THE SPARTAN

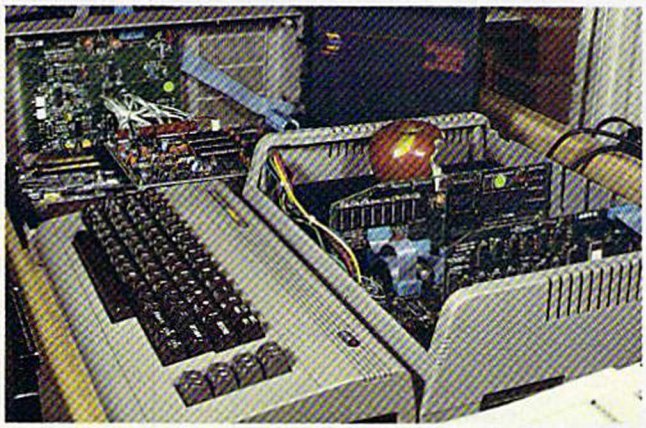
Mimic Systems, Inc.
Commodore 64
Price: $299

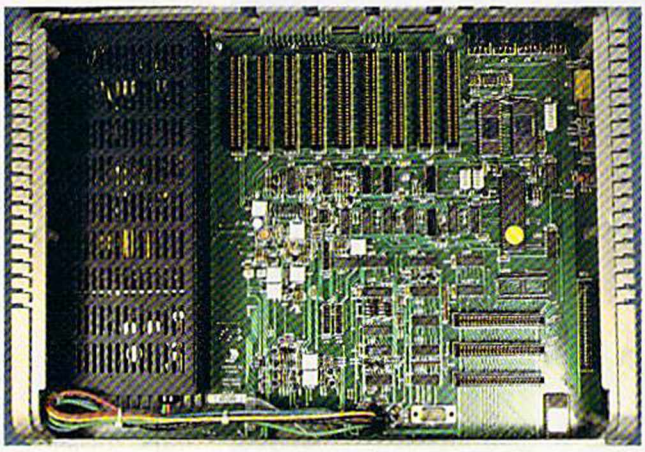
After being heavily advertised for over two years, the Spartan from Mimic Systems seemed destined to become the longest recorded case of vaporware in microcomputing history. It lost its chance at this dubious distinction in May when, to our surprise, a prototype of the Spartan arrived in our New York offices for review. What turned out to be an even greater surprise was that the darned thing actually worked! This was no mean feat considering the number of distinct pieces of hardware which had to be fitted together.

However, we seem to be getting ahead of ourselves. For those of you who may have just come on board the ship of Commodore computing, or for those individuals who missed Mimic Systems' full page color ads in nearly every issue of *Ahoy!* through last November, we state the following: The Spartan is a hardware device which bestows upon your Commodore 64 the ability to emulate an Apple II+ microcomputer. Note that we said II+ and not IIe or IIc. The Spartan is not designed to provide the extended features of these later models.

So what's this, we hear you say? Why should anyone running a C-64 be interested in an itinerant fruit machine? Don't we C-64 users already enjoy access to possibly the largest library of quality software available for any microcomputer?

To these skeptics in our audience we simply say that it is not our intent to indulge in philosophical discourse, nor will we attempt to influence anyone's religious beliefs. We will merely present the facts as they are. After all, our ears still ring from those plaintive cries of fledgling C-64ers: "Is there any way to run Apple software on my computer?" (We have occasionally heard the opposite motif emanating from many a fruity source.)





Top: inside the Spartan, with the CPU and Apple drive cards installed. The 1541 shows the custom DOS card installed.

Bottom: bird's-eye view of interior. To the left is the power supply. The main circuit board, or BUSS Card, displays its array of Apple peripheral slots at the back (top) and three C-64 internal expansion ports at the front (bottom) right. The large chip with the yellow dot (center right) is the custom communication chip.

Besides, at the new price of $299, the Spartan sure offers a lot of fancy hardware.

The Hardware

When it comes to hardware, the Spartan definitely sports some unique features among its several components. The heart of the system is a boxy looking affair styled very much like the C-64. In fact, once installed, the Spartan seems to fit naturally in place. This 12" deep by nearly 5" high C-64-gray plastic container is exactly the same width as the 64. The top surface of the box, which is easily removable to allow for internal access, is the right size and of sufficient structural strength to support a 1702 color monitor. Inside the box is the system's main circuit board, or BUSS Card, and a 60 watt peak switching power supply. Mating the Spartan to the C-64 is straightforward—just gently ram the Spartan into nearly every orifice in the back of the C-64.

The BUSS Card itself has rigidly positioned mating connectors for the C-64's user, cassette, and expansion ports. Flexible hookup cables are provided for the serial and video ports. The only port left unmolested is the television connector, for which you optionally install the cable originally supplied with the C-64. Once mated, the various and sundry connections seem to create a remarkably firm union.

The top lid of the main enclosure is easily removed to reveal a very Applelike environment. The most obvious feature of the enclosed BUSS Card is a row of nine edge card connectors (known as slots in the Apple world) suitable for standard Apple peripheral cards. As the Apple experts in our audience know, Apples are normally equipped with only

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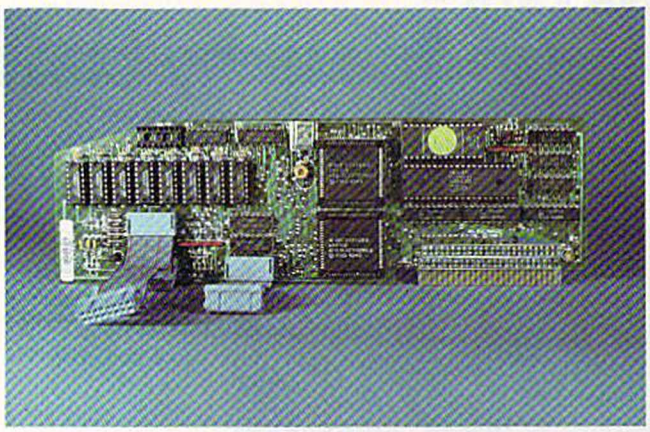
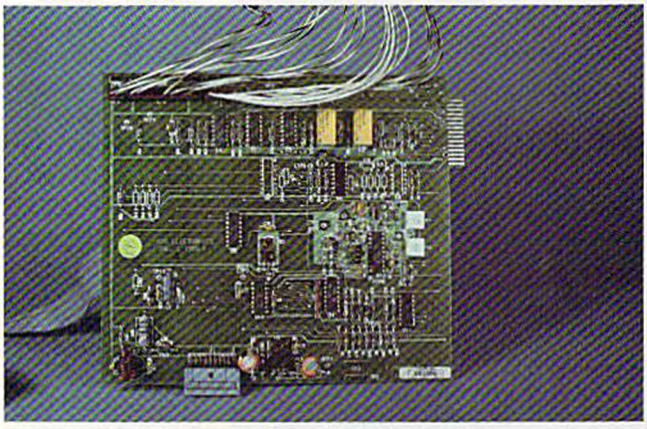
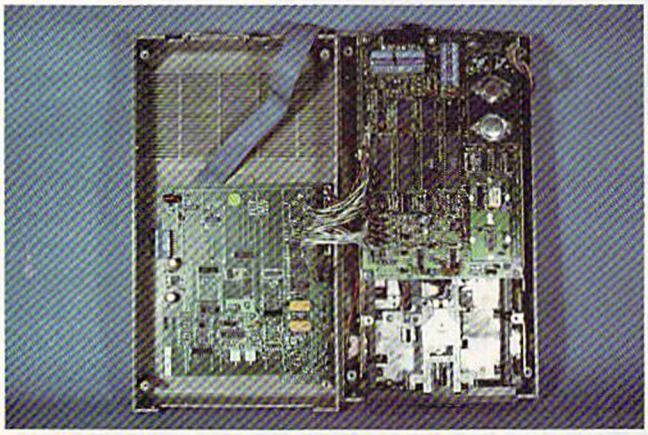






Top: the heart of the Spartan is its CPU card. The large rectangular chip is the 6502 microprocessor running at one megahertz. The eight kilobyte ROM is identified by the green dot. The two multipin square chips are custom LSIs. The upper performs the Spartan's video management. The lower handles memory management. Eight socketed, 64 kilobit dynamic RAM chips comprise the Spartan's memory. The empty socket is for expansion ROM.

Middle: The 1541 disk drive's custom DOS card, which turns the 1541 into an Apple-compatible drive.

Bottom: The 1541 with the custom DOS card installed.

eight slots.

The leftmost connector, designated as Slot A, is reserved for the Spartan's CPU card. The CPU card contains its own 6502 microprocessor (running at 1 megahertz), 64 kilobytes of RAM, 8 kilobytes of ROM, and a collection of support components. Among these chips are a pair of Mimic Systems' proprietary LSIs. These handle the video and memory management of the system.

The remaining slots (0 through 7) are for use with various and sundry Apple peripheral cards. One of these slots will be immediately filled by an Apple disk controller card. This card, included with the Spartan package, is needed to control the Apple disk drives. The one provided with our unit was made by Micro-Sci, a well-known supplier of Apple peripherals. As a rule, Apple disk controller cards can each handle up to two disk drives.

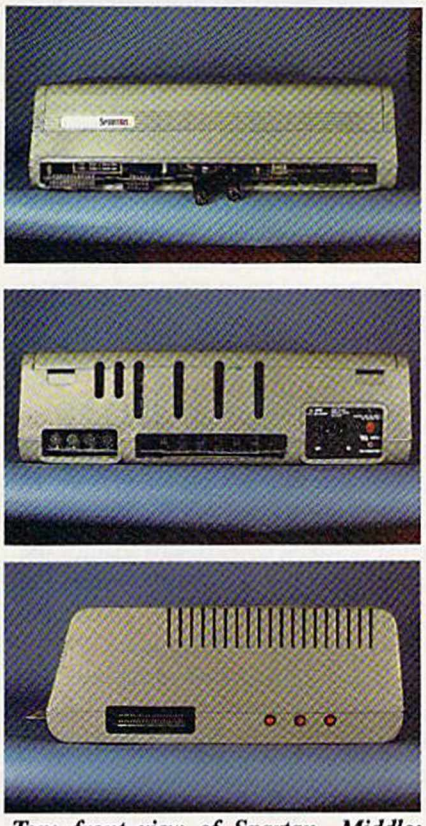
As with the C-64, the bulk of Apple software is disk-based. If you haven't guessed it by now, the Apple disk format is as unique as the Commodore disk format in the microcomputing world. This means that Commodore disk drives and Apple disk drives cannot read disks which were formatted for each other's system, right? Wrong! Mimic Systems was not about to let trivial obstacles of this sort stand in their way.

An essential part of the Spartan package is a specialized DOS card which installs in the 1541 disk drive. The installation is somewhat cumbersome. The drive's cover and internal RFI shield are removed. The DOS card is installed in the top of the drive cover, where it is held in place by four sticky feet. Next the 1541's connectors to the drive's motors and write protect sensing circuits are transferred to the DOS card. A supplemental set of jumper cables are then used to reconnect the 1541's connectors to an alternative set of pins on the DOS card. After all this, the drive cover is supposed to be remounted on the disk drive.

We decided not to take a chance on this last operation. The wires making up the jumpers on our sample were of a heavier gauge than what is usually employed for this application. This was apparently due to a mixup in the hardware specification of the early units. We decided to operate the drive with its cover standing to the side.

Getting back to the Spartan's BUSS Card, we noticed numerous jumpers, connectors, and test points scattered about. Unfortunately the preliminary manual with our system did not contain the information needed to properly identify these parts. A far more detailed technical manual for the Spartan is in the works.

We did manage to locate the Spartan's firmware in ROM. The biggest chunk consists of a 16 kilobyte system ROM which contains a clone version of Apple floating point BASIC, monitor, and autoboot routines. This package was written for the Spartan by Central Point Software, a major developer of Apple programs. Alongside is an eight kilobyte Spartan Phantom ROM which presumably handles the C-64 communications on the Apple side of the setup. There is also a corresponding eight kilobytes of C-64 ROM for the



Top: front view of Spartan. Middle: back view, showing four DIN connectors, extensions to the C-64's cassette and user ports, power connector, and on/off switch. Vertical slots are to permit exit of Apple peripheral card cables. Bottom: right side, sporting fourth cartridge slot and three reset pushbuttons.

C-64 side of things.

It is worth noting that the Apple disk operating system (DOS) must be loaded from disk into 12 kilobytes of the system's RAM. The task of controlling the drives falls to the 6502 microprocessor in the computer. By comparison, the Commodore disk drives have their DOS in ROM and their own 6502 microprocessor. The C-64 merely issues instructions to the drive which then takes virtually independent action.

The second most obvious piece of territory on the BUSS Card is the collection of no fewer than three C-64 cartridge connectors at the front right corner of the board. A close look reveals a fourth cartridge connector extending through the right side of the case. The Spartan lets you install up to four C-64 cartridges at once. Any one of these may be selected and initialized directly from the C-64's keyboard.

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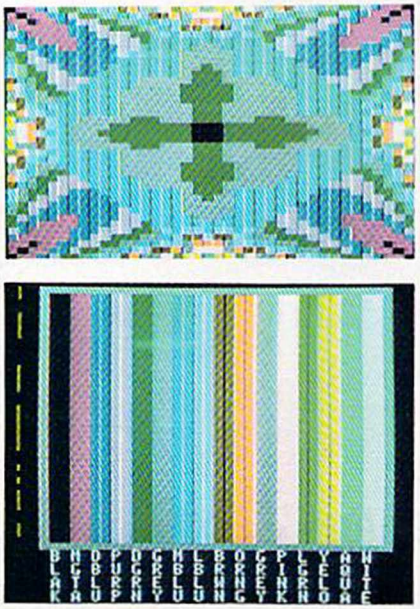

Top: Spartan display of the kaleidoscope program included on the Apple DOS 3.3 disk (not included). Bottom: the Apple II+'s seven colors à la Spartan.

Right above these slots is an empty integrated circuit socket. This is intended for a custom ROM chip to act as a replacement for the Spartan's built-in 8K Phantom C-64 startup ROM. In effect, this represents a fifth (or sixth) C-64 cartridge position. Selection between this socket and the Phantom ROM is via internal jumpers.

The Spartan's rear panel is quite busy territory. There is the usual power connector and on/off switch. (When will microcomputer manufacturers learn to locate power switches where we can reach them?) The C-64 cassette port is also brought out to the back panel, along with the C-64's user port. The Spartan may be set to use a Commodore cassette recorder to save and load Apple programs. The standard audio jacks, which are present on the Apple II+ for cassette use, are not in the Spartan. However, there is a row of test pins on the BUSS Card which may be fitted with an audio adapter. This accessory is available separately from Mimic Systems.

Off to the side is a row of four circular DIN jacks. The outermost jack carries through the C-64's audio and video signals. This lets you hook up a separate, optional monitor dedicated to what's on the C-64 display screen. The next jack is the Commodore serial port for disk drives, printers, and other serial bus peripherals. The C-64 power supply plugs into the next jack. Only the nine volts AC from this supply is used, as the C-64's five volt power is supplied from the Spartan's built-in supply. The innermost DIN jack outputs mixed audio and video from both the C-64 and the Spartan. The significance of this last feature will be described in detail below.

The Spartan even adapts Atari- or C-64-type joysticks for use with Apple software. The Apple and Atari style joysticks are fundamentally different beasts. The former are of an analog design bearing a strong resemblance to a pair of mechanically cross-linked paddles. The latter are of a digital design composed of four normally open contacts which may be closed singly or in pairs by moving the stick diagonally. Thus Apple joysticks may be used to impart quantitative as well as qualitative information.

In practice most games utilize only the directional information imparted by the Apple joystick. For these applications the Atari style joystick may be successfully substituted. The only limitation is that Atari style joysticks have only one fire button to the Apple's two. The Spartan's BUSS Card is equipped with a standard nine-pin game connector. This connector is activated by installing a short jumper between the CPU and the BUSS Card.

Aside from the on/off switch, the only external controls on the Spartan (other than the C-64 keyboard itself) are a set of not one, not two, but three red reset pushbuttons all in a row on the right side. The rearmost of these is functionally equivalent to the RESET key on the Apple's keyboard. The middle button resets both the Spartan and the C-64 when it is running a cartridge-based program. The front button resets only the C-64.

What It All Means

The designers of the Spartan have exercised their ingenuity above and beyond the call of duty in designing the Spartan-to-64 interface. Numerous contingencies have been considered and accounted for. A closer look at the operation of the system is instructive.

The Spartan is a complete microcomputer lacking only a dedicated keyboard, which the C-64 provides. In fact the concept of using the C-64 as a keyboard is fairly easy to implement. The C-64's keyboard is normally scanned 60 times a second by the Commodore operating system. It does not require much effort to change the destination of any collected keystrokes. This means that for the most part neither the C-64 nor the Spartan need be terribly concerned about each other's presence.

As a result the two computers operate independently of each other. It is entirely possible to boot up and run an application on the Spartan, switch to C-64 mode, and load and run a Commodore program.

The operation of the system is guided by an 8 kilobyte C-64 Phantom ROM in the $8000 block of the C-64's memory space. As with any other C-64 cartridge, the Phantom ROM takes control of the computer on power up. The power up screen

FOR C-128 USERS:

We haven't tried this ourselves, but the Spartan may work with the C-128 as well. The physical ports may have to be modified slightly to insert the Spartan into the 128. It appears that the cassette port connector will have to be removed or bent out of the way, which means that the cassette access at the back of the Spartan will cease to exist. However, at this point, the connectors to the user port and expansion port should fit properly. The C-128 will then power up in C-64 mode and the Spartan should function as described in this report. The remaining problem is to figure out how to plug the C-128's square power connector into the Spartan's C-64-style round port. This boils down to the classic problem of inserting a square peg into a round hole.

may be either the Spartan or C-64 display, as selected by setting a jumper on the Spartan's BUSS Card. Regardless of the initial display, both computers go through their initializing routines when the power is turned on. Thus the Spartan's disk drive will whir and chatter and accept and run an Apple application even while the C-64 is busy displaying its opening message.

The primary function of the Phantom ROM is to determine which computer will receive the keyboard's output at any given time. The user selection controls are built into the C-64's function keys, which remain active in all modes. The most frequently used keys will be f2 and f4. The f2 key brings up the C-64 display and transfers the keyboard data to the Commodore 64. In this mode all C-64 functions may be performed. The f4 key returns the machine to Spartan mode, where the Apple takes over. The f6 key executes a C-64 reset, leaving the Phantom ROM mapped in. The f8 key resets the C-64 to its power up state without the Phantom ROM. This last function does not terminate the execution of any programs which may be running in the Spartan at this time. Finally the f1 key disables all the function key functions for one keypress. This lets you access the function keys for C-64 programs which use them.

If you use the Spartan's mixed video port, then the display will automatically switch between modes. It is also possible to obtain a permanent Commodore display by hooking up a second monitor to the C-64 video port on the rear panel.

If you do intend to multitask the Spartan by simultaneously running C-64 and Apple programs, keep in mind the following limitations on the C-64 side. Commercial programs which expect an unadorned C-64 will probably not run, since the Phantom ROM appears as a C-64 cartridge. Any programs which need to access the 8K of RAM starting at $8000 will probably not work. In general, C-64 programs written in BASIC should have no problems, as long as they make no demands on the aforementioned memory.

The Phantom ROM adds several commands to the C-64's BASIC. All of these are preceded by the ampersand or SHIFTed 6 keyboard character. A list of these commands, along with a brief description, may be obtained by entering &HELP. Most of the commands deal with the mutual hardware configuration between the two machines. In particular, functions regarding keyboard and video display setup are provided. It is also possible to divert data sent to a peripheral of one computer to the memory of the other computer. For example, the output of a Spartan word processor may be diverted to C-64 RAM instead of to an Apple printer. You will need a good command of both machines to properly implement these features.

Extensions specific to the C-64 include a built-in machine language monitor and control of the Spartan's built-in, four-slot C-64 cartridge BUSS. As we mentioned above, up to three C-64 cartridges may be installed inside the Spartan. A fourth cartridge may be plugged into the external slot on the right side of the machine. The &SELECT command chooses which cartridge will take effect when the &START command is issued or when the C-64 reset button is pressed. The only ways to change the selection are to reissue the &SELECT command or power down the system. The default cartridge on power up is always the Spartan's Phantom ROM.

Finally, if you would like to know who designed the Spartan, you may read the information molded on the inside of the Spartan's cover or issue the &CREDITS command from C-64 mode.

Spartan Mode

Operation in Spartan mode is virtually indistinguishable from the classic II+ fruit machine. The most notable difference is some minor adjustments to accommodate the keyboard discrepancies between the C-64 and the Apple. The left arrow key serves as the ESCape key. The DEL and left cursor keys duplicate the Apple's left

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arrow key and the right cursor key takes the place of the right arrow. The shifted CLR/HOME clears the screen, as does the Apple's ESC @ sequence.

The Spartan provides several enhancements to basic Apple mode. The most notable is the inclusion of both upper and lower case characters. The Commodore/Z keystroke toggles between upper case only and the full character set. In fact, nearly every letter key has assigned to it a Commodore logo key function. Most of these are BASIC keywords which start with the corresponding letter.

We will leave the description of most Apple-type functions to the various Apple books on the market. The Spartan is packaged with a copy of *The Elementary Apple* by William B. Sanders, published by Datamost. This book presents a thorough introduction to the Apple environment and the Applesoft BASIC programming language. The package also includes a copy of *The Flier* from Central Point Software, Inc., a general purpose Apple disk and copy utility program.

If you are totally unfamiliar with the Apple operating environment, you will be in for some surprises. For example, the Apple's modified line editor is decidedly primitive when compared to the C-64's full screen editor. Bit mapped graphics are readily available from Applesoft BASIC. However, the C-64 bit mapped hi-res and multicolor modes with sprites is a bit more versatile. Apple sound effects are for the most part limited to a series of grunts, squeals, and whistles from the Spartan's built-in loudspeaker by comparison to the sonorous overtones of the C-64's SID chip. Then again, the Apple is basically a holdover from 1977 or thereabouts. By comparison the C-64 is a starry-eyed newcomer.

Perhaps the key question on many of our minds is just how compatible is the Spartan with Apple II+ software. According to Mimic Systems, the Spartan is compatible with more than 90% of general applications but only 75% of the educational programs. An upgrade to the Spartan, which was on the way to our offices as we wrote this, should improve upon these figures.

Our own experience seemed to confirm these quantities. Most programs we tried ran without any problems. These included a collection of Apple games and the *Graphics Magician* and *The Illustrator* graphics programs. We did have considerable difficulty with most Apple disk copy programs. For example, the COPYA utility on the Apple DOS 3.3 system disk does not work. We also encountered some bugs in the BASIC interpreter. In particular the GET command returns a type mismatch error whenever it is used with a numeric variable. Mimic Systems is diligently logging in all user-reported Spartan quirks. If enough of these surface, an upgrade ROM will be issued.

Disk Operations

Mimic Systems strongly recommends a full disk drive alignment of any 1541s to be used with the Spartan. The primary purpose of this is to get the stepper motor pulley pinned to its shaft. The occasional disk drive head chatter brought about by disk formatting and early C-64 copy protection is a way of life for Apple disk drives. Every time the system is powered up the disk drive head is pulled back for some tentative raps. Apple disk errors result in a vigorous workout of the head mechanism. This sort of treatment is not likely to be tolerated by early versions of the 1541.

When running in Spartan mode, the disk drive is powered from the Spartan's own power supply. In fact, the 1541's own power cable may be left off if you will not be accessing C-64 mode. If you plug in the drive's power and hook up its serial bus cable, the same drive may be used for either Spartan or C-64 operation. Switching between the two systems is fully automatic. Just make sure the proper disk is in the drive corresponding to the current operating mode. Apple and Commodore will not tolerate each other's disk formats.

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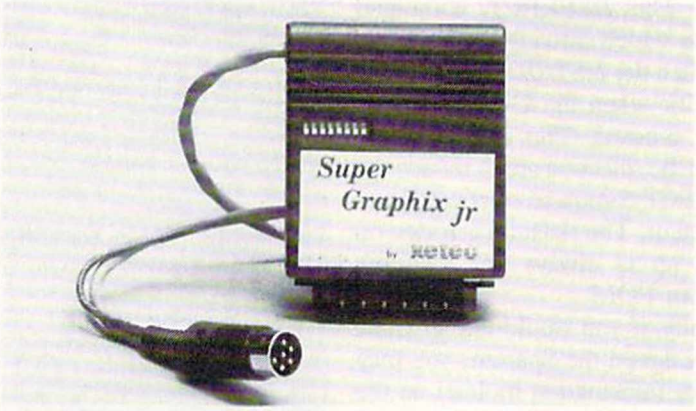

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If you wish, an Apple-compatible disk drive may be substituted for a modified 1541. If you have an Apple drive, you can save $50 by ordering the Spartan without the 1541 DOS card. The Apple drive card will still be supplied.

Conclusions

Overall we were very favorably impressed by what the Spartan had to offer. The hardware certainly seemed well-designed, with enough googaws and gadgetry to gladden the hearts of many a hacker. The system is clearly designed with a totally open architecture. In this regard we are eagerly awaiting the final version manual so we can find out what all of the various little dingbats are all about.

The $299 price tag is reasonable enough in view of all that is being offered. It is certainly the least expensive way to get into Apple computing as of this writing. Compatibility with Apple hardware peripherals should be quite good, the only exceptions being those cards which connect up to points inside the Apple's circuitry. Software compatibility should also be good. However, we do recommend that you arrange to try before you buy any Apple programs for use on the Spartan.

In spite of its late introduction we expect the Spartan to be well-received by the Commodore community. We just wonder what Apple will make of all this.

US: Mimic Systems, Inc., 18027 Highway 99, Bldg. A—Suite I, Lynnwood, WA 98037 (phone: 1-800-663-8527).

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After word processors, spreadsheets, and, of course, games, we find that disk copy utilities flourish where other software fails to survive. The reasons for the popularity of these reproductive entities are numerous, not the least of which is the primitive state of the duplicative software provided by Commodore with the 1541 disk drive. Although better than they used to be, the disk utilities on the 1541 are primitive at best and inadequate at worst.

Commercial copy programs, as a minimum, promise to give back to the user his congressionally granted right to at least one archival copy of his essential software. In fact, it is commercial copy protection's interference with the pursuit of everlasting redundancy that provides the very fertilizer nourishing the growth of the copy utilities.

Super Kit/1541 is supplied on a double sided (flippy) disk. The workhorse utilities are on the first side, with some of the more specialized material on the second. Most of the programs are accessed through a graphically impressive set of menus. These include graphic screens which fade into selection lists accompanied by some animated effects. When you tire of the flashy displays, you may access the programs directly through a special loading sequence.

The first pair of selections are single and dual drive versions of a high speed disk copier. *Super Kit* refers to to these as the "Normal" copiers. In this case normalcy has been extended to include the reproduction of some of the older copy protection schemes which rely on simple DOS errors.

For the tougher stuff, single and dual fast "nibble" copiers are also provided. The *Super Kit* manual describes these as applicable to "light to medium duplication of DOS protected disks." It further goes on to describe these as "state-of-the-art copiers comparable to most nibble copiers available to date." While we are accustomed to products which describe themselves in superlatives, we found ourselves a bit puzzled as to what we were dealing with.

Our confusion was only furthered by the description of the Super Nibbler which is found on the second side of the disk. In this case we were presented with "THE state-of-art full disk copier for those 'impossible' duplications."

Our confusion knew no bounds when *Super Kit* informed us that there was copy protection which was so difficult it was beyond impossible. For this purpose the Disk Surgeon, or parameter copier, is supplied on side two of *Super Kit*. There was some additional confusion on the part of the manual, which frequently referred to this utility as a Sector Surgeon. The Disk Surgeon comes equipped with parameters for 271 original programs. Many of these are not in the beyond impossible category, or even in the impossible category. Instead these parameters are provided to let you clean up some of those old protection schemes. This will generally enhance loading, preserve drive alignment, and make subsequent backups even easier.

Interestingly enough, some of the beyond impossibly protected programs were not to be found on this list. However, our qualms were assuaged by James Domengeaux (pronounced very much like DiMaggio), the person behind this massive collection of program parameters. We received the distinct impression that he would not rest till all the impossible is totally mundane.

All confusion aside, all four versions of the copiers on side one of the disk worked well. The dual drive versions copied disks in well under one minute. Exact times to copy an entire disk varied, as the copiers incorporate intelligence to skip over blank sectors. The copy time for the single drive versions depended more on the manual dexterity of the operator than on the speed of the software. We found that most of the time was spent fumbling disks in and out of drives for the several pairs of swaps required to copy a full disk.

All the copiers provide user control of some of the parameters. The "normal" copiers let you set the start and end track over the range of 1 to 40. The nibblers also include settings for track increment (0.5 to 2.5), number of sync bytes, size of the header gap, length of the sector gap, and length of the header block. These are all pretty hefty parameters, well beyond the comprehension of most neophyte archivists. In any event, it's nice to