 0,1; 0,1
 1,1; 0,0; 1,1
 1,0; 0,0; 1,0

Next, reverse these pairs, so that the color code for the lower block in each pair comes first. In this example, reversal changes the 1,0 pairs to 0,1, and the 0,1 pairs to 1,0. Now write each pair as a single eight-digit binary number, leaving out the hyphen, and convert the result back to decimal. Take this example:

00010001; 00000000; 00000000
 00010001; 00010000; 00010000
 00010001; 00000000; 00010001
 00000001; 00000000; 00000001

Conversion to decimal follows:

17; 0; 0
 17; 16; 16
 17; 0; 17
 1; 0; 1

These numbers correspond to the values in the DATA statement in line 607 of **Listing 3**.

The advantage of using color value 1 for this process is that you can change the color of the object at any time by multiplying each code value by the color value you want.

For example, suppose you want to display the object in color 12. In binary, 12 is 1100. So the four possible code values are 00000000, 00001100, 11000000, and 11001100. These four values are 0, 12, 192, and 204 in decimal — the same values you get when you multiply 0, 1, 16, and 17 by 12. If you assign the desired color value to C, multiply the code value by C before you POKE it into RAM (line 115).

Lines 100 to 145 do the actual POKEing of graphics values into RAM. You must define K to point to the row in the L% display that contains the letter you want to display.

H, the height of the letters, is assigned a value at the start of the program. You must also assign values to X, the screen location (1024 through 2039), and C, the color, before calling subroutine 100.

Be careful when you calculate the RAM location for each pair of squares you POKE. Remember that video addressing isn't a continuous sequence from 1024 to 2048, but is broken into 128-byte segments spaced one-third of the screen apart.

That's why the program calculates the X increment between pairs of rows and between letters (lines 130 and 140) as shown. Also be sure to include a safety test, such as line 111, before the POKE command, to ensure that you don't POKE code into your program space.

Listing 3. Alphabet Polka: Not for the faint of heart, this program defines letters as graphics codes saved in an integer array and POKEd into video RAM as needed.

```

1 REM ALPHABET POLKA [2843]
2 REM BY DAN BISHOP, INCIDER [4569]
3 REM ***** [3500]
4 REM [186]
5 DIM L%(36,20) [2088]
10 N = 36:H = 4 [994]
15 GOSUB 200 [677]
20 GR [176]
25 GOSUB 400 [681]
30 GOSUB 300 [691]
40 INPUT "ANOTHER MESSAGE? (Y/N) ";A$ [5388]
45 IF A$ = "N" THEN 90 [1390]
50 IF A$ < > "Y" THEN 40 [1821]
55 INPUT "ERASE THIS ONE? (Y/N) ";A$ [5249]
60 IF A$ = "Y" THEN GR [1153]
65 GOTO 25 [752]
90 TEXT : HOME : END [924]
95 REM [332]
96 REM ***** [4428]
97 REM DISPLAY LETTER [2907]
98 REM ***** [4428]
99 REM [308]
100 W = L%(K,0) [1748]
105 FOR J = 0 TO H - 1 [1066]
110 FOR I = 1 TO W [1047]
111 IF X > 2047 OR X < 1024 THEN GOTO 125 [1990]
115 POKE X,C * L%(K,I + J * W) [2021]
120 X = X + 1 [737]
125 NEXT I [562]
130 X = X - W + 128 [926]
135 NEXT J [219]
140 X = X - H * 128 + W + 1 [1547]
145 RETURN [177]
195 REM [308]
196 REM ***** [2086]
197 REM READ DATA INTO ARRAY [1524]
198 REM ***** [2088]
199 REM [316]
200 HOME : PRINT "READING DATA..." [3789]
205 FOR I = 1 TO N [871]
210 READ L%(I,0):W = L%(I,0) [2451]
215 FOR J = 1 TO H * W [1385]
220 READ L%(I,J) [701]
225 NEXT J [365]
230 NEXT I [375]
240 RETURN [305]
295 REM [194]
296 REM ***** [3516]
297 REM PARSE MESSAGE [2685]
298 REM ***** [3516]
299 REM [202]
300 FOR L = 1 TO LEN(M$) [971]
305 M$$ = MID$(M$,L,1) [925]
310 K = ASC(M$$) - 64: IF K = - 32 THEN X = X + W:
GOTO 330 [3754]
315 IF K < 0 THEN K = K + 34: IF K = 18 THEN K = 36 [3478]
320 IF K < 1 OR K > N THEN 330 [1701]
325 GOSUB 100 [961]
330 NEXT L [409]
335 RETURN [305]
395 REM [202]
396 REM ***** [897]
397 REM MESSAGE ENTRY [1106]
398 REM ***** [899]
399 REM [178]
400 HOME [151]
405 PRINT "ENTER SHORT MESSAGE..." [1799]

```

Listing 3 continued on p. 79

Listing 3 continued

```

410 INPUT MS [386]
415 INPUT "ENTER COLOR (0 FOR RANDOM): ";C [2154]
420 INPUT "ENTER STARTING LOCATION (1024 TO 1140): ";X [3547]
425 IF X < 1024 OR X > 1140 THEN 420 [2369]
430 IF C = 0 THEN C = INT ( RND (1) * 15 + 1) [2682]
435 RETURN [185]
600 DATA 3, 0,0,0,1,1,17,17,1,1,1: REM "A" [7275]
601 DATA 3,17,0,0,17,16,16,17,0,17,1,1,1: REM "B" [7624]
602 DATA 3, 0,0,0,16,16,16,17,0,0,1,1,1: REM "C" [7485]
603 DATA 3,0,0,17,16,16,17,17,0,17,1,1,1: REM "D" [7624]
604 DATA 3,0,0,0,17,1,17,17,1,1,1,1: REM "E" [7050]
605 DATA 2,17,1,17,16,17,0,1,0: REM "F" [5459]
606 DATA 3, 0,0,0,16,16,16,17,16,17,16,16,17: REM "G" [8532]
607 DATA 3, 17,0,0,17,16,16,17,0,17,1,0,1: REM "H" [8025]
608 DATA 1,16,16,17,1: REM "I" [3495]
609 DATA 2,0,16,0,16,0,17,16,17: REM "J" [5662]
610 DATA 3,17,0,0,17,0,16,17,1,16,1,0,1: REM "K" [7479]
611 DATA 1, 17,17,17,1: REM "L" [3728]
612 DATA 5,0,0,0,0,0,16,16,0,16,16,17,0,17,0,17,1,0,1,0,1:
REM "M" [11516]
613 DATA 3,0,0,0,16,16,16,17,0,17,1,0,1: REM "N" [7468]
614 DATA 3,0,0,0,16,16,16,17,0,17,1,1,1: REM "O" [7453]
615 DATA 3,0,0,0,16,16,16,17,16,17,17,0,0: REM "P" [7902]
616 DATA 3,0,0,0,16,16,16,17,16,17,0,0,17: REM "Q" [7905]
617 DATA 3,0,0,0,16,16,16,17,0,0,1,0,0: REM "R" [7251]
618 DATA 3,0,0,0,17,1,1,1,1,17,1,1,1: REM "S" [6835]
619 DATA 3,16,17,16,0,17,0,0,17,0,0,1,0: REM "T" [7517]
620 DATA 3,0,0,0,16,0,16,17,0,17,1,1,1: REM "U" [7298]
621 DATA 3,0,0,0,16,0,16,1,17,1,0,1,0: REM "V" [7069]
622 DATA 5,0,0,0,0,0,16,0,0,16,1,16,1,16,1,0,1,0,1,0:
REM "W" [10908]
623 DATA 3,0,0,0,16,0,16,0,17,0,1,0,1: REM "X" [7070]
624 DATA 3,0,0,0,16,0,16,17,16,17,0,0,17: REM "Y" [7718]
625 DATA 3,0,0,0,1,1,17,16,1,0,1,1,1: REM "Z" [6889]
626 DATA 2,0,16,1,17,0,17,0,1: REM "1" [5411]
627 DATA 3,16,16,16,0,0,17,17,1,1,1,1: REM "2" [7610]
628 DATA 3, 16,16,16,16,16,17,0,0,17,1,1,1: REM "3" [8264]
629 DATA 3,16,0,16,17,0,17,1,1,17,0,0,1: REM "4" [7646]
630 DATA 3,16,16,16,17,16,16,0,0,17,1,1,1: REM "5" [8040]
631 DATA 3,16,0,0,17,0,0,17,1,17,1,1,1: REM "6" [7407]
632 DATA 3,16,16,16,0,0,17,0,0,17,0,0,1: REM "7" [7607]
633 DATA 3, 16,16,16,17,16,17,17,0,17,1,1,1: REM "8" [8499]
634 DATA 3,16,16,16,17,16,17,0,0,17,0,0,1: REM "9" [8013]
635 DATA 3,16,16,16,17,0,17,17,0,17,1,1,1: REM "0" [8040]

```

When you run **Listing 3**, the program asks you to enter a short message and specify its color and starting location (subroutine 400). Then subroutine 300 parses the message into individual letters with the MID\$ function and converts the letters to ASCII code with the ASC function. The subroutine uses the ASCII code to calculate the appropriate value for K to find that letter's code in the L% array.

Listing 3 recognizes only the 26 letters of the alphabet, the digits 0 through 9, and a blank space. Once your message has been displayed, you can put another message on the same screen or a fresh one.

POKEing graphics codes into RAM as shown here has certain disadvantages. First, each pair of blocks must have the same color. Another drawback is that the first row of squares for your objects must be row 0 or an even-numbered row on screen. If you want them to begin on an odd-numbered row, you must block them out with the actual top row blank.

There are certain advantages to dealing with the actual graphics codes, though. For one thing, the code is shorter, letting you compress your program. For another, your Apple can store decimal

values in arrays where you can access them easily. Also, your Apple executes a series of POKEs much faster than the BASIC graphics commands.

Another important plus is that this approach uses concepts that resemble those of advanced graphics programming. If you're a serious student of programming, you'll want to become familiar with these techniques.

PAGE TWO

There are actually two pages available for lo-res graphics. Using page 2, however, is an exercise for the experienced programmer. Page 2 begins at RAM address 2048, exactly the same address used for the beginning of your program. Guess what happens if you open page 2 of lo-res graphics and clear the screen? That's right — the first 1024 bytes of your program disappear.

One technique for making this area of RAM available is to execute a subroutine that copies all the values in this block of RAM to another part of memory. You can then call graphics mode with either GR or POKE -16304,0. Then initiate page 2 with POKE -16299,0. Now all graphics commands apply to page 2.

When you're finished, execute a POKE -16300,0 to switch back to page 1, POKE 16303,0 to change to text mode (if you like), and execute the block-move subroutine again to copy your program code back into its appropriate place in RAM.

As you might expect, moving segments of program code around in memory is fraught with danger. Not only must you be sure to copy the code out and back correctly, but you must be certain that the area of memory you're using for temporary storage isn't also being used for variable storage by your program. If your program uses some of that memory area while your segment is stored there, imagine what your program will look like after the altered code is copied back!

If you decide to experiment with these gimmicks, be sure to save your program to disk every time before running it. Any slight error or miscalculation could make the entire program unreadable. Come to think of it, you should follow this suggestion whenever you're developing a program.

ANIMATION ANTICS

These two columns should get you started on lo-res graphics programming. Go for simplicity with static drawings, and don't be afraid to play. For example, try this one:
10 GR:COLOR = 13:PLOT 10,10:END

Then work your way up to animation, first on a black screen, and finally with objects moving across a picture. (Use the SCRN function to save and restore the background colors.) As you work with new concepts, things always go wrong at first — but part of the fun of graphics programming is seeing some the fantastic things that happen when your program does something unexpected. And you'll treasure those moments when you succeed in getting your program to do exactly what you want it to. □

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ANIMATED ANTICS 2

Watch your Apple's sleight
of hand as it sketches and erases on both hi-res pages
to create the magic of animated graphics.

By **ROBERTA SCHWARTZ**
and **MICHAEL GALLERY**

PLAYING TRICKS ON YOUR EYES IS the secret of *graphics animation* — a series of still pictures flashing so fast that your brain blends them together in the illusion of movement. If you tried the short animation program in part 1 of this column ("Animated Antics," June 1990, p. 72), you've probably experimented so much with *page flipping* — switching quickly between two images in memory — that by now your Apple II is acting as though it has the hiccups. Well, it's time to expand your animation skills. This month's focus is a bit more challenging.

ANIMATING APPLESOFT

In every model of Apple II computer, Applesoft BASIC lets you use *shape tables* to create, draw, and manipulate two-dimensional shapes on the high-resolution screen. The shapes in a shape table are defined by *vectors*, lines that have a direction. A vector shape is something like an image you might create by arranging toothpicks. (See **Figure 1**.) Shape tables contain up to 255 different shapes, from a simple single vector to an airplane, a bird, or part of an assemblage. (See **Figure 2**.)

With excellent software such as Beagle Bros' *Shape Mechanic*, you don't even have to know how to create shape tables to reap the benefits of shape-table animation. If you draw your shape with any standard hi-res painting program, Shape Mechanic will convert it to vectors. All that's left is to write the code that animates your shape. With the accompanying **Program listing**,

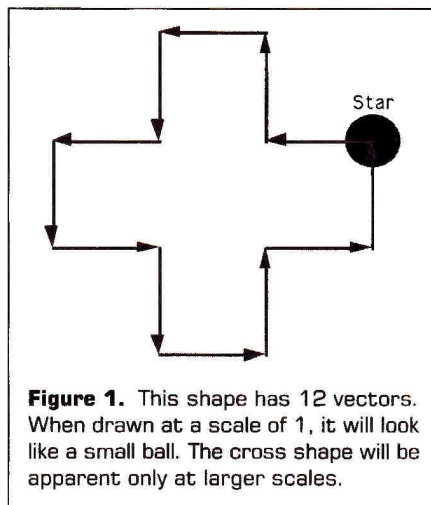


Figure 1. This shape has 12 vectors. When drawn at a scale of 1, it will look like a small ball. The cross shape will be apparent only at larger scales.

even that's easy. This program appeared in our April 1990 column ("That Old Brush Magic," p. 74). Now don't type it in yet. Read it first, along with the explanations that follow.

Shape tables are usually saved on disk as binary files, then loaded into a specific area of memory. Because we wanted you to get instant results when you typed in this program, we wrote it so that it would both create and manipulate a shape table. In the space of this column it's impossible for us to explain in detail how to create shape tables manually; in general, however, the program creates a simple shape (lines 500 and 510), loads the shape into memory (lines 30 and 40), tells Applesoft where the table is loaded (line 50), and moves the shape across the screen (lines 60–90).

DRAWING SHAPES

Now, let's set up the initial parameters that control how Applesoft draws the shape. The three commands controlling this function are $HCOLOR = n$, $SCALE = n$, and $ROT = n$.

$HCOLOR = n$ tells Applesoft which of the six hi-res colors to use: n accepts numbers from 0 to 7; 0 = black1, 1 = green, 2 = violet, 3 = white1, 4 = black2, 5 = orange, 6 = blue, and 7 = white2. Because we want our shape to display in white, we'll use color 3 (line 20).

The command $SCALE = n$ determines the size of the shape. It accepts any number from 1 to 255. Vectors in a shape table are one pixel in length. $SCALE = 1$ yields a shape in its original size. If you increase the scale factor, you multiply each vector by that factor; for example, $SCALE = 2$ results in lines that are twice the size of those you created with $SCALE = 1$. In our program, we choose not to increase the size of the shape, so we set the scale to 1 (line 20).

The command $ROT = n$ determines the orientation of vectors; it accepts numbers from 0 to 255, with 0 being the standard orientation. The result of the $ROT = n$

command is tied to the scaling factor; at a scale of 1, you get only eight rotation steps, but at larger scales, you get many more. Because we don't want any rotation in our shape, we set ROT to 0 (line 20).

Applesoft includes two commands that place the shape on screen: DRAW and XDRAW. DRAW uses the currently set color to carry out that function; XDRAW uses the Boolean XOR operation. (See "That Old Brush Magic," April 1990, p. 74, for more information about XOR.) Both commands require you to specify the

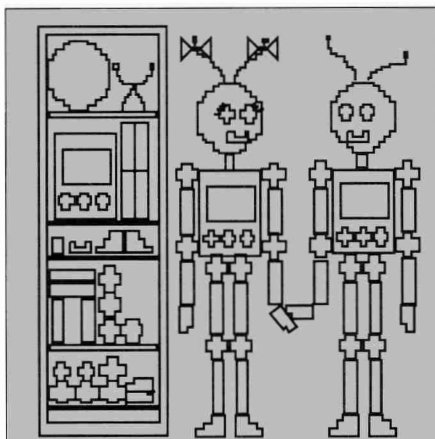


Figure 2. Roberta used a shape table with 30 shapes to create a short animation. When it begins, the shapes are in the cabinet on the left. While the viewer watches, the shapes come out of the cabinet one by one, to form the robot on the right. The robot then uses the shapes to build a female companion. DRAW, XDRAW, and ROT commands allowed for interesting visual effects; simple sounds were programmed in to enhance the animation.

shape in the table you want to draw (by the number in the table) and the x-y location of the shape on screen.

Applesoft wraps shapes; that is, if the shape is drawn too far to the left of the screen, the part that doesn't fit appears on the right side of the screen. Here in our animation, we want the shape to move from left to right across the screen, so we

keep changing the x coordinate in the XDRAW command with a simple FOR/NEXT loop (lines 60 through 90).

The **Program listing** includes two XDRAW commands because of the way the XOR operation works. The first draws; the second erases the shape. When the shape is erased, you see a totally blank screen for one second, making the animation flicker.

Type in the **Program listing** and save it to disk. Note that we'll be making several modifications to this basic program, so you might want to save each version under a new name. Now RUN the program. To return to the text page, type TEXT.

Next, let's use the DRAW command instead of XDRAW. To do this, we must draw first in white, then in black (to erase). Add the following lines to the program:

```
69 HCOLOR = 3
79 HCOLOR = 0
```

Now change lines 70 and 80 to read:

```
70 DRAW 1 AT X,100
80 DRAW 1 AT X,100
```

These changes don't alter the appearance of the animation, and the annoying flicker is still there. To eliminate it, we must keep the viewer from seeing a blank screen. We can do this by using both hi-res screens, and erasing on the screen that's not being viewed. (We're page-flipping.)

Applesoft uses location 230 to determine the screen to which it will draw. If location 230 contains 32, it will draw to page 1; if location 230 contains 64, it will draw to page 2. Now edit your program as follows:

```
10 HGR2:HGR: POKE -16302,0
69 POKE 230,32: POKE -16299,0
79 POKE 230,64: POKE -16300,0
```

Next, change lines 70 and 80 back to XDRAW. Remember that Applesoft won't "page-flip" in 80-column mode.

Although this procedure eliminates flicker, it leaves the starting and ending dots on screen: The first XDRAW draws the dot on screen, but when the program loops to the second XDRAW (for erase), X has been incremented, and the first dot remains. To fix it, add another loop:

```
61 FOR I = 1 TO 2
99 NEXT I
```

You erase the dot because two XDRaws occur at the same X coordinates.

ANOTHER SHAPE

To illustrate the use of ROT=n and SCALE=n commands in animation, we're

going to create a new shape, a single vector pointing to the left. Edit lines 30 and 510 to read as follows:

```
30 FOR I = 0 TO 5:READ T
510 DATA 7,0
```

Run the program now to see a single pixel gliding across the screen. That's our one-pixel, left-pointing vector. Let's scale it by typing in the following line:

```
59 SCALE = 50
```

Run the program now and you'll see a 50-pixel shape gliding across the screen. Let's make it rotate as it glides:

Program listing. Shape-table animation.

```
5 REM Set up full-screen hi-res graphics
10 HGR: POKE -16302,0
15 REM Set color and initial shape parameters
20 HCOLOR=3: SCALE=1: ROT=0
25 REM Loop to read shape data into RAM
30 FOR I =0 TO 10: READ T
40 POKE 768+I,T: NEXT I
45 REM Tell Applesoft where shape is (location 768)
50 POKE 232,0:POKE 233,3
55 REM Animation loop
60 FOR X=10 TO 260
65 REM Draw shape
70 XDRAW 1 AT X,100
75 REM Erase shape
80 XDRAW 1 AT X,100
90 NEXT X
495 REM Shape data
500 DATA 1,0,4,0
510 DATA 39,55,55,53,37,37,0
```

```
60 FOR R = 0 TO 255
61 ROT=R
90 NEXT R
```

And, with a few more changes, you can make clock hands:

```
70 XDRAW 1 at 140,100
80 XDRAW 1 at 140, 100
```

MORE TO COME

We've only just touched the surface of animation through shape tables, and we hope you'll experiment on your own. Next time, we'll explore Broderbund's popular animation program, Fantavision. □

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compiler, extends the language itself. By creating a text source-code file, MD-BASIC lets you write structured, modular Applesoft that still compiles into the standard BASIC language.

These products not only serve those who want to create programs in Applesoft, but also encourage ongoing support for the vast library of existing Applesoft programs. With the luxurious development environments now available, relatively few programmers are willing to face the BASIC

prompt, even to do a minor tune-up on a program.

BASIC DIFFERENCES

Despite their similar intent, Program Writer and MD-BASIC are really quite different. Program Writer creates a hospitable environment for the true Applesoft programmer with a quality editor, macro keys, and a variable reference list. MD-BASIC, which requires a GS and the APW (Apple Programmer's Workshop) environ-

ment, targets actual deficiencies in the language that discourage ongoing program maintenance. It assumes you're a more advanced programmer with a specific need or desire to drop back to Applesoft.

Program Writer, a memory-resident editor for Applesoft, is a better expression of a familiar idea. In fact, several such products, most of which are line-based, have been published throughout the years. Program Writer, however, is a full-screen scrolling editor — kind of like an AppleWorks for BASIC. And with its macro keys you store frequently written expressions for instant recall.

To get going with Program Writer, just launch BASIC in the usual manner and you'll get the bracket prompt. Then run one of the three versions of the editor to load it into memory: One version is the full-featured editor, another has some commands removed so that you can use it

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Building a better BASIC.

with large programs, and the third loads into the language card to make room for very large programs. All versions support both ProDOS and DOS 3.3.

Now with the editor installed, load your program just as you did before, and type a command to toggle into the editor. Now you can page around in the file and do word processor-like editing. When you're ready for a test run, toggle back to the BASIC prompt.

Program Writer's editing commands include search and replace, find, cut and paste, move, and delete. You can also cut and paste between programs; this feature lets you easily build a library of subroutines you'll use often. Program Writer provides automatic line numbering (and renumbering), and a utility that converts files to uppercase if you use it with an Apple II Plus. You can also specify indented displays

to make reading long lines much easier.

One welcome aspect of the product is the ability to view or print a list of the variables you've already used in your program. Although duplicate variables are a common source of problems, you can avoid making this kind of mistake by viewing the list of variables before you assign one.

Program Writer's macros let you customize your programming environment. You could store the print command, for instance, and associate it with a certain key, such as P; when you type Open apple-P you insert PRINT into your code. But although you can link macros to create powerful tools and you can keep any number of macro files on disk, you'll find some limitations. Most notably, Program Writer's macros can't use logic, and you're limited to the macros supplied with the program. The best macro systems let your machine memorize (record) a sequence of keystrokes as you type them; Program Writer doesn't include a recording feature.

Program Writer is well designed and free of bugs. It's the best traditional Applesoft editor I've used, although I long for the days when Beagle Bros sold products like this for \$20 or \$30. Such is the march of progress.

APPLESOFT GS?

Good things happen when good programmers become frustrated with something — because eventually they find a solution. MD-BASIC is such a solution to a particular frustration: The author who wrote the utility thought it would best answer the need for a professional way to write and maintain Applesoft.

MD-BASIC works as a shell utility in APW, the standard development environment for the GS. You write your program with the APW text editor and utilities, then use MD-BASIC to translate the text file into an executable Applesoft BASIC file.

The glaring problem is that you have to leave APW and launch BASIC to test your program. To make any changes, you must then restart APW. When you consider it as a sophisticated tool for long-term project management or new development, however, the power of the environment outweighs the slow turn-around; in this light, the problem doesn't seem so bad. Remember, also, that you can edit the output file

at the BASIC prompt for any fine-tuning.

MD-BASIC supports named procedures, logical branching, declaration of constants, conditional compilation, and the automatic inclusion of library and header files to help with project management and source-code reusability. You don't need line numbers, and you can indent for clarity.

Something as simple as the IF/THEN/ELSE/ENDIF construction can change the nature of your programming. It can turn this sequence:

```
100 IF A=B THEN GOSUB 500:
    GOSUB 600:GOTO 120
110 GOSUB 700
120 PRINT "Program continues here."
into this one:
IF A = B THEN
    GOSUB ThisRoutine
    GOSUB ThatRoutine
ELSE
    GOSUB OtherRoutine
ENDIF
PRINT "Program continues here." ▶
```

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REVIEWS

This code is immediately more readable and easier to debug. It's also easier to follow if you return to the program later.

MD-BASIC includes a module called AmperWorks — a set of ampersand commands that provide extended input/output and certain control features, such as REPEAT/UNTIL and WHILE/WEND.

AmperWorks operates in conjunction with another ampersand utility, such as the interface for Applied Engineering's Fast-Math coprocessor card; MD-BASIC lets you write *aliases* (single-word mnemonics that abbreviate more complicated commands) so that the compiler can understand the added command words.

This utility also includes a decompiler so that you can create a source-code text file to update your existing Applesoft programs. It's fast and does some basic formatting, but the result will still be an hour or two short of clean.

You can "optimize" your compiled output to create a fast, compact program — strip comments, compress statements, organize the program to make the best use

of memory, and generate a cross-reference of variables and labels. The resulting program is faster than most Applesoft programs, but very difficult to understand without the source-code file.

Keep one thing in mind: MD-BASIC is an Apple IIGS utility for creating 8-bit Applesoft programs. It doesn't access the extended features of the GS.

BASIC BONANZA

Although both Program Writer and MD-BASIC began as an idea to enhance BASIC, the utilities have turned out to be radically different. I really wouldn't want to choose one over the other because each one has its place.

Alan Bird, the author of Program Writer, introduces us to the finest utility available for hacking Applesoft. Fans of certain other program editors may argue with that, but you'll really enjoy the product once you get past the ever-changing user interface.

With MD-BASIC, Morgan Davis also gives users a method for managing the

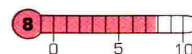
group's ProLine bulletin board (619-670-5379), even with its dozens of files requiring constant change. This product helps fill a gap that wasn't even apparent until after the fact. MD-BASIC isn't as good for hackers, but it's great for the big projects.

Joe Abernathy
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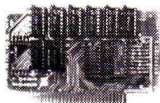
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math, spelling, reading, and writing. All the company's products build fundamental skills and reinforce basic concepts, while most of them incorporate an action-packed game to make learning enjoyable.

Alge-Blaster Plus is no exception. With this program, first- and second-semester algebra students learn how to solve equations and word problems, factor expressions, handle monomials, polynomials, and fractions, and work with graphs. After mastering the basics, kids move on to the

Alge-Blaster game, where they practice their graphing skills by defending a space station from asteroids.

The "Plus" in the title indicates an upgrade. Previously released as Alge-Blaster, the new edition is much improved. With the addition of a Graph module and the Alge-Blaster game, it now offers five activities instead of three. Other improvements are its enhanced presentation graphics and animation, and its more intuitive user interface.

You'll find this interface simple to negotiate with point-and-select cursor control, pull-down menus, icons, dialog boxes, and optional mouse input. (Keyboard fans can use simple keystrokes to issue commands or enter special algebraic characters.) The screen font is also larger and easier to read than the original program's.

The new and improved Alge-Blaster Plus consists of four basic activities — Learn, Solve, Translate, and Graph — and each offers several levels of difficulty. Learn and Solve provide practice in nine different subject areas, including integers, order of operation, factoring, radicals, and quadratic equations. Students begin by selecting an activity, a difficulty level, and a subject area (if applicable).

Once a student completes a predetermined number of problems, the activity ends and the scoreboard appears (for all activities but Learn). The scoreboard presents information about the student, with the activity and level completed, the date, the number of problems attempted, the

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Blasting your way through algebra.

number of problems answered correctly, and the final percentage score. You can print scoreboards for future reference and "certificates of completion" to congratulate a student for working through an activity successfully.

Those who need to master equation-solving basics will appreciate Learn, an interactive tutorial. This activity takes youngsters through the steps necessary to solve several types of problems. First, the program presents a problem and demonstrates how to solve it. The student then works through three additional problems in response to on-screen prompts. Along the way, kids become familiar with algebraic concepts and their properties.

Once students master the basics, they

can move on to Solve. In this activity they work through several practice equations and build on skills they've already learned. Students decide whether to solve the problems on their own or with help. If they opt for help, the program provides prompts and hints.

Translate gives students the opportunity to work with both word phrases and algebraic expressions as they must decide whether to translate equations into phrases, phrases into equations, or both. When Translate presents an algebraic expression or a phrase at the top of the screen, students select the correct phrase or expression to match it from four possible choices. The scoreboard appears after youngsters complete a round of 20 problems.

With Graph, young students learn about lines and slopes, and practice their graphing abilities. Individuals may work at one of two difficulty levels. In Level 1, students decide whether to place a point on a graph, label a point chosen by the program, or both. In Level 2, the program instructs them to find a point, a slope, or both. At either level, students can place a grid on screen for visual assistance, or play against a timer that gives them 20 seconds to provide the correct answer.

After practicing algebra basics, students move on to the Alge-Blaster game, which requires players to use their graphing knowledge to prevent an asteroid from colliding with a grid-based space station. Players earn points for blasting the asteroid (by entering the correct slope) or creating a space web to block an impending collision (by entering the correct coordinates on a graph). Kids can play Alge-Blaster at four levels of difficulty and at normal or fast speed. Even the simplest level is challenging. Sound, colorful graphics, and animation all enhance the game.

While Alge-Blaster Plus is probably the best first- and second-semester algebra tutor around, some of its features impede the program's overall performance. Alge-Blaster Plus currently offers no provision for solving problems on screen; youngsters must perform their calculations with pencil and paper and enter only the answers. The program would be greatly improved if it had an on-screen work area or a

calculator mode to perform the figuring.

Also, the Solve activity sometimes indicates an answer as wrong when in fact it's correct. When I entered $1a$ for one answer, for example, I received the "Try Again" message. The correct answer turned out to be a . The same thing happened when I entered $a(6b + 5)$ instead of $6ab + 5a$, which is essentially the same answer. Students may find restrictions when they change levels or subjects within an activity; they must quit to the main menu first.

All things considered, though, Alge-Blaster Plus provides solid algebra training at an affordable price.

It's a great way to supplement conventional textbook instruction. Teachers will appreciate the program's editing and recordkeeping options, while students will enjoy the self-paced math practice. Congratulations to Davidson & Associates on a job well done. □

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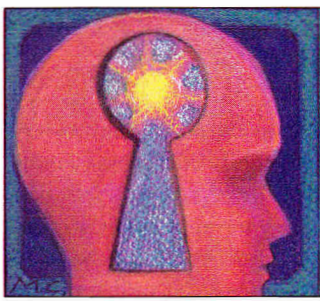
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II BE OR NOT II BE

By **DAVID D. THORNBURG, Ph.D.**

Can Apple create a dual-processor computer to sell for less than \$1000? That, it seems to me, is the major question.

THE ARCHITECTURE OF THE APPLE II IS more than 12 years old. The human body replaces its cells every seven years, so if you purchased your computer in the late 1970s, the "you" who presses the keys today is completely different from the body that bought the computer in the first place. The Apple II has truly stood the test of time.

A SEA OF TROUBLES

Given the tremendously rapid pace of change endemic in this industry, the continuing popularity of the Apple II line is a testament to its versatility.

Of all the other companies that were making personal computers in 1979, Commodore and Tandy/Radio Shack are the only ones still in business today. Of the three, only Apple has maintained compatibility with its original product line.

Radio Shack does most of its desktop business in the MS-DOS world today — the Model I is long gone — and Commodore's flagship is (or should be) the powerful Amiga, not the PET. Tandy has not only moved away from its original platform, it has branched out into new markets, such as the WP-2 laptop word processor, that have tremendous applications in education without requiring compatibility with earlier models.

OUTRAGEOUS FORTUNE

In a funny way, Commodore's and Tandy's success is a result of their failure. These two powerful companies failed to make the inroads in classrooms that Apple achieved.

In the K-12 world, Apple Computer achieved dominance quickly; as a result, many classrooms that once had Tandy or Commodore equipment have now sold or donated their old hardware and software to standardize on the Apple II line. As a result, Commodore and Tandy were free to move into newer technologies without infuriating a massive installed base. Apple

Computer doesn't have that luxury.

Many schools across the nation are still using early Apple IIs. Until recently, Professor Tom O'Brien — the designer behind such software masterpieces as Safari Search, King's Rule, and numerous other excellent programs from Sunburst Communications — was using an Apple II Plus.

Loyalty of this order is common among Apple II users, and it provides an enormous challenge to Apple Computer, as well as to third-party developers.

Back in the 1970s, the old 8-bit 6502 microprocessor was the neatest thing since sliced bread. It formed the foundation of several personal computers, including the Commodore PET and the Apple II.

That chip could directly address a then-whopping 64K of RAM (barely enough for an interesting operating system today), and, except for a couple of minor bugs, it performed really well.

Today, we're inclined to look down our noses at anything less than a true 32-bit machine, such as the Mac II's 68030. Yet Apple II lovers continue to pump out wonderful programs for their machines.

PERCHANCE TO DREAM

Psychologists have suggested that most people operate at only 5 to 10 percent of their true mental capacity.

If we applied this model to computers, we'd have to admit that today's Apple IIs are being pushed to the 98 percent point. Mouse- and menu-driven hypertext tools such as Techware's TutorTech provide "Mac-like" environments on a 64K Apple II — an amazing feat.

The problem, however, is that sooner or later the Apple II will just plain run out of steam. As users become more demanding, they'll no longer be willing to trade off ease of use for speed.

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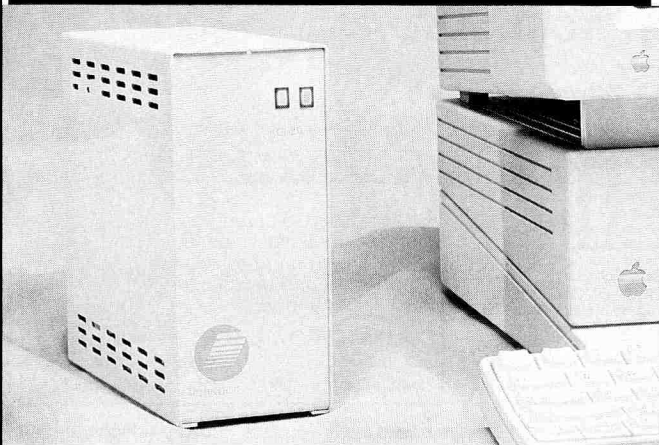
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LEARNING CURVE

looking like a little girl dressed up in her mother's clothes — cute to look at, but definitely outclassed by grownups. While the GS is a great machine in its own right, it's clearly not the color Macintosh "for the rest of us."

NOBLER THOUGHTS

The GS points in the right direction, however. One of its major features is that it lets us continue to use our massive libraries of Apple II software while providing the opportunity to create fancier 16-bit programs that can compete with the Amiga's and the Atari ST's.

The GS has breathed new life into the Apple II line, but it continues to perpetuate the idea that the II and the Macintosh may not ever meet on the same platform.

In the meantime, Apple has devoted a tremendous amount of energy to establishing its leadership at the higher end of the Macintosh spectrum.

While I believe there's a tremendous market for a lap-top Apple II that kids could buy for \$500, Apple believes there's a tremendous market for a \$6000 lap-crunching Macintosh. I think we're both right, but so far Apple Computer has addressed only the higher end of the market.

THE LAW'S DELAY

This puts educators in an interesting spot. Should they move to the Macintosh platform and abandon the Apple II line?

Hardware costs aren't the only factor in their decision. Massive libraries of Apple II software can't run on the Mac.

Even if money were no object, the bulk of Apple II educational software isn't available for the Macintosh, mostly because software developers think that

Apple still wants the Mac to be seen primarily as a business computer.

The short-term solution is to create a dual-processor Apple-computer that runs both Macintosh and Apple II software.

That would preserve the current installed software base (and keep educators from jumping to less-expensive platforms, such as those available in the MS-DOS world), while making it financially feasible for software developers to create spectacular educational programs for the Macintosh.

Can Apple create a computer like that to sell for less than \$1000? That, it seems to me, is the major question.

THE HUE

OF RESOLUTION

No manufacturer in the history of the field has done as much as Apple Computer to maintain compatibility and upward migration within a line of its machines.

Now the only remaining gap is to provide a smooth transition from the Apple II to the Macintosh.

If Apple does that, it will maintain the integrity that has created legions of loyal II users around the world. Teachers today believe strongly in Apple Computer's commitment to education. In the meantime, the clock is ticking. □

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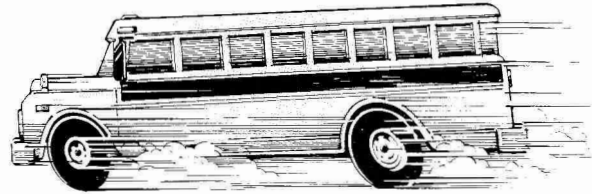
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THE MAIN MENU

Apple users know there's always an easier way to get the job done. A shortcut here, an elegant twist there — that's what *Hints & Techniques* is all about. Bracketed numbers refer to *inCider's* Applesoft Proofer program.

For your copy, send a self-addressed, stamped envelope to Proofer, c/o *inCider*, 80 Elm Street, Peterborough, NH 03458.

APPLESOFT BOOT

By Robert Schack

GOOD COMMERCIAL SOFTWARE — programs such as AppleWorks — starts with a menu that lets you easily select what you want to do next. Wouldn't it be great if all your program disks booted

into a simple-to-read, organized menu of options?

In Applesoft under DOS 3.3 or ProDOS, type in the accompanying **Program listing** and SAVE it as Main.Menu. But before you RUN it, read on: Main.Menu works by displaying a list of options, one of which you highlight by pressing the arrow keys and

then select by pressing the return key.

You should personalize every copy of Main.Menu for each of your DOS 3.3 or ProDOS disks. Simply specify each of up to 21 menu items as a DATA line in two parts: the text for the menu item you want to display on screen and the DOS or ProDOS command to execute that item. (See the examples in lines 150–180.)

Finally, use the name STARTUP to SAVE the personalized menu to your ProDOS BASIC disk, or initialize a DOS 3.3 disk with that version of Main.Menu in memory, so that the program will execute automatically when you boot your Apple next time with that disk. □

Write to Robert Schack at 330 East 71st Street, Apartment Box 8, New York, NY 10021-5547.

Program listing. Main.Menu.

```

1 REM Main.Menu [1955]
2 REM by Robert Schack [3130]
3 REM Copyright 1990, inCider [4833]
10 HOME : TEXT : PRINT CHR$(27): PRINT CHR$(17): PRINT [1668]
15 I = 0: ONERR GOTO 18: REM Count Selections [2319]
16 READ S$:I = I + 1: GOTO 16 [1949]
18 POKE 216,0:SEL = INT (I / 2): RESTORE [2977]
20 DIM F$(SEL),DO$(SEL): REM Maximum of 21 menu items [4810]
30 SPCG = 1: REM Intervening blank lines [2335]
40 T1 = 1: REM Vtab for first line [1870]
50 MN1 = 4: IF MN1 < = T1 + 1 THEN PRINT "INSUFFICIENT SPACE ALLOWED FOR MENU TITLE": END [8310]
60 DF = 1: REM Default item to select [2264]
70 DEF FN CTR(L) = INT ((40 - L) / 2): DEF FN CLCV(X) = MN1 + (X - 1) * (SPCG + 1): REM Centering and Vtab calculation functions [8454]
80 LG = FN CLCV(SEL): IF LG > 24 THEN PRINT "MENU TOO LONG FOR SCREEN": END [3451]
90 M$(1) = "MY DISK MENU":M1 = LEN (M$(1)): FOR X = 1 TO M1:M$(2) = M$(2) + "-": NEXT [8645]
100 M$(3) = "TYPE LETTER, OR USE ARROWS,":M3 = LEN (M$(3)):M$(4) = "THEN PRESS RETURN":M4 = LEN (M$(4)) [19500]
110 FOR X = 1 TO SEL: READ F$(X): READ DO$(X):SEL$ = CHR$(X + 64):F$(X) = SEL$ + ". " + F$(X): NEXT [8429]
150 DATA "DISK 1 MENU (S6/D1)", "CAT,S6,D1" [2544]
160 DATA "DISK 2 MENU (S6/D2)", "CAT,S6,D2" [2024]
170 DATA "DISK 3 MENU (S5/D1)", "CAT,S5,D1" [2117]
180 DATA "START APPLEWORKS", "-APLWORKS.SYSTEM,S5" [2969]
200 REM [322]
220 REM Lines 150-300 reserved for selections [2446]
230 REM [314]
330 VTAB T1: HTAB FN CTR(M1): PRINT M$(1): VTAB T1 + 1: HTAB FN CTR(M1): PRINT M$(2): REM Print menu [21546]
340 X = 1: FOR X = 1 TO SEL: VTAB FN CLCV(X): HTAB 5: PRINT F$(X): NEXT :X = DF: IF LG > 21 THEN 360 [6226]
350 VTAB 23: HTAB FN CTR(M3): PRINT M$(3): VTAB 24: HTAB FN CTR(M4): PRINT M$(4): [6418]
360 VTAB FN CLCV(X): HTAB 5: INVERSE : PRINT F$(X): NORMAL : REM Highlight current choice [8361]
370 KEY = PEEK ( - 16384): IF KEY < 128 THEN 370 [3816]
380 KEY = KEY - 128: POKE - 16368,0: IF KEY = > 97 THEN KEY = KEY - 32: REM If lower case character is entered, convert it to upper case [15371]
390 VTAB FN CLCV(X): HTAB 5: NORMAL : PRINT F$(X): IF KEY > 64 AND KEY < = SEL + 64 THEN X = KEY - 64: GOTO 420 [7422]
400 X = X + (KEY = 21) + (KEY = 10) - (KEY = 8) - (KEY = 11) [5305]
410 X = X + SEL * (X = 0) - SEL * (X = SEL + 1) [3531]
420 IF KEY < > 13 THEN 360 [1350]
430 HOME : TEXT :D$ = CHR$(4): IF PEEK (978) < > 190 THEN D$ = D$ + CHR$(13) [5416]
440 PRINT D$:DO$(X): GET A$: RUN : REM Wait for keypress if catalog [8426]

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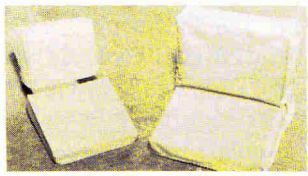
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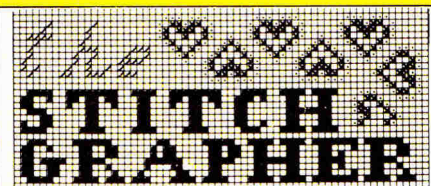
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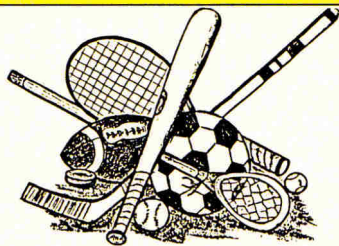
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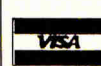
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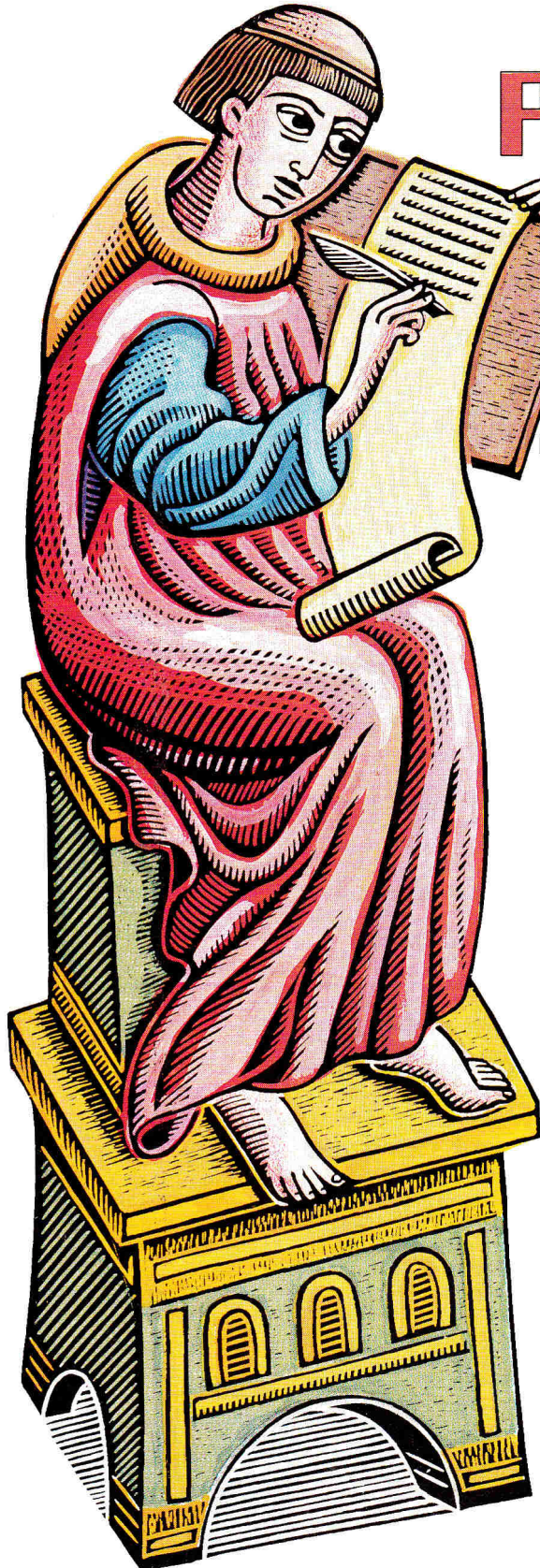
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THE LONG WAIT IS OVER. AFTER months of anticipation, Seven Hills Software is now shipping **GraphicWriter III**—and at first glance, it looks like a serious contender in the fast and furiously changing world of Apple II desktop publishing.

GraphicWriter III is more than a mere update of version II or even the original program, both from Datapak Software. Seven Hills has essentially reworked the program from the ground up. The result is a clean, efficient page-layout package with handy word-processor and painting features. It's fast, it's flexible, and it needs just 768K to run on your Apple IIGS. GS word processors and desktop publishers have until now been notoriously slow—but GraphicWriter III had no problem keeping up with *inCider's* all-star typists. The program includes direct translators for most popular word processors—AppleWorks, AppleWriter, Bank Street Writer, MouseWrite—plus a universal translator for ASCII text files. You can also import single-, double-, and super-hi-res graphics, as well as Print Shop images.

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Seven Hills tried to get GraphicWriter III to run with 512K machines, but the final version does indeed require 768K. Beyond that, the more memory you have, the better off you'll be. GraphicWriter III sells for \$149.95, from Seven Hills Software, 2310 Oxford Road, Tallahassee, FL 32304, (904) 575-0566 or (800) 627-3836. It was a long time coming, but it's here to stay. Look for a full-length feature review of GraphicWriter III in an upcoming issue of *inCider*. □

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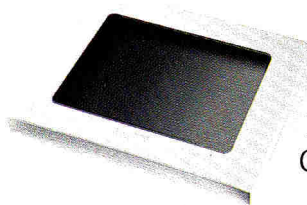
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