

AMIGA

W O R L D

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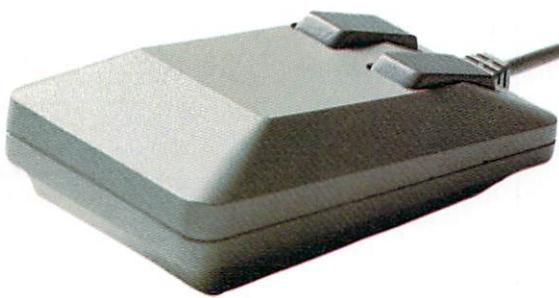
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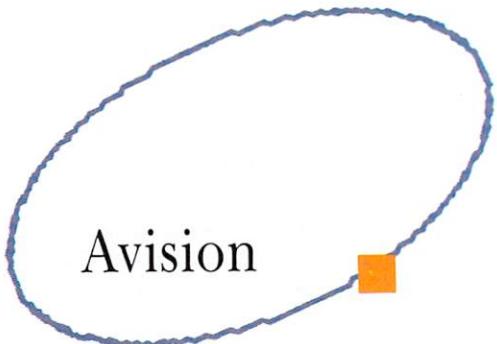
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By Steve Twombly

In December of 1984, I had my first look at an Amiga prototype at the company's headquarters in Los Gatos, CA. Although the Amiga was still unfinished, I was given a demonstration of its sound and graphics capabilities. I was overwhelmed. When I learned what features were yet to come for business users and what this new machine would retail for, I was convinced it would be the most advanced microcomputer to come on the market in 1985 and 1986.

The developers at Amiga had been working on this new micro for more than two years before I saw the prototype. They had been propelled by a vision that a supermicro could be built and delivered in high volume at an unprecedented low price. They wanted to create a supermicro that would fully exploit the capabilities of Motorola's 68000 microprocessor and stimulate the consumer marketplace. The Amiga was designed to create new markets and reach new consumers.

For me, the Amiga vision became a compelling urge to bring to market a dedicated publication that would feature this astounding computer. Immediately, a small team of us began to conceive a new magazine to cover the Amiga. We were all of one mind: Because the Amiga is a unique machine, it needs an equally unique magazine. *AmigaWorld* lives up to that billing.

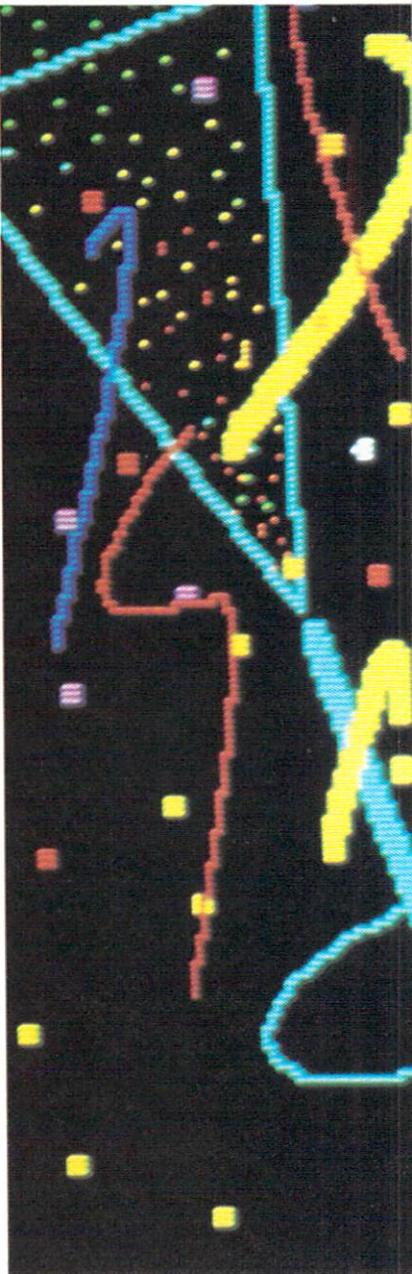
Software developers, too, were impressed with the new Amiga. They saw the opportunity to develop on the Amiga the most advanced and exciting software imaginable. Some of their products are now available and many are yet to come, but their enthusiasm is typical of that found at Amiga headquarters, Commodore and here at CW/Peterborough.

The new Amiga will become a necessity in a variety of markets. It will be a powerhouse for running business applications due to its incredible speed, easily expandable memory and multi-tasking capability. As a creative-

ity and productivity tool, the Amiga is unsurpassed and will be frequently used in performing spreadsheet, database, graphics and word processing applications. The development of integrated and "expert" software programs will reach new horizons with the Amiga. The Amiga's range of capabilities is so broad that it will become a critical addition to specialized professions, such as architecture, advertising, CAD (computer-aided design), marketing, film and video, music and many more.

Both the professional and home user will find it easy to create software that takes full advantage of Amiga's amazing speed, graphics, animation and sound. When you add this to the multi-tasking DOS and user interface with overlapping windows, the variable color and screen resolutions, icons and pop-down menus, you have a computer with programming capabilities unlike any other.

The Amiga was designed with the future in mind. Its philosophy is expandability with continuity. The microprocessor can be upgraded, as can the custom chips. The Amiga's memory is expandable without affecting its design. Its open architecture and multi-tasking DOS will open new dimensions in third-





party development of both peripherals and software. As a result, the Amiga will grow over the next five years without losing software and peripheral compatibility, and users need not fear obsolescence.

Amiga makes real what had previously been only a vision in the microcomputing world. Before the Amiga, such power, speed, sound, color and animation capabilities weren't commercially available for under \$20,000. Now, everyone will have an opportunity to experience this computing breakthrough. We at *AmigaWorld* believe this opportunity will provide a great deal of excitement for many years to come. As you look through and read the pages of *AmigaWorld*, I think you'll see what I mean.

As we explore the Amiga, remember that this first issue provides only a glimpse of what is to come. The future is here.

Zeitgeist

By Guy Wright

AmigaWorld. Whew! It has been quite an effort putting together a new magazine for a new machine that wasn't even finished at the time we went to press. The official word that we were definitely doing a magazine didn't come through until the beginning of May (roughly a month after the time we should have had all the articles typeset and ready to send to the printer). That meant a lot of scrambling around, a lot of digging, a lot of weekends, late nights, last-minute plane trips to California, New York, Pennsylvania, Illinois and enough phone calls to give us all cauliflower ears.

In many ways, starting up a magazine is pretty close to what you might imagine it would be. The frantic pace, the cups of cold coffee, the stories coming in late, the last-minute decisions, the telephone reports from the coast and the thousands of details that have to be tended to. But I am certain you would be more than a bit surprised if you came up here, to the hills of southwestern New Hampshire, and saw the offices and met the people behind *AmigaWorld*.

There is no steel and glass, no 40-story office building with hundreds of frenetic reporters and grumpy editors. No copyboys dashing around with last-minute stories. There aren't dozens of clacking typewriters or smoke-filled rooms, and the phones only ring 90 percent of the time. Instead, we have a converted New England farmhouse with wooden floors. There's a handful of editors and

a few writers, many of whom work at home and send in their stories via modems or word processors and printers. It's a curious mixture of country and technology.

But the key to *AmigaWorld* is the people who did all the running around, word processing, telephoning, designing, editing, typesetting, organizing and so on. There are also quite a number of people not on the *AmigaWorld* staff who helped make this first issue possible. The people at Commodore-Amiga who let us come and see the machine before it was ready, who answered our questions, who did the interviews when they didn't really have time to spare, who stayed up late waiting for calls or got up extra early because of the three-hour time-zone difference between California and New Hampshire, who answered our questions, who helped get the right screen shots, who helped us get in touch with the right people, who photocopied stacks of material and then did it again when something was changed, and who answered still more questions.

We asked a lot of questions. A lot of questions. We hope we asked about the things you are interested in. (But if we haven't, then you can always write to us and we'll try and get the kinds of answers you're seeking.) There are still thousands of questions that we haven't asked yet and thousands of pages of information yet to be printed.

But our whole job wasn't and isn't just asking questions. We

have to take those questions and turn them into articles that make sense. Distill the information and transform it into something meaningful. Our goal is to provide you with useful, entertaining, understandable information and ideas. Articles that reveal the inner workings of the Amiga from Commodore without a confusing array of technospeak. Just as you shouldn't have to know how to rebuild a carburetor to drive a car, you shouldn't need a degree in computer science or mathematics to use the power and versatility of the computer.

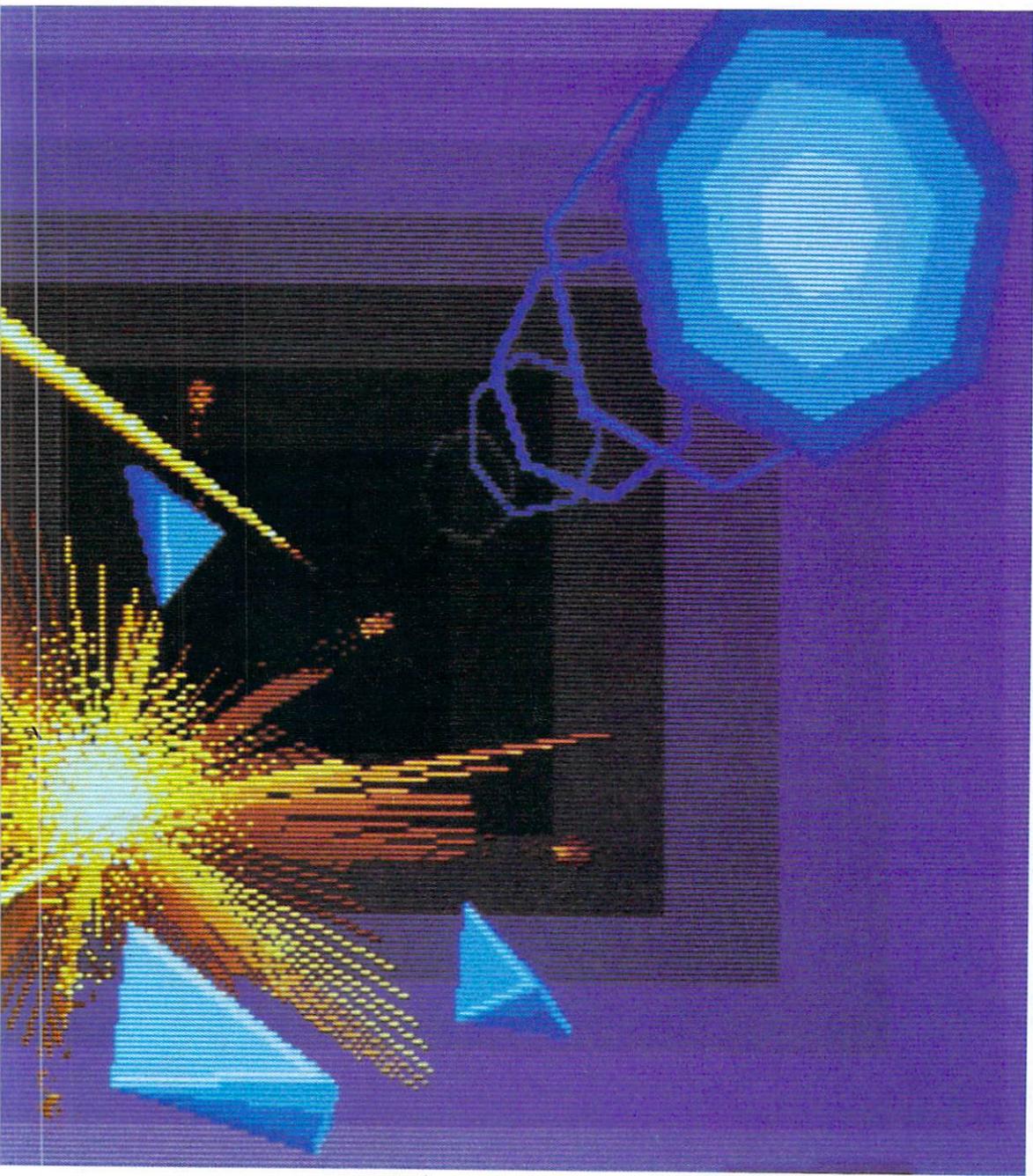
At the same time, we know that you are probably above average in intelligence (after all, you're reading this magazine, aren't you?) and don't need to be spoon-fed. Computers are not simple machines, but neither are they incomprehensible. And while the focus of *AmigaWorld* is (oddly enough) the Amiga computer, we'll be going far beyond dissecting the machine.

We will explore the ways an Amiga can be used for enhancing life; for increasing productivity in business, school and home; for bringing out creativity in music, graphics and even business; for saving you money and time; for amusement; for education; for communication; and for the thousands of things no one has thought of yet. The things that you will be thinking about.

That's the exciting thing about the Amiga computer. It is



Illustration by Jack Haeger

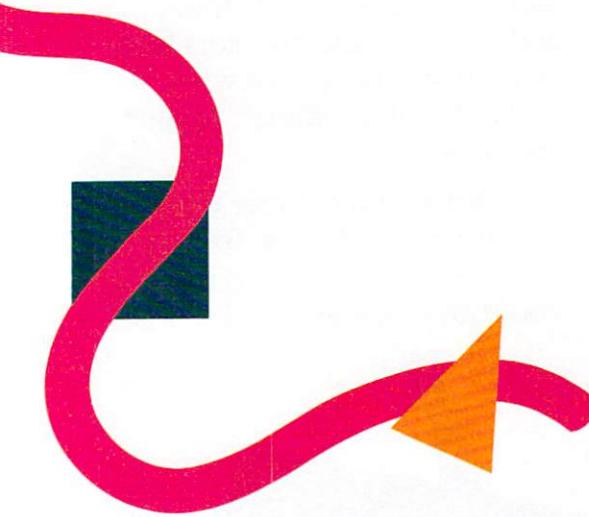


a catalyst for the future of computing. A tool that will bring us into the next age. And the best ideas are going to come from the people who own and use the computer every day. That is the challenge I put to you now. Do something with your Amiga that is the very best ever done. Whatever it is. We are going to be putting out the best magazine we can, to let you know what others are doing with their Amigas and to let others know what you are doing with yours. Do your best, because now there is a machine that can match your imagination.

This first issue of *AmigaWorld* will look into the future a little. Rather than detailing the various commands and specifics, we'll sit back and let the Amiga show off a little. We will focus on its capabilities and what they will mean to you. We'll tell you a bit about its power and versatility. But, with any new project, there will be last-minute changes and alterations, so let me apologize right now for any inaccuracies in this first issue.

The things we will show you and tell you about the Amiga will convince even the most adamant cynic that the Amiga computer is the next wave, and we're all bound to get a little wet. There is no other computer I would rather be involved with and no other magazine. Welcome to *AmigaWorld*.

I would also like to give a special thanks to the entire staff of *RUN* magazine for their patience and invaluable assistance.



Cynicism and Seduction, Speed and Software

By John Pandaris

The Amiga is going to change the way American offices do business, but no one yet knows just how. I'm *AmigaWorld's* business applications columnist, and I don't know, either. In this column, we'll follow the computer, its users and software companies—with luck, we'll stay half a step ahead of them—and find out.

Amiga Solutions won't be strictly a business column in the sense of Honeywell mainframes and Fortune 500 accounting. I sold it to the editors as a "business/personal productivity column," to explore how people work with the Amiga, in settings ranging from corporate offices to homes, and the tools available for that work. I'll try to land somewhere between "Amigas on Wall Street" and a random software roundup, but productivity will be a general topic.

That suits me because I'm a generalist, interested in how people use computers rather than in comparing the arctangent functions of WhizzoCalc Release 3 and AmeriCalc 2.10. Amiga Solutions will try to spot some trends or general directions in the Amiga support and software industry. I've evaluated products and pontificated on trends for half a dozen magazines, and I couldn't resist getting in on the ground floor with *AmigaWorld*.

Snubbing the Mac

I was also hired, I suspect, as the magazine's resident conservative, or cynic, with no connections to Commodore or *Amiga-*

World's parent company, CWC/P—someone who's formed a healthy respect for the IBM PC and its MS-DOS imitators, 1981-vintage technology though they are, and was impressed but not ga ga over the advent of Apple's Macintosh.

The current phrase "power user" will fade as did the odious "user-friendly," but its meaning makes sense in the MS-DOS world. Once you learn eight or nine cryptic commands and dive into a huge pool of rarely simple software, you can do quite well with an antique PC. I'll be the first to admit that MS-DOS' user interface (computereze for how you work it) takes some learning, but I never tire of challenging Mac users to drag race: While Mac-Mouseketeers delete disk backup files, clicking and dragging them one by one to a cute picture of a trash can, I can type del *.bak ten times.

The comparison is particularly unfair to the original (January 1984) Macintosh, which challenged computing's de facto standard with barely a handful of available programs and a bunch of hardware handicaps. Today's 512K Mac, with outside companies' hard disks (and PC vendors' prompt mouse-and-window additions to MS-DOS), have shown the value of easy instructions for powerful software. But the first Mac was best appreciated as a preview, a demo, a scratch-and-sniff ad instead of a bottle of perfume.

The 1984 Mac, to put it plainly, promised terrific software, but it simply lacked the hardware to rival the mighty IBM. Apple's ads, billing themselves as the inventors of the personal computer, are shameful lies, but the Mac team's battle cry of an "in-

I stood up straighter, lost my cynical sneer, gaped rather stupidly and elbowed my neighbors in the ribs. The Amiga had cracked my armor—with sheer, naked power.



Photography by Michael Brown

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"sanely great" computer is merely silly. Computers are simply tools, and no computer is insanely great. Bach, Hawthorne and filet mignon may be insanely great, but no computer deserves this accolade, especially not one with only 128K, no industry-standard parallel printer port and a single disk drive, the latter only slightly quicker than the Commodore 64's infamous 1541, which "loads data faster than you can type it!"

First Impressions

My cynicism was tested on April 10, when *AmigaWorld* editors and I attended a sneak preview of the Amiga at Commodore's Pennsylvania headquarters. Except for having only one built-in disk drive (880K on a microfloppy is fabulous, but single drives make vital file and disk backups a tiresome process), the Amiga looked impressive—a nice keyboard, lots of interfaces and expansion ports, a sharp display. To be exact, it looked like a PC and worked like a color Macintosh.

In order to keep the entry price low, Commodore has configured the basic Amiga as a 256K machine. It has also priced the expansion up to 512K at only \$200. So that, for any serious user, the machine will be typically configured as a 512K machine.

An Amiga engineer showed off the ultracolorful graphics, the smooth movement and animation and the magnificent sound and music with a program that turned the Amiga into a banjo, a snare drum and a ballpark organ. Dealers and writers oohed and aahed: The Amiga was clearly a performance-caliber musical instrument, a CAD (computer-aided design) drafting system and the best arcade-game computer ever designed.

Having awakened at 3:45 AM to catch the plane, I was cranky and cynical: The microfloppy drive wasn't as fast as an IBM hard disk, and we couldn't tell how the Amiga would sound by itself, without big stereo speakers under the table (where, if it were my desk, they'd be kicked to death in a week). More important, what about everyday applications? "What's the point?" I muttered to the writer beside me. "People don't use symphonic sound and animation. They use spreadsheets."

Then, blessedly silencing a booming, animated bouncing ball, a second engineer said, "Now let's turn to the operating system and put some windows on the screen," and flicked two windows to and from the display as quickly as he could tap the mouse button. I

stood up straighter, lost my cynical sneer, gaped rather stupidly and elbowed my neighbors in the ribs. The Amiga had cracked my armor—with sheer, naked power.

All computers are fast; along with detailed accuracy, speed has been the machines' raison d'être since the barn-size ballistics plotters of World War II. Even primitive computers can perform calculations, format text and so on faster than any human or team of humans working by hand.

But the Amiga is *blazing* fast, eerily fast, preternaturally fast. The Apple II beats an abacus and the IBM PC beats the Apple, but, watching the Amiga demonstration, all I could think of was something I once saw during a sports car race at Connecticut's Lime Rock Park: A race-prepared, street-illegal, 500-horsepower Corvette thundering down the main straightaway, slowing for the turn, and then being passed from out of nowhere—from the beginning of the straight, a quarter-mile behind—by a knee-high, white, whirring Porsche 935 Turbo. Other micros simply aren't in the Amiga's class.

Let's Get Technical

There are two reasons for the Amiga's superior speed. The first is its Motorola 68000 CPU (central processing unit), the same chip found in the Macintosh and scores of multi-user office systems. The 68000 handles 32 bits of data at a time, though it funnels input and output at only 16 bits at a time. The IBM PC's Intel 8088, by contrast, has half the capacity—16-bit data, 8-bit address—and its definition of "at a time," the ticking clock rate that governs computing in tiny, discrete steps, is one-third slower.

But, powerful as it is, the 68000 isn't the ultimate processor; Intel and Motorola have made advances, apparent in IBM's ferocious PC AT and Apple's rumored "Turbo Mac." And no chip is quick enough to satisfy software designers, who cry "Faster! Faster!" with even more zeal than users like me. Such programmers have pioneered something that has become standard practice in the PC world, and it's the second secret of Amiga's success: cheating.

Part of it isn't cheating so much as sensibly allocating resources; the racer who owned that Porsche Turbo didn't use it for trips to the drugstore. The central concept of Amiga's architecture is to preserve the 68000 for the data-crunching it does best. Other support chips handle mundane chores such as reading keyboard input and stepping the disk motor, leaving the 68000 free for better things (like a master chef who needn't worry about arranging napkins and silverware).

The cheating part involves DMA (direct memory access), the trick of moving data

The central concept of the Amiga's architecture is to preserve the 68000 for the data-crunching it does best. Other support chips handle mundane chores, such as reading keyboard input and stepping the disk motor, leaving the 68000 free for better things.

through RAM while bypassing the normal CPU and input/output channels. For putting information on the screen ("Go Directly To Video Port; Do Not Pass CPU"), it gives a speed bonus analogous to using a telephone hot line rather than going through a switchboard.

It complicates matters if you're trying to make hardware PC-compatible—you must map obscure byways as well as main roads—but DMA has been a staple of IBM software since programmers found the limits of the 8088 chip (it's fast, but not fast enough for the likes of Lotus 1-2-3). And the Amiga combines the speed of the 68000 with massive amounts of direct memory access.

The 68000 is aboveboard, but the Amiga's top secrets are three custom chips code-named Agnes (animation), Daphne (graphics) and Portia (ports, sound and peripheral control). Besides things like Portia's four-voice sound hardware and mouse/joystick interface, they contain 26 DMA channels plus an additional microprocessor, called the "copper" (part of Agnes, it's the main mechanism for controlling the other two chips, freeing the 68000 from nearly all the work of redrawing the display and updating audio channels).

The most important DMA channel, also part of Agnes, is called the "blitter"—a circuit designed to draw lines and copy screen display data, moving or animating images faster than the general-purpose 68000 could. Never mind that it makes gee-whiz arcade games; the important thing about the blitter is that it runs windows, desktop or workbench environments, through hardware instead of sluggish software. If the rules for shuffling windows and menus are like frequently used phone numbers, Amiga has them memorized. Slower systems, like a PC running Digital Research's GEM, have to look them up.

It's this hot-rod hardware that makes the Amiga quicker than the Macintosh and even the PC AT, both of which must process graphics, sound and windows through their CPUs. Combine the Amiga's dedicated design with the fact that computers are swift anyway (they yawn and idle between fast typists' keystrokes), and you can see why I elbowed my neighbors at the demonstration.

Do you think I'm exaggerating about yawning during pauses? This 68000 chip

spends half its time doing internal operations instead of addressing memory, so it works at full speed, although Amiga engineers only allocated it every other clock cycle (the discrete steps I mentioned) during the constant, TV-style process of re-drawing the display screen. The odd cycles go to disk and audio and display DMA, and the 68000 must share the even cycles with the copper and blitter, which can hog cycles during especially complex or colorful animation, the one time it appreciably slows or handicaps the CPU.

Even under these circumstances (what the developers' tech manual cheerfully calls "nasty mode"), the Amiga should manage to add your spreadsheet before you lose patience. A clock cycle takes 280 billionths of a second, and there are 226 of them during each horizontal scan of a line of screen dots.

Yours for the Tasking

By now, you must realize that the Amiga chips delegate so much responsibility that the CPU is left with only part-time work. Most of the time, in most applications, the 68000 will be as underworked as a circus strongman tearing a Kleenex.

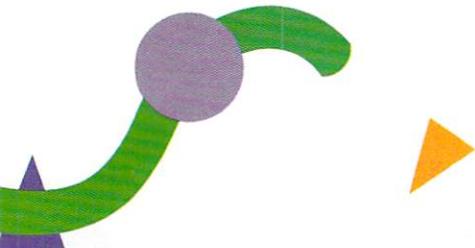
To remedy this waste of power, here's the second thing that impressed me in Pennsylvania: You can assign the Amiga multiple jobs, running more than one program at once. To use jargon, the Amiga is a multi-tasking computer (not to be confused with multi-user systems, which let people at different terminals share a CPU). In fact, it's more multi-tasking than you are, or than you'll need it to be.

This reflects a concept that, until Amiga, has been more common than true multi-tasking among personal computers: foreground and background tasks. Printing a long document, for instance, is often turned into a background task by a spooler (an acronym for simultaneous peripheral operations on line), an area of memory or a separate box that takes the document in one gulp so the computer is free for other work. "Desk accessories," made popular by the Macintosh and followed by PC products like Borland International's SideKick, let you call up notepads or calculators while using a program. The next release of AmigaDOS will incorporate more of these desk accessory functions to exploit the multi-tasking capabilities of the Amiga, thereby enhancing personal productivity.

No doubt many Amiga owners will use multi-tasking in this simple way; I'll probably play Pole Position while printing future columns. But multiple Amiga programs, even those in windows overlapped or completely hidden by the one you're using,

Because of the Amiga's speed, multi-tasking operating system, its ability to address 12 times the memory of the PC and 2.5 times that of the AT, and its hardware and software support for hard disk and tape back-up units, the Amiga is uniquely positioned to fulfill the needs of the business world—at a price that has the competition trembling.





Integrated software is a crusade, in which the Holy Grail is a blank sheet of paper: a screen on which computer users can do anything, in any combination, they might do with a pad and pencil. Scribble some words near the top, put a graph in the middle, tally a table at the bottom, print it out just so... it's a gloriously simple idea, but it's hard enough to break a programmer's heart.



◀ don't wait in the background like calculators. They're fully operational, all functions active, as if running by themselves.

As far as they're concerned, they are. To quote the tech manual, each multi-tasked program has a "virtual terminal," meaning that the software thinks it has a keyboard, monitor and CPU of its own. If I call you on the phone while you're editing a report, you can switch your attention to me often enough, say "Mm hmm" at the ends of my sentences, to make me think I have your undivided attention. To fool computer programs, you have to switch very fast, indeed.

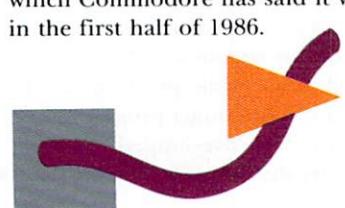
The End of Integration?

The business environment is a hungry environment. The original IBM PC was introduced in the fall of '81 in a 16K version with a cassette port; it was the needs of power users that eventually drove IBM to introduce the XT and AT. A comparison of the Amiga with the PC AT is useful. The AT can address 3 megabytes (mb) of memory; the Amiga can address 8 mb. The AT is the only micro in the IBM line that supports multi-tasking under MS-DOS 3.0. The Amiga also supports multi-tasking. The AT has hardware and software support (e.g., support hierarchical file directory) for a hard disk. So does the Amiga.

The AT, however, obviously cannot provide any of the advanced graphics, animation or sound capabilities that make the Amiga so exciting for vertical markets, especially design environments and the creative arts.

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Commodore has said that the Amiga is the first in a family of products based upon the same technology—given the enormous capabilities of the Amiga's architecture, it is easy to imagine how subsequent versions of the Amiga could be configured to meet the special needs of the business community even more directly. The only missing piece in the Amiga's hardware strategy for business is networking and telecommunications, which Commodore has said it will address in the first half of 1986.



How we use multi-tasking, what difference it will make from day to day, will be one topic I'll follow in this column. We've found the obvious uses already—to sort a lengthy list or receive telecommunications information while working on something else—but it'll be fun to look for more, to relate the Amiga's potential to what is humanly possible.

The Amiga can, but I can't, use a spreadsheet and write a letter at the same moment. But I'd like to have both available and flip between them (though not as often as every 280 nanoseconds), and I'd like to refer to spreadsheet data in my letter. This, though it may be cut-and-paste instead of true multi-tasking, is where I suspect the Amiga will shine, and where it may make its most significant impact aside from graphics and sound. It represents the triumph of dedicated applications and the demise of integrated software.

Integrated software is a crusade, in which the Holy Grail is a blank sheet of paper: a screen on which computer users can do anything, in any combination, they might do with a pad and pencil. Scribble some words near the top, put a graph in the middle, tally a table at the bottom, print it out just so... it's a gloriously simple idea, but it's hard enough to break a programmer's heart.

Ovation, an MS-DOS package that genuinely seemed to grasp the "blank page" concept, sent critics into ecstasy in late 1983 previews—and dragged its vendor into oblivion a year later, having never quite beaten its bugs or made it to the market. Titans clashed last summer: Lotus's Symphony versus Ashton-Tate's Framework. The latter won all around, while the former took the spreadsheet event, but neither one has set the world on fire.

What's good about integrated software is its versatility, such as the freedom to splice spreadsheet rows into text files. What's bad is that there has never been an integrated package whose functions are as good as single-purpose programs. The "one big program" that Ovation promised to be is as distant as Einstein's unified field theory; integrated packages are still mainly separate programs tacked together. And, as long as they're buying separate programs, people want the best ones.

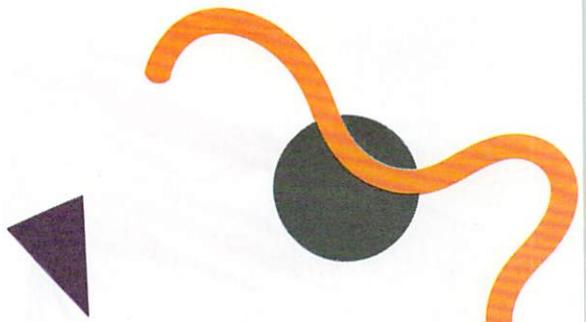
Nobody buys Lotus 1-2-3 for its database function, an awkward imposition of filing on a spreadsheet format. Some buy it for its graphics, a spreadsheet adjunct valuable enough to tolerate a separate program and disk-swapping for printing. But most buy it because it's a big, fast, excellent spread-

sheet. Given the power to have several programs instantly available without starting and stopping, I'll wager Amiga owners will choose individual excellence over integrated compromise. In effect, Amiga owners, using the machine's multi-tasking capabilities, will be able to create their own integrated packages using whatever combinations of individual programs they choose.

Some things will have to be worked out, of course. AmigaDOS has a cut-and-paste clipboard like the Mac's; software companies must support it, with a common format for swapping material between applications. Separate programs probably won't let you play "what-if" games right up till printing time, though it would be ideal if changing the spreadsheet on page 2 automatically redrew the graph on page 5. Integrated software fans complain that learning different programs is a chore; presumably, Amiga commands will be at least similar, with the mouse and menus. Besides, thousands of folks use 1-2-3 and WordStar, which haven't a command in common.

The early deadline has made this an atypical column; I've indulged my love of technical explanations and sweeping generalities, but I haven't had the chance to test any Amiga software. I'll have more to say about software in the future, though, preferably in conjunction with an exciting new product that *AmigaWorld* has promised me first crack at. If it's available, it'll be the star of next issue's column; if not, I should at least have gained more hands-on experience to back my windy generalizations.

Once we learn about its site and strategy in a Big Blue world, we can turn to the Amiga as a star in its own right: a machine that can not only do brand-new things (e.g., using voice synthesis as part of a super telecommunications system or presenting boardroom demonstrations with animated graphics, music and narration), but that will



also let us do traditional things in brand-new ways. It's not insanely great, but it's the most impressive microcomputer hardware I've seen. I'm looking forward to writing about it.

Writing, that is, with a word processing program, working on one document in one window. I'm a conservative about some things. ■

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Circle 30 on Reader Service card.

SOUNDS GOOD TO US...



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Help Key

By Swain Pratt

Help Key is a feature that will seek to provide answers to those questions about the Amiga computer that new users or other interested computerists are most likely to ask. The answers will be forthcoming, at least initially, from members of the staff that developed this new computer. Rob Peck, Director of Descriptive and Graphic Arts at Commodore-Amiga, answered the questions in this first installment. If you have questions about the Amiga that you don't find covered here or in other articles in AmigaWorld, send them in to AmigaWorld editorial, 80 Pine St., Peterborough, NH 03458, and we'll do our best to give you satisfactory answers.

Q: How can the Amiga be described in broad general terms?

A: The Amiga personal computer is a high-performance, low-cost system, with advanced graphics and sound features. We call it the world's first personal supermicro. That's a strong statement, but it's substantiated by the Amiga's capabilities.

Q: How many people were centrally involved with the development of the Amiga?

A: The core of the development staff consisted of about 25 to 30 people, working for nearly two years.

Q: What central processing unit was chosen for the Amiga?

A: The 7.8 MHz Motorola 68000—one of the most efficient and powerful CPUs that exist for microcomputers, and one particularly suited for graphic-intensive applications.

Q: Please describe the Amiga's memory capacity. Can users add external RAM?

A: There are 256K of internal RAM, and users can add on another 256K, using a clip-in cartridge, bringing the total presently possible to 512K, within a contiguous address space of 16 megabytes. Additional external expansion beyond 512K, up to 8 megabytes, is possible, and outside vendors are currently working on expanded memory multifunction cards. There are 192K of ROM, containing a real-time, multitasking operating system with sound, graphics and animation-support routines.

Q: The Amiga has a built-in disk drive. What are the details about this device?

A: It is a built-in, 3½-inch double-sided, double-density drive. The disks are 80-track, formatted as 11 sectors per track, with 512 bytes per sector, giving a total of 880K bytes per disk.

Q: Can other disk drives be connected to the Amiga?

A: Yes; there is provision for connecting up to three additional drives, which may be double-sided, using either 3½- or 5¼-inch floppies.

Q: Is it possible to connect with a hard-disk unit?

A: The hardware and software features of the Amiga fully support hard disk and tape back-up units.

Q: Please describe the Amiga's keyboard. Will it be possible to connect a non-Amiga keyboard?

A: The keyboard is detached, with 89 keys, calculator pad, function and cursor keys. The information about the keyboard output for each of the key-strokes is provided, and if some other manufacturer wanted to produce a more enhanced keyboard with all the Amiga functions on it, I think we would certainly provide all the details necessary for such a connection. As far as I am aware, however, there is no non-Amiga keyboard in the works for this machine.

Q: Can you use a cassette recorder to save and load programs?

A: No, this is not a capability of the Amiga. You can, of course, use a cassette recorder for recording the sounds an Amiga makes.

Q: What about compatibility of various modems with the Amiga?

A: Any standard RS-232 modem should work with the machine. There will be information in the manual that will indicate which pin of the Serial port is appropriate. We know for cer-

tain that the Commodore-Amiga, Hayes SmartModem and Tecmar 2400-baud modem will work. In any case, the wiring connections will appear in the back of the manual.

Q: How do you connect the Amiga to a stereo system?

A: On the back of the machine are two ports—audio jacks—for output to the left and right stereo channels from four special-purpose audio channels.

Q: Can I hook the Amiga up to a video tape recorder?

A: The output of the Amiga is compatible with NTSC (National Television Standard Convention) signals, which means it should be perfectly at home with your standard video recorder. There are ports for simultaneous NTSC composite video and for analog or digital RTV output. In addition to these connections, the system can be expanded to include a VCR or camera interface. The system is also capable of synchronizing with an external video source and replacing the system background color with the external image. This allows for the development of fully-integrated video images with computer-generated graphics. Laser-disk input is accepted in the same manner. This indicates, for example, that you should be able to connect your Amiga in series with your videotape or your camera and use the computer in combination with these accessories.

Q: What languages are built into the Amiga—or planned for the future?

A: A version of Basic is bundled with the machine. Other languages that will work with the Amiga are Logo, Pascal, C and Assembler.

Q: Is the Amiga compatible with any other computer's hardware or software?

A: At the moment, the machine is unique. I can't go into the details here, but we are examining issues of compatibility with certain other levels of software and certain other types of operating systems. At this point, however, the Amiga runs the custom operating system and will do so for the foreseeable future.

Q: What sort of RS-232 output does the Amiga have?

A: You can set it up for just about anything you might want. The connections are specified on the back. We will have a "preferences tool" that will come up under our Workbench program that will allow you to properly configure your Serial port for printers. We can support up to 19,200 baud as far as the transmission is concerned, and potentially even higher than that, if necessary. 31,500 baud is, I think, the top, but 19,200 is the maximum standard one might consider.

Q: What ports are available on the Amiga for connecting peripherals?

A: There's a fully-programmable Serial port that will allow, as I've mentioned, baud rates up to over 31,000; a parallel port, also fully programmable, that's normally configured for Centronics parallel printer output, but that also can be used as a high-speed parallel input port; two reconfigurable controller ports for connecting a mouse, joysticks, light pen, digitizer tablet or paddles; an expansion

port with full access to the 68000 bus for adding such accessories as RAM and additional floppy or hard-disk drives; and then the ports for composite video, a second floppy-disk port, RGB and audio output.

Q: The Amiga's graphics capabilities are reputed to be extraordinary. What are the details about these great graphics?

A: The reason for the truly fine graphics is that we have three custom VLSI circuits to provide the graphics—and sound—while still allowing the main processor to run at full speed most of the time. This special-purpose hardware gives you the following features.

The Amiga produces bit-plane-generated, high-resolution graphics, typically producing a 320×200 non-interlaced display, or 320×400 interlaced, in 32 colors, and a 640×200 or 640×400 display in 16 colors. A special Low-resolution mode is also available that allows you to have 4,096 colors on-screen simultaneously.

This custom hardware also includes a custom-display co-processor that permits changes to any of the system's special-purpose registers in synchronization with the movement of the video beam. This allows special effects such as mid-screen changes to the color palette, splitting the screen into multiple horizontal slices, each having different video resolutions. The co-processor can trigger many times per screen, both at the beginning of lines and during the blanking interval. The co-processor itself can directly affect all the registers of the special-purpose hardware, thus freeing the 68000 for other general-purpose computing tasks.

The special-purpose hardware embodies 32 color registers, each of which contains a 12-bit number that is split into four bits of red, four of green and four of blue intensity information.

This allows the system 4,096 different choices of color for each register. Although an RGB monitor provides the best available output for the system graphics, the NTSC signal has been carefully designed to provide maximum NTSC compatibility. The signal may be videotaped or fed to a standard composite video monitor.

As for sprites, we have eight reusable 16-bit-wide sprites, with up to 15 color choices per sprite-pixel element when sprites are paired, or up to four choices per pixel element when sprites are used individually. The background on which the sprites move independently is called the playing field, and the sprites can be displayed either over or under this background. The sprite is a low-resolution, 16-pixel-wide object that is an arbitrary number of lines tall.

After producing the last line of the sprite on the screen, a sprite processor may be used to produce yet another sprite image elsewhere on the screen. Thus, you can create many, many small sprites by simply reusing the sprite processor as appropriate.

The system hardware also provides dynamically controllable inter-object priority. This means that the system can control video priority between the sprite object and the background on the playing field. You can determine which object appears on top at any given time, as well as sensing collisions between objects or between the object and the playing field.

There is also a custom bit-blitter for high-speed data movement, adaptable to bit-playing animation. The blitter is designed to efficiently receive data from up to three sources, combine the data in one of 256 different ways and optionally store the design data in a destination area. The bit-blitter has a special mode in which it can draw patterned lines into a rectangularly organized memory region at a speed of about one million dots per second.

Q: How can users get a detailed description of the inner workings of the Amiga? Will a hardware manual be available?

A: The hardware manual will be available at or close to the release date of the machine. The same information that has been distributed to our developers will for the most part be available to users. This includes a hardware manual and a description of the operating system's ROM Kernel routine.

Q: Is it possible to damage the Amiga by typing in anything incorrectly, by turning things on or off in the wrong sequence or by plugging in peripherals with the power on?

A: No, you can't damage the Amiga by typing errors or by switching things on or off in the wrong sequence. It is acceptable to plug in joysticks, a mouse or other peripherals with the power on, but we advise that you play it safe by plugging in peripherals with the power off. It's a good practice.

Q: How often is it advisable to clean the disk drive? And how is it best done?

A: Whatever is generally recommended as cleaning intervals—maybe once a month, unless there is very heavy usage. Get a good disk-cleaning kit for a $3\frac{1}{2}$ -inch drive.

Q: Is it safe to take the disks through X-ray machines in airports?

A: Yes.

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List of Software

<i>Program</i>	<i>Description</i>	<i>Developer</i>	<i>Publisher</i>	<i>Release Date</i>
<i>Amiga Assembler</i>	Development tools, including macro assembler, linkage editor and overlay editor for the software community	Metacomco	Commodore-Amiga	Launch*
<i>Amiga LISP</i> <i>Amiga Pascal</i>	Programming languages	Metacomco	Commodore-Amiga	Launch
<i>Graphicraft</i>	Entry level, but powerful paint program, giving user control over Amiga's graphics capabilities	Island Graphics	Commodore-Amiga	Launch
<i>Paintcraft</i>	Professional level graphics and art production program	Island Graphics	Commodore-Amiga	Oct. '85
<i>Chartcraft</i>	Powerful business graphics package for charts and graphs. Produces 3-D, shaded, exploded and expanded graphs, plus a variety of special effects for business presentations	Island Graphics	Commodore-Amiga	Oct. '85
<i>Videocraft</i>	Advanced animation effects; an image-manipulation program using icons and pull-down menus for easy and rapid implementation	Island Graphics	Commodore-Amiga	Oct. '85
<i>Textcraft</i>	Powerful entry level word processor stressing ease of use, on-screen documentation and templates for business letters, memos, etc.	Arktronics	Commodore-Amiga	Launch
<i>Musicraft</i>	Entry level program featuring the Amiga's advanced sound systems and capabilities	Everyware	Commodore-Amiga	Oct. '85
<i>Amiga "C"</i>	68000 C language compiler for Amiga software development in C, a language popular because of its power and portability	Lattice	Commodore-Amiga	Launch
<i>General Ledger</i> <i>Accts Receivable</i> <i>Accts Payable</i> <i>Sales</i>	Small business programs from the popular Rags to Riches series, featuring on-screen documentation, a common command set and the ability to swap data between programs	Chang Laboratories	Commodore-Amiga	Oct. '85
<i>Amiga TLC Logo</i>	Enhanced adaptation for the Amiga of the TLC-Logo programming language for educational applications	The Lisp Co.	Commodore-Amiga	Oct. '85
<i>Telecraft</i>	Easy to use but sophisticated communications and terminal emulation package	Software 66	Commodore-Amiga	Oct. '85
<i>Amiga Harmony</i>	Professional sound synthesis and music program from a leading music publisher	Cherry Lane Technologies	Commodore-Amiga	Sept. '85

<i>Program</i>	<i>Description</i>	<i>Developer</i>	<i>Publisher</i>	<i>Release Date</i>
<i>Flight Simulator</i>	State-of-the-art flight simulation program using the Amiga's advanced graphics animation and sound	Bruce Artwick	Commodore-Amiga	Jan. '86
<i>SynCalc</i>	Sophisticated and multi-featured spreadsheet program; data compatible with VisiCalc	Synapse/Borland	Commodore-Amiga	Nov. '85
<i>Mutant</i>	Strategy arcade game	Synapse	Commodore-Amiga	Nov. '85
<i>Enable</i>	Highly acclaimed second-generation integrated package with word processor, spreadsheet, database, telecommunications and graphics	The Software Group	Commodore-Amiga/Software Group	Nov. '85
<i>Enable/Write</i>	Advanced word processing program for professional users; a module of the Enable package	The Software Group	Commodore-Amiga/Software Group	Launch
<i>Enable/Calc</i>	Advanced spreadsheet program for professional users; a module of the Enable package. Allows data compatibility with Lotus 1-2-3 (including Lotus macros), dBase II and VisiCalc	The Software Group	Commodore-Amiga/Software Group	Oct. '85
<i>Enable/DB</i>	Advanced database program for professional uses; a module of the Enable package	The Software Group	Commodore-Amiga/Software Group	Nov. '85

BUNDLED WITH THE AMIGA

<i>AmigaDOS</i>	Operating system	Commodore-Amiga	Commodore-Amiga	Launch
<i>Tutorial</i>	Text and graphics program introducing features of the Amiga	Mindscape	Commodore-Amiga	Launch
<i>ABasic</i>	Powerful basic programming language with advanced features, such as multiple windows for editing and debugging	Microsoft	Commodore-Amiga	Launch
<i>Amigascope</i>	Rolling demo program featuring the graphics capabilities of the Amiga	Electronic Arts	Commodore-Amiga	Launch
<i>Speechcraft</i>	Speech program with user-definable parameters (male-female voices, etc.) allowing unlimited text-to-speech conversion	Softvoice	Commodore-Amiga	Launch

*Scheduled for release on or before the Amiga's launch date.