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A C500. THE POWER YOU CAN AFFORD.



Model Name	Millennia 450	Millennia 500	Millennia MAX 600
Processor	Intel Pentium® III processor 450MHz	Intel Pentium III processor 500MHz	Intel Pentium III processor 600MHz
RAM	64MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	8.4GB hard drive ^o	8.4GB Ultra ATA hard drive ^o	13.6GB Ultra ATA hard drive ^o
DVD/CD-ROM	40X var. ^o speed CD-ROM drive	40X var. ^o speed CD-ROM drive	New 8X DVD-ROM
Graphics	8MB nVidia Riva AGP graphics	8MB nVidia Riva AGP graphics	16MB nVidia AGP graphics
Sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound	PCI 64-voice Wavetable sound
Speakers	—	—	Monsoon MC 200 3-piece speaker system
Monitor	17" Micron 700Cx (15.9" display)	17" Micron 700Cx (15.9" display)	17" Micron 700Cx (15.9" display)
Communication	—	3Com USRobotics V.90 WinModem	3Com USRobotics V.90 WinModem
Micron University	1-year free ^a online training	1-year free ^a online training	1-year free ^a online training
On-site Warranty	5-yr./3-yr. Micron Power limited warranty	5-yr./3-yr. Micron Power limited warranty	5-yr./3-yr. Micron Power limited warranty
Software	Microsoft Windows 98 Microsoft Office 2000 SBE Norton AntiVirus	Microsoft Windows 98 Microsoft Office 2000 SBE Norton AntiVirus	Microsoft Windows 98 Microsoft Office 2000 SBE Norton AntiVirus Micron Easy Internet
Factory Direct Price	\$37/mo. \$1197 <small>Business Lease 48 mos.^{oo}</small>	\$40/mo. \$1298 <small>Business Lease 48 mos.^{oo}</small>	\$56/mo. \$1844 <small>Business Lease 48 mos.^{oo}</small>



Millennia MAX 500
JUNE '99



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Voodoo³ 3500: Why 3Dfx's best videocard isn't good enough.

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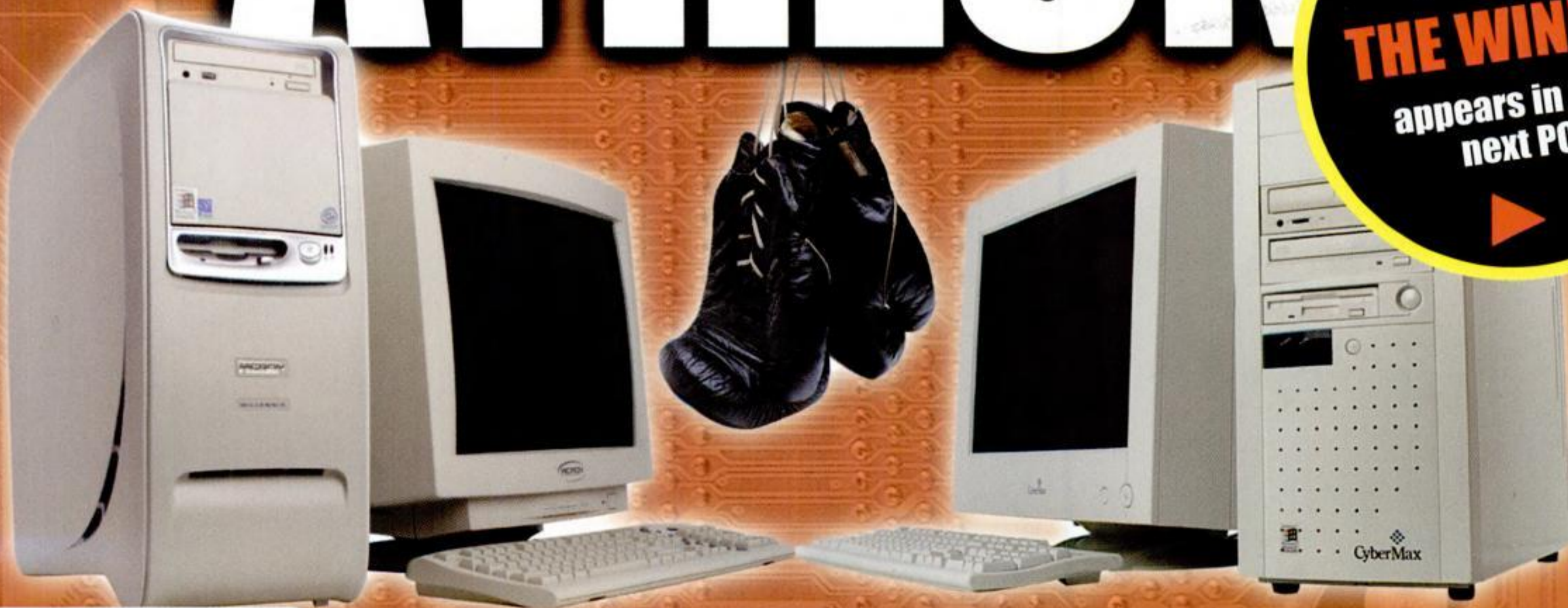
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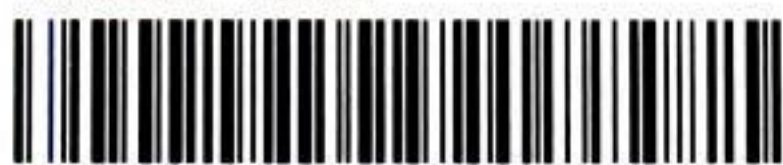
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- ▶ Which is faster? We name the processor champion!
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- ▶ Complete guide to picking the right CPU for you

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A VICTIM OF
BAD GRAPHICS.**

**MY SON IS A
VICTIM OF BAD
GRAPHICS.**



NVIDIA

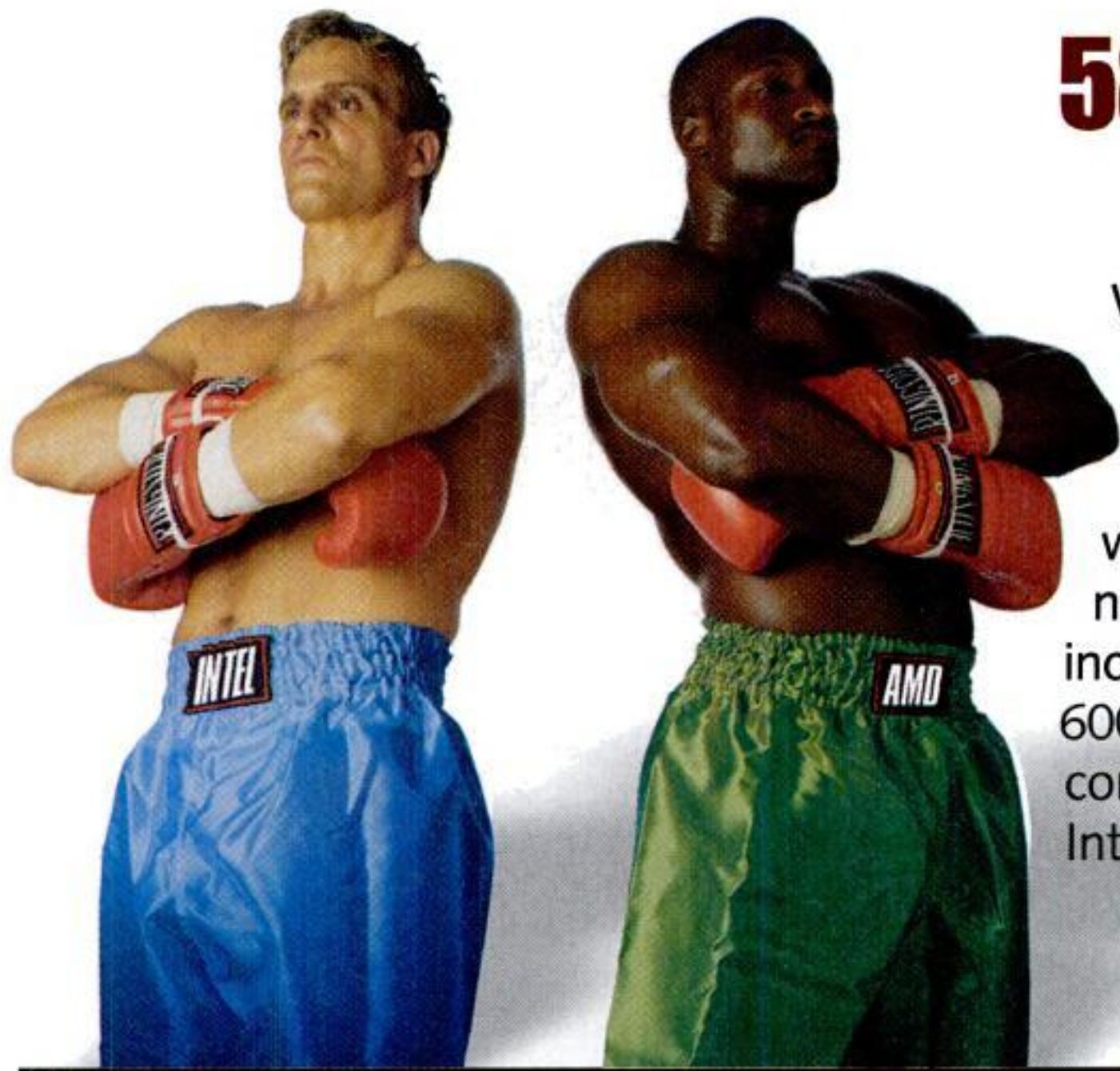
Don't worry, at NVIDIA, amazingly fast, cutting-edge graphics processors are all we do. The results are ultra-smooth frame rates and incredibly vivid colors that allow you to see and play 3D/2D games exactly the way game makers intended. Not to mention an Internet experience that comes to life. If you demand this kind of performance out of your games and the Internet, then demand your next PC or graphics accelerator comes loaded with a NVIDIA chip. There's no reason to settle for anything less. Graphics to the nth degree.



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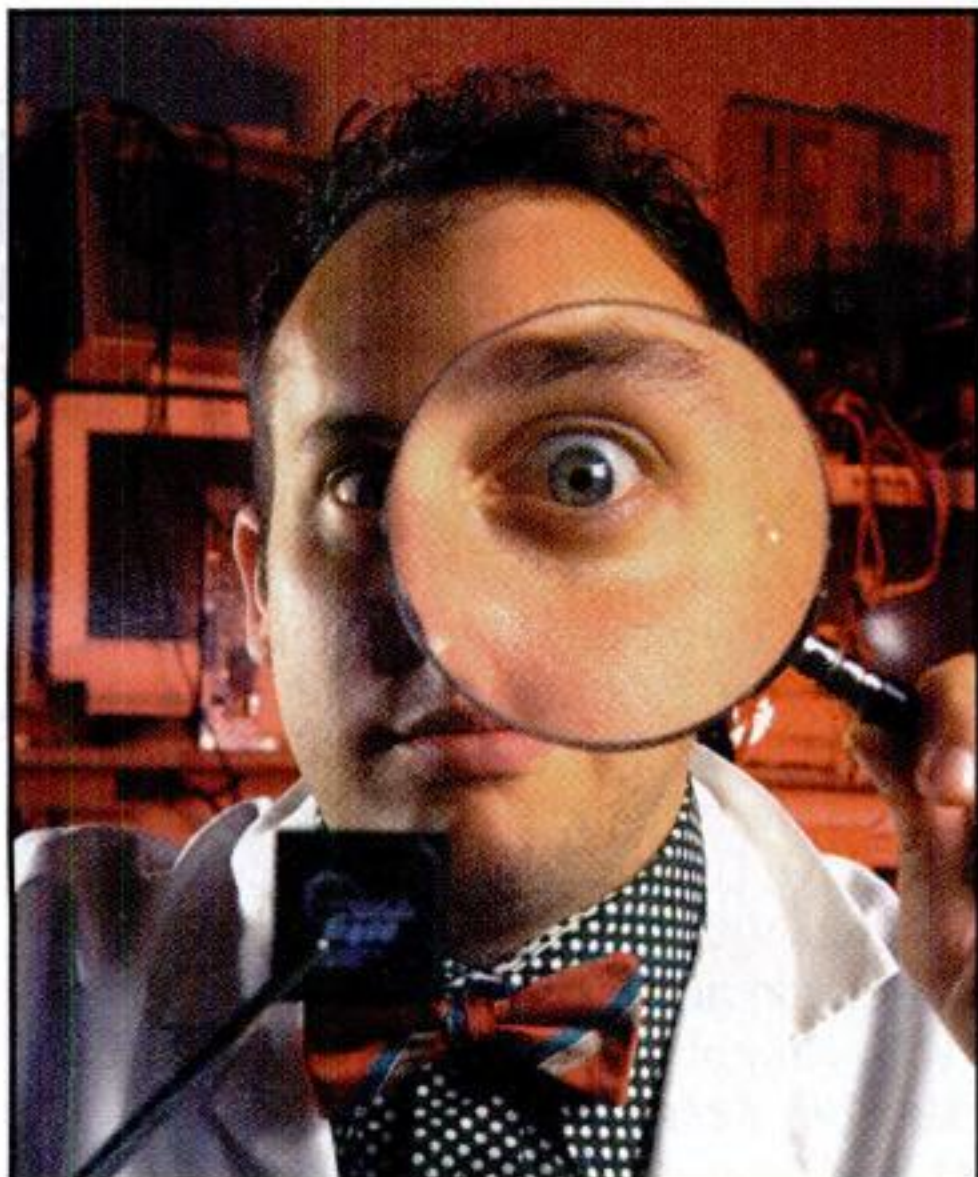
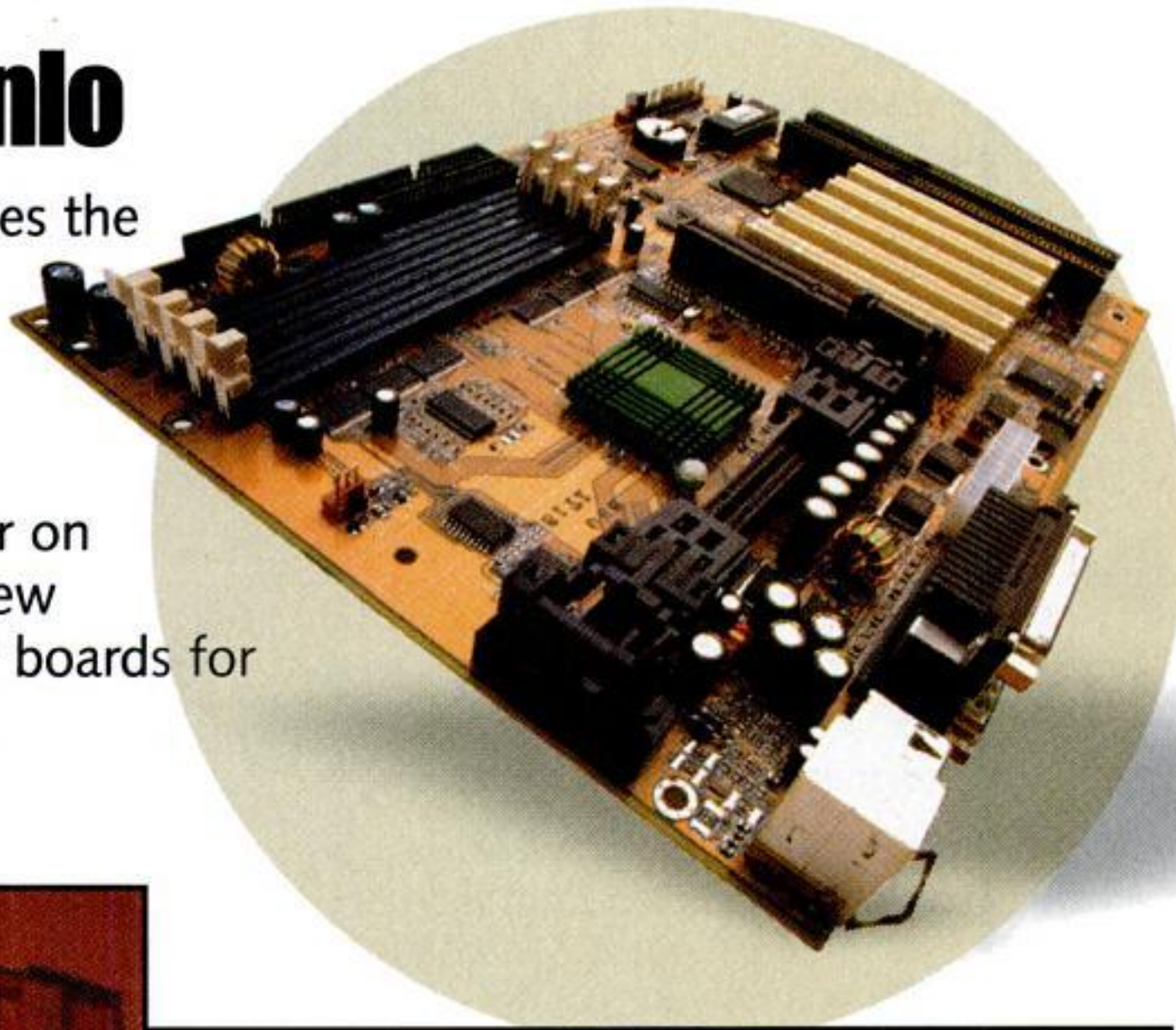


58 Pentium III vs Athlon

We pit Intel's and AMD's fastest processors against each other in the title fight for Pure PC Power. The winner deserves a slot in your next machine. The fight card includes reviews of the best 600MHz heavyweights, and a complete guide to making the Intel-AMD decision.

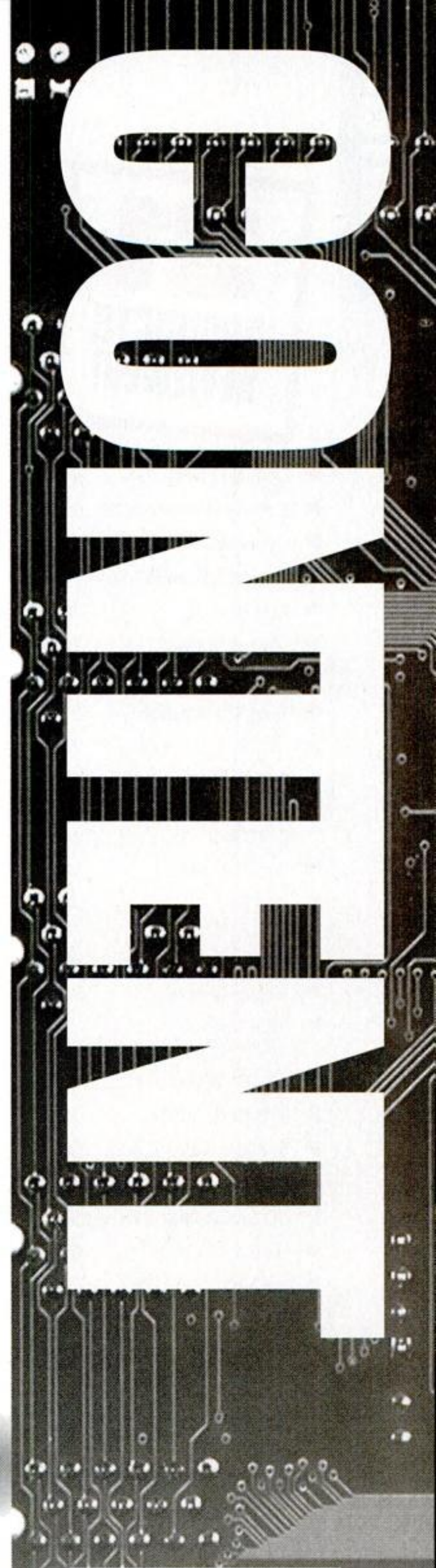
68 Mobo Downlo

Your motherboard determines the make-up of your entire computer—so it's time to learn how it affects every upgrade you'll ever make. We tell you what to look for on the mobo when buying a new system, and review six killer boards for infinite upgrading madness.



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▶ Tired of watching the bar crawl across your screen as you download crap from the net? So are your neighbors. Someday, 1.5Mbps of broadband bliss will hit your cul-de-sac. Someday. *Maximum PC* looks at what lies between you and the high bandwidth you crave.



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On the hardware tip, we're hittin' TNT2 Ultra cards from Asus and Elsa; 2+Megapixel digi-cams from Olympus, Sony, and FujiFilm; the Voodoo³ 3500 TV from 3dfx; TV Tuner Cards from ATI and STB; four USB-based web cams from Kodak, 3Com, Nogatech, and Creative Labs; a Printer from Lexmark, and Digital Video Production Kits from Digital Origin and ADS. We're also getting soft with Kingpin: Life of Crime, Heavy Gear II, Dungeon Keeper 2, 3D Studio Max 3, and Poser 4—but not necessarily in that order.



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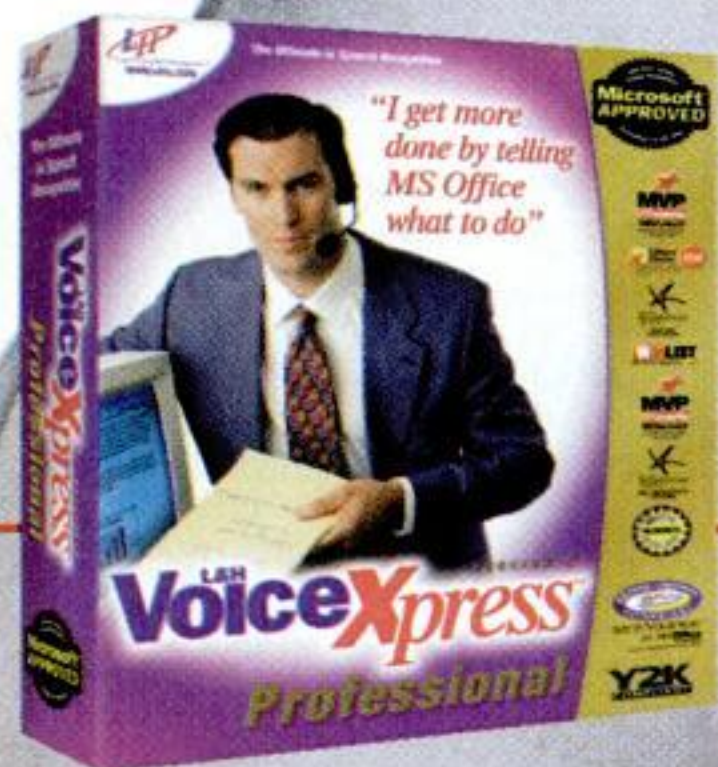


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It's Time for Me to Say Good-Bye

A long time ago, in a galaxy far, far away... a friend asked me to apply for a job with

the company he had recently joined. That friend was Jon Phillips, and the company was Imagine.

Since our days at San Francisco State University, Jon and I had worked together on various publications, and he had hooked up a gig with *The Net* magazine. I was heading up online coverage at *Publish* magazine and didn't want to move, but I decided

to apply as a favor to Jon.

I met with Matt Firme, whose work I knew from *PC Gamer*, about taking over a magazine called *CD-ROM Today*. He wanted me to make it into a magazine that I would get off on, the ultimate guide for tech freaks, a hot-rod mag for computer owners.

The next day, I gave my resignation letter to *Publish*.

In its day, *CD-ROM Today* was an innovative publication. It was the first magazine to bundle a monthly disc packed with great software, a tradition *Maximum PC* continues. But as CD-ROM technology had grown more common, the magazine had become less sexy. Our task was to recapture the thrill of pushing the technology envelope. We wanted a magazine that would distinguish itself from the big corporate tomes by displaying depth, irreverence, and a commitment to work harder and go further in the quest to deliver exactly what computer owners wanted.

Thus was born *boot*.

Dedicated to Pure PC Power, a handful of editors set out to rock the world by doing a PC magazine better than anyone imagined possible. Editors

ran their own benchmarks, based on the actual applications that PC owners used, and wrote their own stories. We tested gear until it broke or caught fire. We told the truth and spoke out against bad products, even when they were made by our advertisers. It was new. It was revolutionary. It was a helluva lot of fun.

After two years, *boot* needed to grow. As a birthday present, Imagine bought the subscriber list of *Home PC* magazine and relaunched *boot* as *Maximum PC*. With more support, the magazine thrived and reached more people than ever before. The competition began to drop like flies: *Byte*, *Windows*, and *Computer Life* all faded into the mist.

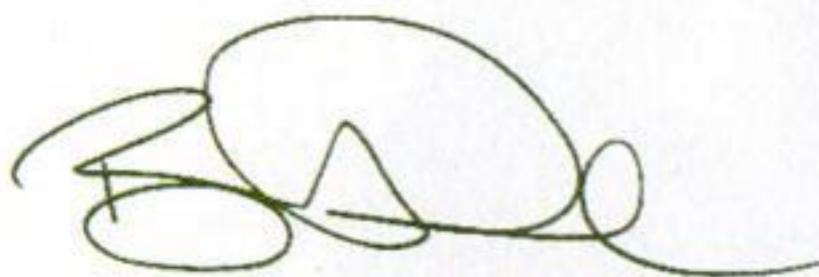
Now, while *Maximum PC* is in peak form, I am handing the helm over to the same man who coerced me to take that job interview many years ago. Stepping down as editor in chief of *Maximum PC*

is hard, but it's made much easier by the knowledge that someone as over-qualified as Jon Phillips is prepared to take the magazine even further.

As for me, I'll be moving on to head up all technology-related online publishing for Imagine and its parent

company, Future. We currently run the *Maximum PC* Network and *MacDaily*, and have big plans for these and other launches in the coming months. We'll be working closely with our international partners based in England, France, Italy, and Germany, so you can expect bigger and better things to come.

Thanks to all of you for all the support and honest criticism these past three years. Jon... You have the comm.



Brad "Big Daddy" Dosland
Editor in Chief

MAXIMUM PC

oct99 vol4 issue10

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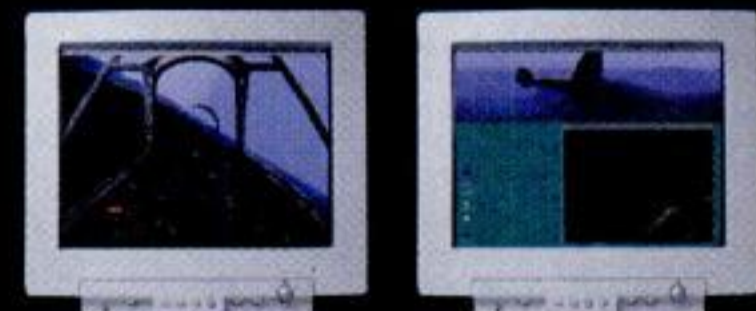
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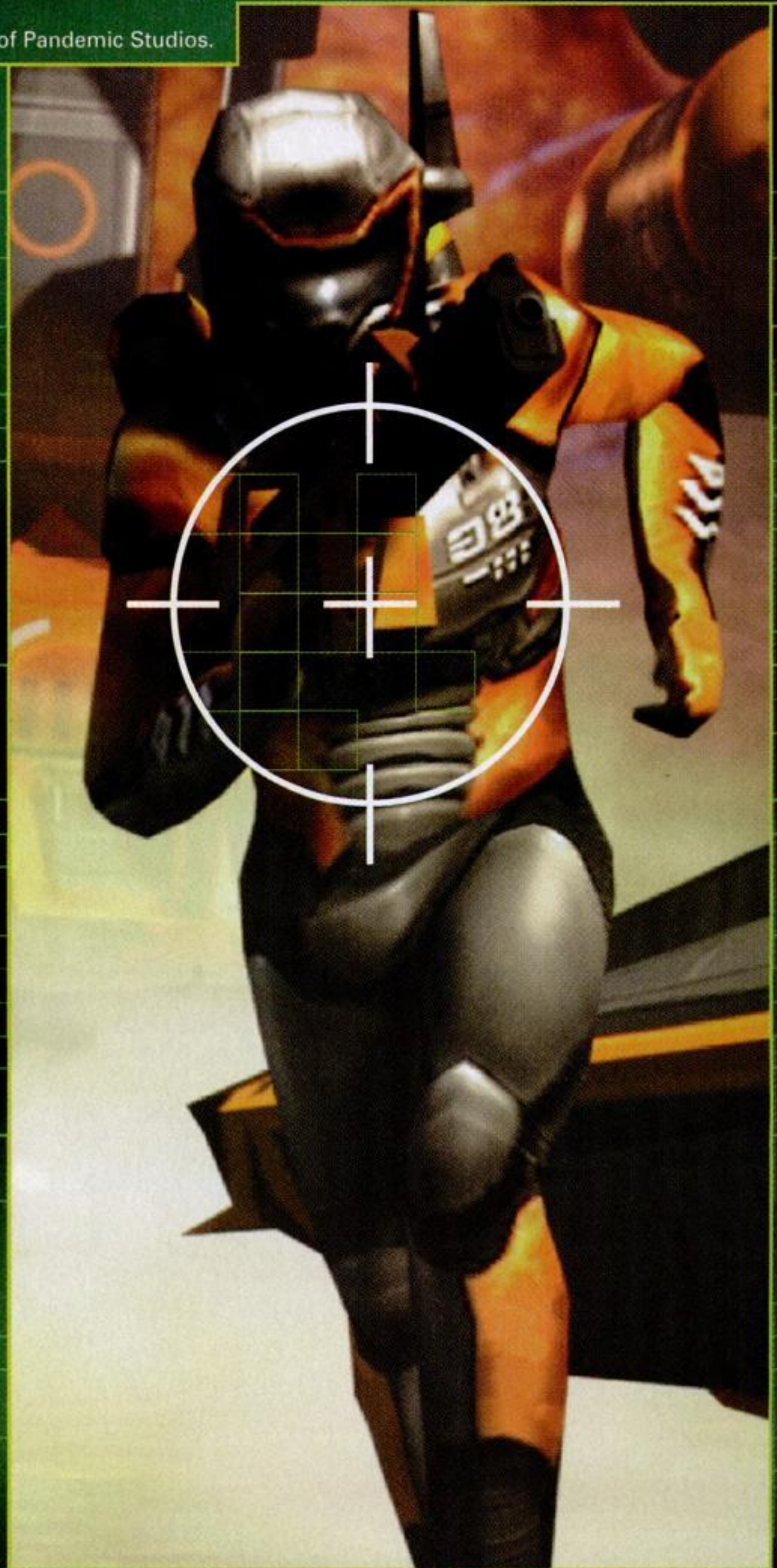
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Look for Battlezone II™ this fall. Screenshots courtesy of Pandemic Studios.



The "KILL-ZONE" as seen by a standard 350 dpi mouse.



The "KILL-ZONE" as seen by the 1000 dpi Razer™ Boomslang™.



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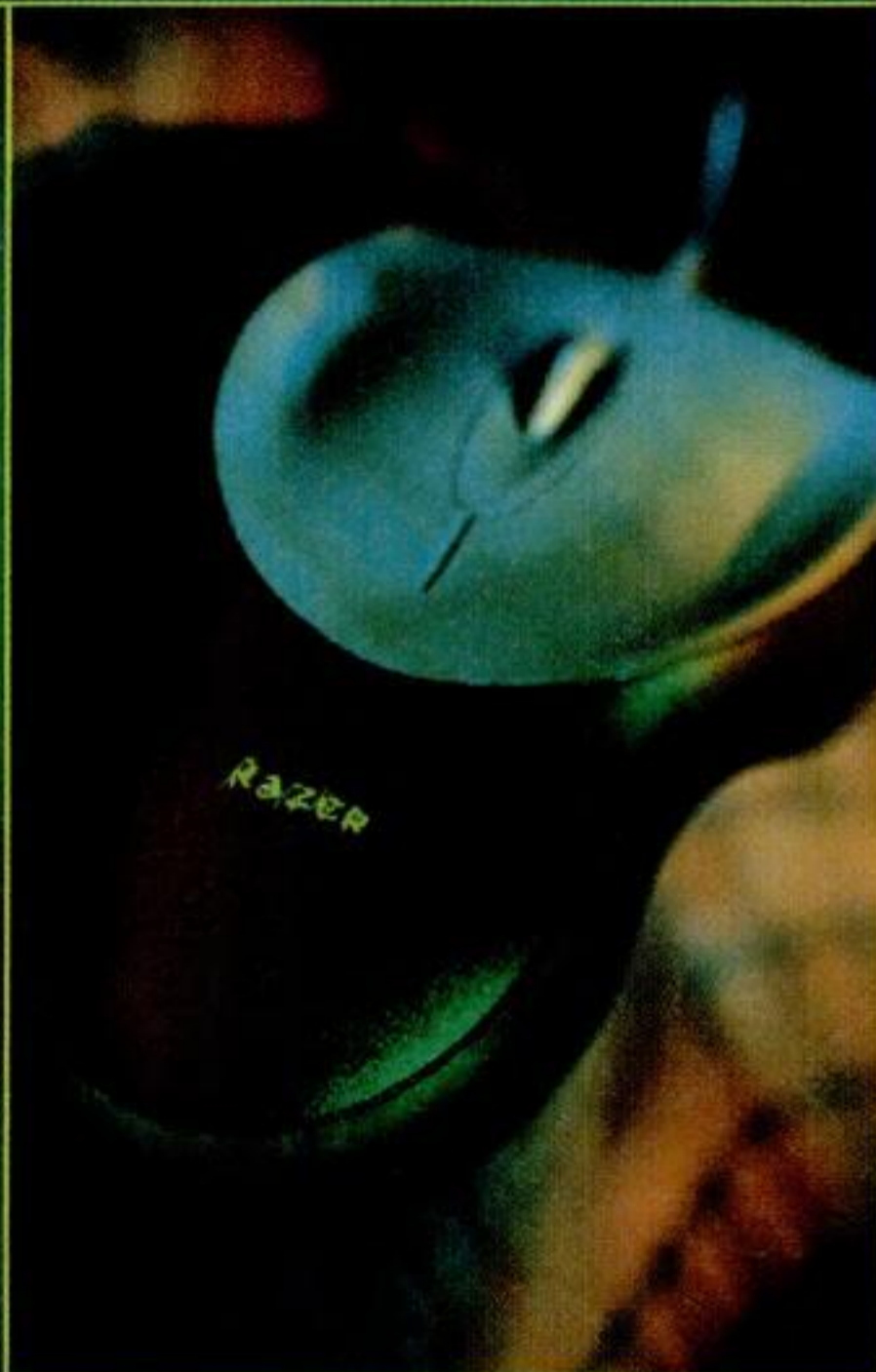
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Here's the deal: You (being the smartest readers in the world) write letters about the magazine, the PC industry, the software you love or hate, and the hardware that runs it. We read it and share as much of it as space permits in the mag and online, and respond or comment when the letter calls for it. Get it? Now get busy and write us at commport@maximumpc.com.

How To Steal Bandwidth From Dorm Rats

In your August cover story ("Down-Home Networking"), you left out a card that might be the simplest solution for many wired home networks—the Farallon EtherWave card is the crown jewel of simplicity. The EtherWave card allows multiple computers to be connected via Ethernet cable *without* the use of a hub. The only limit is distance. That said, I can attest that even distance should never really be a problem for these cards.

In college, I lived in a fraternity dorm. As such, the administration was in no hurry to provide us with Ethernet, but the dorm next to us did have Ethernet. Two friends and I really wanted some of the good stuff, so we decided to steal Ethernet from the neighboring dorm. Three days before school started, when the freshmen were there for orientation, we wandered around the Ethernetted dorm until we found a room whose inhabitants weren't going to use their nodes. We paid them "bucks-per-foot" and proceeded to run two cables out their window and down the side of the building, and began burying the cable underground. Two sidewalk crossings and 300 feet later, we ran it up the side of our building and into our window, where it met up with our wonderful Farallon EtherWave card. From there, we connected three more computers, all of which could work simultaneously without a hitch.

I have no actual numbers, but speed was never a problem; neither was downloading or game playing. These cards can be purchased for \$79 apiece in either the PCI or ISA flavor. I still use my EtherWave to connect my main computer, which is a simple server, to my home stereo for MP3-playing purposes.

—Christopher Pugh

Dreamy Display Divulged

As I was reading your September 1999 issue, I was surprised to find that you failed to mention the type of monitor you used in the Dream Machine. Was it left out intentionally or was it omitted by human error?

—Nipman25

Executive Editor Jon Phillips replies: We wanted the article to focus on building a perfectly personalized box from scratch. And because plugging a regular old 15-pin monitor cable into a videocard doesn't take a ton of technical know-how, we left monitors out of the equation. Same goes for speakers, mouse, and keyboard.

For the record, however, the monitor pictured in the article (and the monitor we'd choose for both Dream Machine 99 and Extreme Machine 99) is the Sony F500. This virtually flat 21-incher has stolen *Maximum PC's* heart for more than a year, includes the most impressive array of professional controls we've ever seen, and is our de facto display for videocard testing. Sony's 19-inch F400 uses the same flat-screen technology, but includes fewer killer controls.

For the final word on *all* the best products of the year, pick up our Gear of the Year issue in December.

When Software Collides

In the August issue of your magazine, there was an article comparing McAfee and Norton anti-virus software. The article states that both programs were able to pick out 53 of 60 viruses thrown at

them in unzipped files, while Norton could detect only 45 of the 60 viruses in zipped files. Did these programs miss the same viruses? If not, would running both programs have picked out all 60 viruses? Can you run two anti-virus software programs together without any possible software conflicts?

—Richard Rotmistrovsky

Associate Editor Josh Norem replies:

Although Norton and McAfee found the same number of viruses in the basic hard drive scan test, it's difficult to determine whether they missed the same ones. Although we logged every virus found by each program and compared the lists, each program appears to name the viruses in its own way. While some viruses have very clear, virus-like names, such as "Armageddon," others are more cryptic, such as "26_D." Why the programs identify viruses differently is anyone's guess, but my theory is that different technologies behave, well, differently.

It's totally safe to have two anti-virus programs installed on your box at the same time. However,



"Two friends and I really wanted some of the good stuff, so we decided we were going to steal Ethernet from the neighboring dorm."

This month:

- ▶ Ethernet thieves
- ▶ Palm vs. CE: A reader disagrees
- ▶ Alienware's do-it-all gaming box
- ▶ Game blame continues



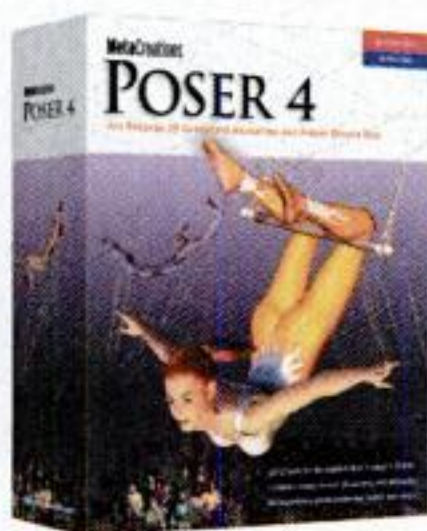
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COMMPORT

we've found that if you have *Norton* on your system and attempt to install McAfee, you'll get a dialog box prompting you to uninstall *Norton*—but that's just competition talking.

Palm Prejudice

Your mobile device coverage (August 1999) is so CE-prejudiced, it's hard to see through all the "I love my Palm" signs!

Kenn Durrence completely ignores the fact that, unlike a Palm device, you can jack up CE units will all sorts of cool gear and CF cards. And Brad Dosland's review of the Palm VII totally lacks

a critical look at the device's problems; it reads like a press release of "gee whiz" and "wow" features. You didn't even list the cost as one of the minuses, and let's face it, the Palm VII is pricey!

Its "wireless access" is just downright lame. It has crippled web and e-mail access. Worse, you have to pass your e-mail through a freakin' Palm account, and the price is brutal! It's also a definite minus that everything is locked directly into Palm. That's a 100% monopoly, baby. Palm can charge whatever it wants—there's no open competition because Palm

went with its own standard. And it's a U.S.-only solution. I'm in Canada and feel ripped off.

I've used both devices, and the Palm is so severely limited in its functionality that I'm amazed you guys love it so much. Windows CE certainly isn't perfect (in some ways, it's downright dysfunctional), but it's innovating and growing at a phenomenal rate.

—Jason Dunn

Editor-in-Chief Brad Dosland

replies: A Microsoft fan crying monopoly? That's a new one. The only limitations to Microsoft's success in the palmtop space are the abysmally poor CE products that have been released to date. The new color

models reviewed in the August roundup don't reverse that trend.

In terms of fairness, both of the CE reviews cited the devices' CF memory-expansion abilities. If anything, we regret being so soft on the piss-poor color screens: The Philips was positively unusable in direct sunlight, and the Compaq was stigmatism-inducing indoors. Unacceptable, no matter what whistles and bells you pack under the hood.

Palm, on the other hand, hasn't been on our most-favored-nation list lately, either. Palm's all-show, no-go Palm V garnered a meager 5 verdict in the May issue. But the Palm VII is a genuine "wow" product. Limitations aside (and those limitations were noted in the review), Palm has shipped the first wireless web access and its impact is profound. In our extended testing, it has proven itself invaluable time and again.

As for "pricey," the Palm VII costs some 10% more than the CE devices reviewed; we think that's a fair price to pay for a PDA that can be used both indoors and outdoors.

Is Windows a RAM Snob?

I was about to purchase a new PC with 768MB of RAM, but the salesperson told me that Win98 can address only 384MB and that I would be wasting my money by buying more. Considering the current giveaway price of memory, I want to purchase as much as possible (maybe even a gig). What OS is capable of addressing 1GB or better?

—Ron Orczyk

Associate Editor Josh Norem

replies: Most of the previous memory limitations in Windows 95/98 were not the fault of the operating system, but of Intel's chipsets—namely, the VX and TX. These chipsets cached only 64MB of RAM, but the new BX and LX chipsets don't carry that limitation. And although we have been known to commit hardware gluttony at times, we think anything over 256MB of RAM is simply overkill, unless you're running a server or performing 3D rendering and other hardware-intensive applications.

Nevertheless, we say go ahead, pack your box with a gig of RAM. Windows 98 and Red Hat Linux each support



"Brad Dosland's review of the Palm VII lacks any critical looks at the problems, and reads like a press release of 'gee whiz' and 'wow' features."

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2GB; BeOS supports an unlimited amount of RAM, according to Be technicians.

Celeron vs. Pentium II

I've seen advertisements claiming that the Intel Celeron can test as fast as a Pentium II. Can a Celeron 400 really compare to a P-II 400?

—Tom Hartley

Executive Editor Jon Phillips

replies: A Celeron 400 and P-II 400 can indeed offer the same performance in many processing situations. The P-II and Celeron procs are based on the same core P6 architecture (which is also employed by the Pentium Pro and Pentium III). However, the Pentium II employs 512K of half-speed L2 cache, while the Celeron includes 128K of full-speed L2 cache. That is, in 400MHz CPUs, the P-II's L2 runs at 200MHz, while the Celeron's L2 runs at 400MHz.

L2 cache is essentially high-speed memory. It's used to store frequently used data and instructions close to the CPU core, and keeps the CPU from looking to "slower" main

memory for number-crunching. Evidence would indicate that 128K of full-speed L2 cache offers about the same performance as 512K of half-speed.

That 400MHz P-II, however, is spec'd to run on a 100MHz main memory bus, while the Celeron is spec'd for a 66MHz main memory bus. Obviously, the faster bus offers more performance, and comes into play with memory-intensive computer work like simultaneously running several intense applications.

Alien to Us

Alienware is selling a system that includes both a TNT2 2D/3D videocard and a 3dfx Voodoo³ videocard, combined using Alienware technology. Why would someone want this? I just can't see the performance gain with this configuration. Should I look into a Voodoo³ for better performance?

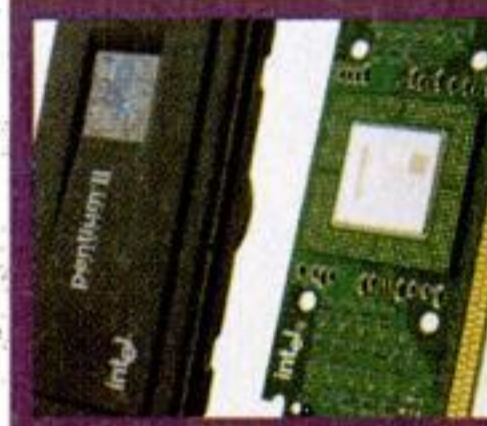
—Jack

Associate Editor Josh Norem

replies: Alienware's latest box had us scratching our heads as well. The Voodoo³ and the TNT2 are currently the supreme

mack daddys of the gaming world, with the TNT2 holding an advantage over the Voodoo³ by supporting large textures and 32-bit color. So, Alienware thought it would be cool to put both of them into the same system for those who couldn't decide which one to buy. The TNT2 goes in the AGP slot, while the Voodoo³ 2000 goes in the PCI slot. As it's configured, the system provides a manual toggle switch between cards (though you have to reboot after switching cards in order to activate the one you selected).

The most basic benefit of this setup is that it gives you support for every major API out there: Direct3D, OpenGL, and Glide. Glide is 3Dfx's own API; it's only available in Voodoo-based cards. In our opinion, the only time a gamer would ever use Glide over OpenGL would be for Glide-only games, and we don't know of a single upcoming game that will have such limitations. Most of today's killer games (*Half-Life*, *Quake III*,



"A Celeron 400 and P-II 400 can indeed offer the same performance in many processing situations."

Kingpin, et al) support OpenGL.

To answer your question about the Voodoo³: If you switch from a 2MB Rage 128 to a 16MB Voodoo³, you'll see a big improvement in 2D performance. And in 3D, it'll be like jumping to warp speed. The Voodoo³ is a great card for all the games on the market today—with the word "today" being key. The Voodoo³'s lack of support for large textures and 32-bit color make its longevity questionable. See this month's review on page 98.

Two Procs, One Chip

I ran across some intriguing info from www.pixelfusion.com about putting multiple processors onto one chip. Of course, it's an expensive way to accelerate graphics (for now), but will this someday affect us? Or is it vaporware?

—Tom Dustrude

Fast Forward columnist Tom

Halfhill replies: The technique you read about (integrating multiple processor cores on a single chip) has been talked about for years. It's called CMP,

or chip multiprocessing. A special chip for IBM's S/390 mainframes uses this technology. Also, Sun Microsystems has announced a new processor architecture called MAJC—Microprocessor Architecture for Java Computing, pronounced "magic"—that is designed for CMP. I'll soon be writing about it for *Maximum PC*. It is indeed a fascinating technology.

'Blame Game' Blow-Ups

T. Liam McDonald's August Game Theory column on the Littleton, CO, massacre elicited a barrage of letters. Readers generally gave our gaming columnist a hearty "right-on," but the dissenting opinions were compelling, indeed.

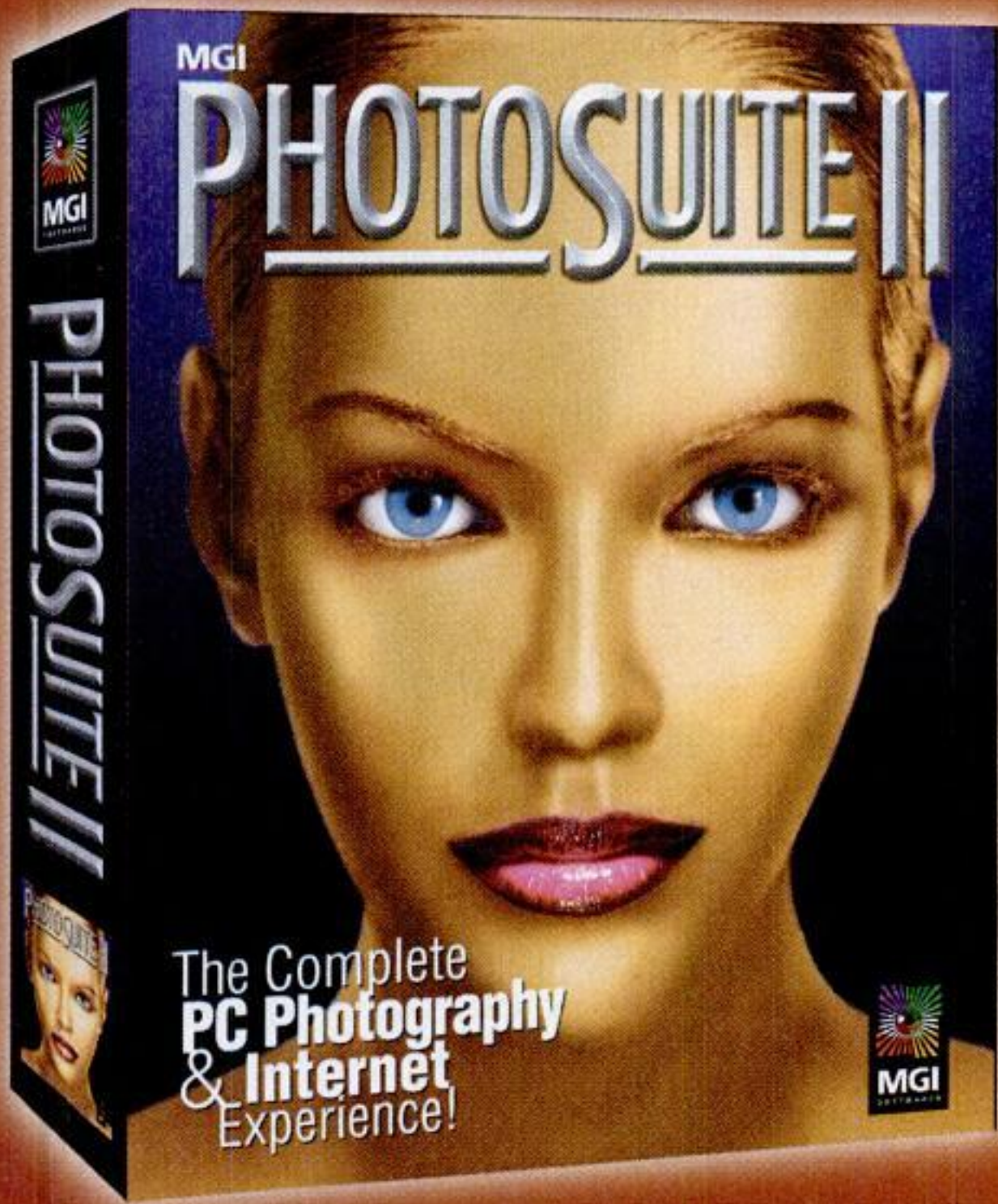
I agree with you 200%. There is a world (literally) of difference between pushing a button and pulling a trigger. I spent five years in the United States Marine Corps, with extensive training for combat. A person who takes it upon himself to go out and actually kill someone had the action in mind. Playing a game about "killing the enemy," or playing a game with any violence at all, for that matter, has nothing to do with it. I also

agree, as a father, with your thoughts on parents keeping an eye on their children. If a parent is so worried about what games their children are playing, why aren't they worried about what their children are thinking? Blaming video games, music, and movies is just an extremely lazy way out.

—Matt Cathen

I was disappointed in T. Liam McDonald's stance. As far-out and radical a position as Dave Grossman has taken on one side, most of the gaming industry has staked out just as extreme a position on the other. Instead of making sure there is nothing the gaming industry can do, you cry, "It's the parents' fault!" Then you shrug your shoulders and go about creating the latest gotta-be-more-grotesquely-violent-than-before computer game. The movie, music, and gaming industries just keep repeating the same mantra over and over like a bunch of Borg: "It's the parents' fault." I do not blame the gaming—or any other—industry in any way for Columbine. I'm just saying *it would be nice* if they tried to change the landscape, in the interest of saving a generation of kids.

—Jerry Foster



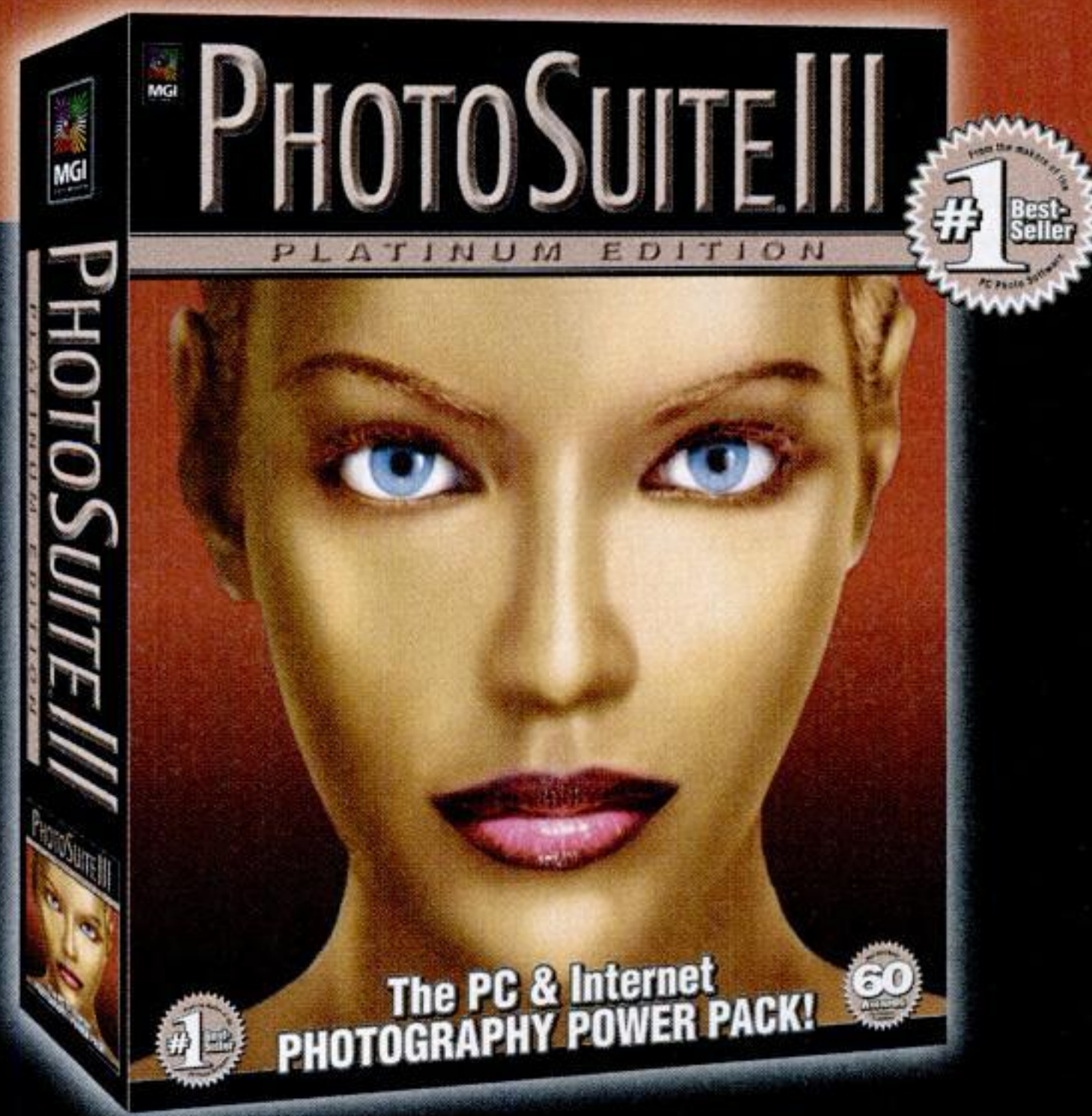
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GAMES

The latest and the greatest for the PC.



There's good news for consumers who have been anxiously awaiting the release of Diablo II, ambiguously slated for release "sometime in 1999." With the recent release of the action/RPG title **Darkstone**, Gathering of Developers has succeeded in delivering a well-crafted alternative. At the very least, the addictively engrossing game will tide hungry Diablo fans over while they pass the time. But thanks to some well-placed improvements, **Darkstone** could be the medieval fantasy game to knock Diablo off its pedestal.

The story revolves around Drakk, an evil dragon who rules the land. In order to save the world, players must locate seven magic crystals which, once united, can help defeat the dragon. Unlike in Diablo, **Darkstone** players are given the ability to control two characters simultaneously. The lead character remains active, while the accomplice remains a few steps behind in a defensive or offensive stance. Character choices include the male or female versions of four character classes: the knight, the thief, the priest and the sorcerer.

Darkstone's vast world of castles, dungeons, villages and forests and its coterie of characters, including over 100 types of nasty monsters, are fully realized in 3D. A player-controlled camera allows players to rotate and zoom in order to see the environment from every imaginable angle. **Darkstone** offers seemingly infinite game play with its Random Quest Generator. Each game includes eight primary quests, randomly chosen out of a possible 22.

Players are immersed in a coherent universe brimming with surprise, emotion and deep stories. 3Dfx acceleration brings high realism, particle effects, real-time colored lighting, strong animation and beautiful graphics. It supports network play for up to eight players and Internet play for up to four. **Darkstone** is available now in retail stores across the nation. Read more about it, see screen shots, or download the movie online at www.godgames.com.

See our ad for **Nocturne** opposite the *Game Theory* article.

COMMPORT

T. Liam McDonald is wrong to say that games have no role in the problem. The things our society deems entertaining (including games) are very much linked to the general state of our society. Violent entertainment has plenty to do with senseless acts of violence.

No thinking human being needs studies to validate the effects of desensitization. Many potential doctors faint when they encounter their first cadaver. Many highway patrol officers vomit when they encounter their first serious car accident. Many police officers are devastated when they are forced to shoot and kill their first criminal. These

reactions fade with each encounter. A sane adult recognizes the difference between these real-life examples and similar examples in our entertainment. A child has much more difficulty making that distinction.

We all get angry at times, and we are tempted to lash out in violent ways. Our natural revulsion toward bloodshed helps prevent rational human beings from acting on those temptations. A few hours of *Doom* will not strip away that natural revul-

sion, but playing many violent games over time will erode it. When this effect is combined with the effects from other forms of entertainment (movies, television, sports), our natural revulsion toward bloodshed is seriously impaired.

—Brian Walker

I agree with T. Liam McDonald's "Blame Game" column, but believe he didn't go far enough in pointing out the intentional misdirection people are attempting in order to shift blame away from more culpable parties. It is easier to point the finger at a faceless industry, and at the Internet in general, than to point the finger at grieving parents. It is also far easier to limit the liberties of unorganized game developers than it is to curtail the very-well-organized weapons industry. Blaming games is like blaming your road rage

on the guy who cut you off on the freeway. People's loss of touch with reality is not about the subject they are obsessed with, it is about the obsession itself.

The big difference between the game industry and the gun industry is that no computer game I know of has ever made it possible to kill anyone.

—Doug Bliss

T. Liam McDonald's piece is well-written and a refreshing change from the normal media reaction to the tall tales [Lt. Col Dave] Grossman loves to tell. I'm happy that someone other than game makers has finally pointed out some of the gaping holes in Grossman's twisted and self-serving logic.

It is disheartening that [Grossman], a self-anointed "expert on violence in video games," has been a guest on *60 Minutes* in prime-time and even testified before the Senate on this subject (calling the Kentucky suit the "Lexington and Concord" of his war against games, typifying the hyperbole that inundates his "messages") without the tiniest shred of credentials. Additionally, his disregard of facts and of the truth when he finds them inconvenient is disturbing, and it appears that no one in the media really cares enough about getting the story straight to follow up on his accusations and proclamations.

I am hopeful that future media attention paid to Mr. Grossman will follow your lead and consider what it is that he's saying before accepting it as the Gospel, and scrutinize a man who really knows very little about games and youth.

Todd Hollenshead

CEO

id Software Inc.

creator of *Doom* and *Quake*

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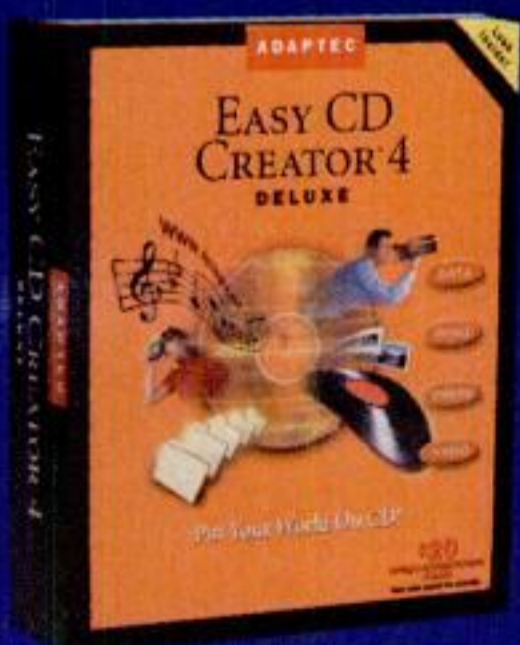


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technology ► internet

Where's Broadband?

Politics, aging networks are slowing down your access to a fast Internet

Although you may feel like the very last person on Earth without broadband Internet access, rest assured—there are millions of people watching their lives tick away as they wait for a 100MB file to download. Just like you.

Industry members and analysts say that a combination of network-infrastructure problems, technical difficulties, undefined standards, and politics is keeping everyone from bandwidth nirvana.

The two most popular services—Digital Subscriber Line (DSL), which sends data over copper telephone wires, and cable modems, which send data over coaxial cable TV lines—each face unique obstacles.

For DSL providers, incompatible standards have inhibited the roll out. According to Mark Peden with the ADSL Forum, a group that promotes phone-line-based broadband, the industry didn't settle on the consumer-grade version of

ADSL, called G.Lite, until just a year ago. G.Lite offers from 384Kbps to 1.5Mbps downstream signals.

It's also been expensive for providers to sort out the tangle of established phone lines in many older cities. Peden says that because many phone systems are antiquated and convoluted, the tests used to determine whether DSL is possible on phone lines often don't match reality. Phone lines might test positive for DSL support, but when the equipment is installed, the actual conditions preclude DSL.

It's not just old cities' systems that cause headaches for DSL providers. People in new communities assume their modern phone lines support high-speed access, but the opposite is true in some cases. New communities are often built with Digital Loop Carriers (DLCs): Instead of the traditional trunk of copper wire running to a neighborhood, phone companies



Having warm thoughts of broadband? Keep dreaming. That may be the only place you'll find faster Internet access.

have used high-tech (and cheaper) fiber-optic lines, which are then split into copper lines. Since DSL is designed to work over copper and not fiber, carriers must rip out the DLCs before they can offer DSL service.

On the cable side, providers

must make even more network infrastructure upgrades before they can extend broadband as an option to all. Industry observers estimate that only 20% to 50% of cable systems support two-way communication, required for uploading and downloading data. Before

ILLUSTRATION BY SCOTT PECK

SPIN CYCLE

This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Toshiba Drive Does CD-RW and DVD	Toshiba has introduced a new drive that handles the chores of a CD burner and reads DVD-ROM discs.	The ATA-33 drive will cost under \$400 and come in ATAPI.	"Today, users have to choose between CD-RW writability or DVD-ROM compatibility. This product gives them the functionality of both," said John Freeman of Toshiba.	Great, now if someone could combine a Zip disk and a floppy, all we'd need is two drive bays in a PC.
VIA Eats x86 Market	Chipset maker VIA Technologies has purchased x86 CPU makers Cyrix and WinChip.	Although it's not clear which market VIA Technologies will pursue, some believe it has its eye set on the information-appliance market or the low-end CPU market.	"VIA's acquisition of IDT's Centaur further solidifies our design capability in the x86 arena," said Wen-Chi Chen, President of VIA Technologies.	VIA has chipsets, close ties to motherboard makers and now CPUs. Single board computer, anyone?

offering cable modems, operators must upgrade entire network sections. And like the phone companies, the cable industry is hampered by new standards. Cable Labs, the industry group that certifies hardware, has approved only a handful of modems that will work on all the various cable systems.

Cable companies say they are aggressively upgrading networks. According to Excite@home, in March 1998, Internet access was available to 15 million homes. By June 1999, that number had increased to 17 million homes.

The industry is also facing the problem of return-on-investment. Is there really enough demand for the service that a provider will be able to recoup the millions of dollars it needs to spend in order to upgrade its infrastructure?

"It's debatable whether they are sitting on a gold mine," says Karuna Uppal, a senior analyst with the Yankee Group. While Uppal agrees that there is a high demand for high-

speed data in some areas, other regions of the country may not be champing at the bit for 100Kbps downloads. "There's certainly demand, but not everybody and their dog is saying 'I want DSL or cable modems,'" Uppal says.

That may be the case for some, but in a spot survey of *Maximum PC* readers, the number-one upgrade on everyone's list is high-speed data access. How bad is the need?

"I'd sell all my children and hand my soul to the devil for broadband right now," one *Maximum PC* reader wrote when asked what he'd do for faster net access.

Another quipped: "Who do I have to kill to get DSL? No really...who?"

Yet another wrote: "I live way out in the middle of nowhere in a place that some call the 'armpit of America.' I would do just about anything for cable or DSL access, but neither is offered in my rural area, and neither is coming for years down the road. I've been

spoiled by T1 at school and at work, and I almost can't stand to surf on my 31.2K connection at home."

The last reader may have to wait a lot longer than anyone else. According to a study funded by iAdvance.Org, a group that champions high-speed Internet access for all, antiquated federal regulations are keeping things slow.

The study, "Breaking the Backbone," also found that 12 states, including Alabama, Arkansas, Idaho, Montana, New Hampshire, West Virginia, and Wyoming, have virtually no broadband access.

"I'd sell all my children and hand my soul to the devil for broadband right now,"

—*Maximum PC* Reader

The problem stems from regulations designed to keep local phone-service carriers out of the long-distance voice market. Because the regulations also apply to data networks, local telephone

companies aren't building the infrastructure necessary to get people faster access.

"Someone who lives in San Jose, CA, may be able to get into the Internet backbone pretty easily, but someone who lives in Fresno or Eureka, CA, will have a much more difficult time," Matt Miller, a spokesman for iAdvance, says.

While federal regulations prohibit telephone companies from building out data networks, the Federal Communications Commission (FCC) is also taking a do-nothing stance, iAdvance says. The FCC believes broadband is growing at an acceptable pace and that the government must stay out of the market right now in order for it to expand.

If you're still watching Navigator download at 3.2Kbps, you'd better pull out a good book, because it looks like you're going to have a long wait for broadband. ☀

The Future of Broadband

Just 1.25 million people in the United States currently have broadband. Who knows how

long it'll take for providers to upgrade infrastructure and reach all 270 million Americans?

US INSTALLED BASE OF CABLE AND DSL*

YEAR END	1998	1999	2000	2001	2002
Cable Modem	425,000	1 million	2 million	3 million	4.3 million
DSL	35,000	250,000	700,000	1.5 million	2.7 million

*Source: Yankee Group

to the pertinent details.

28 ▶				
HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Diamond, RIAA Bury Hatchet	Any lingering doubt about MP3s' legitimacy ended when Diamond and the Recording Industry Association of America abandoned all legal hostilities.	Diamond has been in a protracted legal battle with the RIAA since introducing its MP3 player, the Rio.	"Rio set in motion a new age in digital music. We felt it was important to bring this exciting new technology to market," said Ron Moore of Diamond Multimedia.	Let the downloading begin.
BitBoys Oy Busts Out Glaze3D	It won't be out for months, but BitBoys Oy's new graphics chip sounds like it's ripped out of the future.	Running at 150MHz, the 32-bit, true color, quad-pixel rendering pipeline enables incredible fill rates of 2,400 million texels per second on the high-end 2400 chipset.	"By combining our rendering core and the best embedded DRAM technology, we're introducing this product well ahead of others," said BitBoys Oy GM Mika Tuomi.	We'll believe it when we see it.

It Just Works

Microsoft's next OS: same old, same old?

When Windows 98 was released in June 1998, it didn't take long for people to begin accusing Microsoft of selling a glorified Windows 95 "bug patch" to PC users for \$89.

Now, with the announcement of Microsoft's upcoming Windows 9x revision, dubbed Windows Millennium, PC users can't help but feel a strong sense of déjà vu all over again.

"It's another Microsoft cash crop," remarked one *Maximum PC* reader, referring to Microsoft's decision to push back the release of the NT-

Microsoft originally planned for Windows 98 to be the last OS based on the 95 kernel. The company wanted Windows NT 5.0, renamed Windows 2000 Professional, to become the standard OS thereafter. When development problems cropped up, Microsoft scrapped all consumer-level 2000 plans and announced it would instead release incremental updates for Windows 98, such as Second Edition and Millennium.

The backtracking has left many Windows users wondering whether Millennium will truly be

"Millennium is a maintenance release that sinks all the patches into a single product."

—Rob Enderle, Giga Consulting

based Windows 2000 and release Millennium in the meantime. Indeed, many feel Microsoft is simply milking the Windows 98 cow because it can.

"Millennium edition is a maintenance release that sinks all the patches into a single product, making it easier to support and less likely to break," says Rob Enderle of Giga Consulting. "Microsoft is trying to get some of the advantages of Windows 2000 while getting it to run on Windows 98."

a newer OS, or just a shallow ploy to gouge people for another \$89.

Responding to the negative feedback, Microsoft officials say Millennium is a lot more than a warmed-over 9x. The company says it's too early to disclose specifics, but Millennium will focus on four hot areas: digital media, home networking, the online experience, and "it just works," meaning an OS that should just work.

Those who've seen developer versions of Millennium say that



The face of your next OS: Microsoft Millennium in early beta. It may look similar to Windows 98, but Microsoft promises sweeping changes.

right now, it's a schizophrenic mish-mash of Windows 98 and Windows 2000. It ditches DOS, but has the look and feel of Windows 98.

Chris Hilbert, webmaster of BetaNews.com, says the only graphical changes noticeable in Millennium are the Windows 2000 desktop icons and a different Start menu. "In several places, it states that it is Windows 2000, but the help file and the MS-DOS window state that the operating system is Windows 98. I think Millennium is just something Microsoft threw together to ooh and ahh the audience with this developer release," he says.

Microsoft denies that Millennium contains Windows 2000 code, but screenshots obtained by *Maximum PC* show otherwise. When asked about

the inclusion of code from Windows 2000, a Microsoft spokesman says, "Those claims are purely speculative, and I can't comment on them."

Beta tester Brian Danielson, also of BetaNews, says the OS could be called "Windows 98 SE 2000." Danielson says that according to leaked documents he reviewed, "Microsoft plans on this being a very fresh, new OS. There may not be a Start menu, and the desktop may include visuals that you see in a game like *Quake III*, like 3D animations and environments, and special effects."

But testers say it's not all smoke and mirrors, and that the biggest step for Millennium is the exorcism of 16-bit legacy support, as well the removal of DOS. ☀



HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
3dfx To Do Cinema Efx	3dfx has introduced a technology called the "T-buffer" that promises several photographic effects and full-scene anti-aliasing to eliminate jagged edges in games.	The common Hollywood or cinematic effects include: depth of field, motion blur, soft shadows, and soft lighting. None of the features will compromise speed.	"Framerate is still king," says Scott Sellers.	We'll believe it when we see it.
AMD President Atiq Raza Resigns	AMD President Atiq Raza unexpectedly resigned from AMD as the company announced more financial woes.	Raza had been on tap to become AMD's No. 1 man if CEO Jerry Sanders left.	"My decision to leave AMD was a difficult one," said Raza. "I'm leaving for personal reasons, but I look forward to contributing to AMD's future success."	Many attribute AMD's limited success to Raza, and it's questionable that the company can do as well without him.

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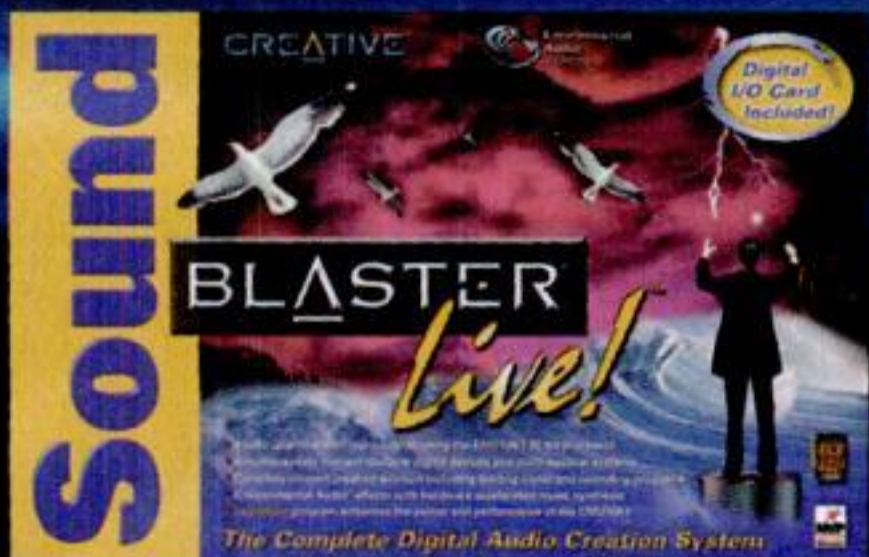
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See What You Think.

► **Maximum PC takes a bite out of bad service and gear**

WATCH THE DOG



This month:

- ProGen goes broke
- MediaGX laptop disappointment
- Biting back at telemarketers



www.maximumpcmag.com

Readers share their customer-service woes in the Dog Pound.

large deal with Costco, and apparently many of the PCs sold through the chain were returned. Bastian said they are in the process of locating people who had equipment in for repair when ProGen shut down. Those who haven't heard about their equipment should send a letter and any documentation, such as a receipt, to James Bastian, c/o Marshack, Schulman and Hodges LLP at 8001 Irvine Center Drive, Suite 900, Irvine, CA 92618. Those who purchased equipment from ProGen directly and never received it should file claims with the U.S.

PROGEN DEGENERATES

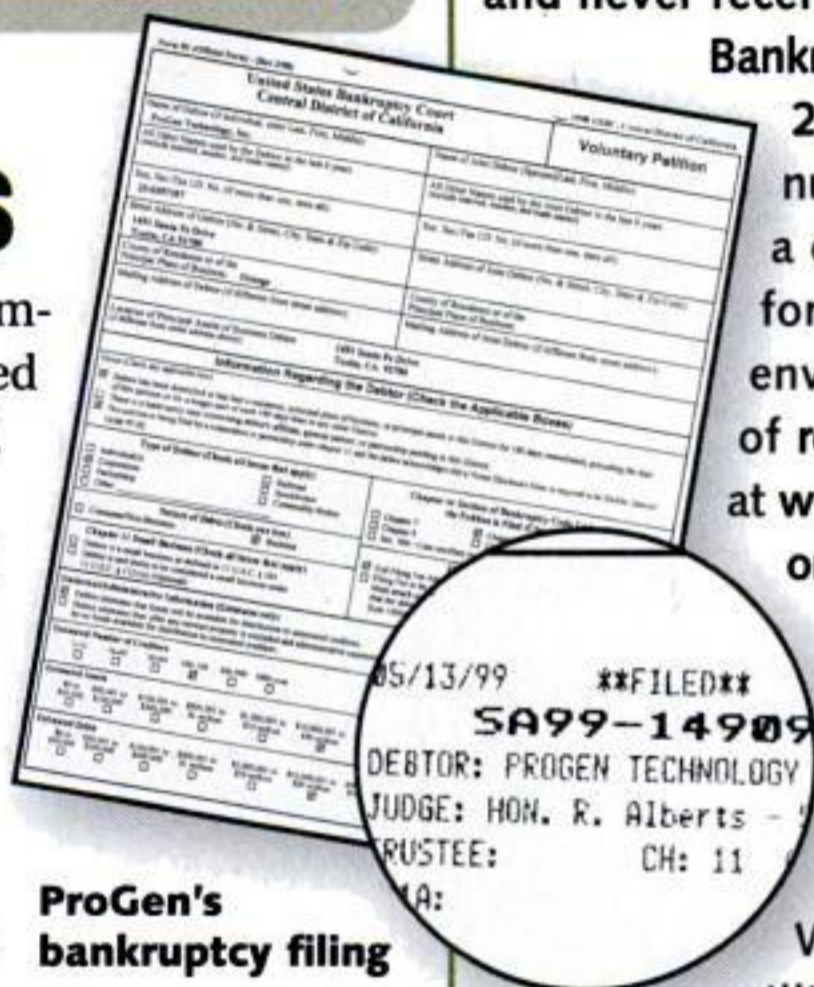
DEAR DOG: I have about 10 years of computer experience, so a friend recently asked me to help her family purchase a new PC. I ordered a 350MHz Pentium II from **PROGEN** because the company seemed to price its systems fairly. The system ran great until I tried to get on the net. The modem gave the old "no dial tone" error. I tried everything I could think of—checked the phone line, reinstalled the modem, tried a different PCI slot—all with no success. My buddy who's been a tech person for many years couldn't figure it out, either.

We finally gave in and called ProGen. It took forever to get through to tech support, and when we did, all we got was an answering service. We left a message and waited for a call back, but never heard from them. I was finally told that I was to be put on a list and would eventually be called back. I'm still waiting. In the interim I installed a modem from a scrap computer and it runs fine, but that doesn't change the fact that my friends paid for a modem with their system. Can you help?

—Alexander M. Cianfrocco

THE DOG RESPONDS: Cianfrocco's experience wasn't the only complaint the Dog received about ProGen, but don't worry—they'll never trouble another consumer. The Tustin, CA, company shut its doors and filed for Chapter 11 bankruptcy protection on May 13, 1999. Unable to successfully implement a reorganization, the company and creditors decided to go for broke—literally. On June 17, ProGen's bankruptcy was converted to Chapter 7, or liquidation of assets.

What caused the demise of ProGen? The attorney representing ProGen in the bankruptcy case, Andrew K. Mauthe, refused to accept any questions about the company, even those about how to help ProGen's customers. The Dog sends a big doggie poop to Mauthe. James Bastian, the attorney representing the trustee dissolving ProGen's assets, was more helpful. According to Bastian, ProGen's demise may be the result of excessive returns. The company had recently signed a



ProGen's bankruptcy filing

Bankruptcy California Central Division, P.O. Box 22026, Santa Ana, CA 92702-2026. The case number is SA99-14909. You should also include a completed copy of a standard B-10 claim form, along with a self-addressed, stamped envelope, and ask for a file stamp as proof of receipt. Form B-10 can be obtained on the web at www.uscourts.gov/bankform/formb10new.pdf or at the closest bankruptcy court.

You may also send a copy to Mr. Bastian, who'd like to know how many people are owed money.

What are your actual chances of getting any cash back? Pretty slim.

When ProGen went under, it had some \$20 million in claims filed by the big boys it owed money to, including nearly \$1 million to Intel, \$241,416 to case maker In-Win, and a whopping \$4.7 million to Wyle Electronics. Bastian said they are also investigating where some of ProGen's funds went in the final days. "There's a lot of questionable transactions that we're looking at right now," Bastian told the Dog. "They're very preliminary, but it appears there are a lot more questions than answers."

BOGUS PR

DEAR DOG: In January, I bought a **CYRIX 266MHZ CTX** laptop from Circuit City. I wasn't looking for anything fancy, just something to play with. After dealing with a battery problem, I installed *Nuts & Bolts 98* to find out whether anything else was wrong. I was shocked when I ran *Discover Pro* and it indicated the processor was a 166MHz! But at bootup, the system clearly states that it's a 266MHz. Circuit City told me to take it up with CTX. I gave up on CTX after I was disconnected while on interminable hold. Help!

—Todd Ellington

THE DOG RESPONDS: We first thought you might have been a victim of a mistake made by the salesman who sold you a Cyrix with a Performance Rating of 266, but a much lower clock speed. ("Performance Rating" was once used by Cyrix and other x86-clone CPU makers to convince consumers that MHz wasn't the only measure of

"The Dog sends a big doggie poop to ProGen."



"MediaGX processors have always been sloppy seconds when it comes to performance."

speed.) But the Dog contacted CTX and was told that its notebook lineup, which it no longer makes, was never sold with a clock speed below 233MHz. The two models released last June sported Cyrix's MediaGX processor at 233MHz and 266MHz—but MediaGX processors have always been sloppy seconds when it comes to performance. Could the MediaGX perform as badly as a vintage Pentium 166MHz? Sure. It doesn't look as though you were literally "ripped off" by Circuit City or CTX. More likely, you were taken in by a laptop comprised of parts known for poor performance.

DRIVE MIX-UP

DEAR DOG: I purchased a **SONY CDU-711/CH** drive from an online store in August 1998. In two places on the box it was referred to as model 711, but in a third place it was called model 701. I contacted CDW about this and they took it back, but they couldn't figure out the problem. After contacting the store about 12 times, I was told to e-mail Sony directly. I also contacted another online store and asked if they could guarantee I'd receive a 711/CH; they said yes. I received it, and in three places on the box it showed the model 711/CH. I installed the drive and it booted as a 711/CH. I have since received several

701s sold as 711/CHs from online stores. The buffer and access times are different. What's the story here, Dog?

—MB Ziegler

THE DOG RESPONDS: Here's the skinny according to a reliable source at Sony. While Sony once stocked the CDU-711/CH drive kit with the CDU-711 drive, it has since substituted the CDU-701 drive, a "cost-reduced" version, in the kit. In order to avoid screwing up the kit SKU, Sony continued to use the same catalog number. Thus, the CDU-711/CH kit comes with a CDU-701 drive. Is this false advertising? More like a mistake. If



Sony CDU-711/CH drive

you check Sony's site, you'll see that the info on the CDU-711/CH kit clearly says the kit comes with a CDU-701 drive, which is about 10ms off in seek compared to the CDU-711. The PDF for the kit, however, seems to describe the older kit with the slightly faster drive. ☀

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic the dog on them by writing watchdog@maximumpc.com. The dog promises to get to as many as possible, but only has four paws to work with.

DOG BITES ►

A NIGHT OUTSIDE FOR THE DOG

Bite thyself!, several readers proclaimed when, in the July issue, the Dog applauded the U.S. Postal Service's decision to force those using private mail boxes to use the term "Private Mail Box" in their addresses instead of "Suite." The Dog inadvertently indicated that the new regulations applied to mail boxes in U.S.P.S. offices; that's incorrect. The new regulation, which goes into effect early next year, applies only to private Commercial Mail Receiving Agencies (CMRAs), such as Mail Boxes Etc. According to the U.S.P.S., only P.O. box renters are disallowed from using the term "Suite" to have mail delivered to them. The Dog deserves a thwack on the nose with a newspaper for that error, but stands by the assertion that the new rule is a good one. Some readers disagree with the Dog's position, however.

D. Baird in Vancouver, WA, wrote: "I read with interest your note about the post office changes to the way CMRAs conduct business. However, your approval is curious, since the changes you laud also include disturbing violations of privacy for people conducting business with the public.

"Say I'm divorced from an abusive husband. I rent a mailbox and open a mail-order business. Now, I'm required to give a 'permanent address' where I can be contacted at all times. I give my home address, since this is all I have. My husband hears about my business, and goes to the post office where my mail is processed. He tells them he's a dissatisfied customer and *they give him my home address.*

"The post office has traditionally been antagonistic toward CMRAs, and I believe this new regulation has more to do with stifling competition than public safety."

FIGHT BACK!

Annoying telemarketers got you bugged out? Here's a few useful tips, culled from www.fraud.org, on how to bite 'em back hard:

1. Request that you be put on the telemarketers' "do not call" list. Federal regulations require all telemarketers other than non-profits to maintain those lists. Ask them to also put you on the "do not call" lists of any companies they work for.

2. After you've asked to be put on the list, repeat your request in a letter. Keep a copy for your records.

3. Keep a record of their calls. When you ask to be put on a "do not call" list, write down the date, time, name, phone number, and address of the company in question. Ask for a supervisor if the lackey won't supply the information. If the same company calls again, jot down the company's name and date.

4. If a telemarketing company calls you after you've requested to be put on the list, you may have the right to sue under the Federal Telephone Consumer Protection Act, Public Law 102-243, which gives consumers the right to sue harassing telemarketing companies for monetary damages. Your state may have additional regulations you can hit them with.

5. To file a suit, look for the closest small-claims court. You won't need a lawyer and it's fairly inexpensive to file a suit. Also consider filing a complaint with the FCC or the state attorney general's office; most operate consumer protection divisions.

6. The company may approach you about settling the case instead of dealing with the hassle of going to court. They won't be calling back after this stage.

For more information on pesky telemarketers, contact the National Fraud Information Center at 800.876.7060. ☀

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- Fred Lugano, weatherization.com, Vermont

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PERIPHERAL VISION



Replay Networks ReplayTV

ReplayTV lets you record your favorite shows and watch them anytime you want, but it differs from your old-school VCR in that it records shows in MPEG-2 format to an internal hard disk, instead of to a videotape. Via a phone line connected to a set-top box, ReplayTV downloads the week's programming lineup in your area. Click on a show and it records; double-click a show and ReplayTV will record the show every time it's on—any time of day, on any channel. And with ReplayTV you can pause a show while you're watching it live, then pick up where you left off and skip the commercials. You can even record programs based on keywords built into a program's description: Type in "Gillian Anderson" and ReplayTV will record every program in which Anderson is set to appear. The price may seem steep for what amounts to a glorified hard drive—but no commercials? Cool. **\$699 for ten hours of television storage, \$899 for 14 hours of storage, \$1,499 for 28 hours of storage; Replay Networks; www.replaytv.com; 800.266.1301**

Xybernaut MA IV

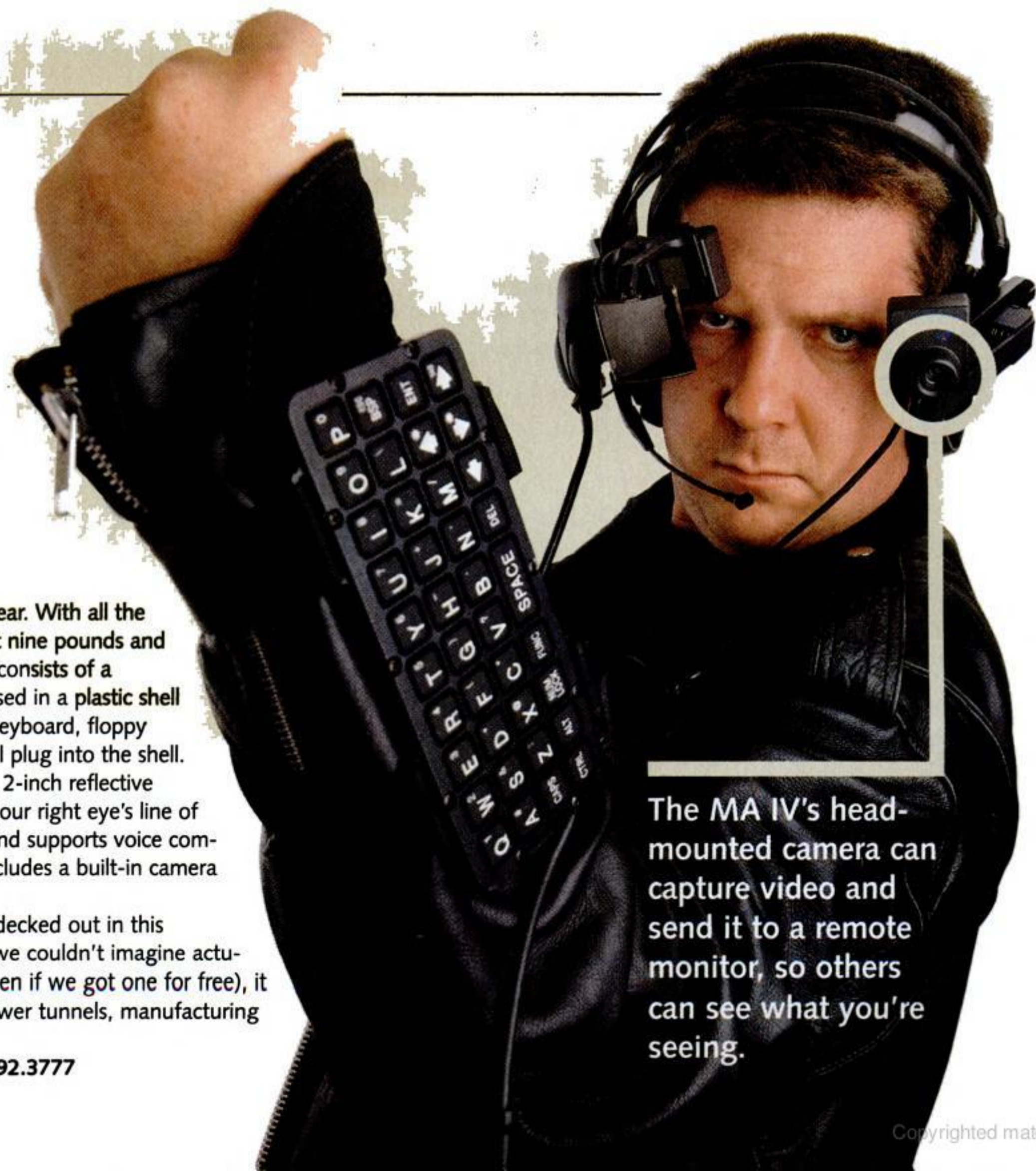
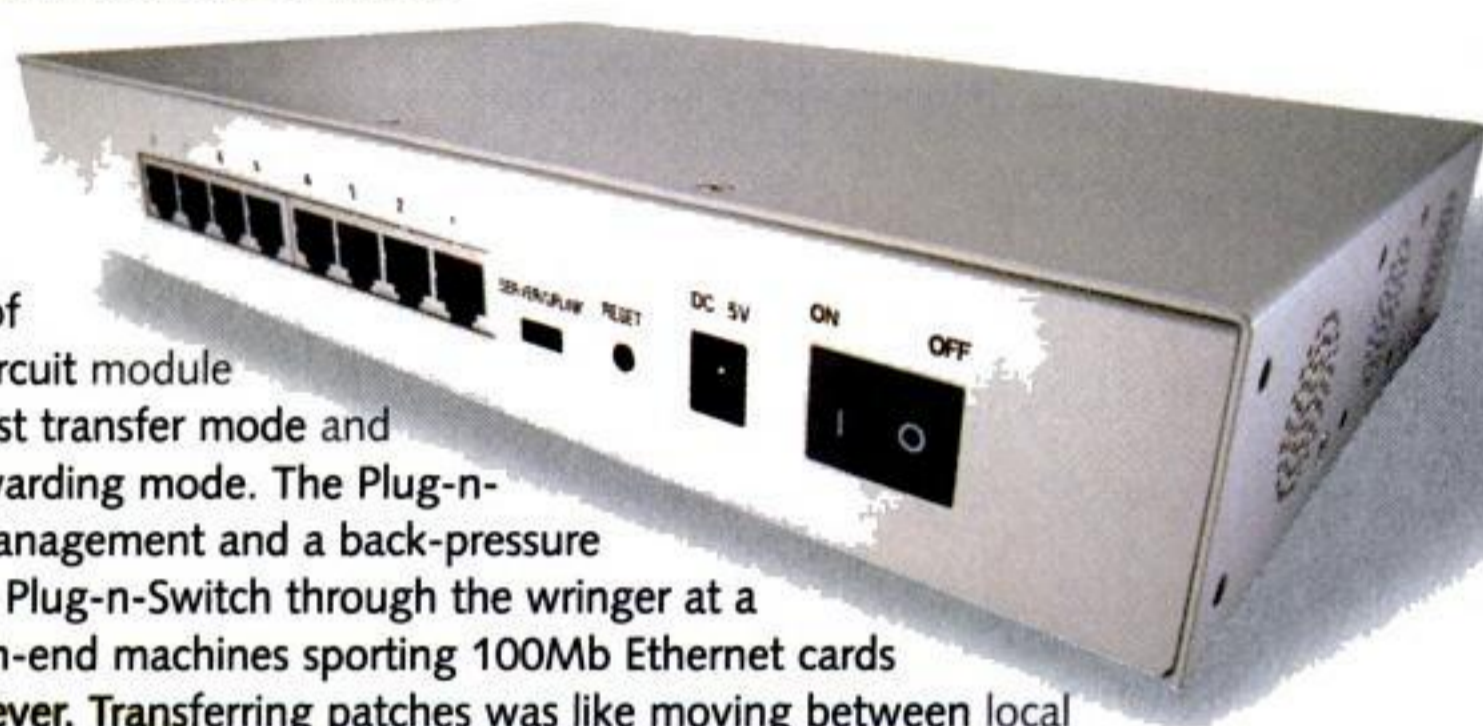
Xybernaut's MA IV is the ultimate in übergeek wear. With all the accoutrements, this "wearable PC" weighs about nine pounds and allows you to compute anywhere. The base unit consists of a 200MHz Pentium MMX with 128MB RAM encased in a plastic shell that attaches to your waist. The wrist-mounted keyboard, floppy drive, battery pack, and head-mounted display all plug into the shell. The 1-inch LCD reflects onto a semi-transparent, 2-inch reflective surface that projects the Windows desktop into your right eye's line of sight. The unit runs all standard Windows apps and supports voice commands. Sure, the price is steep, but Xybernaut includes a built-in camera that captures video to a LAN.

You'll laugh (we did) when you see yourself decked out in this robowear—but the thing actually works. While we couldn't imagine actually using the MA IV for more than a minute (even if we got one for free), it could be useful in industrial situations such as sewer tunnels, manufacturing plants, and job-training facilities.

\$9,687; Xybernaut; www.xybernaut.com; 888.992.3777

SOHOware Plug-n-Switch

Don't settle for a wimpy, bandwidth-splitting hub when connecting Ethernet wiring in your home, small, or corporate office—a switch will give you full bandwidth for each port. When we spotted SOHOware's big, bad, eight-port, self-managing 10/100Mbps autosensing switch, we had to have it. Where a typical eight-port hub supports just 12Mbps per port, this monster switch guarantees a full 100Mbps for each port. This thing's so burly, it supports per-port bandwidth up to 200Mbps in full-duplex mode, for a total of 1.6Gb! A built-in intelligent circuit module automatically selects the fastest transfer mode and the most efficient packet-forwarding mode. The Plug-n-Switch also provides buffer management and a back-pressure jamming scheme. We put the Plug-n-Switch through the wringer at a recent LAN party with six high-end machines sporting 100Mb Ethernet cards and had no problems whatsoever. Transferring patches was like moving between local hard drives, and setting up the switch was truly plug-n-play. **\$242; SOHOware; www.sohoware.com; 800.632.1118**



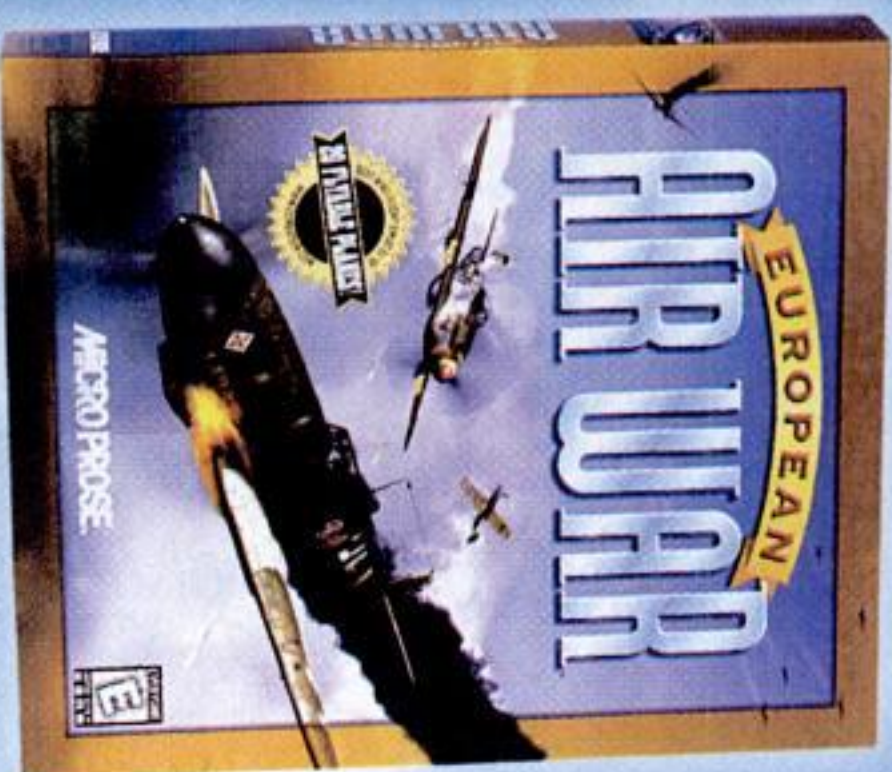
The MA IV's head-mounted camera can capture video and send it to a remote monitor, so others can see what you're seeing.

"European Air War's outstanding gameplay and wealth of features make it the current leader of the WWII simulation crop."
-PC Gamer, 89%, Editor's Choice Award



"This World War II simulation captured the feeling of being in a living, unpredictable combat environment better than any other sim released this past year."
-Computer Gaming World, 4 stars

"The care and attention to detail that went into every aspect of European Air War, from the hefty manual to the bomber nose art, represents a serious achievement."
-CNET GameCenter



"European Air War succeeds at providing the experience that makes arm-chair fighter pilots believe they're truly leaving their mundane surroundings behind!"
-Gamespot

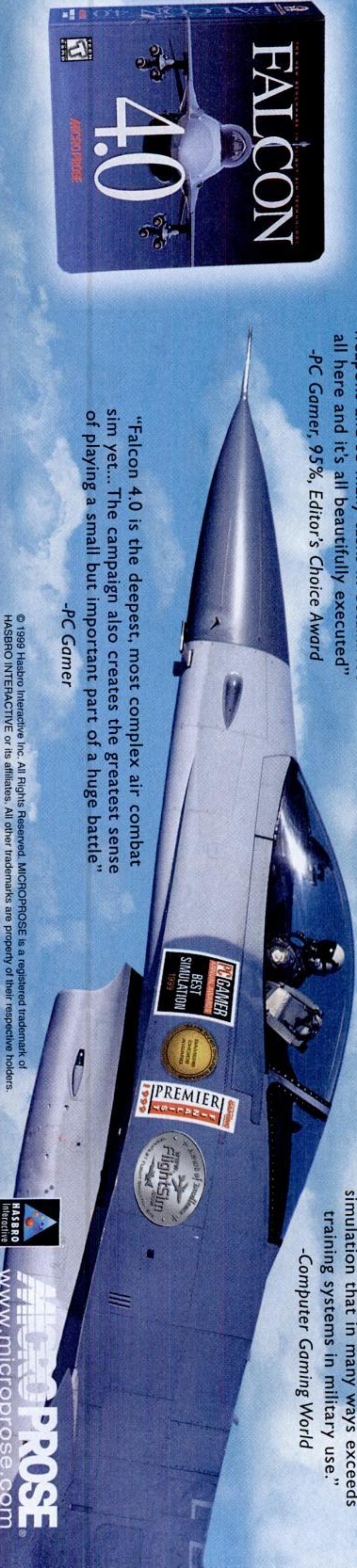
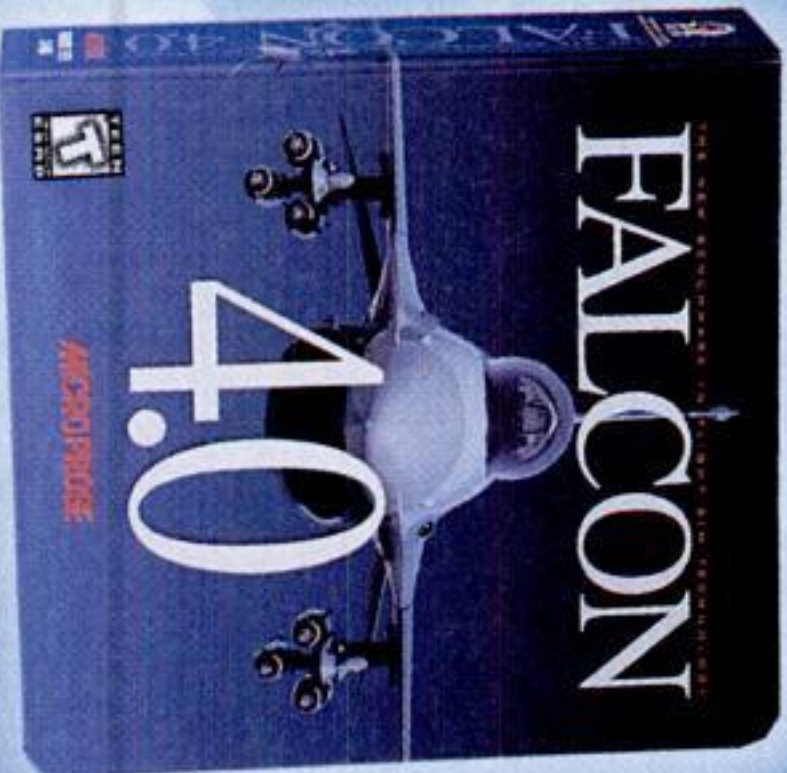
R A C K I N G U P T H E K I L L S !

"Bottom line: this sets the new standard in flight sims."
-Washington Post

"Falcon 4.0 is an incredibly detailed simulation that in many ways exceeds training systems in military use."
-Computer Gaming World

"No previous sim covers so many different weapons and so many tasks in detail... it's all here and it's all beautifully executed!"
-PC Gamer, 95%, Editor's Choice Award

"Falcon 4.0 is the deepest, most complex air combat sim yet... The campaign also creates the greatest sense of playing a small but important part of a huge battle!"
-PC Gamer



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Maximum PC, Kick-Ass Product, July 99 Reviewed configurations may differ from advertised configurations.



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- New Quantex Gaming Bundle – 3 Titles
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\$1999

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 Q-QUOTE NUMBER: max10s25

"The I-1410 goes where no notebook has gone before, at least not during Maximum PC's lifespan: It set new records on more than half of our performance-pounding benchmarks. Hail to the new chief." Maximum PC, Kick-Ass Product, September 99



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- 8GB Ultra ATA Hard Drive
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Business lease:\$83/Mo., 36 Mos. \$0 Money Down
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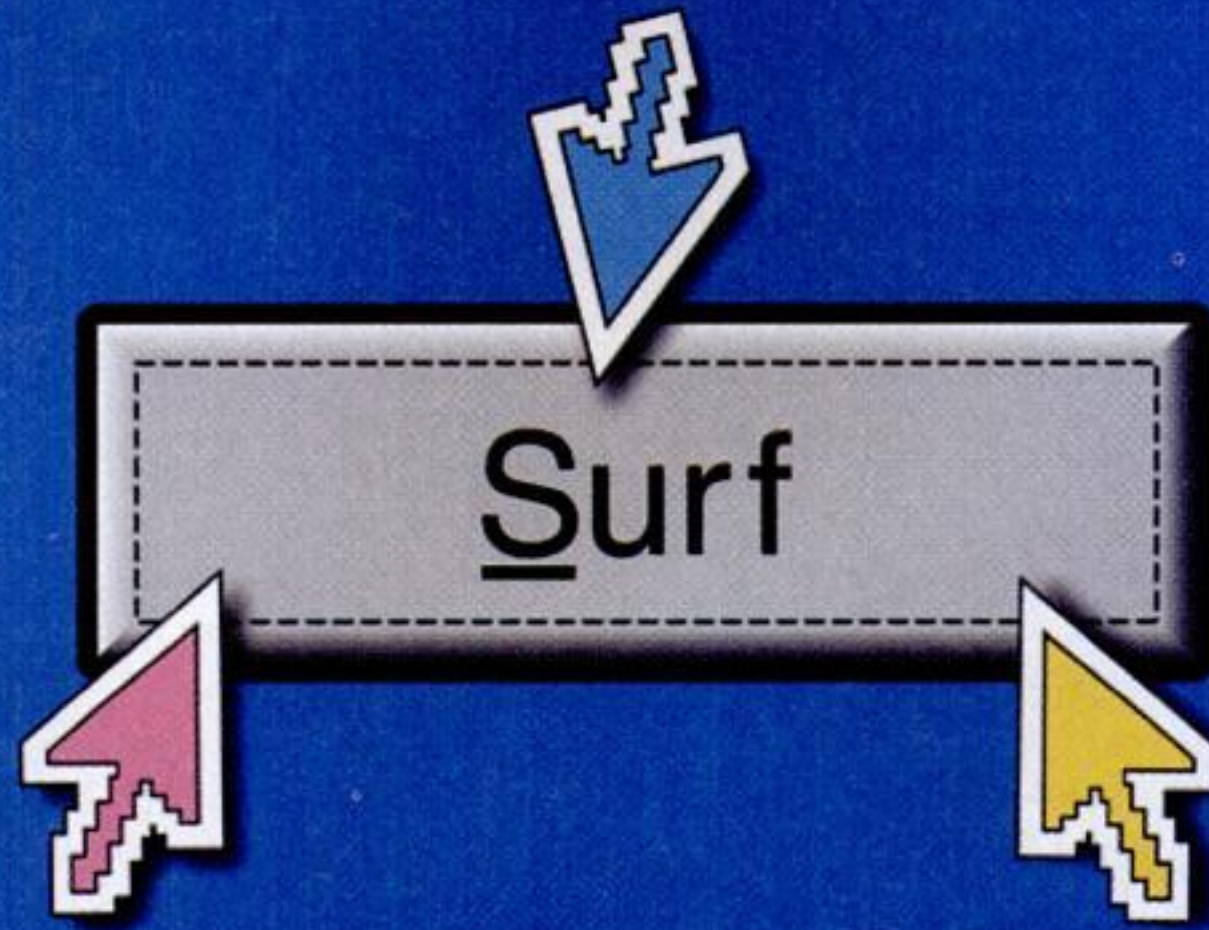
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FAST FORWARD

If its new Athlon processor isn't a hit, AMD probably won't survive as an independent company.

But wait! AMD is a big company—second only to Intel as a supplier of PC processors—and it has gained impressive market share over the past two years with the K6. On top of that, AMD was the first x86 vendor to introduce new extensions for faster 3D graphics (3DNow!), while the installed base of Pentium III chips with Intel's SSE instructions still hasn't caught up.

All that is true. But it's also true that even as AMD ships more K6 processors inside more low-priced PCs, the company keeps losing money while Intel grows fat on profits. The problem, as I explained in my column last May ("How to Win the CPU Price War"), is that AMD encounters stiff market resistance when it tries to sell chips at the same prices as Intel chips. That's because AMD has trouble keeping up with Intel's clock speeds, and shoppers tend to view Intel as the "name brand" and AMD as "brand X." AMD has been selling chips at a loss just to stay in the race.

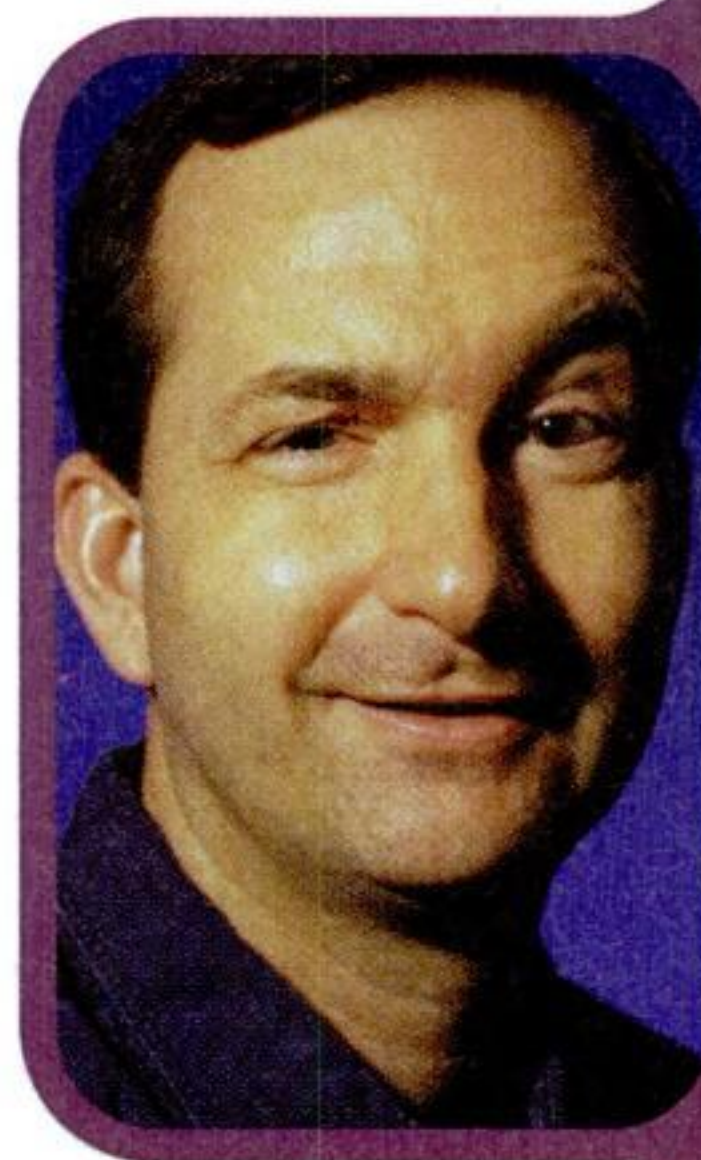
So, it's Athlon to the rescue!

Sure, it's a dumb name. Pentium, Xeon, and Celeron sounded just as dumb when they first appeared. We'll get used to Athlon, too. What's important is that Athlon is either a new beginning for AMD or the beginning of the end.

Formerly known as "K7," Athlon is the first seventh-generation x86 microprocessor. To satisfy the public fascination with high clock speeds, AMD has turned to a technique known as super-pipelining. This technique breaks down the execution of program instructions into a larger number of pipeline stages—analogueous to lengthening the assembly line in a factory. Although it might seem that a longer assembly line would slow down production, it

internal resources for executing multiple instructions simultaneously. (For details, see our "Pure Power Preview" in the January 1999 issue.) But nothing captures public attention like clock speeds, and Athlon is hitting 650MHz out of the gate. To match it, Intel will push the Pentium III to the same frequency at about the same time.

What's notable is that AMD is now running neck-and-neck with Intel, and both chips are manufactured in .25-micron processes. Much faster clock speeds are coming soon, as AMD and Intel move to .18-micron processes. The smaller, more densely packed transistors will shorten the paths through which electrical signals must travel, so the chip can run at higher frequencies. AMD got a break in June when Intel admitted that its .18-micron version of Pentium III, code-named Coppermine, would be delayed two months, until November. That gives AMD a little more time to finish out-fitting a new .18-micron fab in Dresden, Germany.



TOM HALFHILL was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry. Contact him at thalfhill@maximumpc.com.

When AMD's new fab begins production next year, Athlon will get a neck-snapping speed boost. Not only will Athlon make the transition to .18 micron, but it will also become the first x86 chip to use copper instead of aluminum for its interconnect layers. (These are the metal layers in a silicon chip that wire the transistors together.) Despite its confusing code name, Intel's Coppermine isn't really copper—it's aluminum, which is less conductive than copper. AMD has partnered with Motorola to design this copper technology, which should help copper-powered Athlon to break the 1GHz barrier in 2000.

K7: AMD's Last Hope

INTEL'S NEMESIS PINS EVERYTHING ON ATHLON

actually speeds things up once it gets going, because each task is simpler and easier to complete. In a microprocessor, super-pipelining allows instructions to flow through the chip at higher clock frequencies.

There's nothing new about superpipelining. All of Intel's P6-series chips (Pentium Pro, Pentium II, Pentium III, Xeon, Celeron) are superpipelined, as are most high-performance RISC processors, such as the Alpha. But superpipelining is new for AMD, and Athlon's implementation looks very impressive. That's not surprising, because Athlon's chief architect, Dirk Meyer—the senior engineer who led 120 other engineers on the project—previously worked at Digital, where he helped design the Alpha 21064 and 21066 chips. The Alpha is considered to be the ultimate "speed demon" because of its industry-leading clock frequencies. In fact, as I predicted last year, the Alpha 21264 recently became the first CPU to reach 1GHz (1000MHz) without the aid of tricks such as liquid supercooling.

Of course, Athlon boasts many other improvements besides superpipelining: a faster system bus, a superior FPU, better instruction decoders, enhanced branch prediction, and more

Even as AMD ships more K6 processors, the company keeps losing money while Intel grows fat on profits.

All this sounds great for AMD, but many things can go wrong. AMD has a troubled history of designing killer CPUs, only to foul up the manufacturing or the last-minute design tweaks. If AMD blows it this time, I fear the result will be a financial disaster. AMD's stock will nosedive and the takeover sharks will start circling. For the sake of competition, let's hope Athlon doesn't become AMD's biggest Y2K problem. ☀

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ON THE LINE

I'm writing this from London, where the Internet blazes hotter than any summer day. While it's been a cold couple of months here as far as the weather goes, I don't care—I've been inside, working on web projects and remembering why I love working on the web: It's damn exciting.

Right now, London, like most of Europe, is genuinely starstruck—one might even say obsessed—with opportunities on the Internet. Just a few weeks ago, the *Financial Times* (www.ft.com) offered the headline "Blair to chide business on failure to exploit Internet: Government report finds companies lag behind United States in e-commerce." Other headlines followed: "Net Gain for Industry," "Learning to surf is a matter of survival," "Blair pushes Business to embrace net," and on and on.

The *Guardian* (www.guardian.co.uk), one of the United Kingdom's leading news sources, wrote, "Tony Blair is right to issue a 'wake up call' to industry to grasp the opportunities offered by the Internet. The U.K. is years behind the U.S. in applying [the Internet's] revolutionary potential and could fall behind Germany and even France." Further, "It is impossible to overestimate the importance of the Internet in business. It is not a question of a whizzy new technology gradually finding wider application. The Internet is a basic business tool which industry and commerce will ignore or under-use at their dire peril."

These are strong statements—and a surefire indicator that all bets are placed and the race is well underway.

What's interesting to me is that all these reports and comments reflect what their authors see on the Internet right now, not the projects currently in development. Those who actually do technology design/integration/consulting know otherwise. While the U.K. may not have embraced the web early on, and lags behind the

London Calling

THE WEB IS ABOUT TO EXPLODE IN EUROPE

United States in presence and financial strategies, e-commerce and web-based businesses are in fact exploding across all industries, and should smack the world in the face come January.

Leaders in European banking, investment, telecommunications, media and publishing, transportation, and entertainment are all in the process of not just establishing "web sites," but restructuring businesses and inventing new ones. The U.K. has had the unplanned luxury, in the same way Microsoft had, of sitting back and watching U.S. businesses make mistakes before taking the plunge. So, while these products, services, and e-commerce offerings might be late, they'll undoubtedly be better. They'll be more usable, more valuable, and faster, and will depend on newer technologies that allow them to adapt quickly to the next level—wireless.

Unfortunately, the roadblock might not be what Blair and others are suggesting—a need to "wake up" and understand the importance of the Internet. The issue has more to do with finding and retaining people with the technical education to make it happen, which is even more difficult in the U.K. than it is in the United States.

In fact, in April 1999, Deloitte and Touche released an analysis of the state of the European economy's technology sector, in which William Touche, lead partner, stated that in spite of "an extremely healthy outlook.... there are clearly two main issues evident from this survey—the shortage of skilled staff ... and the availability of development capital at the smaller company end."

Microsoft, cunning as it is, took steps years ago to guard against such a human-resource crunch by donating £50 million (\$80 million) to build a technology research lab at Cambridge University in 1997. Its attempt to alleviate the capital crunch—a £10 million (\$16 million) investment promise (also in 1997) for small technology ventures, with an emphasis on Cambridge-area technology firms—was simply not enough.

The Deloitte and Touche report goes on to state that "57% of companies are worried about the strong pound—with many technology companies geared towards export and looking to expand overseas, this is a concern." But just this August, Interregnum, a venture-capital and marketing company, and Software Business Network (SBN) announced the launch of "enterprise.USA," a program to assist U.K. IT entrepreneurs in establishing businesses in the United States. It provides advice on raising capital, developing market strategies, and setting up back offices, which "are often the main barriers faced by British businesses expanding overseas," according to the announcement.

"While the U.K. may not have embraced the web early on, e-commerce and web-based businesses are in fact exploding across all industries, and should smack the world in the face come January."

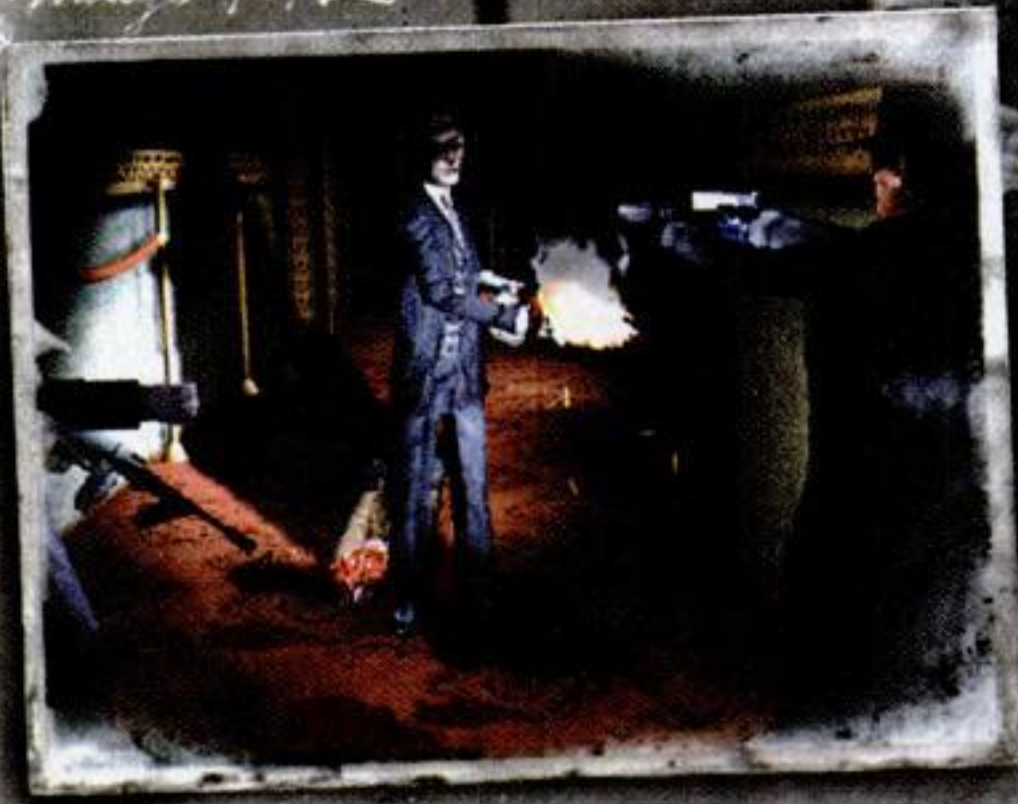
All this is to say that I'm not so sure the UK market needs to wake up so much as Blair and other economic spectators think. The fact is, Europe, and London especially, are raging right now. I'd suggest that Blair, the British government, and the business sector focus less on driving people to build and more on making an accessible Internet that will allow the millions of U.K. residents consume these online businesses. Local calls are still being charged by the minute... ❁



SHEL KIMEN has worked in the industry, traveled the world, and covered the Internet for both *The Net* and *boot* magazine. She can be contacted at skimen@maximumpc.com.

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Chicago, 1933



NOCTURNE

*In the womb of darkness,
a new genre of game is born.*

UNLEASHED HALLOWEEN 1999

*You do not want to know what I know.
Knowledge is fear. A black hole that
devours that part of the self you
cherish. You do not want to know what I know.*

It is 1933, and in the shadowed world around you there exists an ungodly evil: werewolves, vampires, ghouls and flesh-eating zombies that wait just outside the light's unlocked door to feed upon innocence. There also exist guardians of the good and just, tireless vigilantes capable of tracking down this evil and turning it upon itself. You are one of them. And you hunt, as your vile quarry does, by night.

"...the ghouls overwhelmed the hero, clubbing him with their own severed limbs before feasting on his guts. And that was right about the time we knew we couldn't wait to play Nocturne. This game will be causing some hellacious nightmares later this year."

- Computer Gaming World

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- Adrenaline Vault

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▶ THE SCOOP FROM A MAJOR PLAYER

GAME THEORY

Three heavy hitters from the world of first-person shooters are primed to blow online gaming wide open, and it won't be a pretty sight. Amid the blood, gore, and Skaarj scattered on the battlefield, the future of online computer games will be decided. Will they find a home in middle America in the new millennium, or retreat into a dark age of solo play?

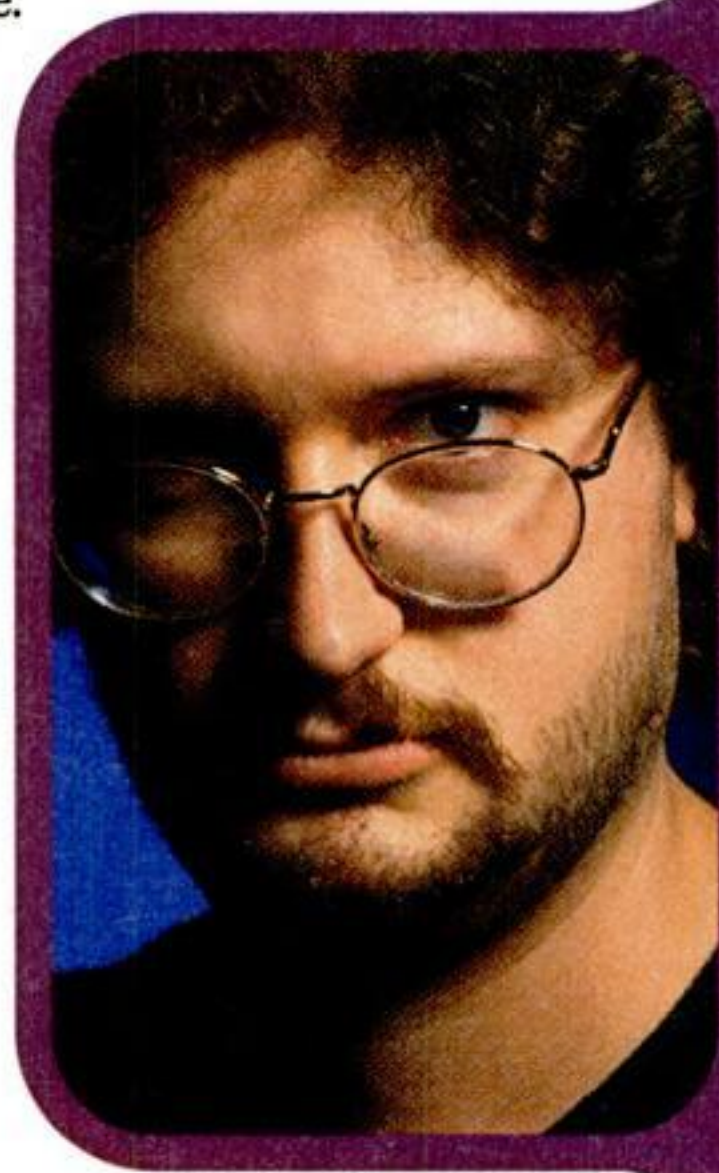
Ultima Online proved the viability of online-only with its 150,000-odd users who line up to pay \$10 a month and are so so hardcore that they'd buy virtual property at auction for real money. So it's no surprise that id, Valve, and Epic/GT are doing a full-court press into the online realm. And both Interactive Magic and Origin have announced their intention to focus on multiplayer to the exclusion of single-player games. Before the industry goes online-only, though, the battle to lure gamers into the online realm will enter its next stage with the much-anticipated releases of three new games: *Quake III: Arena*, *Team Fortress 2*, and *Unreal Tournament*.

id's *Quake III* has the home-court advantage, coming from the company that invented the concept of going online to frag the crap out of friends and strangers. It also has the finest programmer in computer gaming, John Carmack, leading the way, and a coordinated rollout for Windows, Mac, and Linux. Though the rallying cry is simplicity—gamers must be able to access Quakeworld servers via web browsers and begin gaming with "three clicks," according to id CEO Todd Hollingshead—and the online code is being heavily optimized to conquer the dreaded lag-monster, many factors can't be taken into account, including the structure and speed of the user's own ISP. Cable modems are making serious inroads, but conventional modems are the norm, and the code has to be written for them. Will a nation of people

I don't want to sound unduly negative about *Unreal*, since it looks outstanding, but with neither the brand-name appeal of *Arena* nor the innovation of *TF2*, Epic has an uphill battle if it's to capture a large mainstream audience.

And that's the crux of the problem: All these games look good and have the potential to further refine the online-gaming experience, but they could all be a tough sell to a mainstream audience numbed by theories of media violence and easily confused by the complexities of Internet gaming. Even *Ultima Online's* once-runaway enrollment has leveled off at 150,000 users. Less complex action games should be able to capture a larger market, but will they?

A prime characteristic of the online gamer is his inscrutability. He is utterly impossible to predict. There's no doubt that a couple hundred thousand loyal and knowledgeable PC gamers (such as, say, you) will log on and go nuts for any or all of these fragfests. But there's a glass ceiling that keeps the millions of computer owners off these game servers. Since I've never shied away from offending people in the past, I'll come right out and say that many of the



T. LIAM MCDONALD is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at tmcDonald@maximumpc.com.

hardcore deathmatchers are part of the problem. Their juvenile behavior is a turn-off for many, and voice support will only enhance the unpleasantness of the experience. The appeal of online gaming is at least partly social, but how long will a newcomer last with a sneering teenager

swearing at him? A gross generalization? Sure, but if you've spent any time on these servers, you know full well how unpleasant many of the people can be.

Gaming's Next Move

WE'RE GOING ONLINE, BUT WILL WE STAY THERE?

with AOL accounts and VCRs blinking "12:00" comprehend the limitations of the online gaming medium?

Regardless, *Arena* will undoubtedly define the new standard—which puts Valve and Epic on the defensive from the get-go, since Valve's *Half-Life* wowed critics and fans but hasn't exactly become a household name the way *Doom* and *Quake* have, and Epic's *Unreal Tournament* has yet to fulfill the potential of its engine. Of the three new releases, *Team Fortress 2: Brotherhood of Arms* already appears to have the strongest design and the best potential to capture a new audience. Since the game is heavily grounded in well-balanced team and co-op play, with 12 different "roles" for gamers to play, it's already more than a *Quake*-esque slaughterhouse. Complex commands and voice support (as yet unproven) make it more sophisticated, but will this translate into a wider or more narrow demographic?

Of the three games, *Unreal Tournament* will have the hardest time finding and maintaining an audience, despite its varied play modes. Its impressive technology aside, it hasn't exactly endeared itself to gamers through brilliant solo play—the *Unreal*-engine games have been dreadful one and all—and a year after release, people are left wondering why its multiplayer was a train wreck.

Online games will be a tough sell to a mainstream audience numbed by theories of media violence and easily confused by the complex technologies of Internet gaming.

Though the three new titles will certainly lure new gamers into multiplayer, the combination of new technology at the far end of the hardware curve, variables in online connections, and a dubious social milieu will keep any of the games from becoming a breakout online success like eBay: that is, an online forum that attracts hundreds of thousands of people with diverse backgrounds and interests. Gaming is marked by a series of leaps to plateaus, with growth leveling off until the next great push. We're about to see the next great leap, followed by a very large plateau. ●



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INTERROGATION

the MAXIMUM PC interview



WHAT IS THE MATROX?

Matrox's new Millennium G400 is the latest videocard to vie for the 3D crown. Dan Wood, Director of Technical Marketing, shows us his tech goodies and tells us what's next from Matrox.

Maximum PC What computer game character do you most resemble?

Wood [laughs] I guess I'm like the Predator in *Aliens vs. Predator*. I keep a low profile and then bring my technologically superior weapons to bear and kick some serious ass.

Maximum PC Microsoft's Kevin Bachus, architect of DirectX, recently told us that 3dfx and nVidia are more aggressive about introducing new features.

Wood In my opinion, the G400 is one of the most revolutionary new products in some time. This is based on an analysis of the new features, rather than just playing an evolutionary game of "OK, I'm the fastest *Quake* card today."

And Matrox is introducing a new product called the Matrox RT 2000, which delivers real-time playback of two DV streams together with 32-bit graphics with 3D DVEs and transitions. This product will be introduced at \$1,300.

I'm very comfortable calling Matrox a technology innovator.

Maximum PC Other 3D-card companies are introducing new products every six months. How can

Matrox remain competitive releasing products on an annual basis?

Wood We've been introducing multiple products; however, some of the products have been targeted at business. At this point, we have more R&D resources working on next-generation chips than we've ever had, so I expect our introduction of new products to be extremely competitive.

Maximum PC But is this pace just too damn fast for consumers? Should they really be expected to buy new hardware every six months or so?

Wood I don't think every consumer buys a new card that often. A few of them do—the real hardcore people who also have the money. Changing the videocard is a really good way to play the latest and greatest games at the closest to the cutting edge. And because they're relatively inexpensive, we're seeing a lot of people willing to change them fairly frequently.

Maximum PC 3dfx bought STB and S3 bought Diamond. With all the consolidation that's going on these days, where does Matrox fit in?

Wood The best form of flattery is when you're copied. Matrox and ATI were the two companies that originally built their own chip technology and their own boards and marketed to consumers. And interestingly, in terms of revenue, we're also the largest companies in the graphics market over the past few years. It makes a lot of sense to be a vertically integrated company. I think others have noticed this trend and are now scrambling to be more competitive.

Maximum PC So, is an ATI/Matrox merger in the works?

Wood [laughs] In business, anything is possible. However, our technology and R&D is strong enough that we're going to be able to do quite well on our own.

PROFILE

Name: Dan Wood

Rank: Director of Technical Marketing at Matrox Graphics

Mission: To oversee all aspects of developer relations; scope out competitive products; help develop new product roadmaps; and identify technical features that will be demanded by consumers worldwide

Last Known Whereabouts: Dorval, just outside of Montreal, Quebec. In Canada, eh?

Maximum PC Do you think all these mergers ultimately hurt the consumer?

Wood There are fundamentally too many companies investing too much money in this market at this point. Some kind of shakeout had to happen. These mergers are just part of that. Besides, consumers have too many choices as it is.

Maximum PC Too many choices?

Wood It's not a monopolistic market where you can only buy one brand of one product. There are so many different chips coming from so many different companies that in a sense there's too much information out there for consumers to wade through. The amount of R&D that has to fund the development of these chips cannot be paid back if every chip is a winner.

Maximum PC Has 3dfx lost the crown?

Wood It has. 3dfx came to market with extremely good technology and at this point we're seeing more evolutionary products, rather than revolutionary products. Clearly, 3dfx is missing some key technical leadership positions in terms of visual quality.

Maximum PC 3dfx was late to deliver 183MHz parts in volume. Do you think they added a TV/FM tuner to their 3500 card to compensate for the delay?

Wood Other companies are making faster products, so it's interesting to see 3dfx adding all sorts of bells and whistles to make the 3500 somewhat compelling—instead of just making it the highest performing card out there.

You'd have to draw your own conclusions about why they'd want to do that.

Maximum PC Yet, despite these shortcomings, Voodoo-based cards still top the sales charts.

Wood At retail that may be true, but retail is a very small channel overall. It's very high profile, but many more graphics cards are sold when people buy machines from major OEMs, and from even smaller system integrators, through e-commerce or mail-order—more than those sold when people simply walk into a retail store and physically pick up a standalone card.

Maximum PC Matrox had a huge customer-support failure earlier this year. What caused that breakdown and how can you ensure it won't happen again?

Wood [pauses] Yeah. We did have a longer turnaround time in support than we are happy or comfortable with. Since then, we've increased the level of staffing substantially. I don't have exact numbers, but I'm sure that the body count has at least doubled. We've



“I’m a big fan of the Commodore 64. I still play Mule emulated on my current machine all the time!”

extended the hours that people are monitoring the phones and we've increased the amount of e-mail and forum support. At this point, people can expect a one-day turnaround to the questions they send, via phone or e-mail, to our tech-support team.

Maximum PC What took so long to get OpenGL support for the G200?

Wood We bit the bullet and decided to develop a full [OpenGL ICD](#) as opposed to doing a [mini-GL driver](#), and it was an extremely large amount of work. We spent quite a lot of money trying to bring the development team up to speed as fast as we could. It's actually gotten more resources than even the DirectX effort, because it is such a big driver to write. This full ICD is in the G400 box.

Maximum PC Is the PCI bus still viable?

Wood Not as a cutting-edge graphics bus. The G400 is our first [AGP](#)-only product. The high-performance segment we're targeting with the G400 is mostly [AGP](#)-capable machines. We don't see a lot of people who

want the most performance the PC can deliver asking for [PCI](#). We're trying to push content developers to have much more visually rich scenes. And this means a lot more data has to be transferred across that bus—and [PCI](#) just doesn't have the bandwidth to do it. With [AGP](#)'s higher raw bandwidth you're capable of uploading many more textures and many more vertices for higher polygon-count scenes.

Maximum PC How does the delayed 4x [AGP](#) spec affect those plans?

Wood The [AGP](#) 4x-equipped systems will be more competent because main system memory bandwidth is going to increase at the same time, by moving to [Direct Rambus](#). Those two things will give a much-needed boost to the overall system performance because even in cutting-edge [AGP](#) 2x PCs today, the processor and the graphics card can be bottlenecked by main memory. Having a wider bus to take full advantage of that higher bandwidth will allow everything to scale.

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looking at her like that.**



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Maximum PC Off the top of your head, how many games can you name that actually require AGP?

Wood Most games require AGP, if you want to run at the highest resolution and color depth. As you scale up, you have less room for textures in the off-screen memory and you'll be forced to texture out of AGP. If you take a 16MB card—which has a lot of memory on it—and you scale up the resolution even to something like 1024x768/32-bit, and triple buffer it and add 32-bit z-buffering, there's almost nothing left for textures.

Maximum PC What's the most compelling AGP game you've seen?

Wood *Quake III* uses a lot of textures. They're actually breaking the 256x256-texture limit and allowing you to dial textures all the way up to 512x512. And you can forget about running *Quake III* at a reasonable resolution, such as 1024x768/32-bit, unless you've got full AGP texturing support.

Maximum PC But if other developers aren't using large textures, why bother with AGP?

Wood The issue isn't just the size of them, but how many of them are there and how much off-screen memory is left over after you eat up what you have for your frame buffer and your z-buffer. With a game running 1024x768/32-bit, triple buffered with 32-bit z-buffer, you're looking at 12MB gone right off the top. With a 16MB card, you only have 4MB left—which isn't much. Of course, if you tried to scale all the way up to 2048x1536, you'd really be hosed.

Maximum PC How does texture compression come into Matrox's plans?

Wood Texture compression is not supported in the G400 product line. It's interesting, but we're so fast at AGP texturing anyway that we have very fast results without compression. Still, it's great that some companies are driving for compressed textures and motivating game companies to put out higher-resolution versions of source textures. Microsoft's decision to use S3's texture compression in DirectX was good. S3's algorithm seems to do a pretty good job.

Maximum PC Environment-mapped bump-mapping is one of the key features of the G400. For the uninitiated, what exactly does it do?

Wood Environment-mapped bump-mapping adds depth complexity to a scene without adding a lot of extra polygons. Most surfaces in the world aren't flat—they have bumps all over them, whether it's a person's face, the scratched surface of a car hood, or something like metal grating or

wood bark. And developers can't cast polygons for all this detail work because excessive polygon counts make games way too slow. Bump-mapping gets much higher surface detail by using a third texture map, in addition to the base texture and the environment-map, called the "bump-map." And by accelerating it in hardware, we can achieve a much more realistic rendered scene without slowing down the system.

The other thing you can do with bump-mapping is take the actual rendered environment, reflect it off a surface, and make it look realistic. People's eyes see light reflected off of objects and, as an object moves, we expect to see light reflecting in different directions based on the bumpiness of the object. When you're playing a 3D game, you want the world to be as immersive as possible. Having lighting that correctly reflects off object surfaces makes an amazing difference in terms of realism.

Maximum PC Could this "eye candy" be a detriment to hardcore gamers who don't want cool visuals at the cost of performance?

Wood There can be a slowdown in performance, but with the G400 it's relatively minor. Framerate is the most important thing—up to a certain point. Once you get past 60fps, adding extra frames per second doesn't matter. Many games run at extremely high framerates, but it's better to use new technology to make the rendered images look better.

Bump-mapping is made up of three textures blended together with special circuitry. The G400 has two texture units in it. For bump-mapping, we actually do two of the textures in one pass, and then in the last pass we do the third one at double speed, because we use both the available engines to do it. That means the raw performance of bump-mapping is about two-thirds of what regular dual texturing

"There are so many different chips coming from so many different companies that there's too much information out there. Consumers have too many choices as it is."





RAM!

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waiting for?**

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Hmmm...

"We found on Dell Dimension PCs that a 266MHz Pentium II with 96MB of RAM was similar in performance to a 550MHz Pentium III with 32MB of RAM."

ZDTag, the ZD Testing and Analysis Group

would be. But again, that delta would only show up when you're fill-limited by the hardware, which is not usually the case. Bump-mapping tends to be almost free, and the visual quality you get in turn is so high and apparent that we think it's definitely worth it.

Maximum PC The G400 does hardware bump-mapping. What about all the other cards that don't?

Wood If the hardware supports alpha-blending, there's another approach called embossing, which simulates the effects of bump-mapping in hardware, but it's nowhere near the level of visual quality of true environment-mapped bump-mapping. It's readily apparent when you switch modes in an A/B comparison.

Maximum PC Bump-mapping has been in DirectX 6 for awhile, so why have game developers been so slow to take advantage of it?

Wood Developers needed hardware to make bump-mapping a reality. The bump-mapping demos run phenomenally quickly with hardware. Without hardware, however, they'd only run at something like one frame per second. It really didn't make any sense for developers to support this feature without actually having the hardware to run it, because it's so computationally intensive.

Maximum PC What games will we see this fall that will actually support bump-mapping?

Wood Let's see: *Slave Zero*, *Expendable*, *Battlezone II*, and *Messiah* for starters. It's going to be in a patch for *Dungeon Keeper II* and *Descent 3*. *Carmageddon III* is going to have bump-mapping from the start, as will *Drakkan* and *Wild Metal Country*.

Maximum PC The G400 features dual-head support, a concept unfamiliar to many gamers. What is it?

Wood Windows 98 supports multiple monitors. This means you can actually have different windows open on different desktops. In the past, you had to have multiple cards to support that, meaning you had to have one card on a PCI bus and another on an AGP bus. This was a rather poor way to do things for 3D gaming because copying things like textures from one card to another really wasn't efficient. We realized we could integrate in one single AGP board the ability to drive two different displays using our G400 graphics chip and our TV output chip, which contains a second RGB RAMDAC. The more we thought about it, the more we realized that there are a ton of new features we could bring to the PC with this.

Other neat things include dual-head



“S3 currently doesn't seem to have a very strong offering in the high-performance market, where right now Diamond's boards are mostly being sold.”

zoom, which allows you to select any portion of the visible screen, highlight it, and have it pop up on your second monitor zoomed to the full size of the monitor. You can then pan around the window and turn the filtering on and off.

Maximum PC Does this allow you to run different resolutions and color depths on the secondary display?

Wood Absolutely. You can now run your primary display up to 2048x1536 at 32-bit color, and the secondary display can go independently up to 1280x1024 resolution. Televisions are always NTSC or PAL, meaning it's roughly 640x480 at 60Hz. If a television set is hooked up to the second output, you can run 640x480 at 60Hz as your second Windows desktop. But if you want to play games out to the TV, you can actually run the games at up to 1024x768 at 32-bit and 150Hz on your RGB monitor and still run it out to TV at the same time. So now the TV output quality is also enhanced

because we're actually taking a super-sampled Windows desktop and sending it down to a lower-res NTSC output—you don't have to run your expensive RGB monitor at 60Hz, which looks horrible.

Maximum PC What games will support the dual-display features?

Wood One of the first ones is Microsoft's *Combat Flight Sim*. It supports dual head in a really neat way. In one-monitor flight sims, the cockpit obscures most of the view. But with dual-head, you can open up other view windows, such as exterior plane views or 3D map views.

There's a whole bunch of realtime strategy games coming, including Gremlin's *Wild Metal Country* and Silicon Dreams' *War Monkeys*. *Star Trek: Armada* is a realtime strategy-style game that's going to look amazing with dual monitors. On the primary screen you'll have your typical top-down realtime strategy viewpoint. On the second monitor, you'll have what they call a “cine-

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BRIO 8338	\$93.00	62.69
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Power Mac G3 PC100	\$93.00	68.39

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Artica	Flat Panel	17.3"	17.3"
S-1	Monitor	15.0"	14.0"
M-1	Monitor	17.0"	16.0"
L-1	Monitor	19.0"	18.0"
XL-2	Monitor	21.0"	19.7"

matic view," where you have a realtime 3D camera flying through the battle and projecting it in realtime rendered 3D.

Multimonitor would also be applicable in things such as RPG-style games, where for something like *Ultima Online*, you could have chat windows open on one monitor while the action is going on in the primary.

The very last thing on the gaming side we're seeing is people in the equivalent of split-screen, head-to-head games. Each player could have their own monitor to get the full-screen view of the action as they're playing each other at the same physical computer.

Maximum PC What do you think of AMD's new Athlon processor?

Wood It looks really strong. AMD's making a real run at being competitive, and the big benefit has been to consumers who have seen prices declining. In terms of the processor complexity increasing, once again, when you're dealing with designs that are in the millions of transistors, it's not just about how fast the clock goes, but how efficiently the architecture works. Brute force alone doesn't apply anymore if you want to win. People are looking at doing more intelligent things with their silicon area to accelerate the applications.

Maximum PC Sega uses the PC's PowerVR technology for its Dreamcast console. Is that the future for 3D chipset companies?

Wood PowerVR-based technology will not make a resurgence back on the PC anytime soon. When you miss a couple of cycles it's really hard to get back in the game.

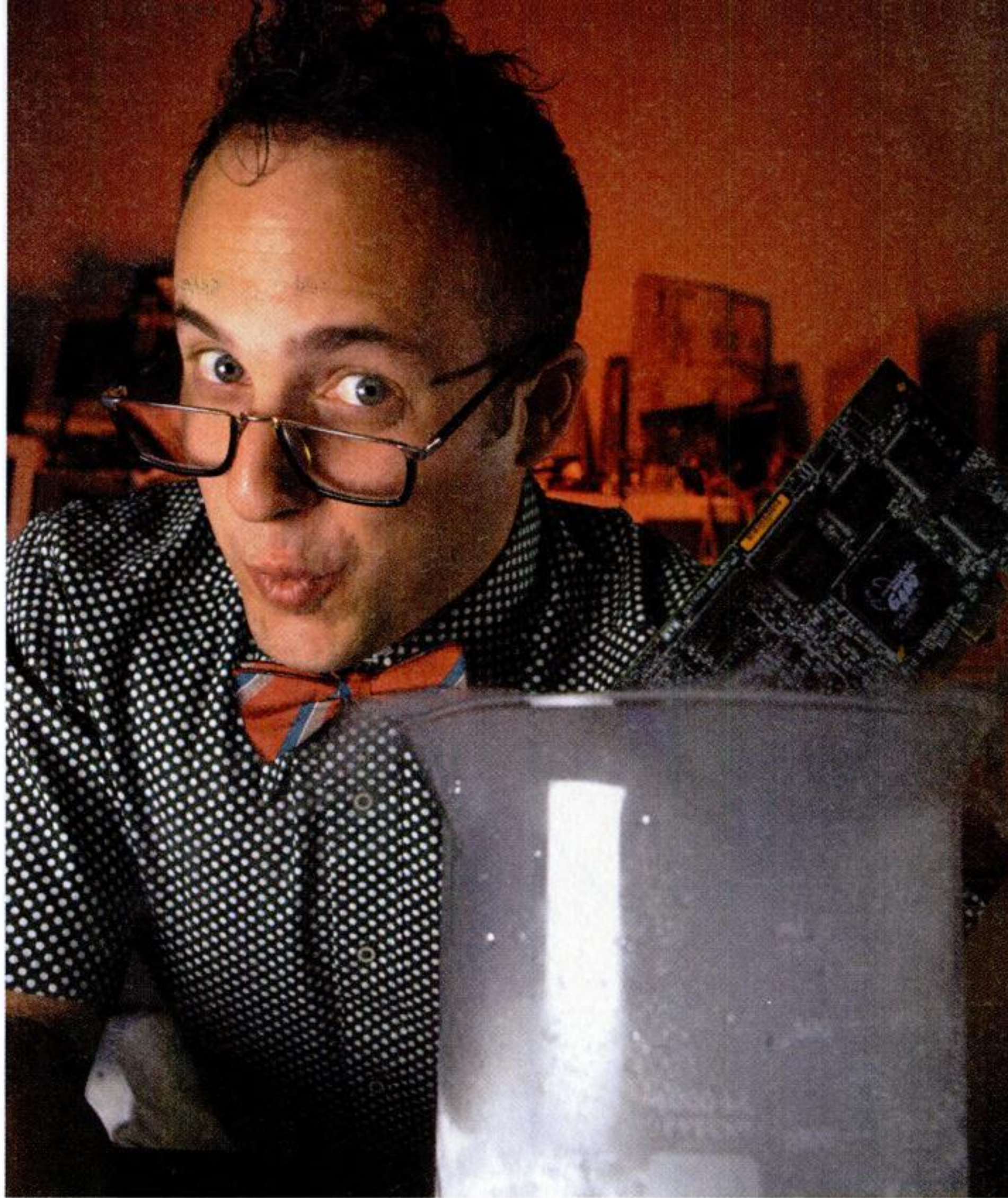
Maximum PC That sounds a lot like Rendition.

Wood We're all in a very competitive industry with a lot of money going into making the best product. There are a lot of stages along the way where you can go wrong—but there's no room to go wrong. If you get anything wrong along the way, chances are that enough of your competitors won't, and you very quickly run out of money and lose your ability to compete.

That's the danger existing in the market right now, and it's very important not to miss any design cycles.

Maximum PC So, what would it take for Matrox to die?

Wood The mistake that is most able to destroy a company is underestimating the technology requirements and missing design cycles. The amount of time you have to hold your breath, so to speak, is smaller for a company of Matrox's size.



“Framerate is the most important thing—up to a certain point. Many games run at high framerates, but it's better to use new technology to make the images look better.”

Maximum PC The G400 may have an edge over the current competition, but what about the new chips coming out this fall, namely nVidia's NV10 and 3dfx's Voodoo4?

Wood Any smart competitor's next-generation hardware will include environment-mapped bump-mapping, because there's going to be tons of games out there supporting it and it really makes a big difference to visual quality. Anybody missing environment-mapped bump-mapping in its next-generation chip spec is making a big mistake.

And some of the products being bandied about for a fall release are actually going to end up making an impact in 2000. So, given its performance and all its special features, whether it's environment-mapped bump-mapping, dual head display, or the rendering quality of its 32-bit rendering, the G400 is the high-performance king throughout calendar '99.

Maximum PC What's the baseline for a next-generation videocard?

Wood The year 2000 videocard will have at least four times the fill of a cutting-edge videocard today. Fill rates these days are well above 300 megapixel, so it's got to be well above a gigapixel; it's got to have support for all the features of DirectX 7; it's got to have some ability, of course, do things like bump-mapping and multi-head display; and framerates have to be extremely high, along with color quality. You must support higher resolution textures. And I think there's real interest in solving the anti-aliasing problem at the next step of the game.

Maximum PC If you couldn't use the G400, what would you use?

Wood The Commodore 64.

Maximum PC Really?

Wood I am a big fan of the Commodore 64. I still play Mule emulated on my current machine all the time. ☼



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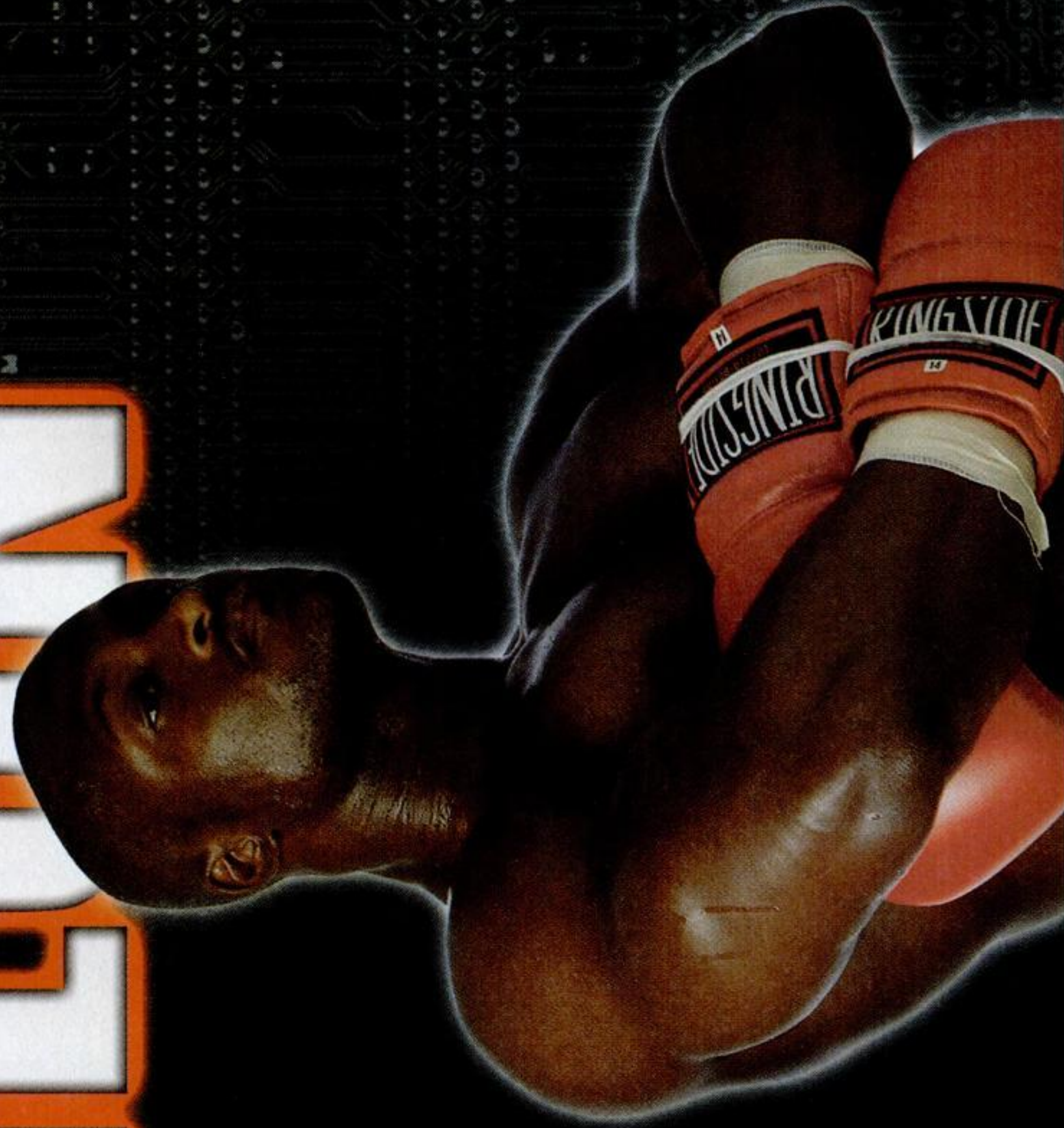
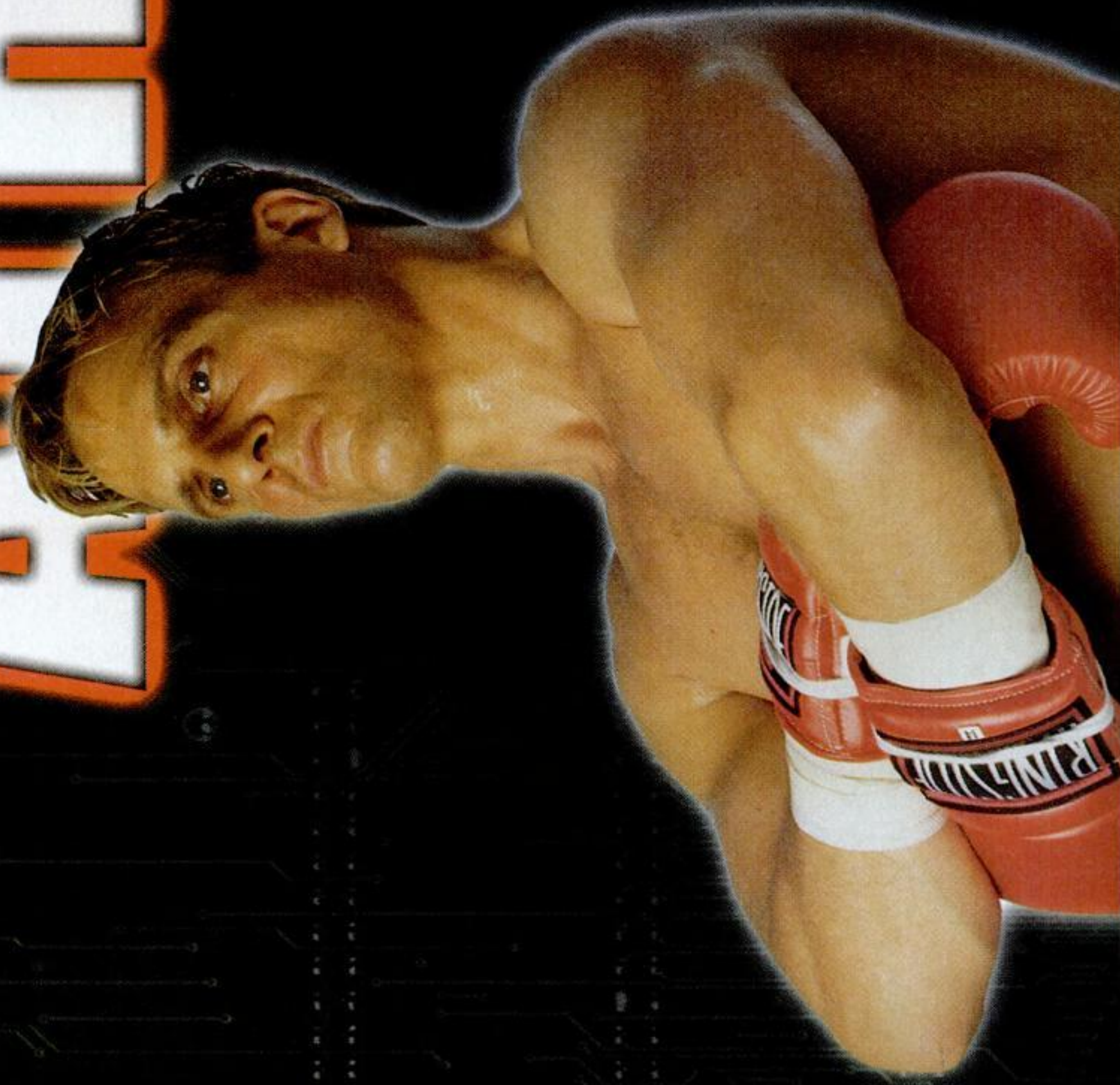
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MOORE'S LAW AND THE MAXIMUM PC WORLD CPU ASSOCIATION PRESENT

PENNINGTON VS RATHBON





IN THE
ULTIMATE

CPU SHOWDOWN



Can Team Intel withstand the AMD challenge? We pit two Pentium III systems against two Athlon systems to determine the Processor Champion of the Century. Don't buy your next system before we name the winner.

The line on Intel

During the weeks prior to the Athlon's release, Intel bulked up the P-III to 600MHz, to match the Athlon's expected weigh-in speed. But wait! Anticipating Intel's strategy, AMD bumped up one of its team members to 650MHz. A 600MHz P-III will be fighting this buffed-up AMD bruiser in tonight's main event. It's unlikely that the P-III will be able to stand up to the Athlon's sheer clock frequency, let alone AMD's extra [floating-point unit](#). Nevertheless, P-III fighters have been training with a special weapon—the [SSE](#) instruction set—which is missing from the Athlon's repertoire of punches. We expect SSE to help the P-III beat Athlon in the telling *Photoshop* round. For a full scouting report on the P-III, see our March 1999 cover story.



The line on AMD

When AMD began training its new Athlon processor, it did so with sheer clock speed in mind. Sure, the Athlon's [superscalar](#) architecture includes three floating-point units to the P-III's two, but the Athlon's [superpipelining](#) strategies are what's keeping the processor one step ahead of Intel clock speeds. And in the battle for the CPU title, clock speed reigns supreme. In short, the Athlon's 50MHz advantage in core frequency will have a more profound affect on overall performance than its extra floating-point unit or faster channel to system memory. Based on what we saw in last month's contest, the P-III might be able to withstand the Athlon on an even 600MHz playing field, but watch out in the mis-matched main event. For a full scouting report on the Athlon, see our September 1999 feature.



The Undercard... 60
The Main Event... 62
Judges' Decision... 65

DELL DIMENSION XPS

• Fast, powerful... uninspired

The two Pentium III systems reviewed here are great performers on the inside, but one is just a little sexier on the outside. Almost identically configured, Dell's XPS and Micron's Millennia Max both include a 600MHz P-III processor, 128MB RAM, an Ultra DMA/66 hard drive, and a TNT2 Ultra graphics board—all awesome features we expect from top-of-the-line systems. They perform nearly

identically, but since we have to tinker with these machines daily, we'd like to see a little creativity on the outside. While Micron plays with line, color, and design on its new box, Dell uses the same boring case we've seen for the past two years. Note to Dell: It's time to reinvent the box.

The major differences in the two

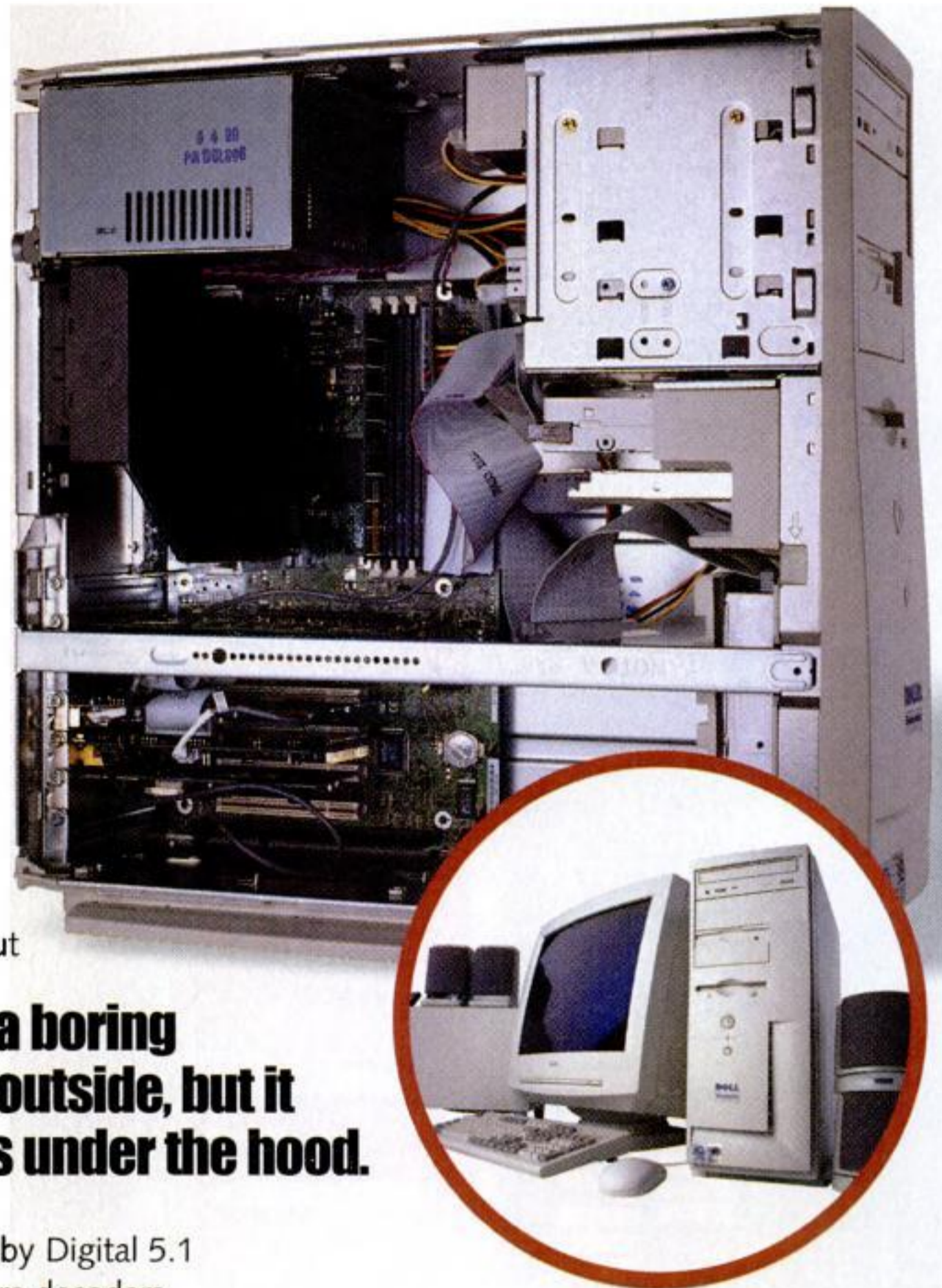
machines' internal components include the hard drive (Micron uses IBM's Deskstar, Dell uses a Maxtor 92049U6), the DVD-ROM drives (Micron employs a Pioneer 8x drive, while Dell uses a slightly slower Hitachi 8x), and the MPEG-2 decoders (Micron includes Sigma Designs', Dell uses Quadrant's).

We love hardware MPEG-2 decoding, so we're pleased to see it here. While software decoders are cheaper, they can't play movies out

The XPS may be a boring machine on the outside, but it has what it takes under the hood.

to TV or decode true Dolby Digital 5.1 sound, two tasks hardware decoders handle with ease. Unfortunately, Dell partners the Quadrant DVD decoder with Altec Lansing's four-point surround-sound ADA880 speakers, instead of a full 5.1 surround-sound setup. The ADA880's satellites cross over to the sub at about 25Hz, with the tub-thumpin' powered sub dropping off between 40Hz and 50Hz. But rather than including a dedicated center satellite, it emulates the center channel by using parts of the signal from the left and right speakers. It's a fudge, but not enough to beat 'em up over.

Comparing the two systems' expansion capabilities looks like a ping-pong match. While the XPS has one more PCI slot than the Millennia Max, the Max has one more 5.25-inch external drive bay. The XPS has a special fan device over the processor to suck the air out, but the Millennia gives you the option to place a fan over your graphics board in case you want to overclock the sucker.



The XPS includes a Zip drive, but the Millennia has CD-RW.

In all, the Dell XPS is solid, but its

straightforward, stock beige exterior is a good indication of what's inside.

—Rick Popko

PLUSES

- Good MPEG-2 playback
- Solid performance
- Strong sub-woofer

MINUSES

- Nothing really innovative
- Speaker set not 5.1
- Mobo not ULTRA DMA/66-compliant

UNDER THE HOOD

THE BRAINS

CPU	Pentium III 600MHz
L2 Cache	512K
RAM	128MB 100MHz SDRAM upgradable to 768MB
Moboard	Intel Seattle 3 ATX
Drive bays	Two 5.25-inch (one free), four 3.5-inch (two free)
I/O ports	Two USB, one serial, one parallel, game port, and S/PDIF, S-video and composite out for DVD

DISPLAY

Video	32MB Diamond Viper V770D with nVidia TNT2 Ultra
Monitor	Dell brand M990 19-inch (18-inch viewable, .26mm dot pitch)
Resolution	1600x1200/75Hz@32-bit

STORAGE

Hard Drive	Maxtor 92049U6 18.5GB Ultra DMA/66
CD/DVD	Hitachi 8x DVD GD-5000
Removable	Imega Zip, standard floppy
Fax/Modem	3Com 56K PCI

SOUND

Sound	Creative Labs Sound Blaster Live!
Speakers	Altec Lansing ADA880 five-piece

OTHER

Quadrant hardware MPEG-2 decoder

THE BUNDLE

Windows 98 | Microsoft Office 97 Small
Business edition | Network Associates VirusScan
4.0.2 | MS Bookshelf

BOOT 0:54 DOWN 0:03

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD	bootMark	277
WINDOWS APPS	SYMark 98 official score	231
HARD DRIVE	HD Tach MB/sec	20.7
CD-ROM	CD Tach98 drive rating	26.7
3D RENDERING	Newtek Inspire3D sec	371
IMAGE EDITING	Adobe Photoshop 5.0 sec	107
DIRECT3D	Expendable fps	56.3
OPENGL	Quake II v3.20 fps	70.0

straightforward, stock beige exterior is a good indication of what's inside.

—Rick Popko

MAXIMUM PC VERDICT

Price \$2049, \$2,459 w/monitor
Company Dell
Phone 800.388.8542
URL www.dell.com



COMPAQ PRESARIO 5861

• Athlon isn't everything

The Compaq Presario 5861 is a strange bird, combining a massive Athlon punch with a collection of half-assed components that don't do the AMD processor justice.

Benchmark scores highlight this imbalance; the Presario beat the Dell and Micron machines in only the CPU-dependent tests, SYSmark and bootMark. But when the Athlon wasn't the central component being tested, the Presario quickly became the lab whipping-boy. In OpenGL, Direct3D, Inspire, and Photoshop tests, the Presario posted scores bested by even the Dell T550 (P-III 550MHz) we tested in July.

PLUSES
The Athlon rocks
Klipsch speakers have amazing tonal range
FireWire on mobo is a nice touch
No ISA slot

MINUSES
No Zip or CD-RW is a cardinal sin
Dinky 13GB hard drive
THX speakers should offer true 5.1 Dolby Surround

Compaq is obviously targeting softer-core users with this PC, as many of the features we've come to expect in cutting-edge systems are either totally absent or half-heartedly implemented. Case in point: The Presario has no

mass storage medium whatsoever. No Zip, no CD-RW, nada. And if you're thinking, "No problem, I'll just use the hard drive," think again. Although Compaq threw in a 7,200rpm IBM Deskstar drive with Ultra DMA/66, it holds only 13 gigs—roughly half the current standard for power desktops. Ultra DMA/66 is supported on the 5861's motherboard.

So, Compaq didn't design this system for all-out power; we can

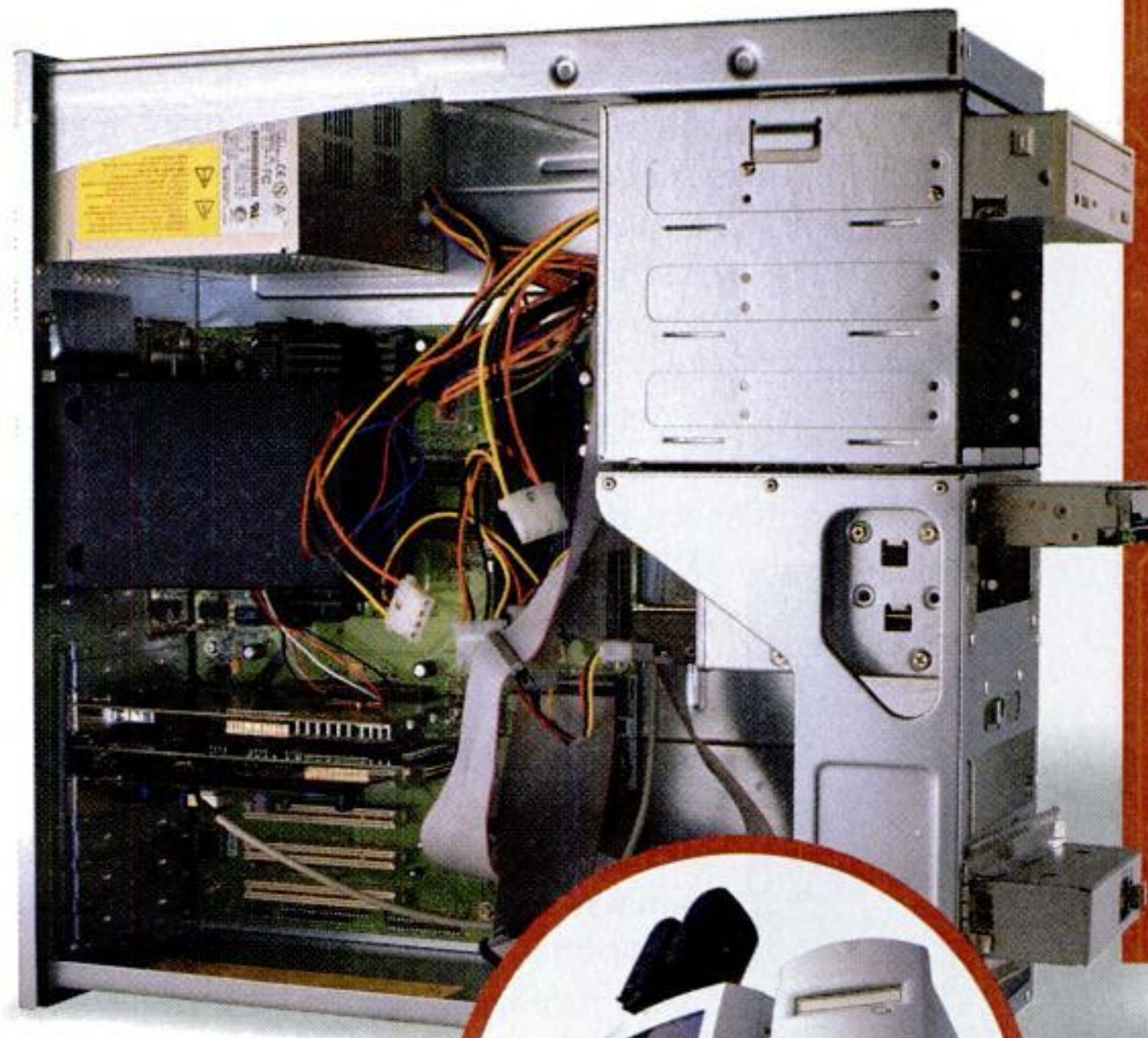
Compaq's first Athlon is overpriced and underpowered.

live with that. What is the 5861 designed for? Certainly not next-gen games—the Presario's Voodoo³ 3000 placed dead last in our OGL and D3D benchmarks. Though the Voodoo³ is a fine card for 2D, Glide, and OGL, with the NV10 and Voodoo⁴ on the horizon, it's already in danger of obsolescence. Compaq could have done better by including a TNT2 Ultra as standard fare, instead of an upgrade option.

DVD image quality was grainy on the Compaq 8x DVD player, but sounded great thanks to the THX-certified Klipsch speakers. Plugging the 400-watt, five-piece setup into the Diamond MX-300's dual stereo-out jacks gave earth-shaking four-channel surround that didn't distort even at obscene volumes. Only when playing extremely low tones (around 30kHz) did we discover a flaw in the design: The air being moved interferes with cone movement, resulting in a weird fluttering sound.

We tip our hats to Compaq for including two USB and one IEEE 1394 port on the front of the case (two more USB ports reside on the back), and for abandoning

the dreaded ISA bus. But a power system this is not, and in the company of top-end systems from Dell, Micron, and the



PENTIUM VS ATHLON

UNDER THE HOOD THE BRAINS

CPU	AMD Athlon 600MHz
L1 Cache	128K
L2 Cache	512K
RAM	128MB 100MHz SDRAM, upgradable to 384MB
Moboard	FIC SD11
Drive bays	Three 5.25-inch (two free), two 3.25-inch (one free)
I/O ports	Four USB, one parallel, one serial, IEEE 1394

DISPLAY

Video	3dfx Voodoo ³ 3000
Monitor	Compaq MV920 19-inch (18-inch viewable, .26mm dot pitch)
Resolution	1600x1200/75Hz@16-bit

STORAGE

Hard Drive	IBM Deskstar 13GB Ultra DMA/66
CD/DVD	Toshiba 8x DVD
Fax/Modem	U.S. Robotics 56K WinModem

SOUND

Sound	Diamond Monster Sound II MX-300
Speakers	Klipsch ProMedia v.2-400

THE BUNDLE

McAfee VirusScan MGI Videowave MS Encarta MS Works MS Money MS Word 97 RingCentral Fax
--

BOOT 1:11 DOWN 0:05

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark	296	
WINDOWS APPS SYSmark 98 official score	250	
HARD DRIVE HD Tach MB/sec		Would Not Run
CD-ROM CD Tach98 drive rating	26x	
3D RENDERING Newtek Inspire3D sec	413	
IMAGE EDITING Adobe Photoshop 5.0 sec	112	
DIRECT3D Expendable fps	44	
OPENGL Quake II v3.20 fps	57.4	

*Test would not run, but hard drive performance was good.

almighty CyberMax, the Presario 5861 is simply way out of its league.

—Josh Norem

MAXIMUM PC VERDICT

Price \$1799, \$2413 w/monitor and speakers
Company Compaq
Phone 800.888.0220
URL www.compaq.com



MICRON MILLENNIA MAX

• A case for something new



Micron's redesigned 600MHz Millennia is unequivocally a Kick Ass computer. Only two things kept this machine from earning a perfect 10: It still includes two ISA slots at the expense of a PCI slot (which is somewhat forgivable), and its Ultra DMA/66 hard drive is bottlenecked by the Ultra

PLUSES

- Awesome internal case design
- Good performance
- Includes both modem and Ethernet
- Ready to overclock
- Great 2D/3D
- True Dolby Digital speakers

MINUSES

- Two ISA slots
- Not Ultra DMA/66 compliant
- Nonpowered subwoofer

DMA/33 controller built into the mobo's chipset. With that out of the way, we can gush about all the good things Micron implemented in this system.

Micron has completely redesigned the Millennia's case. The new exterior design met with mixed reactions from our staff. Some thought the box looked streamlined and sophisticated. Others felt the case was underwhelming,

and that the plastic floppy face might make it difficult to remove an improperly ejected disk. Everyone agreed that the pull-down face-plate protecting the Sony CD-RW had to go.

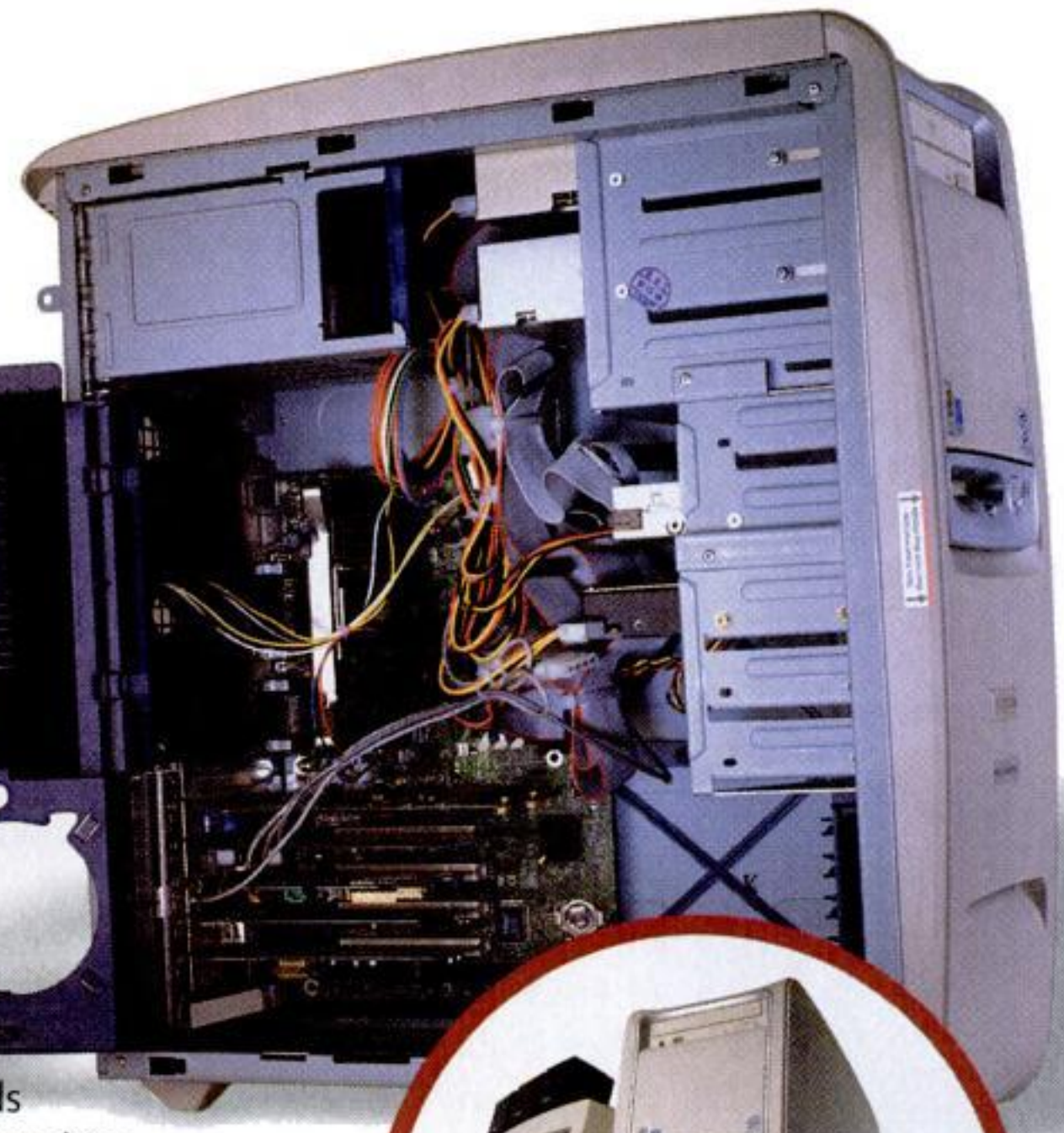
The side of the box pops off with a spring-loaded latch. Once inside, you're first greeted with a new patent-pending card guard. This removable tray serves two purposes: It holds two additional fans (a treat for graphics

The redesigned interior begged us to overclock, but the hardware DVD playback eventually won our hearts.

card overclockers), and it prevents cards from popping out of their slots (which some AGP cards tend to do). The second major internal innovation is the pop-out motherboard; flick a couple of plastic tabs up and the mobo slides smoothly out of the case for easy upgrading.

While the Max's performance was on par with Dell's XPS, its expansion possibilities are limited—all four PCI slots are full. On the other hand, the machine comes with both a Fast Ethernet interface and a 56K modem. Chances are you won't need both, so you can always pop one out.

What puts the Max over the top are its 32MB TNT2 Ultra card, Sigma Designs' Hollywood+ DVD decoder card, and Cambridge SoundWorks' Desktop 5.1 AC3 speaker system. The TNT2's performance is outstanding, netting 55fps in *Expendable* and 71fps in *Quake II*. DVD picture quality out to TV was as good as a DVD set-top box. And after the bruising it took in our September issue, Cambridge bounces back with the DeskTop



Theater 5.1 digital surround-sound speaker set, which truly fills the room with sound. Though the sub isn't powered, it hung on to bass frequencies to about 40Hz.

UNDER THE HOOD

THE BRAINS

CPU	Intel Pentium III 600MHz
L2 Cache	512K internal
RAM	128MB, expandable to 768MB
Moboard	Intel Seattle 2 SE440BX
Drive bays	Three 5.25-inch (one free), five 3.5-inch (three free)
I/O ports	Two serial, one parallel, two USB, Ethernet, S/PDIF, Modem

DISPLAY

nVidia	TNT2 Ultra 32MB SDRAM, AGP 2x
Monitor	Micron 19-inch (18-inch viewable, 0.26mm dot pitch)
Res/Refresh	1600x1200/75Hz@32-bit

STORAGE

Hard Drive	IBM 27.3GB 7,200rpm Ultra DMA/66
DVD	Pioneer 8x
Removable	Floppy, Sony CD-RW
Fax/Modem	3Com 10/100 Fast Ethernet, U.S. Robotics 56K modem

SOUND

Sound	Aureal Vortex AU 8830
Speakers	Cambridge SoundWorks DeskTop Theater 5.1 DTT2500 Digital

OTHER

Sigma Designs' Hollywood+ MPEG-2 decoder card

THE BUNDLE

Microsoft Outlook | Word | Excel | Norton Anti-Virus | Adaptec DirectCD | Adaptec EasyCD Creator

BOOT 3:01 DOWN 0:02

REAL WORLD BENCHMARKING	CPU/MOTHERBOARD	bootMark	279	
	WINDOWS APPS	SYSmark 98 official score	234	
	HARD DRIVE	HD Tach MB/sec	19.4	
	CD-ROM	CD Tach98 drive rating	27.1	
	3D RENDERING	Newtek Inspire3D sec	371	
	IMAGE EDITING	Adobe Photoshop 5.0 sec	104	
	DIRECT3D	Expendable fps	56.0	
	OPENGL	Quake II v3.20 fps	71.1	

If we could take home any P-III machine we have in our lab, it would be this one.

—Rick Popko

MAXIMUM PC VERDICT

Price \$2,431, \$2,799 w/monitor
 Company Micron
 Phone 888.228.9634
 URL www.micronpc.com



CYBERMAX AP6 MAX

• Pure Athlon addiction



A lesser-known brand than Dell, Micron, and Compaq, CyberMax entered our lab an underdog. But thanks to its 650MHz Athlon CPU and a laundry list of top-shelf hardware, the AP6 Max left scorch marks on our test bench. With its new processor, AMD is sending a clear message to Intel loyalists: The party's over.

PLUSES

- Supernova desktop performance
- Case wiring is flawless
- Perfectly flat monitor is beautiful

MINUSES

- No case fan
- USB speaker connection came loose frequently
- CyberMax wants it back

Right out of the box, the AP6 made a mockery of previous benchmark records. The first to fall was *SYSmark*: The AP6 posted a jaw-dropping 277, a score 43 points higher than the *Millennia's*. Next up was the venerable *bootMark*: The AP6 hit 321, a whopping 41.2 points higher than the *Millennia*.

Still not convinced? Next, we fired up

HD Tach to test the cavernous Seagate Barracuda 25.4GB Ultra DMA/66 hard drive. After the smoke cleared, we were faced with another record-breaking score—the 7,200rpm drive ripped an amazing 23.8MB/sec read speed.

Our 3D-gaming benchmarks pit the AP6's *Voodoo3 3500 TV* against the *TNT2* cards in the Dell and Micron systems. Though the 3500 lost by only 1fps in our *Expendable* test, it offers radio, TV, and video

Kick Ass is almost an understatement.

options that nVidia boards could only dream of.

With the quick turn of a few thumbscrews, you can slide off the cover and access the AP6's beautiful interior. Wiring this clean should be displayed in a museum. CyberMax gets a nod for attaching the USB, parallel, and serial ports to the case with a polished chrome plate, with no color-coding for peripherals. But as beautiful as the AP6's case is, its glaring lack of a mounted fan to blow hot air out cost the CyberMax a verdict point in the final tally.

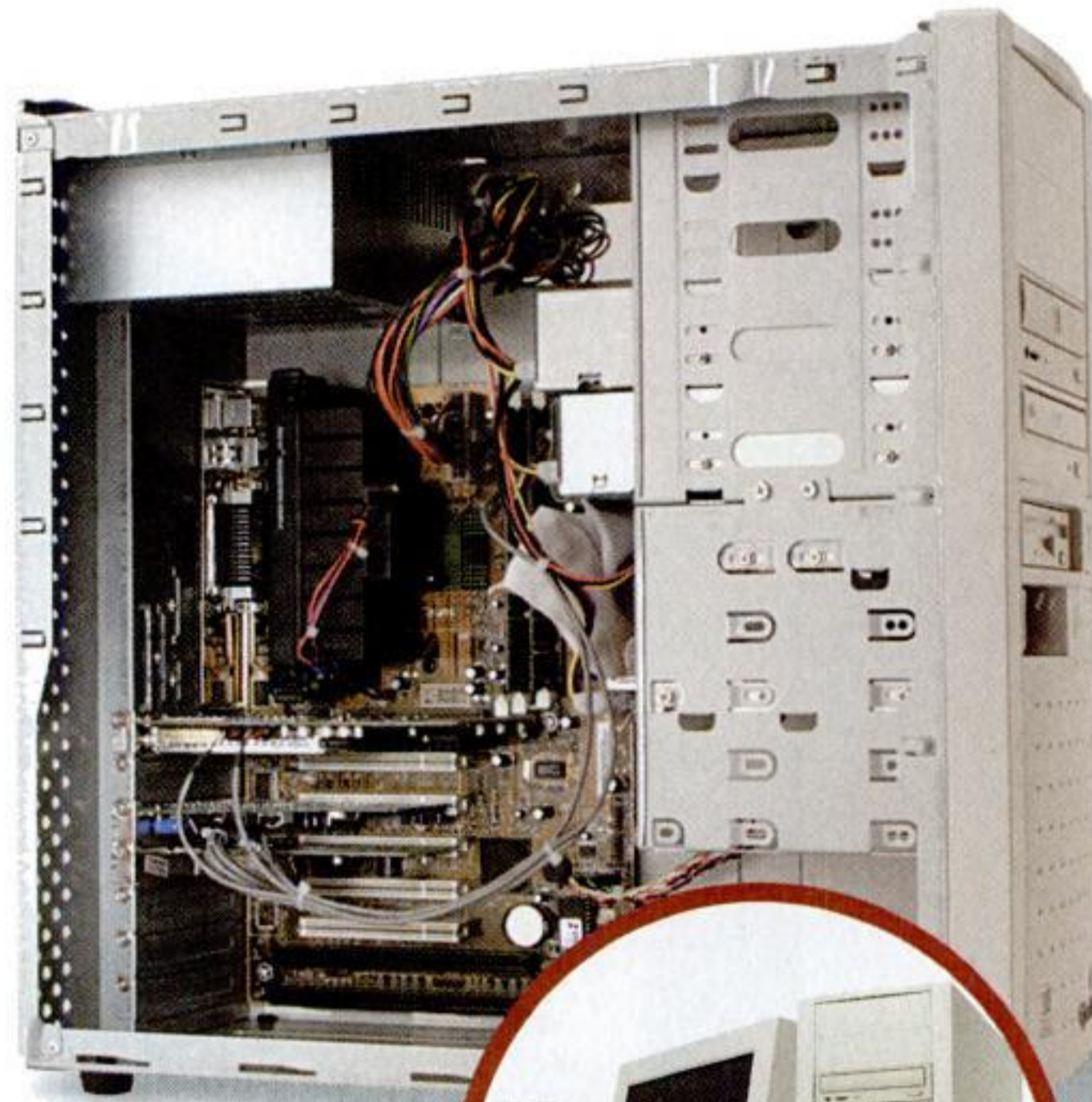
Watching DVD movies on the perfectly flat 19-inch monitor is a kick. The Aural Vortex 2.0 soundcard and Altec Lansing's three-piece ADA305 speakers complement the movie-theater experience with clean tones, thick bass, and damn good emulated surround sound. Add to the list of great components Sony's CRX100E, a CD-RW that received a 9 in our February issue.

The first system we've ever reviewed from CyberMax, the AP6 floored us with its superclean case, choice components,

and blinding desktop speed. The Athlon is one fast mutha, and when it's combined with top-drawer components, the result is a

dangerously fast PC. Bravo CyberMax—you've earned not only our respect, but also our coveted Kick Ass award.

—Josh Norem



UNDER THE HOOD

THE BRAINS

CPU	AMD Athlon 650MHz
L1 Cache	128K
L2 Cache	512K
RAM	256MB 100MHz SDRAM, upgradable to 384MB
Moboard	MicroStar 6167
Drive bays	Four 5.25-inch (two free), one 3.25-inch bay (none free)
I/O ports	Two USB, two serial, one parallel

DISPLAY

Video	3dfx Voodoo3 3500
Monitor	Amtran 19-inch (18-inch viewable, .25mm dot pitch)
Res/Refresh	1600x1200/75Hz@16-bit

STORAGE

Hard Drive	Seagate Barracuda 25.4GB Ultra DMA/66
CD/DVD	Toshiba SD-M1212 6x
Removable	Sony CD-RW CRX100E (24x24)
Fax/Modem	U.S. Robotics 56K WinModem

SOUND

Sound	Aural Vorex 2.0
Speakers	Altec Lansing ADA305 Powercube

THE BUNDLE

Corel 2000 | Maxis Enthusiast Pack | Compton's Encyclopedia 99 | Compton's Reference Collection 98 | *Calendar Creator 5.0* | *Oregon Trail* | *Final Four NCAA Basketball* | Compton's World Atlas | *BodyWorks 6.0* | Compton's Interactive Cookbook | *Arkose Works* | *Creative Workshop*

BOOT 1:05 DOWN 0:02

REAL WORLD BENCHMARKING	CPU/MOTHERBOARD	bootMark	321		
	WINDOWS APPS	SYSmark 98 official score	277		
	HARD DRIVE	HD Tach MB/sec	23.8		
	CD-ROM	CD Tach98 drive rating	20x		
	3D RENDERING	Newtek Inspire3D sec	372		
	IMAGE EDITING	Adobe Photoshop 5.0 sec	87		
	DIRECT3D	Expendable fps	53		
	OPENGL	Quake II v3.20 fps	69		
				0	

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THE JUDGES' DECISION

And the winner is ... AMD Athlon! While the fights were extremely close, the CPU-specific benchmarks on the proceeding pages show that the Athlon has the edge in real-world performance. In both the evenly matched undercard and lopsided main event (in which the Pentium III weighed in light by 50MHz), the Athlon proved itself the more formidable processor.

In an even 600MHz match-up, the Athlon-driven Compaq machine posted a bootMark score that was 16 points higher than that achieved by the stronger performer of the two 600MHz P-IIIs. In the main event, the Athlon hit a 41 point advantage. The bootMark gauges a CPU's pure integer and cache performance. The bootMark rounds go to Athlon—decisively.

The same story unfolded during the SYSmark 98 rounds. The 600MHz Athlon beat the 600MHz P-IIIs by 16 points. The 650MHz Athlon widened the advantage to 43 points. SYSmark 98 (www.bapco.com) is a suite of 14 popular Windows 98 applications, and is an excellent gauge of both integer and floating-point performance. The Athlon easily toyed with the P-III in the SYSmark rounds, indicating it's simply the superior processor if you use a wide variety of Windows 98 apps.

The Athlon lost the *Inspire* 3D rendering rounds—a bewildering setback, considering that the processor is supposed to be so floating-point-capable. In fact, in *Inspire*, the 650MHz Athlon couldn't even out-punch the 600MHz P-III. But the Athlon actually performed better than expected in the *Photoshop* rounds, in which we expected the P-III's SSE instructions to give Intel a clean advantage.

Our version of *Photoshop* (version 5.2) is SSE-optimized, and the actions in our *Photoshop* script make use of many effects filters that hook into SSE calls. Sure enough, even the Athlon's ostensibly superior floating-point power couldn't help it overcome the Intel SSE onslaught in the 600MHz vs. 600MHz *Photoshop* round. But look what happened in the 600MHz vs. 650MHz mismatch: The Athlon batted away those SSE hooks and uppercuts, and used sheer speed to take the *Photoshop* test by 16 seconds. Once again, sheer core frequency shows what it can do when pushed against the ropes.

The P-IIIs systems did better in the 3D gaming rounds—but we can't consider the results a decisive referendum on CPU power due to videocard differences among all the systems that competed. The two P-III systems included TNT2 Ultra videocards. The Compaq machine included a Voodoo³ 3000, while the Cybermax included a Voodoo³ 3500. Because the Voodoo³ is simply a slower 3D chipset than the TNT2 Ultra, we can't decisively say the Pentium III is a better gaming CPU (even the Voodoo³ 3500 falls frames short of the TNT2 Ultra when both cards are tested in the same base system). We should also note that our 3D gaming benchmark demos are geared more toward revealing a 3D card's rasterization power than the CPU's ability to execute its portion of the 3D-rendering pipeline.

The bottom line: The Athlon wins—but mostly because it was the faster-clocked CPU on the night of the fight.

The Best CPU For You

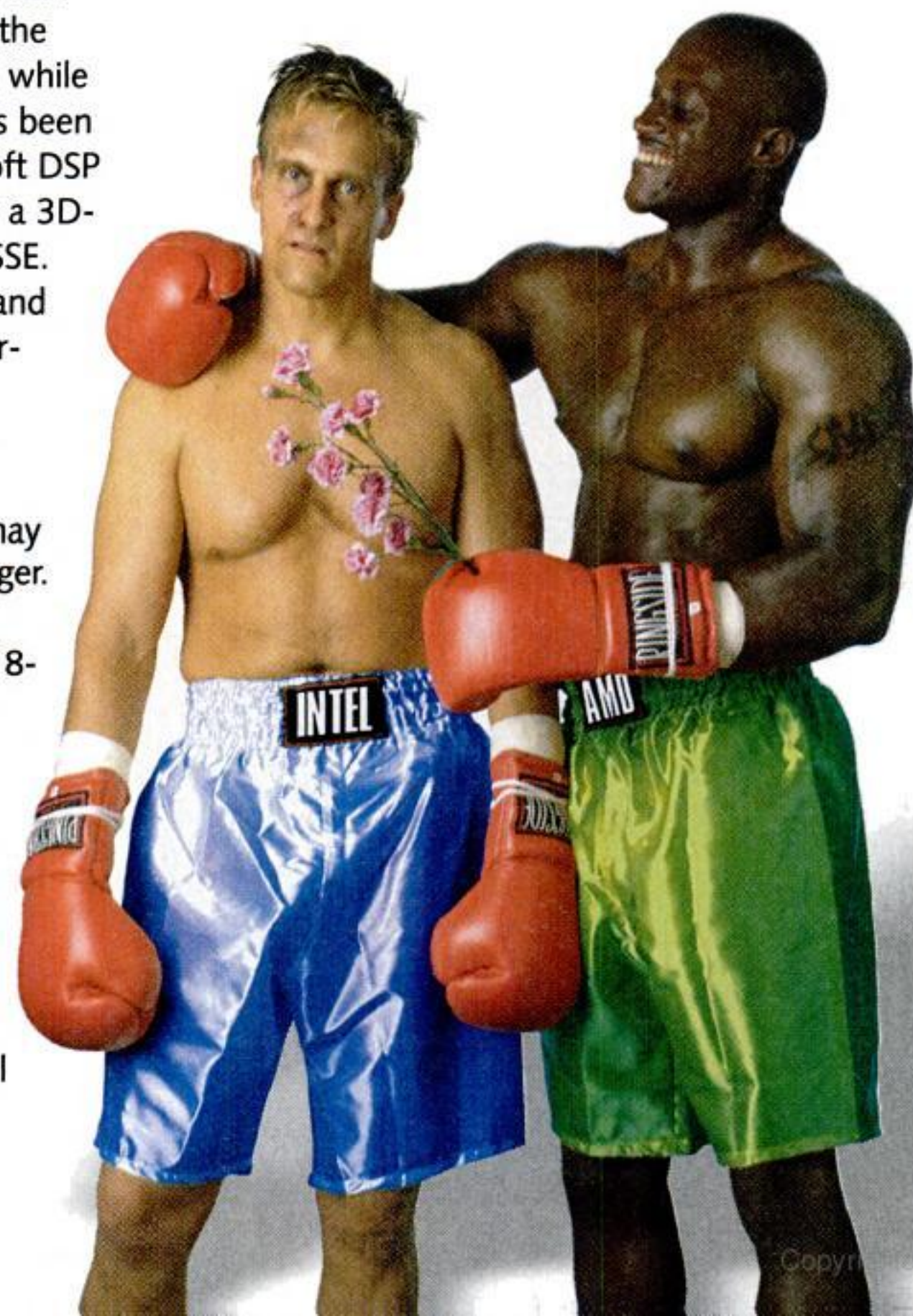
All clock speeds being equal, the P-III looks like the better processor if—and only if—your “must-have” applications are optimized for SSE instructions. The awesome power of SSE becomes ever more apparent as we review more SSE-optimized applications (check out the *EditDV* review on page 114). And while AMD's 3DNow! instruction set has been augmented by new integer and soft DSP instructions, 3DNow! is essentially a 3D-gaming technology compared to SSE. (With respect to 3D gaming, SSE and 3DNow! offer essentially equal performance boosts.)

With that stated, consider your upgrade path; regardless of which processor family you choose, you may want to wait before pulling the trigger. By November, the best Pentium III systems should be based on the 0.18-micron “Coppermine” CPU manufacturing process and Intel 820 chipset. At launch, these machines will run a variable 100/133MHz system bus, use high-bandwidth **Rambus DRAM**, and clock up to 667MHz (on the 133MHz bus setting; a 700MHz P-III could happen in 1999, but we assume it'll run on a 100MHz bus setting).

The looming advent of a 133MHz Intel system bus tells us the P-III vs. Athlon question is about to get much more complex, especially since AMD hasn't announced that it will employ Rambus DRAM—the kind of memory that can finally leverage the Athlon's 200MHz memory bus—in the near future. Sure, Athlon systems should easily hit 700MHz by the end of the year, but these systems will be bottlenecked by 100MHz SDRAM. AMD's move to 200MHz Rambus DRAM is slated for sometime in the first half of 2000. Because RDRAM will cost so much in the early going, AMD's road map might make good strategic sense. You can expect the upcoming 820-based P-III systems to be priced relatively high.

For now, all clock speeds are *not* equal, and it appears that AMD will continue to win the sheer core-frequency war and dominate Intel with better benchmarks on the high end. The upstart company has already announced that it will offer a 1GHz part when it jumps to its own 0.18-micron process in 2000. Can Intel match this speed with the P-III's superpipelining techniques? This remains to be seen. But without a doubt, the next super-heavyweight matchup will be a good one. ✨

—Jon Phillips



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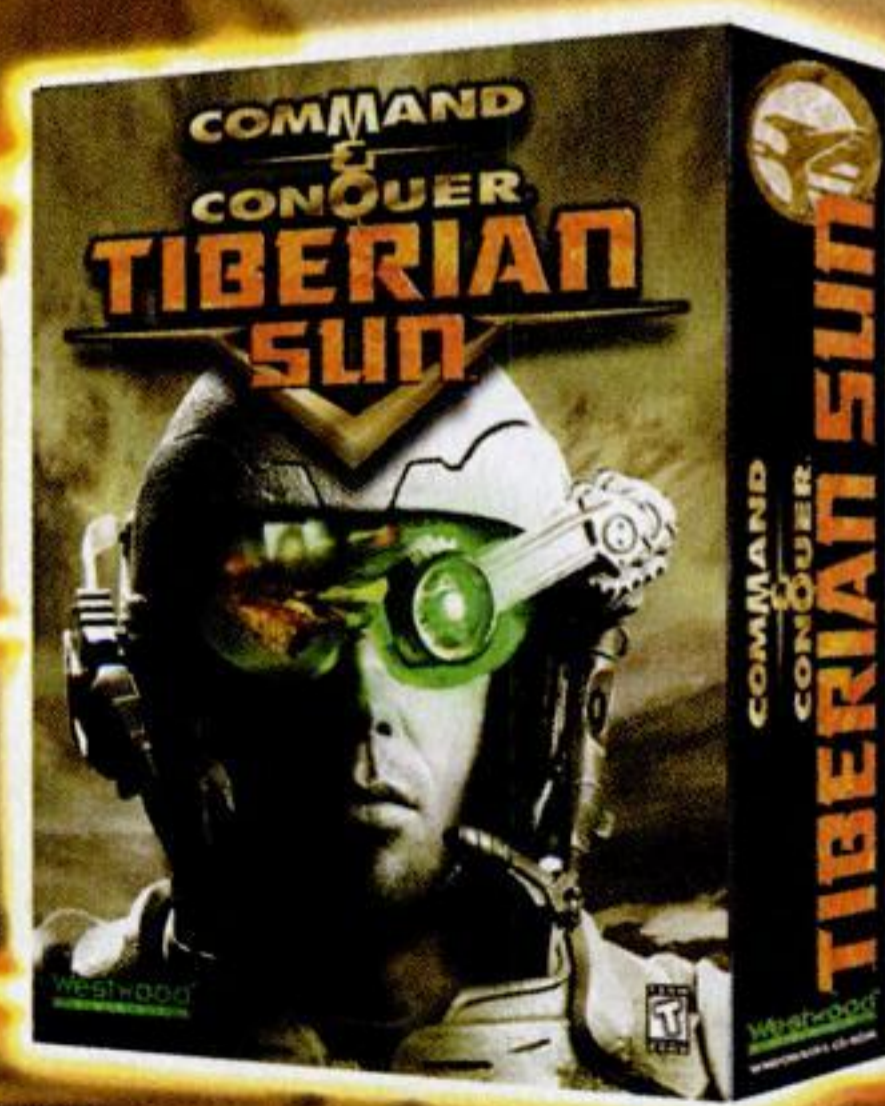
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mobo down-10

BY GORDON UNG

Your motherboard dictates the configuration of your entire system—so it's time to learn how it affects every upgrade you'll ever make.

Quick, what's the most important component in your computer? The CPU? Videocard? Hard drive? Nope, none of the above.

The most important component is actually the motherboard, which holds the right of refusal to all future upgrades. Want to swap your old PCI videocard for a no-excuses TNT2 or Voodoo³ 500? You can't do it if your motherboard doesn't support AGP. Want to add more memory? You may not be able to unless you get permission from mommy.

Indeed, at some point everything in your PC is connected to the motherboard. Choose the wrong board, and you'll find yourself with a prematurely obsolete computer. Choose the right board, and you'll give yourself room to grow for years. In the next few pages, we tell you everything you need to know about choosing the right mobo—whether you want to build the perfect PC from scratch, or are looking for a pre-fab PC that contains a board that's ready for expansion. We also review a smattering of motherboards available today.

If you haven't built a computer since the days of the 486 processor, you'll find that today's boards offer many pleasant surprises. Once-optional items such as [EIDE](#) and [USB](#) support come with every modern motherboard. Likewise, any motherboard worth its salt comes with a minimum of three [DIMM](#) slots for memory upgrades. Other great options include onboard [Ultra2 SCSI](#) support (for blazing-fast hard drive performance), onboard 10/100 Ethernet support (for high-speed networking), and onboard sound. All these soldered-on components preclude the need to consume precious PCI slots when it comes time for those inevitable upgrades.

Before we jump head-first into the motherboard miasma, you should be familiar with *Maximum PC's* lengthy synonym list. At any given time, we will use the following words as substitutes for "motherboard": mainboard, mobo, mommyboard, mommy, muddaboard, and placa madre.

And if a board is old enough, it may also be referred to as a "grannyboard."

CHIPSET: NORTHBRIDGE

Your core-logic chipset directs traffic for all system buses and devices, determines what you can and cannot connect to your mobo, and is divided into two parts. The chipset's northbridge chip controls traffic for your PC's high-priority hardware—memory, PCI cards, AGP card, etc. The northie also determines your AGP version, as well as memory type, speed, and amount.

PS/2/USB/ PARALLEL/SERIAL

Your plumbing to the outside world. I/O support is fairly reliable in most motherboards and not worth fretting about—just make sure you have a full set of ports.

LAN

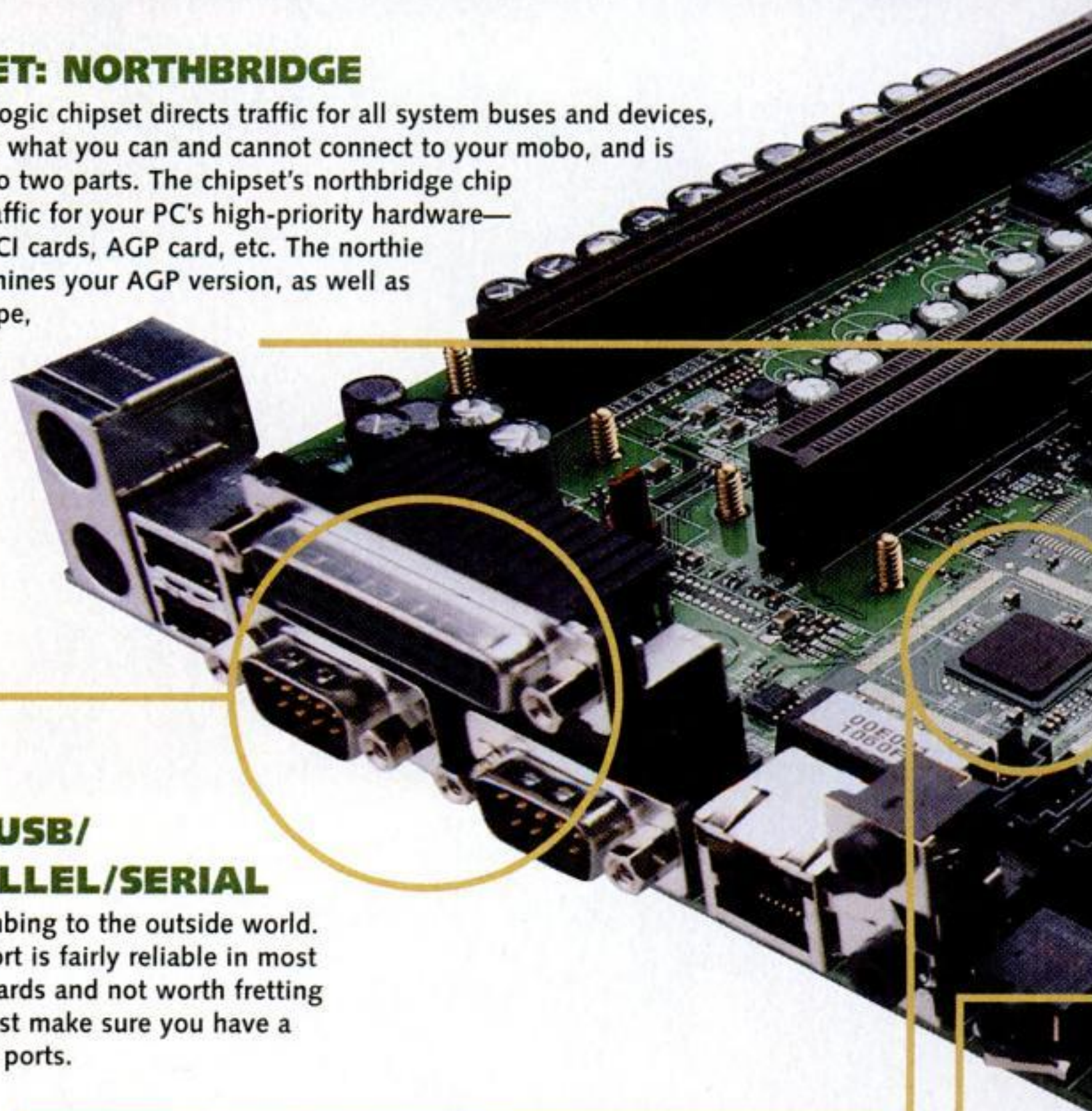
An Intel 82559 10/100 Ethernet controller adorns this board, for ultra convenience. What's the main reason to include a [NIC](#) onboard? To save PCI slots. And, because motherboard manufacturers will pay far less than what you will for a NIC, you may save some money in the long run (you'll need a NIC for [DSL](#) service, for example).

SOUND

Like an onboard NIC, onboard sound is convenient, and saves PCI slots and money. But be conscious of what onboard sound chip you get. PCI-based chips will generally offer better performance than ISA-based chips. Most of the sound chips soldered on motherboards don't come close to "true PCI soundcards" (à la the Sound Blaster Live!) in the amount of features offered. However, if you don't care about [3D positional audio](#), Sound Blaster 16 compatibility will be enough.

Up Close & Personal:

Pictured here is the Tyan Thunderbolt. See page 72 for a full review.



MEMORY SLOTS

In this pre-Rambus era, most desktop-level motherboards use 3.3-volt, 168-pin Dual Inline Memory Modules—affectionately known as DIMMs. While you can still find combo boards that also use older 72-pin SIMMs, we recommend that you stick exclusively with DIMMs for higher performance (plus, mixing memory is a dubious proposition). And don't assume that four DIMM slots means you can jam in four 128MB modules for an easy half-gig of memory. Some mobos provide four slots to allow for maximum flexibility in DIMM sizes, but may not support 128MB in each slot. Finally, Rambus RIMMS will not be compatible with old DIMM slots.

EIDE INTERFACE

This bus interface connects your EIDE drives to your motherboard. Almost every mobo available supports up to four EIDE devices. If your EIDE bus offers only ATA/33 support, your drives will hit a 33Mbps throughput ceiling during sequential reads, which pack your drives' read buffers with a steady stream of data. ATA/66 support increases the ceiling to 66Mbps, but currently only appears in the Whitney 810 chipset and some Athlon chipsets. Of course, ATA/66 on your mobo is irrelevant if you don't also have an ATA/66 drive.

SCSI INTERFACE

Some high-end mobos come with onboard SCSI support, which saves you the trouble of installing a PCI-based SCSI controller if you go with SCSI hard drives. While ATA/66 rivals SCSI in terms of sequential read speeds, SCSI offers multithreading, command tag queuing, and connect/disconnect.

CMOS BATTERY

This little nubbin powers the CMOS chip that houses all your BIOS information. We're talking configuration settings for drive types, port speeds, time, date, and other system particulars. Because this info is so vital to booting your system, it needs its own independent chip and power source, to protect your PC from the vagaries of hard drive crashes and power failures.

CHIPSET: SOUTHBRIDGE

Like any Boston street hooligan, this southie controls all the action on the other side of the train tracks—blue collar tasks such as hardware monitoring, and directing EIDE, serial port, and parallel port traffic.

ISA SLOT

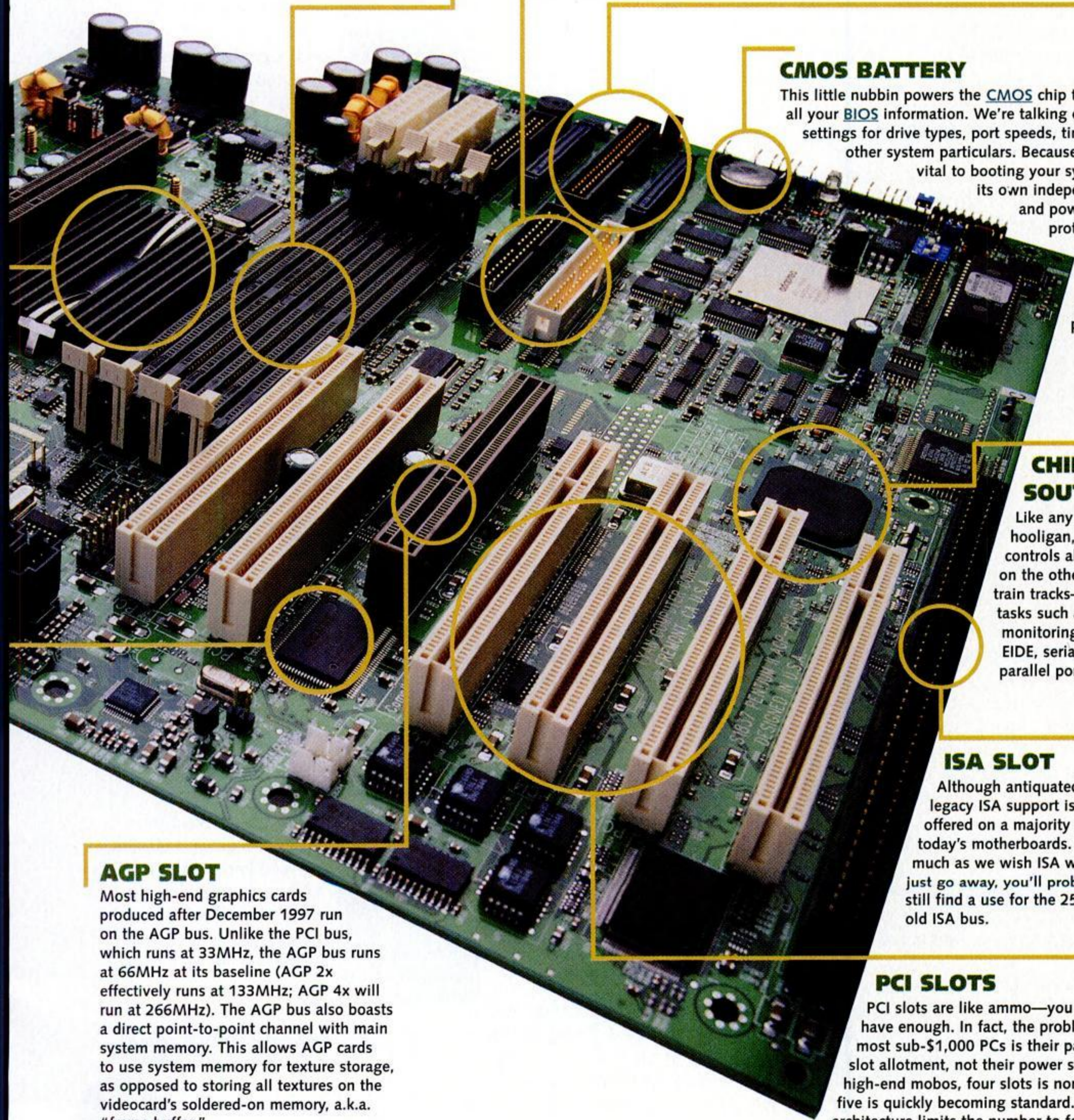
Although antiquated, legacy ISA support is still offered on a majority of today's motherboards. As much as we wish ISA would just go away, you'll probably still find a use for the 25-year-old ISA bus.

PCI SLOTS

PCI slots are like ammo—you can never have enough. In fact, the problem with most sub-\$1,000 PCs is their paltry PCI-slot allotment, not their power specs. On high-end mobos, four slots is normal, but five is quickly becoming standard. The PCI architecture limits the number to four before resorting to extra circuitry to support more slots.

AGP SLOT

Most high-end graphics cards produced after December 1997 run on the AGP bus. Unlike the PCI bus, which runs at 33MHz, the AGP bus runs at 66MHz at its baseline (AGP 2x effectively runs at 133MHz; AGP 4x will run at 266MHz). The AGP bus also boasts a direct point-to-point channel with main system memory. This allows AGP cards to use system memory for texture storage, as opposed to storing all textures on the videocard's soldered-on memory, a.k.a. "frame buffer."



HOW TO PICK THE PERFECT MOTHERBOARD

What would be the mother of all motherboards? How about a board with 12 PCI slots, six ISA slots on a bus that doesn't slow down the rest of the system, and dual AGP slots, so we can begin running our favorite 3D cards in scanline-interleave mode? We'd also like eight memory slots with simultaneous support for PC133 SDRAM, Direct Rambus, and DDR RAM.

Of course, such a fanciful beast doesn't exist, and because of technical, political, and marketing reasons, it never will. So when it comes to picking a motherboard, you need to determine your "must-have" features, then find a board that includes everything you need for a price you can afford. Factor in how long you think the technology soldered onto the board needs to remain viable, and your buying questions will answer themselves.

There are really three levels of motherboards to pick from. The bottom level is defined by integrated wonders such as DFI's PW-65-D, which includes bare-bones audio, video, and modem functionality right on the PCB. This is what you want when building a simple PC that you never, ever intend to upgrade. Just plug in your drives, memory, and CPU, and you're good to go.

Most budding system hackers will want to start with a mid-level mobo that features a single processor slot, basic EIDE hard drive, I/O support—and nothing else. With PCI slots aplenty, motherboards such as the Abit BX-6 R2 and FIC PA-2013 will let you tailor your machine to your personal video/sound/modem requirements, while giving you the best bang for your buck.

On the high end, you'll find überboards like the Tyan Thunderbolt. A massive mobo with two Pentium II/III slots, built-in NIC and SCSI support, and six PCI slots, the Thunderbolt is geared for NT workstation duties. Nonetheless, a lot of extreme home users like the Thunderbolt because it's a great hedge against obsolescence: The dual CPU slots prepare you for the time when a consumer OS supports multiprocessing in games; the NIC is ready to go when DSL arrives on your block; the SCSI channel is perfect for the jump from EIDE to SCSI hard drives; and six PCI slots let you go nutty with add-on cards that have yet to be invented.

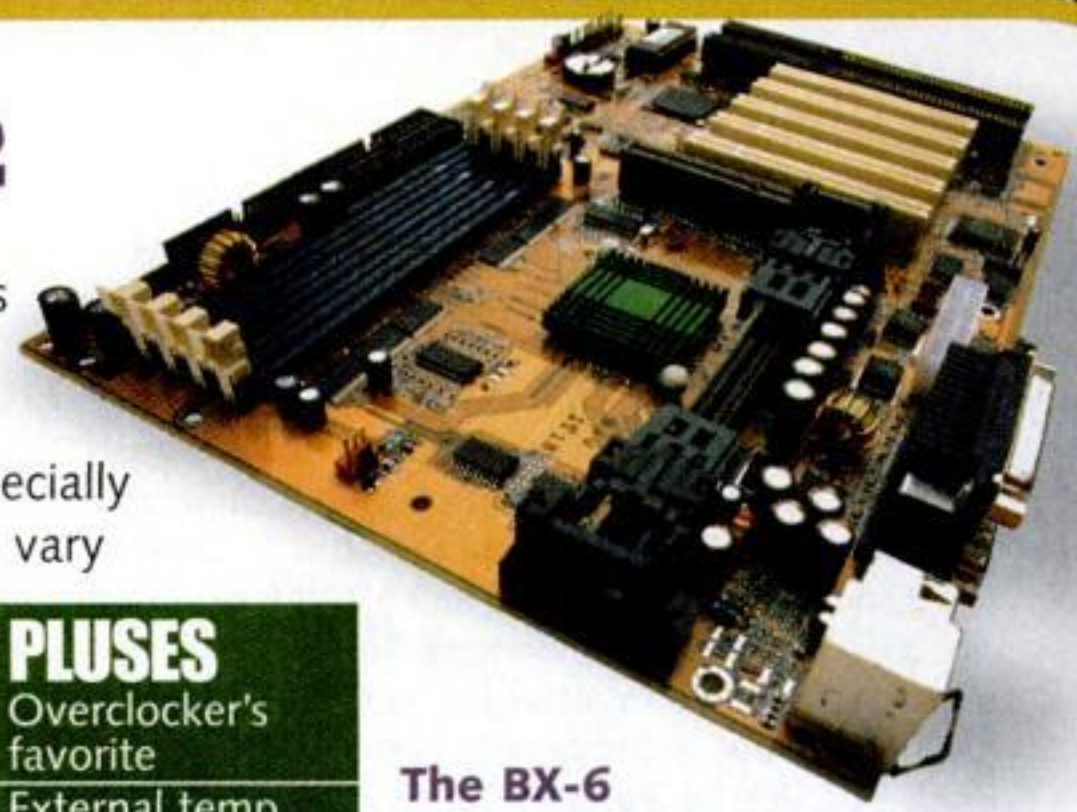
When buying any mobo, consider the following:

PCI SLOTS If you're still complementing your 2D/3D videocard with two Voodoo² boards running in SLI mode, you're going to need lots of PCI slots for your other add-ons. Even if you get a six-slot board like the Tyan Thunderbolt or the Asus P3B-F, you'll still only have three slots left for miscellany like an MPEG-2 decoder card, soundcard, FireWire card, or ATA/66 controller. Remember that the mobo will use a PCI-

Abit BX-6 R2

The BX-6 R2 is the latest in a long line of power-user boards from Abit. Boasting five PCI slots and four memory slots, the BX-6 has a feature we especially love: a softBIOS that'll let you vary your CPU's voltage to the point of frying your machine. With those kinds of safeguards disabled, you know you're ready for some action! Coaxing extra power from a Celeron 300A, the Abit performed like a champ during overclocking, going up to 450MHz. We even clocked our 400MHz P-II up to 448MHz for kicks. Benchmarks were excellent overall, and Abit includes a way-cool tethered temperature probe.

Although it swallowed every PCI card without gagging, the BX-6 threw us exception errors when we filled all four DIMM slots. We originally assumed the problem was related to our individual board, but we reproduced the problem on another BX-6 R2.



PLUSES
Overclocker's favorite
External temp probe

MINUSES
Didn't like Micron RAM

The BX-6 offers soft jumpers that'll let you fry your circuits at will!

Although Abit owners have reported problems between memory and TNT cards, we surmise that our boards were allergic to our Micron RAM (none of the other mobos tested had problems with this memory). The BX-6 functioned fine when we didn't fill all its RAM slots.

MAXIMUM PC VERDICT

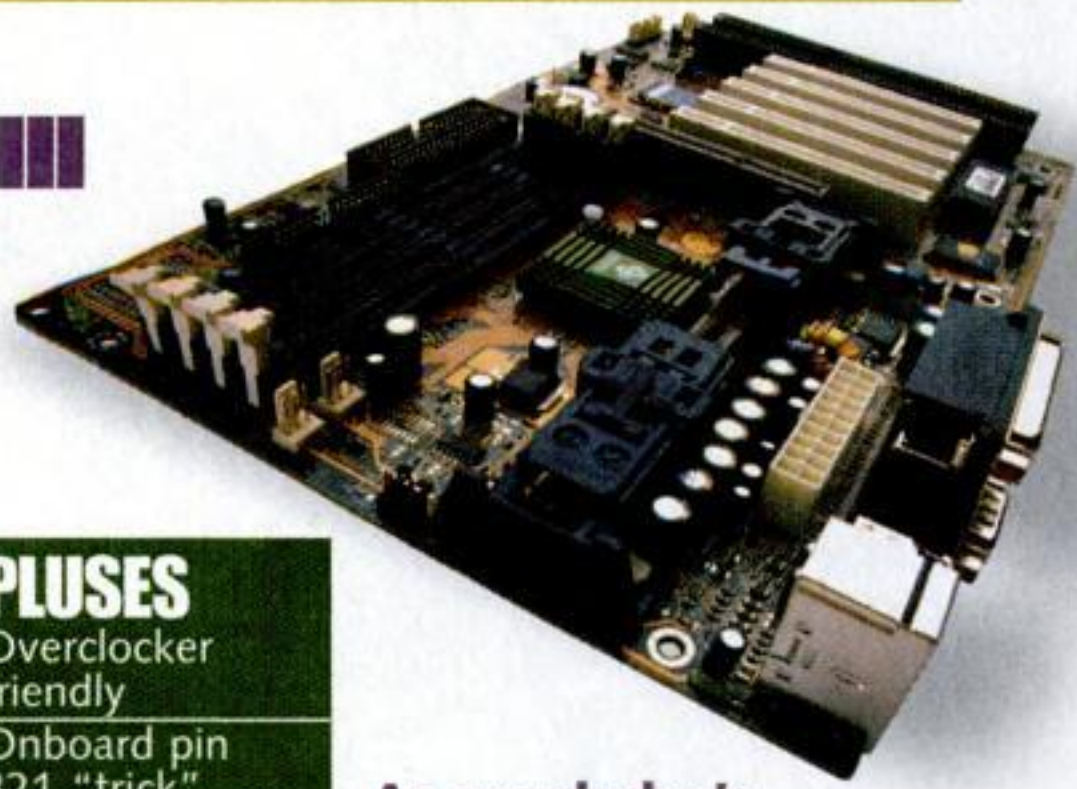
Price \$125
Company Abit
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URL www.abit.com.tw



Soyo SY6BA+III

The SY6BA+III is a sleeper board that'll grab your gonads and hang on. It looks like another wannabe BX-6 clone, but Soyo's engineers tricked out the BIOS in ways we haven't seen before. You get full details on your CPU, and "math assistance" that tells you, for example, that 66x7 equals 462MHz. Isn't it nice to know your new speed before you overclock? Soyo even includes onboard hardware support that replaces the "tape over pin B21" trick. (This hack can disable overclocking-prevention measures that Intel hard-wired into some Pentium IIs.)

Core CPU voltage can be increased, but only by percentages of base voltage, not by decimal points. And core voltage cannot be lowered. PCI speeds are set automatically; user control over the PCI clock would certainly be a plus. But who's



PLUSES
Overclocker friendly
Onboard pin B21 "trick"
Power LED
No compatibility issues

MINUSES
Power-supply connector placed awkwardly
Memory slots too close to AGP slot
Needs more voltage settings

An overclocker's best friend, the SY6BA+III edges out the BX-6.

complaining? Soyo even includes a power LED that lets you know when it's OK to unplug system components. Abit used to lead the hardcore crowd, but the SY6BA+III edges out the BX-6 R2.

MAXIMUM PC VERDICT

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to-PCI bridge chip to exceed the four-PCI-slot limitation, and some add-on cards may have problems when running in the fifth and sixth slots.

BOARD LAYOUT That \$49 motherboard may look good in the store, but pay close attention to where the designers placed components. Did they place a capacitor in the way of your extra-long videocard? Is the power connector so close to the CPU, your fan-cooling solution won't clear it? Look at the board layout, and think about the components you'll be plugging in.

RTFM Great documentation will make your upgrading projects much easier. Don't get stuck with a no-name motherboard that has an inadequate manual. Make sure the manual is on the manufacturer's web site before you buy the motherboard. Most class acts will publish the full manual in Acrobat PDF format. If the manual isn't online, the manufacturer is probably too ashamed to publish it.

SUPPORT *Maximum PC's* Watchdog gets many complaints about motherboard vendors. Usually, the complaints concern unresponsiveness or a complete lack of support. The reality is this: Don't expect any help from mobo companies. These manufacturers generally don't make components to sell directly to the masses; they sell parts to dealers and distributors, who then bear the brunt of support issues. Although many mobo companies will help you replace a dead-out-of-the-box board, getting anything more out of them is a victory indeed.

Make sure you purchase your motherboard from a reputable dealer. In fact, buying from your local PC store may be the best option. Instead of dealing with the hassle of returning a board to an online vendor, you can trot downtown and say you wanted an ATX motherboard, not an AT.

AT OR ATX? AT boards hail from the stone-age of PC history. AT uses a large DIN keyboard connector and requires you to plumb external I/O hookups for PS/2 mice, USB, serial, and parallel. Unless you're in love with that old server case you've had for years, we recommend that you ditch the AT case/mobo paradigm in favor of the modern ATX spec.

The ATX spec redesigned the power connector, power supply, and case, and reconfigured where components are placed on the motherboard. ATX concentrates all external I/O into a single rectangular block that comes out the back of the case. ATX also allows the operating system to turn the computer's power supply off during shutdown.

We recommend shying away from the odd-duck NLX and LPX formfactors. Both employ modern amenities à la ATX as described above, but because they're designed to be "space-efficient," (that is, to fit inside pizza-box-sized cases), they may limit your ability to upgrade down the road.

CHIPSET The most important factor in your motherboard choice will boil down to the chipset

Intel SE440BX-2

After driving Soyo's SY6BA+III around the block, Intel's SE440BX-2 "Seattle" seemed as sedate as a white, four-banger Ford Taurus. What can we say? The Seattle's Award BIOS screen is barren of user-configurable options. Its four PCI slots and three DIMM slots also put the Seattle in second place in terms of expansion capabilities. And this safety-conscious board wouldn't even let us overclock the Celeron 300A!

What the SE440BX has going for it is reliability. Used by almost every top-tier PC maker in the world, the Seattle has a solid reputation for taking a lickin' and keepin' on tickin'. Onboard sound support is delivered by a Yamaha PCI chip, which was easily disabled to make room for our Sound Blaster Live!. The Seattle posted and functioned fine in our compatibility test and offered performance on par with the rest of the BX-based lot.



PLUSES

Reliable performance

MINUSES

No-frills BIOS
Downright dull

Intel mobos are as reliable as Jimmy Stewart—and about as sexy as Stewart in a sheer black nightie.

Safety-conscious system integrators will want to reach for Intel, but those with an eye toward upgrading should pass on the SE440. The BIOS options are just too conservative.

MAXIMUM PC VERDICT

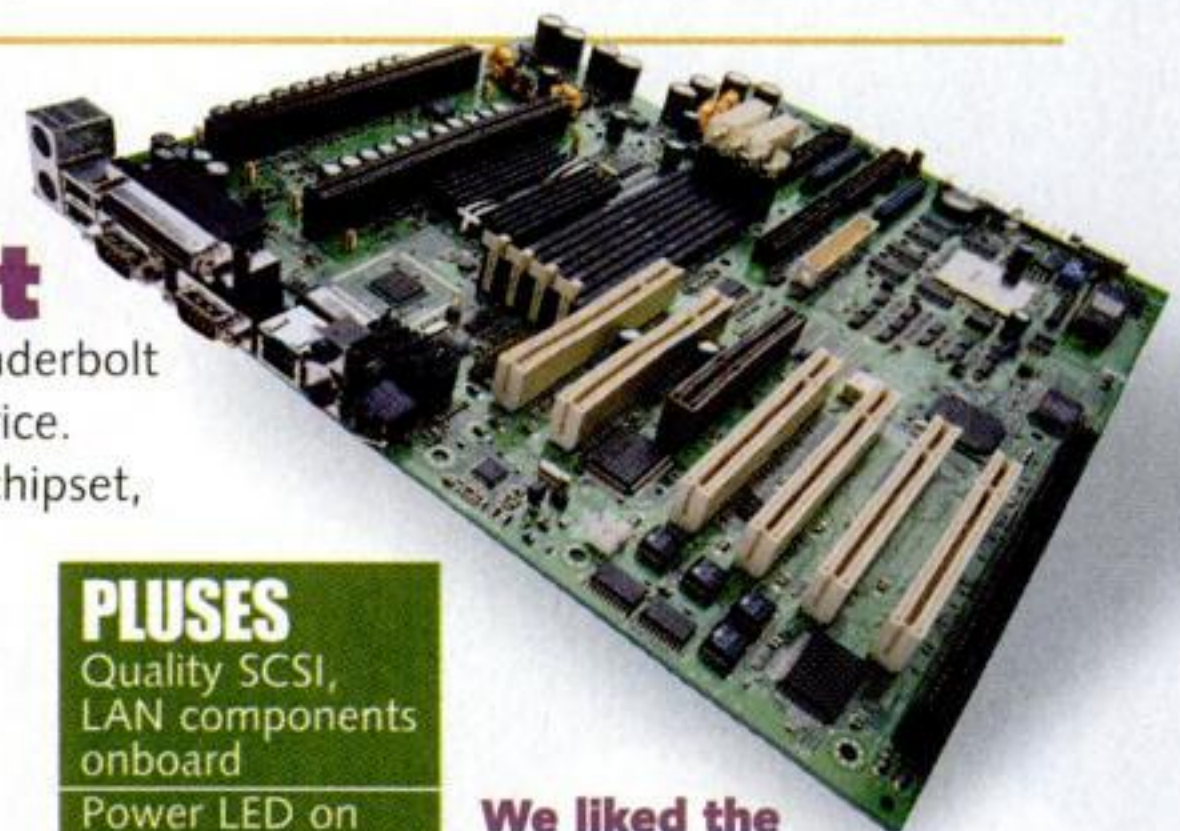
Price \$125
Company Intel
Phone 408.765.8080
URL www.intel.com



Tyan Thunderbolt

In features alone, the Thunderbolt is almost worth its hefty price. Based on Intel's GX Xeon chipset, the Thunderbolt includes two Slot 1s and supports up to 2GB of SDRAM. The board gives you an Adaptec Ultra2 Wide SCSI controller with support for LVD, as well as 10/100 Ethernet support on an Intel chipset. The only part Tyan skimped on is the Ensoniq-based sound chip. It's only good enough for government work, but we were able to disable it by throwing a jumper.

The Thunderbolt allows for major bus-speed tinkering, and we've always had great overclocking success with it, but we couldn't get our Celeron 300A to run Windows. Multipliers will theoretically take a CPU to 8.0x100MHz, however, and there's enough pages of BIOS options to keep you experimenting for days. Keep in mind that you'll need



PLUSES

Quality SCSI, LAN components onboard
Power LED on mobo

MINUSES

Not best in overclocking

We liked the GX-powered, six-PCI slotted Thunderbolt so much, we stuffed one inside Extreme Machine 99.

Windows NT or 2000 Professional to run two procs (for the scope of this article we didn't test dual-proc performance). This thing has so many PCI slots, we actually had trouble filling all six! The Thunderbolt is our pick for big mofo mobo needs.

MAXIMUM PC VERDICT

Price \$539
Company Tyan Computer Inc.
Phone 510.651.8868
URL www.tyan.com



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and what it supports. The chipset decides what kind of CPU your mobo can accept, how the video-card talks to the CPU, and how data is transferred from the hard drive to RAM. If your chipset doesn't support new features such as AGP 4x (for next-gen videocards), ATA/66 (for next-gen EIDE hard drives), or faster memory like Direct Rambus or 133MHz SDRAM, you'll have to buy another motherboard to remain up-to-date in the new millennium. Intel's 820 chipset, AMD's 750, and VIA's KX133 all promise next-gen features.

With all these treats on the horizon, it's difficult to recommend purchasing older chipsets (such as Intel's BX) except for one thing: compatibility. Out the gate as a rock-solid chipset, the BX has proven itself to work with most hardware—and who knows if upcoming chipsets will offer pristine compatibility. When buying a fully integrated system from a big-

MAKE SURE YOUR PRE-FAB SYSTEM HAS THE RIGHT MOBO

name OEM, you still need to care about the motherboard stuffed inside it. Does the board support future upgrades? Before you get "iMac'd," consider the following.

CPU SUPPORT If you plan to upgrade your CPU, will the mobo support faster, newer processors? Many Celeron mobos that featured the first version of the 810 chipset, for example, do not support Pentium IIIs.

THE MULTIPLIER What's the highest multiplier the board supports? The answer is important in the event you decide to upgrade to a faster CPU. For example, if your 450MHz P-III system is set out the gate at 4.5x100MHz, you want to make sure you can set the multiplier at, say, 6.5x100MHz to stuff in that 650MHz proc you're looking forward to. The multiplier also affects your overclocking opportunities.

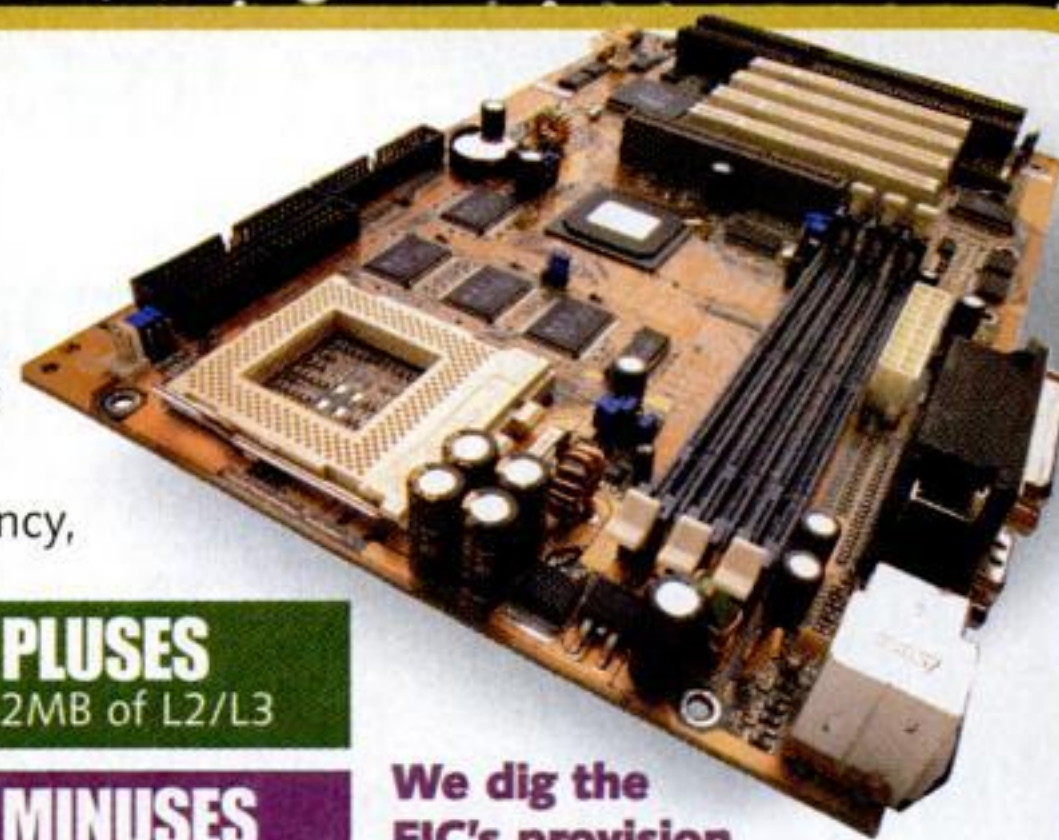
MEMORY SUPPORT What kind of memory does the mobo support? Will it support an upgrade from 100MHz SDRAM to 133MHz SDRAM (upcoming VIA chipsets will support both speeds). Does the mobo support error correction? If you're running a server, you may need ECC (Error Correcting Code) support, which corrects single-bit errors and detects multi-bit errors.

CHIP DISABLING Can onboard sound and video chips be disabled? Unfortunately, some onboard graphics and sound chips don't shut off without a fight—which is a problem when you add in your superior PCI and AGP cards. When buying a system, specifically ask if you can shut down onboard multimedia chips, and tell the clerk you'll return the computer if you run into problems.

FIC PA-2013 R2.0

Firing up FIC's Super 7 PA-2013 made us remember what we didn't like about the old days. To make any bus, frequency, or voltage changes, we had to hunt for jumpers on three different parts of the PA-2013. We also had to load no less than three patches to get Windows 98 running. But once it was up, the PA-2013 was a champ.

With 2MB of L2 cache onboard, the PA-2013 effectively gives you three levels of cache when coupled with AMD's K6-III CPU (the 2MB of L2 miraculously transforms into L3). Our 450MHz K6-III proved to be swift on several benchmarks—even when the 450MHz was underclocked to 400MHz! With its VIA MVP3 chipset, the PA-2013 also glided past our compatibility tests with nary a problem. The only negative we noted was slow memory transfer speeds on the *STREAM* test. This didn't seem to affect overall performance, however.



PLUSES
2MB of L2/L3

MINUSES
Jumper Hell

We dig the FIC's provision for L3 cache, but hard jumpers? Still, it's not a bad board if you're going the old Socket 7 route. Just make sure you plug in an AMD K6-III.

Even though AMD doesn't limit overclocking, we couldn't get the K6-III to overclock. Experience tells us to lay the blame on our CPU.

MAXIMUM PC VERDICT

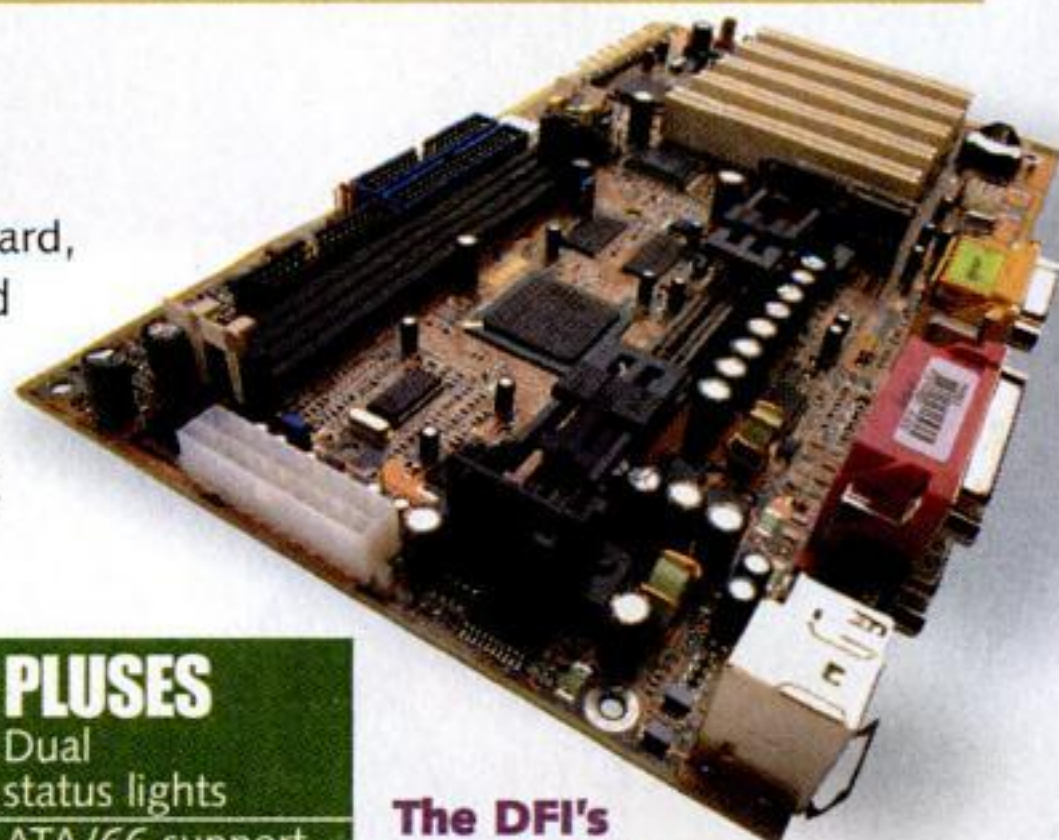
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8

DFI PW65-D

For an all-in-wonder motherboard, DFI's PW65-D is a leap forward over sucky integrated competitors. Based on Intel's 810 Whitney chipset, the DFI is not officially sanctioned to run the Pentium III, but DFI "guarantees" it'll work. Indeed, we experienced no problems with this Revision A3 board. It ran Celerons and P-IIIs as expected, and even a P-III.

The PW65-D comes with 4MB of video memory to give a boost to its Intel i752 graphics controller, which is integrated in the Whitney chipset. But even with the extra memory, the board's graphics pale when compared to today's state-of-the-art 3D acceleration. Still, the PW65-D is designed for people who don't want to mess with upgrading. The mobo turned in OK scores in our DirectX and OpenGL gaming benchmarks, and passed



PLUSES
Dual status lights
ATA/66 support
No ISA

MINUSES
Welded-on video

The DFI's integrated video will slow your games to a crawl—but you have to love ATA/66 support and a PCB bereft of ISA!

our compatibility tests without problems. Here's a thought: Buy this board for your car's new dedicated MP3 player.

MAXIMUM PC VERDICT

Price \$90
Company DFI Inc.
Phone 510.623.5010
URL www.dfi.com

7



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chipset CHA-CHA

1998

Here's a brief primer on modern motherboard chipsets—recent past, immediate present, and near future.

•INTEL 440BX

The BX brought us full 2x AGP speeds, ATA/33 support, and a 100MHz frontside bus. It can address up to 1GB of buffered memory, or up to 512MB of more conventional unbuffered SDRAM. The BX supports most of Intel's product lineup from the 266MHz Celeron to the 600MHz Pentium III, and all speed grades of the Pentium II.

•INTEL ZX

Intel's original ZX chipset, later renamed ZX-66, got a bad rep in spades. PC enthusiasts skipped its limited 66MHz bus for full-on BX boards. A second version of the ZX, the ZX-100, offers full 100MHz bus support. Both versions support a maximum of 256MB of SDRAM. Though marketed as a Celeron chipset, ZX-100 also supports Pentium III.

•INTEL 810

The initial version of Whitney wasn't "compatible" with Pentium III CPUs. Intel downplayed the matter by saying the chipset was intended only for the Celeron. Several modifications later, motherboard makers say the bugs are gone and 810 works fine with P-IIIs (although without an official endorsement from Intel; Intel does have plans for an "810E" version that will be P-III approved). 810 is the first chipset to completely dump the ISA bus and is the first Intel chipset to include ATA/66 support. Its fatal weakness may be its integrated i752 video.

•VIA APOLLO PRO

Checking in as the first chipset to support a 133MHz frontside bus, the Socket 7-lovin' Apollo Pro flips the big bird at Intel. The chipset also grooves with ATA/66 support and a 1.5GB SDRAM maximum.

•INTEL 820

Available (we hope) in September, Camino will support breakthrough technologies such as AGP 4x, ATA/66, a 133MHz frontside bus, and Direct Rambus memory, and pounds the nail in the coffin of the ISA bus. If all goes well, this chipset will carry us well into the new millennium and command the most powerful Intel PCs available.

2000

•AMD 750 IRONGATE

This is AMD's first in-house chipset in many years, and comes very close to Intel's 440BX, feature for feature. It sports AGP 2x, and supports 100MHz SDRAM—on its superfast, 200MHz memory channel.

REAL-WORLD testing

HOW TO BREAK A MOBO'S SPIRIT

Sure, motherboards are more reliable than ever, but the awful truth is that no system component—even the mother of all system components—is a paragon of compatibility. Any given mobo might have an allergic reaction to any random add-in part, so we performed stringent compatibility testing with all the boards in this roundup.

Every motherboard received a gamut of persnickety add-in parts. Available slots permitting, we shoved

in an STB nVidia TNT 1.10 AGP card, a Creative Labs Sound Blaster Live!, a Diamond Shotgun dual V.90 modem, a 3Com Ethernet 10/100BaseT NIC, and dual Diamond Voodoo² boards. We also jammed in a Logitech USB mouse and a Storm Technology USB scanner.

Although Storm Technology is gone from this planet, its drivers are one of the few embedded USB drivers in Windows 98. Many add-in cards—

mobo COMPARISON



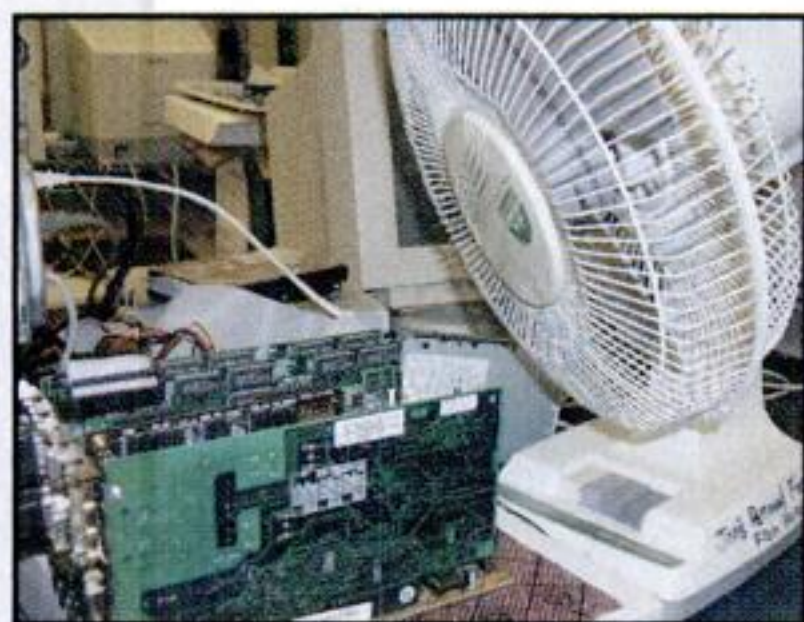
DARE TO COMPARE

FEATURES		SOYO SY6BA+III
PCI/ISA Slots		5/1
DIMM Slots/Max RAM		4/1GB
IDE		Ultra ATA/33
AGP		2x
Chipset		Intel BX
CPUs Supported		P-II/P-III/Celeron
BENCHMARKS		
Expendable (frames per second)		26.8
Quake II (frames per second)		36.1
Final Reality AGP Test (frames per second)		39.28
STREAM 2.0	Copy 32	252.96
	Copy 64	253.97
	Scale	259.11
	Add	300.94
	Triad	239.40
bootMark		196.0
Overclocking		Pass

recommendations

best
OVERCLOCKER'S
board

While you can't go wrong with the BX-6 R2, we picked Soyo's SY6BA+III as the best all-out tinkering board. Both boards have strengths and weaknesses, but the Soyo's extra-feature-rich BIOS settings and ability to handle every piece of RAM we threw at it gave it the edge.



Gordon stole "Jon's Personal Fan From Home" to throw a breeze on this steaming pile of goo. Pssst: It doesn't really work.

from the primordial TNT board to the Sound Blaster Live!—are notoriously hard on mild-mannered motherboards. All cards were run with the latest drivers available. We also loaded each machine with four 32MB sticks of Crucial Technology memory.

Essentially, we did our best to fill every available slot with silicon and then watched to see if anything broke (compatibility aside, some

mobos simply can't handle a full electrical load). If anything did break, we mentioned it in the individual mobo reviews.

After compatibility tests, we ripped out all the sundry add-ins, and began performance testing. The Slot 1 mobos were tested with a 400MHz P-II, 128MB SDRAM, Quantum Fireball Plus KA hard drive, STB nVidia TNT videocard, and no add-in soundcard (the DFI board was tested with its own i752 graphics controller enabled). The FIC Socket 7 board was tested with the same config, but we used a K6-III 450MHz.

We ran our two standard gaming benchmarks at 1024x768 to uncover disparities among the boards in overall gaming performance. We found no differences. Our *Final Reality* AGP test stuffed 16MB textures through the motherboard to gauge relative AGP strength. Again,

all the mobos—except the FIC board, which benefited from a faster CPU—performed similarly in this framerate test.

We cast about for a good memory performance test and found *STREAM* (www.cs.virginia.edu/stream), a DOS-based app that pumps megas of data through the frontside bus and measures the board's memory bandwidth in megabytes per second. *STREAM*'s five different tests perform various mathematical functions on the same piece of data to yield the bandwidth scores. For the sake of comparison, a 1997-era PC turned in averages of about 60MB/sec, while a Cray supercomputer averaged about 391MB/sec in the copy functions.

We finished our testing by seeing how well the boards overclocked, attempting to drive a Celeron 300A on a 66MHz bus to 450MHz on a 100MHz bus. ☘



**FIC
PA-2013 R2.0**



**INTEL
SE440BX-2**



**DFI
PW65-D**



**TYAN
THUNDERBOLT**



**ABIT
BX-6 R2**

	FIC PA-2013 R2.0	INTEL SE440BX-2	DFI PW65-D	TYAN THUNDERBOLT	ABIT BX-6 R2
	4/2	4/2	5/0	6/1	5/1
	3/768MB	3/768MB	2/512MB	4/2GB	4/1GB
	Ultra ATA/33	Ultra ATA/33	Ultra ATA/66	Ultra ATA/33	Ultra ATA/33
	2x	2x	2x (onboard video)	2x	2x
	VIA Apollo MVP3	Intel BX	Intel 810	Intel GX	Intel BX
	AMD K6-III, K6-2, K6, K5, Intel Pentium series, Cyrix 6x86, M-II, IDT WinChip	P-II/P-III/Celeron	P-II/P-III/Celeron (Intel offers no official support for R-III)	P-II/P-III (x 2) and Celeron Slot 1	P-II/P-III/Celeron
	23.9	25.9	20.7	26.0	26.5
	36.6	36.1	21.2	36.2	36.2
	45.98	39.45	4.52	39.31	39.28
	138.53	242.42	228.57	252.96	258.08
	137.04	259.11	223.78	243.35	253.97
	138.83	259.11	228.57	248.06	252.96
	149.30	329.90	265.19	277.46	306.71
	148.15	281.52	215.73	249.35	236.45
	233.8	192.1	191	194.2	193.2
	Fail	Fail	Fail	Fail	Pass

**best
SUPER 7
board**

If you're still living in the Socket 7 glory days, the PA-2013's 2MB of onboard L2 will make your monkey stand up and chatter. Sure, it still has jumpers spread to all corners of the PCB, but that's what Socket 7 lovers live for.

**best
WORKHORSE
board**

Sure, you can't overclock the Thunderbolt as easily as those welterweight mobos, but this baby is the Mike Tyson of motherboards. With its six PCI slots, dual Slot 1s, LVD Ultra2 SCSI, and 10/100 Ethernet, you can't ask for more. For serious work—not play—the Thunderbolt is our pick.

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-Maximum PC Jan '99

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Zippering Loose Lips

How can I find the password to my office manager's Hotmail account? Sometimes she will leave some e-mail in the temp file, and from what I can tell, she's giving out our confidential trade secrets to some of her contacts. For the benefit of my business, it is important for me to see what's going on. Is there any way to find her password or hack into Hotmail? I don't think she would give me her password if I asked her for it.

—Tito

It's generally acknowledged that employees have limited privacy in a workplace; employers may have the legal right to search a desk, locker, computer, and even a personal notebook or Palm Pilot if the item is being used in a work-related capacity. Does this extend to browser-based mail? It hasn't been settled as a legal issue, so you should definitely consult the company attorney before attempting to break into your office manager's Hotmail account. And from an ethical standpoint, I'm sure every employee of your organization would (and probably should) protest, quit, and burn you in effigy if you exercised the option to rifle through their personal communications.

However, if you have no heart and no scruples, there are a few tricks you can use that should achieve better results than nonchalantly dropping by her office to glance over her shoulder. Since you're already perusing her hard drive when she's not there, try installing *Invisible KeyLogger Stealth* (www.keylogger.com) on her PC to aid your data collection. It'll capture every keystroke she makes in Windows or DOS and record them to a log file you can dig through at the end of the day in search of her Hotmail password. Heck, you may not even need to break into her Hotmail account, since *Invisible KeyLogger Stealth* will capture every keystroke of the mail she's typing. The cool thing about this utility is that it doesn't show up in the task manager as a running program, so should she decide to see whether you've loaded something to snoop on her, she probably won't be able to find it.

Although there are Hotmail password hacks floating around the net, don't count on them working—many of the site's security holes have been patched. If she's running *Internet Explorer 5*,

you could simply use the built-in password caching to get into the mail account. You can also jump onto her machine after she's been in her Hotmail account; if she didn't log out, you'll be able to browse back to Hotmail and access the e-mail.

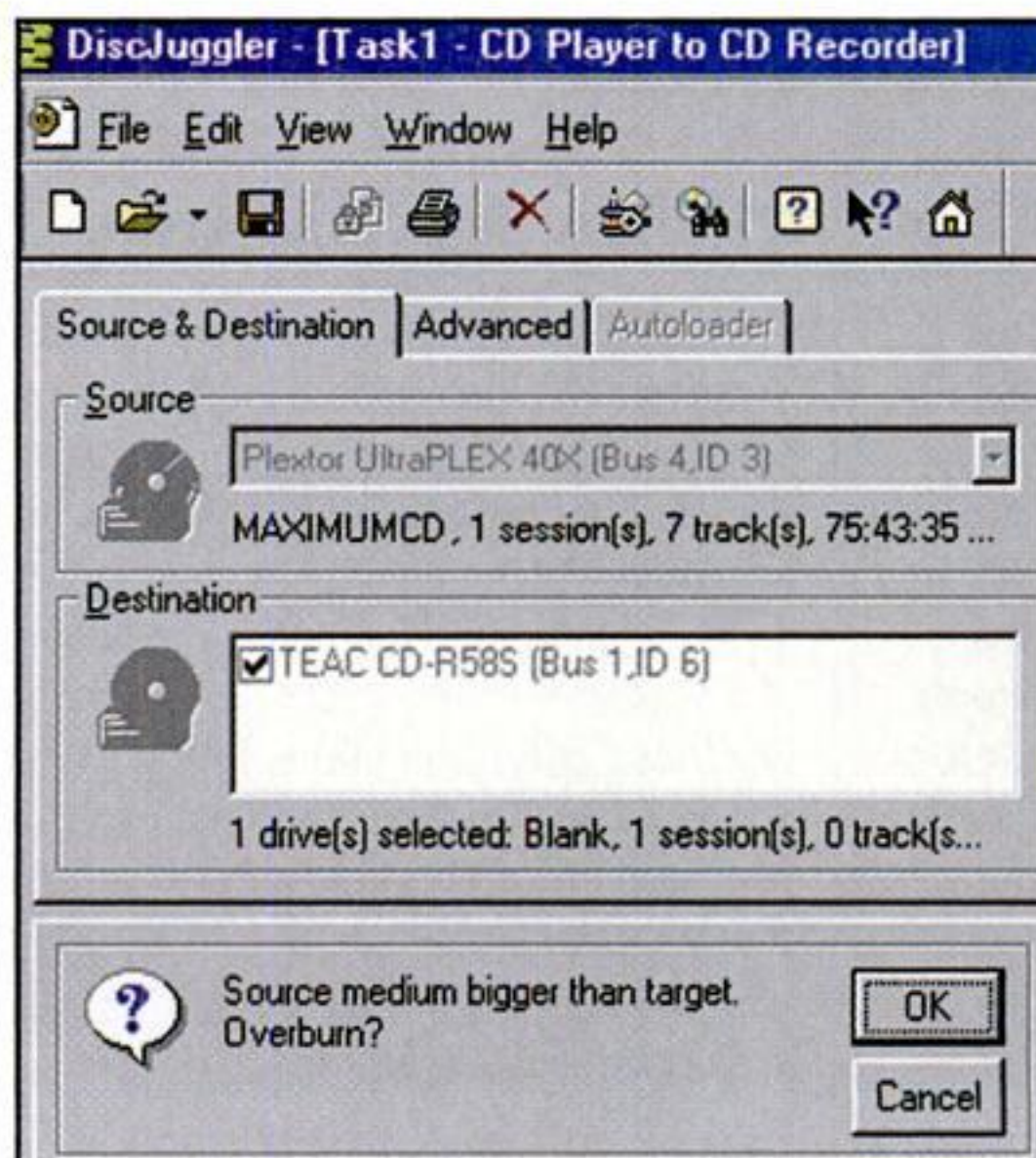
And don't rule out social engineering: Her password for Hotmail may very well be the same one she uses to log into NT, Novell, or voice mail. Try entering her birth date, the name of her significant other, kids, or pets, or her address or phone number as passwords. And then there's the super-tricky password: password. But be advised that with any of these scenarios, you may be going down a road you'll wish you had never taken.

Every employee of your organization would (and probably should) protest, quit, and burn you in effigy if you rifle through their personal communications.

Fill It to the Rim

I'd like to buy a CD-RW drive so I can back up and store files and games, but my friend told me that some games, such as *Star Wars: Phantom Menace*, require overburning to accurately copy. He said that overburning is writing more data onto a disc than the media is designed to hold. Are some CD-RW drives capable of overburning? If so, can I tell whether a specific drive is?

—Derek W.



If your CD-R drive supports it, DiscJuggler is a one of the few apps that lets you overburn a CD.

ASK THE

DOCTOR

This month:

- ▶ Digging up office dirt
- ▶ Deleting files indiscriminately
- ▶ CONFIG.SYS? We don't need no stinking CONFIG.SYS
- ▶ The overburning question

Overburning does indeed mean packing onto a CD more information than a standard piece of CD media is supposed to hold. With overburning, you can typically burn 79 minutes of data onto a regular 74-minute disc (depending on the manufacturer). We haven't seen any figures yet on how much you can pack onto any given manufacturer's disc, but they're sure to crop up soon.

Overburning really comes into play when the source disc is larger than the destination disc. Game manufacturers use this as an inexpensive copy-protection scheme, since most CD-R drives won't burn a disc larger than 74 minutes. Examples of titles that require overburning to copy are *Kingpin* and *Tomb Raider 3*. We haven't played around with *Phantom Menace*, although we don't doubt that it's also protected this way.

Since overburning is a relatively new feature to CD-recording software, only a few companies currently support it. Try out *Nero* from Ahead Software (www.ahead.com) or *DiskJuggler* from Padus (www.padus.com). Most other CD-recording software can burn onto 80-minute discs, but only if your CD recorder supports 80-minute media. The list of CD-R/RW drives that support overburning is too long to include here, but you can look for your recorder on the lists posted at Ahead's and Padus' web sites.

12-Step Fallout

Please help. I removed all unused protocols, adapters, and services in my network control panel, per Step 9 of your July 99 12-Step, and now my dial-up adapter won't save the password.

—Cyrus Ravage

The Windows "perpetually forgotten password" problem may not directly result from emptying the Control Panel of everything but the Dial Up Adapter and the TCP/IP protocol. It's a problem often exhibited by Windows 95 after the Password List Update is installed on top of Service Pack 1. It can be caused by password list corruptions, damaged dial-up-networking components, or list version differences. In the simplest of cases, creating a new profile via the Users control panel (or Profiles Control Panel, depending on your version of Windows) should fix the problem by generating a new password list file.

If that doesn't work, try reinstalling Client for Microsoft Networking in the Network control panel. Be forewarned—

this defeats some of the system pruning you just did in the 12-Step. If you choose this method, make sure Windows Logon is selected as your Primary Network logon in the Network control panel. With whichever fix you choose, leave the password field blank if you don't want to log on to your computer every time it boots up.

Just Say Yes

When I delete a batch of files or folders, Windows gives me a stupid warning about the files being an application, read only, system, or some such crap. One of the options is "yes to all," but in reality it doesn't work for all—it keeps asking me the same old question for every "dangerous" file. I have tried every conceivable Registry mod/hack, but with no luck. I just want to zap folders and files, be they system, read only, or executables, with no questions asked. Any solutions?

—Nicolas Nicolaou

We hate Microsoft handholding as much as the next guy, and we've attempted to obliterate all those annoying pop-up boxes from our PCs. But other than unchecking the delete confirmation box in the Recycle Bin properties, there isn't much you can do to get rid of Windows' irritating file-protection messages. All of those, "Are you absolutely, positively sure you want to delete this?" boxes cannot be removed using conventional methods. Those boxes are beyond the Registry, and require third-party software to be disabled. To pull this off by yourself, you'd have to perform a major hack on the Windows code. Good luck.

Where did Microsoft bury Tweak UI on Windows 98?

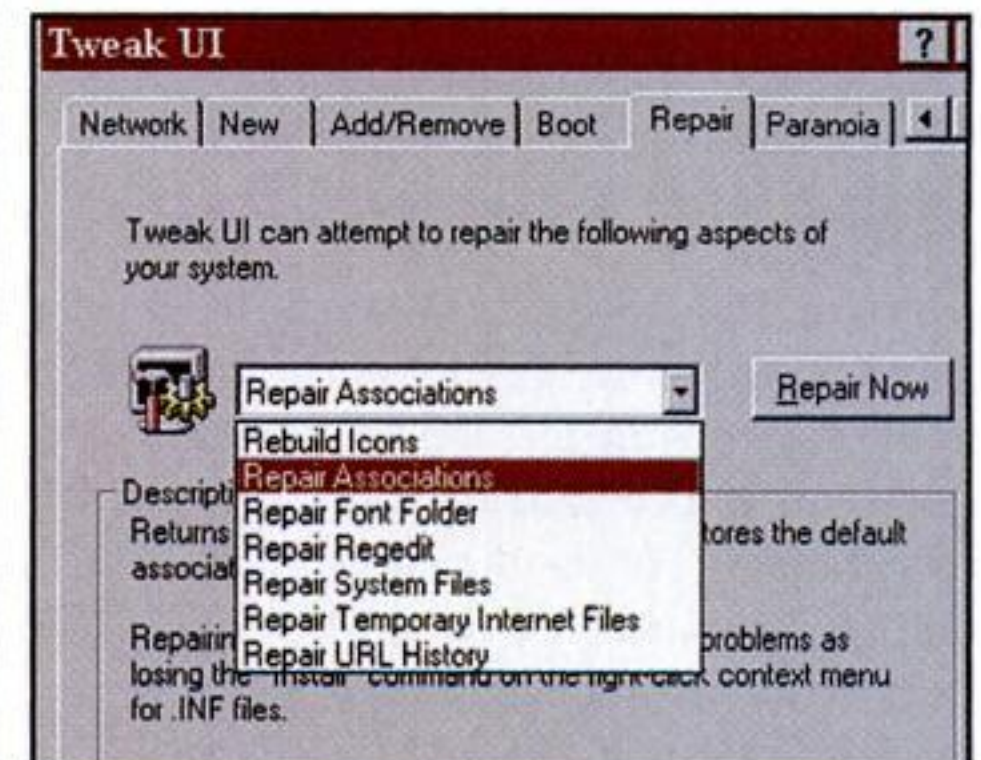
Twice As Tweaky

Where did Microsoft bury Tweak UI in Windows 98? Microsoft claims on its web site that Power Toys is supported only on Win95, but I'm sure I've heard it was hidden in Win98.

—Malayclipse

For those not in the know, Tweak UI is a super-swanky tool created (but not supported) by Microsoft that provides access to all kinds of interface mods. Using it, you can customize the boot-up process, automate your login, clean up the Add/Remove program listings,

permanently eliminate the arrows and the "Shortcut to" from new shortcuts, and even speed up the Start Menu. TweakUI is chock-full of handy little tweaks and well worth tracking down.



Besides being packed with all sorts of interface tweaks, Tweak UI also includes some handy repair tools.

While the version available on Microsoft's web site is intended solely for Windows 95, Win98 users need only look as far as the Windows 98 CD for the Win98 TweakUI tool. Just browse to the \Tools\Reskit\Powertoy folder and right-click on the TWEAKUI.INF file to install it into your Control Panel. For reasons known only to Microsoft, Tweak UI isn't available on the Windows 98 SE CD, but the old version works just fine with Second Edition. We're running it right now. Tweak, tweak.

Config.Dis

The lame computer company that built my system tells me that the AUTOEXEC.BAT and CONFIG.SYS files aren't necessary for Windows 98. This sounds to me like another boneheaded response from an underinformed tech-support representative. Set me straight on this subject.

—HumblePcUser

The tech support rep you talked to may be boneheaded, but in this case the bone is pretty damn sharp. That's right—in Windows 98 you don't need those two files at all. But you do need them for DOS, so we wouldn't recommend deleting them. AUTOEXEC.BAT and CONFIG.SYS are configuration files that DOS runs every time you boot your PC, telling it what programs should be automatically started, where to

look for all the important programs, and how your PC's memory is managed. If you want to read these files, go to Run under the Start menu and type "sysedit." You'll see both files pop up in a cascading fashion,

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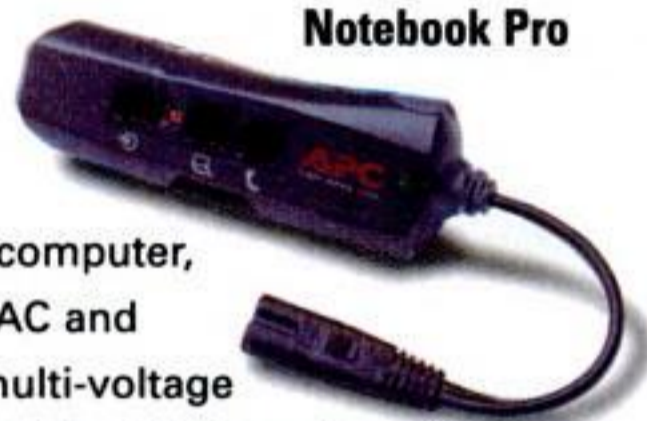


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But since they are legacy, chances are they don't contain a lot of important stuff. CONFIG.SYS mainly loads device drivers for DOS, allowing you to access hardware devices such as your CD-ROM (in DOS). AUTOEXEC.BAT (AUTOMATICALLY EXECute) contains lines that could be entered at a DOS prompt, but since this would take so long, the file holds them all in one place, allowing for automatic execution upon startup.

Windows 95 absorbed many important CONFIG.SYS and AUTOEXEC.BAT commands into its convoluted configuration files, doing away with the need for HIMEM.SYS, IFSHLP.SYS, SETVER, and LASTDRIVE=n. The only time you should load any of these files, or any real-mode device driver, is when you absolutely need them for DOS. Windows works much more efficiently with its own configuration files, thank you very much.

Scratch Yourself Out

I plan to sell my old computer. How do I remove my login name and replace it with the new owner's name in Windows 98?

—Mikey

I hope you're up to a little Registry hacking, Mikey. To change your login name, run the Windows Registry editor by typing "regedit" in the Start menu's Run command. Then head straight to HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\Current Version. In the pane on the right you'll see a "Registered Owner" key. Right-click on it and select "Modify" to enter the new name.



Deep within the Windows Registry is the information you entered when you installed Windows. Change it before selling your computer.

Too New

When I right-click on the desktop and select New (or when I select it through Windows Explorer), I get all these junk options that I never use. They really bog down the speed of

my computer. Is there a way to rid myself of this crappy Microsoft "feature"?

—Chris

Microsoft doesn't want you fiddling with these settings, but you're not going to let those Redmond boys push you around, are you? Of course you aren't. There are two ways to fix this "feature"; the first involves the Tweak UI utility described in the "Twice As Tweaky" question answered on page 82. Tweak UI's New tab gives you a menu of all the current options for new folders. Simply check or uncheck the boxes according to which programs you'd like

to see in the new context menu.

The second method involves renaming the Registry keys of those file types you want excluded from the new drop-down menu. Be forewarned: Any Registry editing requires the three Cs: caution, care, and confidence. If you're willing to exhibit all three qualities, open up the Registry editor (as explained in the last letter) and search for "ShellNew." Windows uses the ShellNew key to mark each file type (.doc, .txt, .bmp) listed in the New Files context menu. Rename this key (oldShellNew is fine) and the files won't appear in the New Files menu anymore.

Name That Tune

I like to play audio CDs on my computer using Microsoft's CD Player. I even go as far as storing artists' names, album names, and track titles. I also like to reformat my hard drive every few months, and every time I do so, I lose all the CD information that I stored. How can I back up this information so I don't have to enter it all every time I reformat?

—Chirag Raval

The quick-and-dirty solution can be found in the Windows directory. Go there and copy the CDPLAYER.INI file to a floppy disk. After reformatting your drive, gingerly slip the file back into the Windows directory and voilà, all your CD information will return. You can also let the web do the work for you; there are hordes of freeware and shareware audio players available that access the massive CDDb (Compact Disc Database) using a special code found on all music CDs. Simply insert your CD and whammo: The player will automatically contact the database via your Internet connection, and the disc name, artist, and track titles are all instantly downloaded and displayed. You can download audio players at www.cddb.com.

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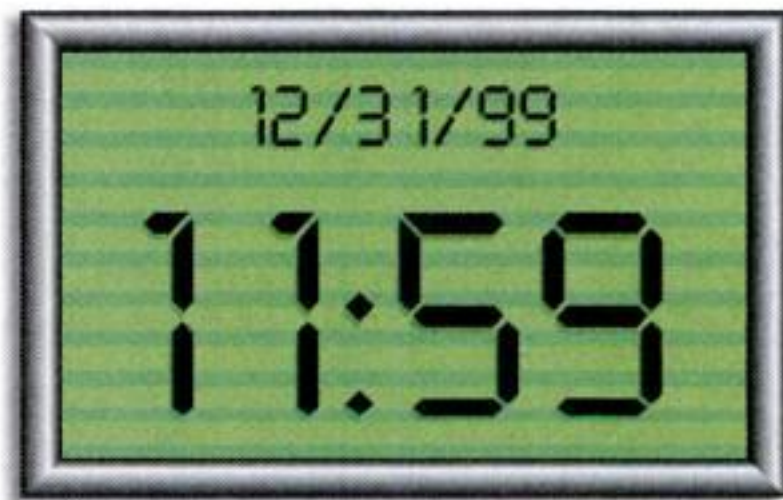
If you're reading this, you probably have a Y2K problem. That means on New Year's Day, 2000 your \$3,000 computer simply won't work well — if it works at all. Imagine going to work on Monday Jan. 3, 2000 and finding out you're unable to do the things you've come to rely on, like check your e-mail, write a memo or browse the Web.

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Your personal tech briefing on the concepts and components that make up the PC experience.

How Data Moves Around Your Motherboard

If one plane flying from Seattle to Florida stops in St. Louis, and another plane flying from New York to Seattle stops in Detroit, how many airline personnel will it take to restrain the angry passengers who've eaten nothing all day but a bag of heavily salted peanuts?

No, we don't want you to become a flight attendant (your mother wants you to be a doctor, and we're not tangling with her), but we do want to get you up to speed on the way data moves around your motherboard. It happens much like the way the airline industry moves folks around—as many passengers as possible are packed together and shuttled as quickly as possible from one place to the next according to a predetermined route, with specific stops made along the way.

Just as there are limits on the number of planes that can fly the friendly skies at once, the number of routes and the speed at which data can travel through your motherboard limits your system's throughput and performance. Our goal is to arm you with enough information to make good choices when purchasing components for your system. In the event of an emergency, please place your head between your knees in preparation for landing.

—Sean Cleveland

The Core-Logic Chipset

Your motherboard's core-logic chipset acts as the air traffic controller that directs the movement of data between all of your computer's devices. Often referred to by proper name, such as Intel 440BX or VIA MVP3, the core-logic chipset regulates the system speed and directs all instructions from the CPU and memory to the buses that connect every device and peripheral in your machine.

Buses are the electrical pathways through which your machine's internal components communicate with one another—in the airline analogy, buses are the flight patterns. They are defined by bandwidth, or their data capacity (measured in bits) multiplied by the speed at which they can carry data (measured in megahertz). For more info on calculating your bus's bandwidth, check out the sidebar.

Each expansion slot on your motherboard branches off into a bus, and each bus is named after the slot with which it is associated. ISA, PCI, and AGP buses are the most familiar names to many PC users, but others, such as the frontside and backside buses, play important roles in making your PC be all it can be.

HOW BIG IS YOUR BUS?

To calculate the bandwidth of a bus, multiply its speed by its width. A bus's speed is measured in megahertz (MHz); its width is measured in bits, but you'll need to convert it to bytes by dividing the number of bits by eight. For example: The PCI bus is 32 bits (4 bytes) wide; it runs at a speed of 33MHz. So, the PCI bus has a total bandwidth of 33×4 , or 132MB/sec.

Remember: This bandwidth is divided among all devices sharing the bus—no device has access to all the bandwidth, unless it's the only device on the bus. Therefore, the total amount of data sent from devices plugged into the PCI bus will never exceed 132MB of data per second.

System Bus

Your PC's system bus is like the L.A.-to-New York flight pattern—it's a main artery. The system bus links the CPU to the core-logic chipset, and coordinates data flow for each peripheral and device connected to the motherboard. The width, or capacity, of the system bus is 64 bits, so systems that support a 100MHz system bus have a total bandwidth of 800MB/sec.

Both Intel and AMD expect to significantly expand the system bus in their next-generation chipsets. Currently, the AMD-750 chipset powered by the Athlon (née K7) supports a whopping system-bus speed of 200MHz. Because communication between the Athlon's core-logic chipset and main memory is facilitated over an exclusive channel, so no other devices can drain the bandwidth—a major boon to multiprocessor systems.

The forthcoming Intel 820 chipset (code-named Camino) and 840 chipset will support a 133MHz system bus, but you'll need [Rambus DRAM](#) (RDRAM) memory to ride this chipset.

Backside Bus

If your CPU has [L2 cache](#), it communicates with L2 through the backside bus. The width of the backside bus is 64 bits, and the total bandwidth ranges from 800MB/sec (in an early Pentium) to a zany 4.8GB/sec (in the latest 600MHz screamer).

The backside bus keeps the processor from seeking data from slower devices, such as main system memory or hard drives, and therefore wasting clock cycles. Since data instructions are stored sequentially in the cache, the backside bus can quickly retrieve each instruction from there, one after the other, garnering another boost in system performance. Data can stay in L2 cache for up to a few seconds before it's replaced—that doesn't sound like much, but it's

plenty of time for the backside bus to locate and transport the data to the CPU.

On Pentium IIs, Pentium IIIs, and the new AMD Athlon, L2 cache resides on separate chips located near the processor on the same circuit board. Other processors—such as second-generation Celerons, the AMD K6-3, and the forthcoming Pentium III “Coppermine”—take a cue from the Pentium Pro, in which L2 cache is onboard the processor die. The advantage of on-die L2 is full-speed communication between L2 cache and the processor; processors with an off-die L2 typically access their cache at half the speed of those with L2 onboard.

Frontside Bus

The frontside bus shuttles data between your CPU and memory, and between your CPU and peripheral buses. While the ISA, PCI, and AGP buses—the intricacies of which we’ll explore shortly—are sometimes referred to separately as peripheral buses, they’re actually part of the frontside bus. When an application launches, the data required to run it is copied from the hard drive (typically) into main memory. The CPU runs the code directly from the memory and, via the frontside bus, uses the chipset to coordinate with the peripheral buses.

While communication through the frontside bus is slower than communication through the backside bus, it’s definitely becoming less of a bottleneck. The frontside bus has the same speed as the system bus—either 66MHz, 100MHz, or 200MHz, depending on your machine’s processor and motherboard. Like the system bus, the frontside bus is 64 bits wide, so the total bandwidth for a 66MHz system is 528MB/sec; with a 100MHz system, the total bandwidth is 800MB/sec.

Speed innovations for the frontside bus are a recent development, ushered in by the 100MHz system bus in Intel’s 440BX and 440GX motherboard chipsets. Intel planned to push the frontside bus speed beyond 100MHz this fall, with chipsets using RDRAM, but memory manufacturing issues have delayed this. As of press time, Intel plans to add RDRAM support in only the Camino chipset, and the company has officially thumbed its nose at PC133 SDRAM. In the meantime, VIA is pushing for faster 133MHz DRAM and better with its Apollo Pro+ 133 chipset.

ISA Bus

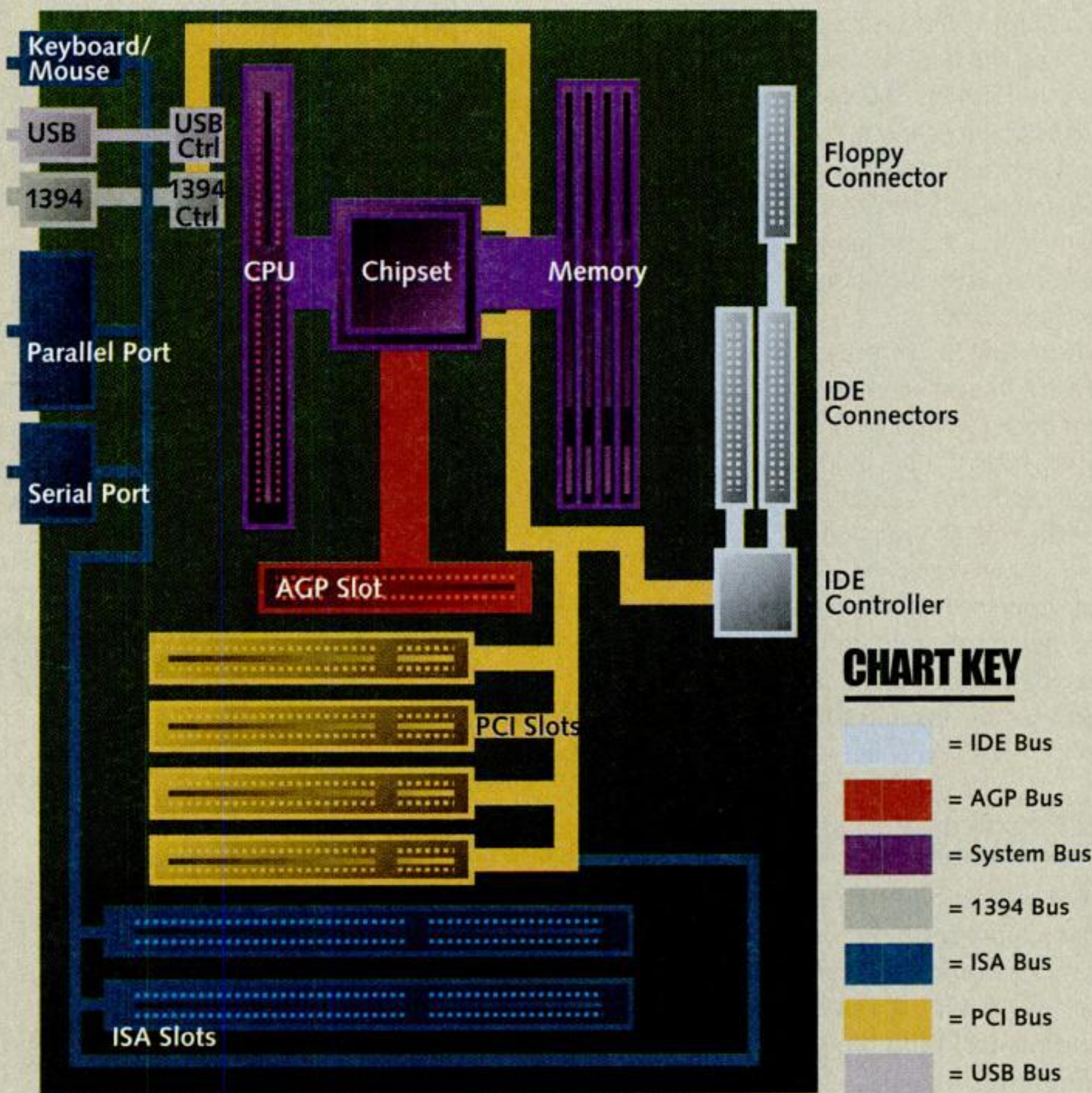
The moldy-oldy Industry Standard Architecture (ISA) bus is the dog-ass slowest bus on your motherboard. Running at just 8.3MHz, the 16-bit ISA bus must share its 16.6MB/sec total bandwidth among all devices attached to it. In the past, all cards, including the videocard, were plugged into the ISA bus; now, it’s merely a data-starved ghetto. The PC99 specification calls for the retirement of ISA, and that has most power users cheering. There’s just one problem: The keyboard and PS/2 mouse ports are still part of the ISA bus. Future motherboards will provide legacy support for these devices.

PCI Bus

The Peripheral Component Interconnect (PCI) bus sustains a speedier connection between your system’s expansion cards—particularly the videocard—and its processor than the ISA bus provides. Videocards have always required more bandwidth than the ISA bus allowed and thus do not play well with the other cards in the ISA sandbox. But with its 32-bit width and 33MHz

BUS ROUTES

The traditional Pentium II and III motherboard architecture uses northbridge and southbridge chips to control the flow of data around the various buses. Although not as efficient as Intel’s new hub design, the old architecture pulls together several different buses that run at varying speeds and makes it all work.



speed, the PCI bus provides a much bigger sandbox. Its 132MB/sec total bandwidth ensures there’s enough room for every card. Both USB and FireWire ride on the PCI bus.

While the PCI bus’s bandwidth makes for plenty of breathing room in the desktop world, it’s not spacious enough to run high-performance servers with multiple hard drives in a RAID configuration.

The result is the development of two new PCI-type buses, PCI-X and NGIO; both promise to blow bandwidth wide open.

AGP Bus

The increasing complexity of CPUs and videocards has rendered even the PCI bus insufficient to handle those components' bandwidth needs, so Intel developed the Advanced Graphics Port (AGP) bus. The standard AGP bus runs at 66MHz, as opposed to PCI's 33MHz, resulting in a total bandwidth increase over PCI of 132MB/sec to 264MB/sec. With AGP, videocards access memory directly, enabling storage and manipulation of high-resolution textures.

Currently, the AGP 2x bus rules the roost, with a hefty 528MB/sec total bandwidth. In AGP 2x, two 32-bit data chunks are transferred per each 66MHz cycle, effectively doubling the transfer rate to a glorious 133MHz. Sidebanding adds to this scenario by allowing the graphics processor to queue new data requests while the main bus is gathering data. The result is more efficient transfers overall.

But look! Up in the sky! Arriving this fall in chipsets from both VIA and Intel, AGP 4x will again double the total bandwidth, for a total of 1.06GB/sec. Though you may have a newfangled videocard that supports AGP 4x, you'll still need to upgrade your motherboard and memory in order to take full advantage of it. And because the peak bandwidth of PC100 100MHz SDRAM is 800MB/sec, you won't see the benefits of AGP 4x until you upgrade to faster memory.

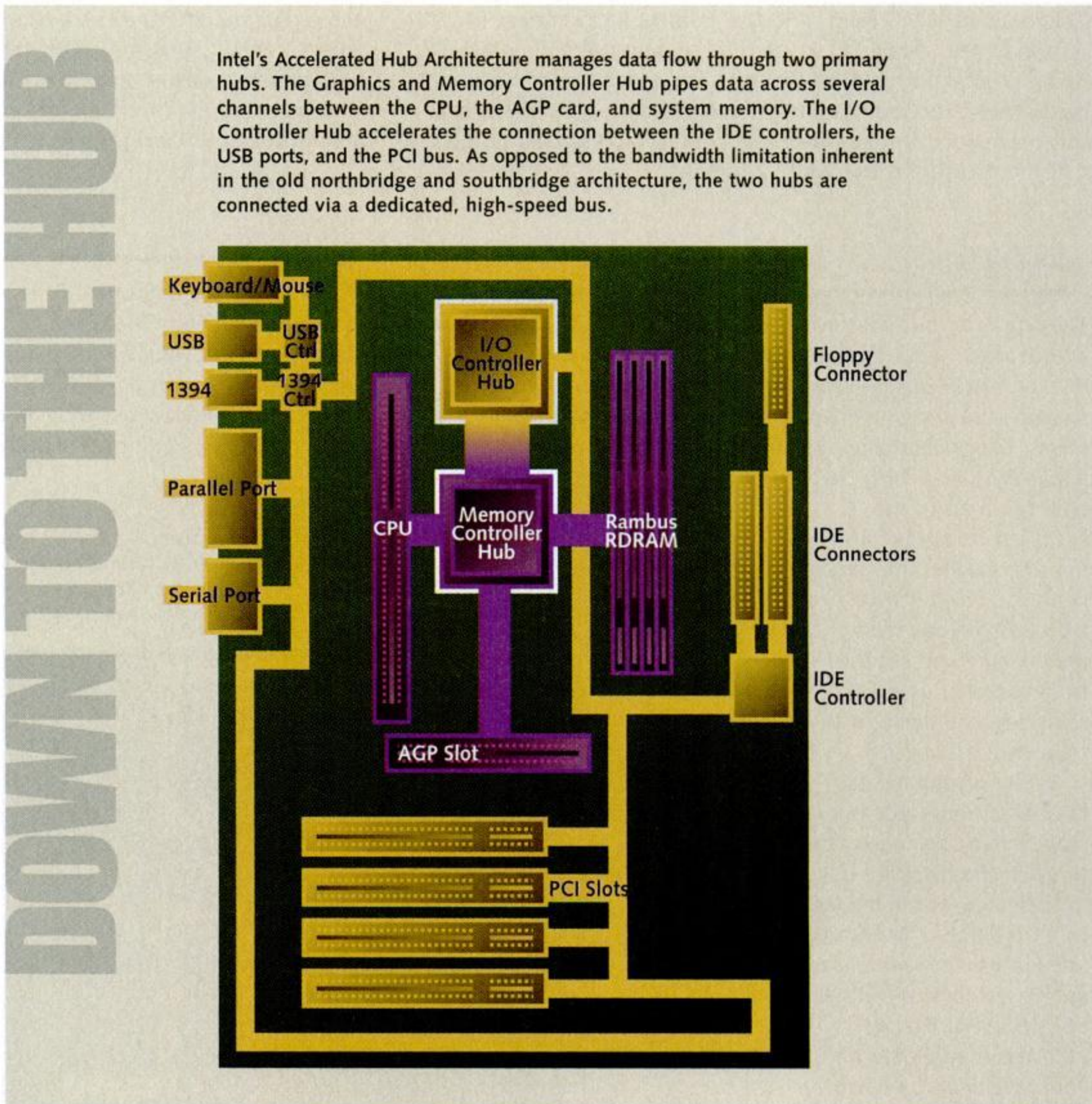
Intel Accelerated Hub Architecture

Low-cost motherboards have been bottlenecked by integrated video chipsets sharing resources with system memory (called UMA, or Unified Memory Architecture), forcing the speed of the AGP bus down to a paltry 66MHz and delivering poor gaming performance. With the 810 chipset, code-named Whitney, Intel is offering a low cost chipset that addresses these problems.

The 810's new hub architecture includes a dedicated "interlink" bus that communicates directly between the CPU, the system memory, the PCI bus, and the integrated AGP video chipset. With a width of 64 bits and a speed of 133MHz in 2x mode, the interlink bus boasts a beefy bandwidth of 1,064MB/sec—twice that of the PCI bus. The interlink bus connects the 810's two main hubs, the Graphics and Memory Controller Hub and the I/O Controller Hub, enabling a direct connection from graphics

and memory to I/O devices such as IDE controllers, dual USB ports, and PCI add-in cards.

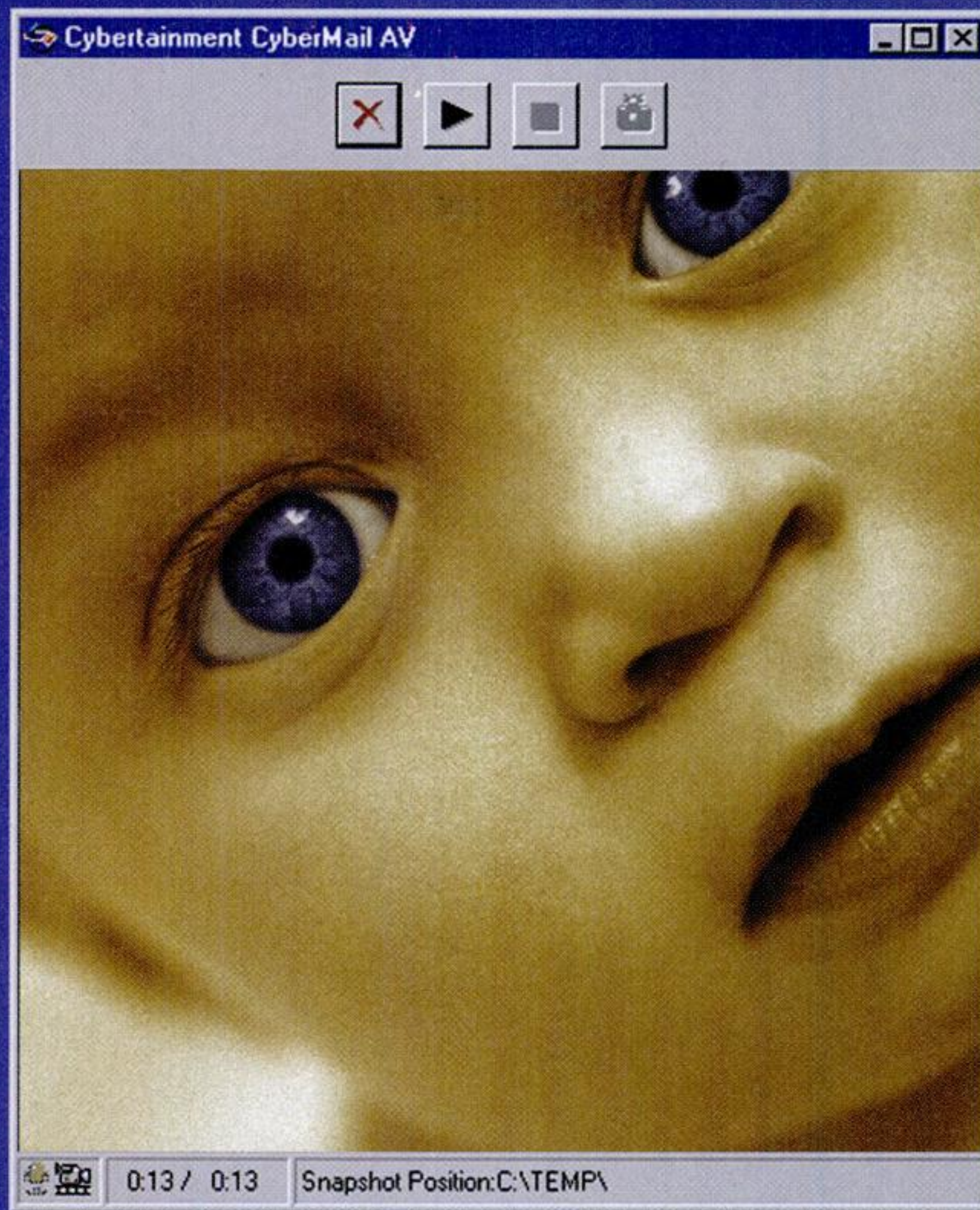
And perhaps best of all, the 810's interlink bus will effectively do away with the ISA bus. Exits are located at the fore and aft of the cabin... ☀



BUS BANDWIDTH

BUS TYPE	WIDTH (BITS)	SPEED (MHZ)	TOTAL BANDWIDTH
Backside bus	64	100-600	800MB/sec-4.8GB/sec
System bus at 133Mhz	64	133	1.06GB/sec
System bus at 100Mhz	64	100	800MB/sec
System bus at 66Mhz	64	66	528MB/sec
AGP 4x	32	266	1.06GB/sec
AGP 2x	32	133	528MB/sec
AGP 1x	32	66	264MB/sec
PCI-X	64	133	1.06GB/sec
Accelerated Hub Architecture 8	(2x-mode)	133	133.3MB/sec
PCI	32	33	133.3MB/sec
VLB (Theoretical)	32	33	133.3MB/sec
Micro Channel	32	10.33	40MB/sec
EISA	32	8.33	33.3MB/sec
16Bit ISA	16	8.33	16.6MB/sec
8 Bit ISA	8	8.33	8.3MB/sec

A comparison of buses broken down by width, speed, and bandwidth.



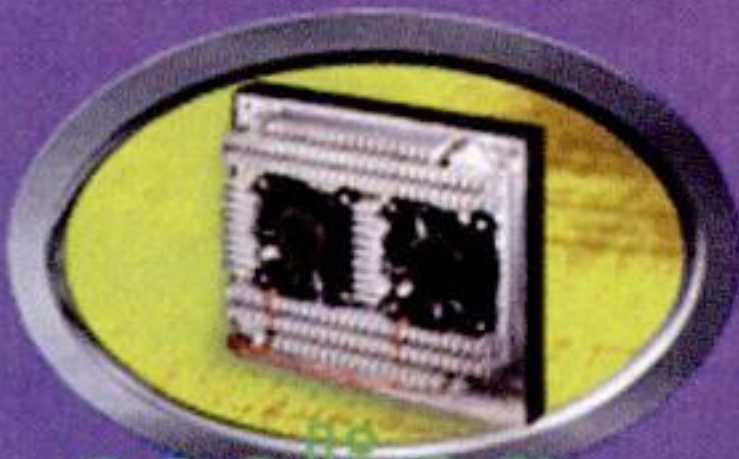
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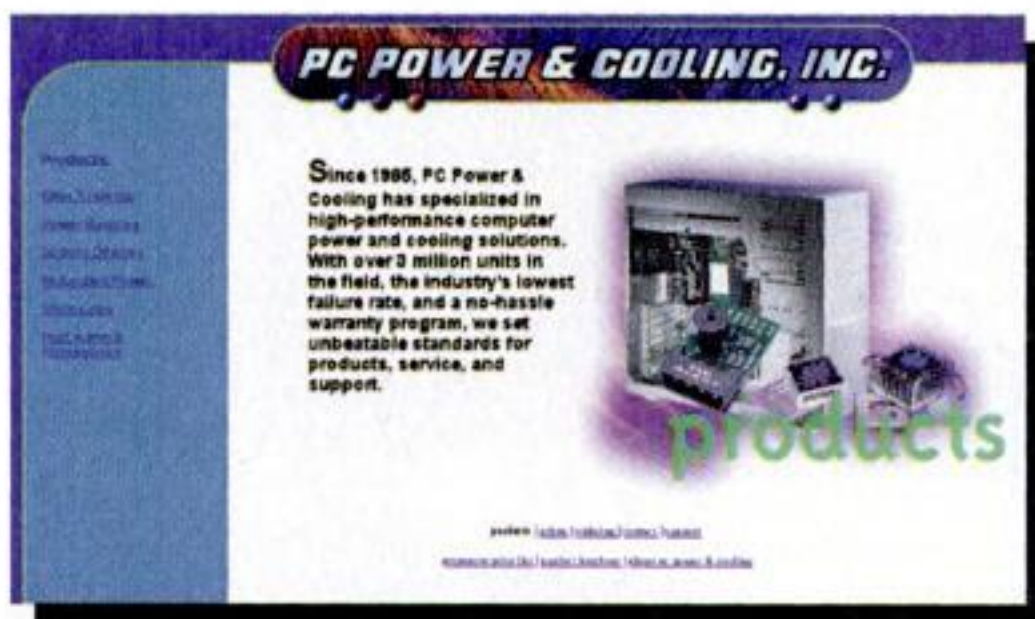
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How to Read the Benchmarks

Our Dell Dimension test system is used to establish zero points for all desktop benchmarking and as a test bed for individual component evaluation. The Quantex notebook serves the same purpose for notebook

reviews. The base system scores represent the average acceptable performance of high-end machines as of 07/99. We will update the mid-point systems every six months with machines from different OEMs.



DESKTOP ZERO-POINT SYSTEM:
Dell Dimension XPS T500: P-III 500MHz, 440BX chipset, 128MB 100MHz SDRAM, 32MB TNT2 videocard, 12.7GB 7200rpm UDMA/33 hard drive, 40x (advertised speed) CD-ROM.



NOTEBOOK ZERO-POINT SYSTEM:
Quantex I-1410: 366MHz mobile Pentium II, 96MB SDRAM, 8MB ATI Rage LT Pro video chipset, 8GB hard drive, 4x DVD-ROM.

Desktop Systems

REAL WORLD BENCHMARKING	BENCHMARKING			
	SCORE	LOW POINT	MID-POINT	HIGH POINT
CPU/MOTHERBOARD bootMark	228	26	228	430
WINDOWS APPS SYSmark 98 official score	204	96	204	300
HARD DRIVE HD Tach MB/sec	15.1	2.2	15.1	28
CD-ROM CD Tach98 drive rating	26.2x	13.8x	26.2x	40.0x
3D RENDERING Newtek Inspire3D sec	441	562	441	320
IMAGE EDITING Adobe Photoshop 5.0 sec	126	202	126	50
DIRECT3D Expendable fps	53.3	0	53.3	120
OPENGL Quake II v3.20 fps	51.5	0	51.5	120

The specific score achieved by the system.

The mid-points denote "acceptable performance" and are based on the precise scores achieved by our base Dell and Quantex systems. As we review new systems each month, their benchmark scores will fall either below or above the mark of acceptable performance.

The more a system underperforms the mid-point system, the further into the red its bar moves. The numbers shown at the low-point are the lowest scores we expect to see in any shipping product.

The more a system outperforms the mid-point system, the further into the green its bar moves. The numbers shown at the high-point are the best scores we expect to see in the next six months.

KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by **AARON LAUER**

Versatile Videocards

TWO NEW TNT2S OFFER COOL FEATURES BUT SLOW SPEEDS

With the glut of TNT2 boards currently crowding store shelves, it's pretty hard to differentiate one from another. Each runs at a different clock speed and touts various driver tweaks, but they all pack essentially the same features. This isn't a bad thing if you're looking for first-rate image quality and ultra-fast rendering, which are the hallmarks of the TNT2 experience. But if you want a TNT2 board with some extra va-va-voom, check out the latest offerings from Elsa and Asus.

The Elsa Erazor III and the Asus V3800 TVR stand out because of their video-in and -out features and support for 3D glasses. Both cards

are designed around the standard TNT2 specs, so don't expect the faster-clocked performance of an Ultra TNT2 board like the Diamond Viper V770—they just don't have it in them. In fact, if you're looking for the highest framerates, these are not the cards for you. Actually, their video-in and -out capabilities don't shine, either—the TNT is an especially odd choice as a video-editing platform, considering how weak the chipset is at video playback.

So, what *do* these cards have going for them? Well, the 3D glasses are kinda cool.

—Sean Downey

PLUSES

Highly tweakable drivers
Support for video in and out

MINUSES

Poor DVD playback
Poor video capture
Moderate performance marks

THE SPECS

CLOCK SPEED

125MHz bus
150MHz memory

RAMDAC

300MHz

AGP SUPPORT

AGP 4x/2x

LOCAL MEMORY

32MB SGRAM

MAX 32-BIT RESOLUTION

1600x1200

MAX 16-BIT RESOLUTION

1920x1200

MAX 1600X1200 REFRESH RATE

85MHz

BUNDLE

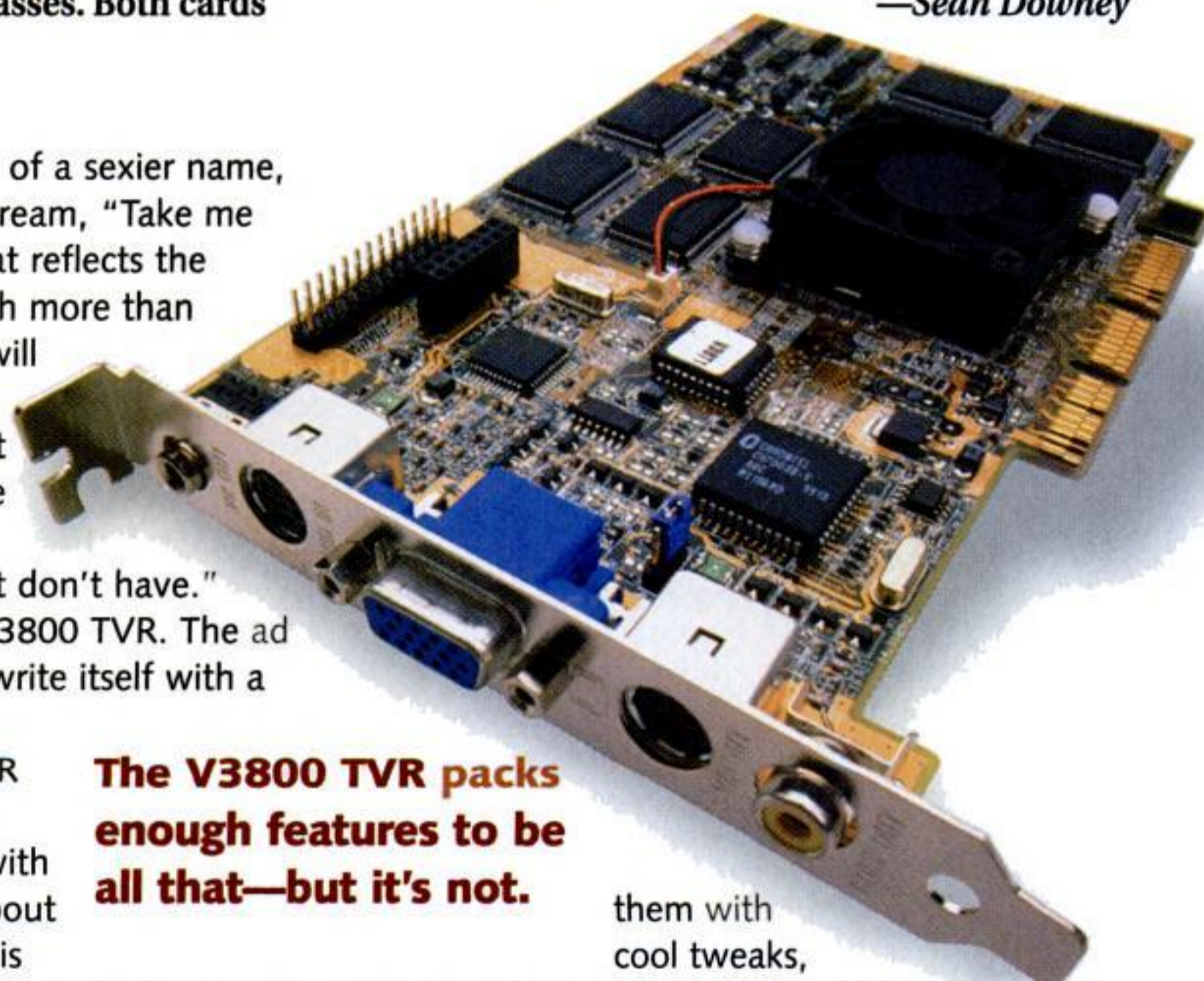
Win9x | NT drivers |
Asus DVD player |
Turok 2 | ExtremeG 2

Asus V3800 TVR

The V3800 TVR is in dire need of a sexier name, because the specs just don't scream, "Take me home." It needs something that reflects the card's aspirations to be so much more than other TNT2s. Something that will make you notice it across a crowded room. Something that says, "Dance with me, because I have unique features and drivers that the other cards just don't have." Something like the Shagadelic 3800 TVR. The ad campaign would pretty much write itself with a name like that.

Unfortunately, the 3800 TVR gives you too many reasons to avoid dancing the texel twist with it. The best that can be said about the video-in and -out features is that they work. Video-out image quality is pretty good, but DVD playback on a TV is a washed-out mess. And video capture is capable of only the lowest-ambition projects, such as a postage stamp-sized streaming video of your children at play. Capturing at anything above 320x240 results in a boatload of dropped frames.

Don't think that the V3800 has two left feet—the drivers are pretty damn slick. Asus packed



The V3800 TVR packs enough features to be all that—but it's not.

them with cool tweaks,

such as a monitor fine-tuning utility with separate settings for 3D and 2D, and an over-clocking slider that can potentially take the core clock to 190MHz. Of course, overclocking results will vary according to your system configuration, so don't get your hopes too high.

Without a catchy ad campaign, the V3800 TVR is going to have a hard time selling itself. Stocked with 32MB of 150MHz SGRAM with a core conservatively clocked at nVidia's recommended 125MHz, the V3800 TVR is definitely a middle-of-the-road performer. In our benchmarks the card landed squarely in the realm of unimpressive. Even against another middle-of-the-road card, such as the Erazor III, the V3800 comes in second in everything but our *Expendable* timedemo.

REAL WORLD BENCHMARKING

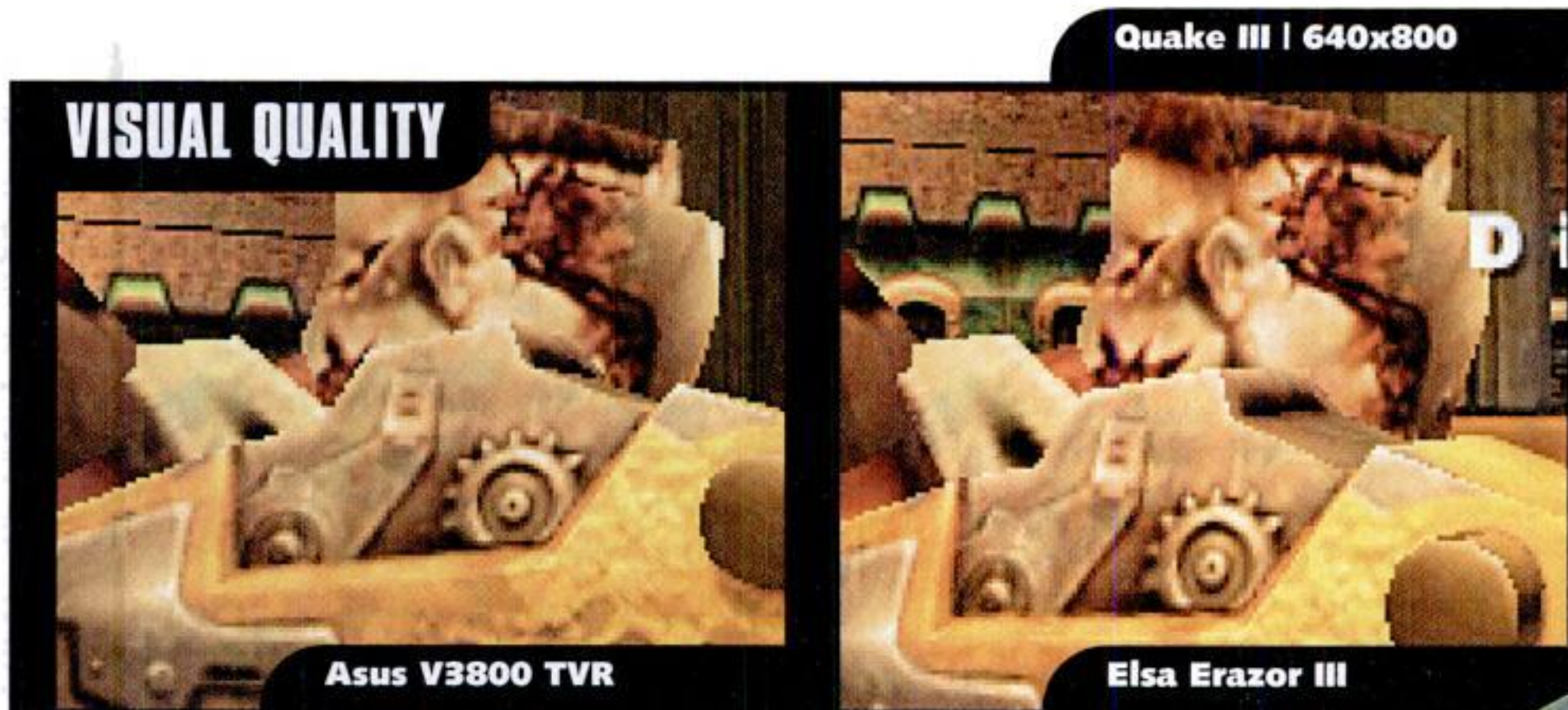
QUAKE II 1024x768 fps	50.4	
HALF-LIFE 800x600 fps	39	
EXPENDABLE 1024x768 fps	46	
DESCENT 3 800x600 fps	51.7	

TEST SYSTEM: Benchmarked on Dell 500MHz Pentium III test system using version 1.91 of the Asus drivers. K7 benchmarks are posted online. As always, V-sync is enabled.

MAXIMUM PC VERDICT

Price \$230
Company Asus
Phone 510.739.3777
URL www.asus.com





VISUAL QUALITY

Asus V3800 TVR

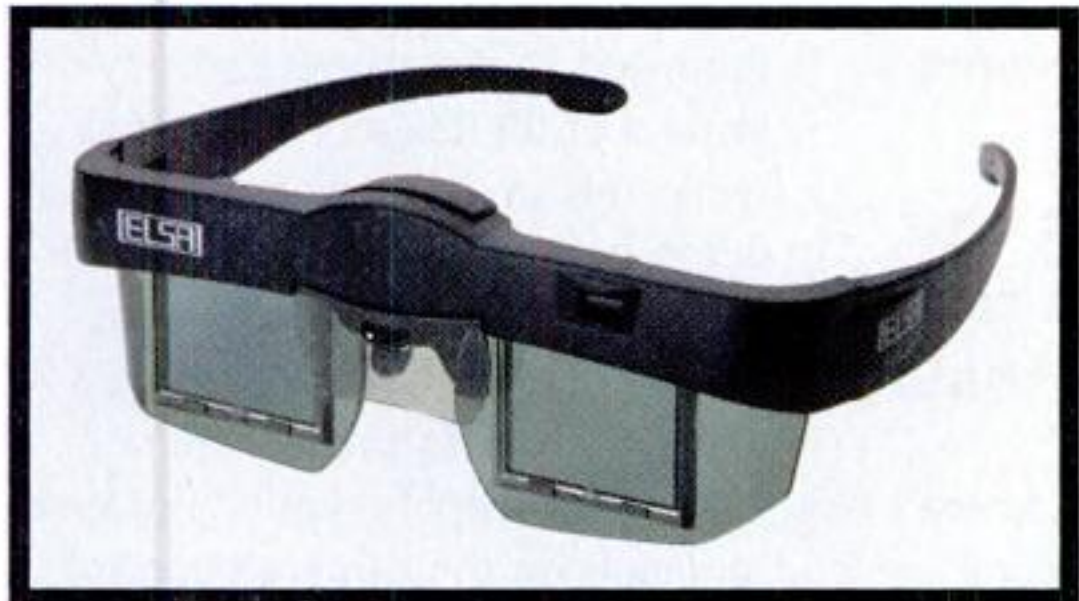
Elsa Erazor III

Elsa Erazor III

The Erazor III isn't going to rock your world like a high-performing TNT2 Ultra board would, but the card's additional features may succeed in making your head turn. Its video in and out are well implemented, and the 3D Revelator shutter glasses are the best we've seen. Beyond the moderate performance marks put out by the Erazor's baseline TNT2 graphics processor, the board has some good stuff going for it.

Clocked at 125MHz and stocked with 32MB of 150MHz SDRAM, the 3D Blaster sticks close to nVidia's reference specs. While better than the Asus V3800 TVR, the Erazor III's benchmark scores aren't going to win it any ribbons. It did, however, manage to squeak by the Guillemot Xentor—the best performing standard TNT2 card that we've seen—in our two Direct3D benchmarks.

You can attribute the Erazor's performance marks to Elsa's excellent drivers; the well-rounded Elsware puts a lot of great tweaks in easy-to-reach places. But unlike other TNT2s we've reviewed, it

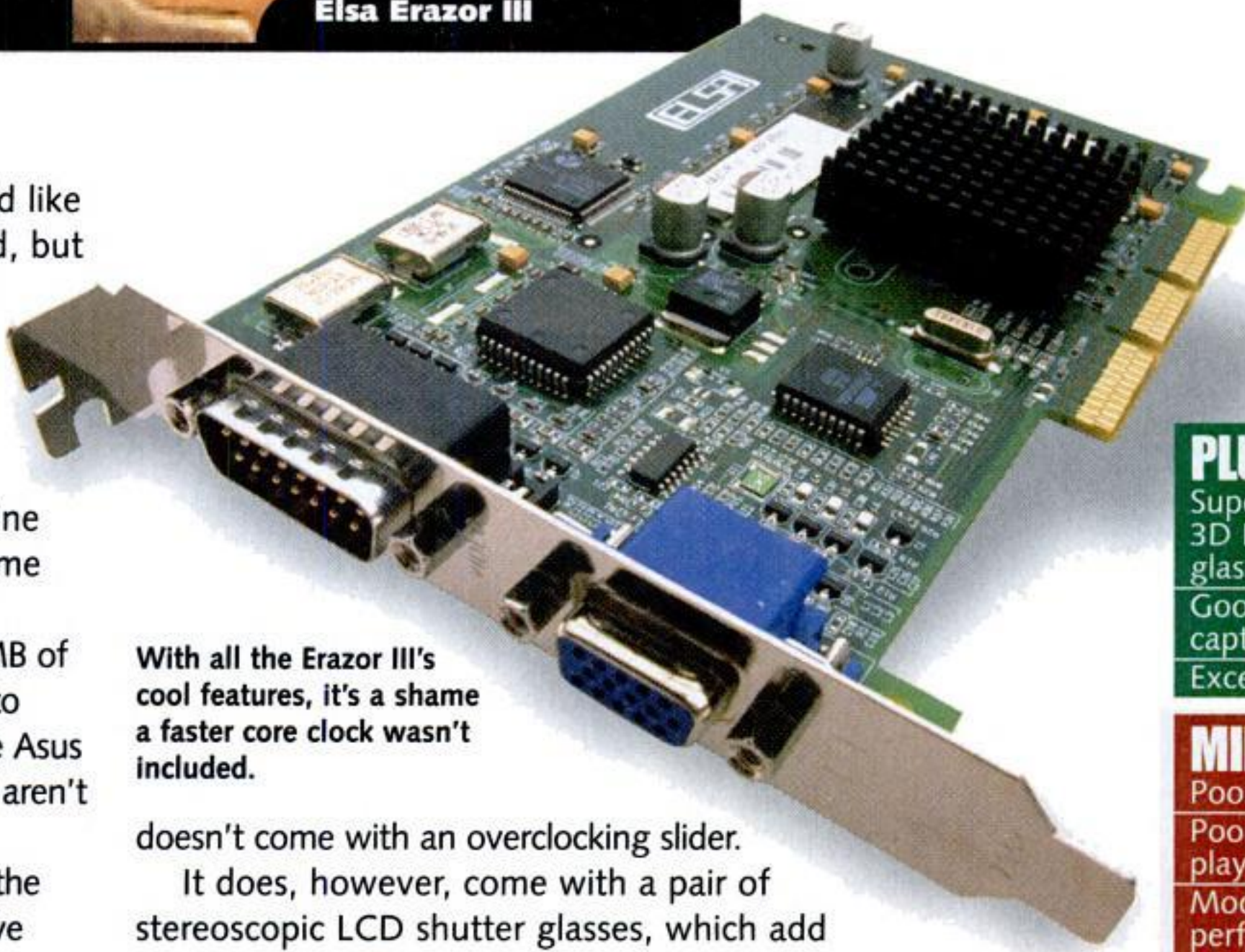


The 3D Revelator glasses take awhile to get used to, but the 3D visuals are dazzling.

REAL WORLD BENCHMARKING

QUAKE II 1024x768 fps	56	<div style="width: 56%;"></div>
HALF-LIFE 800x600 fps	40.2	<div style="width: 40.2%;"></div>
EXPENDABLE 1024x768 fps	45.8	<div style="width: 45.8%;"></div>
DESCENT 3 800x600 fps	54.6	<div style="width: 54.6%;"></div>

TEST SYSTEM: Benchmarked on Dell 500MHz Pentium III test system using version 1.91 of the Asus drivers. K7 benchmarks are posted online. As always, V-sync is enabled.



With all the Erazor III's cool features, it's a shame a faster core clock wasn't included.

doesn't come with an overclocking slider.

It does, however, come with a pair of stereoscopic LCD shutter glasses, which add jaw-dropping 3D depth-perception to any Direct3D game. Controlled by an infrared sensor, Elsa's 3D Revelator glasses are the bee's knees, especially in games such as *Descent 3*. When activated, the shutter glasses flicker in sync with the different views rendered by the card. The Elsa software calculates the difference between the rendered views based on z-buffer values reported by the game. Since the 3D Revelator sports a maximum shutter speed of 140MHz, it exhibited no flickering problems during our tests.

The biggest problem with the Erazor III is its video playback. While the card never dropped a frame in our AVI or DVD playback tests, pixelated edges and shimmering compression artifacts were the order of the day. Surprisingly, video capture was strong, although the bundled *MainActor* video-editing software is a joke. We had decent results at 320x240 but we couldn't get M-JPEG capture to work. Compared to the 3dfx Voodoo³ 3500 TV and the Asus V3800 TVR, the Erazor III has the best video-capture support. It just needs some good software to go with it.

- PLUSES**
- Super-swanky 3D Revelator glasses
 - Good video capture abilities
 - Excellent drivers

- MINUSES**
- Poor video out
 - Poor DVD playback
 - Moderate performance marks

THE SPECS

CLOCK SPEED	125MHz bus 150MHz memory
RAMDAC	300MHz
AGP SUPPORT	AGP 4x/2x
LOCAL MEMORY	32MB SDRAM
MAX 32-BIT RESOLUTION	1600x1200
MAX 16-BIT RESOLUTION	1920x1200
REFRESH RATE	85MHz
BUNDLE	Win9x NT drivers MainActor Demo sampler

MAXIMUM PC VERDICT

Price \$289
Company Elsa
Phone 800.272.3572
URL www.elsa.com





Sony DSC-F55

With the DSC-F55, which looks suspiciously identical to its predecessor, Sony follows up previous memory mistakes with another blunder. After dooming the performance of the Mavica line by providing a floppy disk as a storage medium, Sony set out to reinvent the CompactFlash/SmartMedia wheel. The result? Its own proprietary removable media.

Can anyone say BetaMax? Some companies never learn, which is too bad because behind the feeble MemoryStick ticks a pretty great camera. A killer MPEG movie-recording feature is perfect for shooting snippets that can be e-mailed, included in presentations, or burned to a digital scrapbook. And movie quality is damn impressive.

The DSC-F55's image quality is also quite good, despite a lens that, though emblazoned with the respected Carl Zeiss name, is something less than the size of a contact lens. But the little camera does wonders with it, producing great images that stand up to considerable scrutiny.

Unfortunately, some of Sony's other design

choices disappoint. The spacious preview LCD doesn't include a plastic shield, so smudges quickly obscure your view—a view that's critical, since the DSC-F55 doesn't include a rangefinder, either. Since you'll always use the backlight-optional LCD to frame your shots, Sony has graciously included a rechargeable lithium-ion battery cartridge. It holds plenty of charge, but if you're away from an outlet or the charger, you're screwed, because corner drugstore batteries won't work here.

The DSC-F55 marks a great start for this reborn line, but it has a long way to go before getting our nod.

MAXIMUM PC VERDICT

Price \$899
Company Sony
Phone 800.352.7669
URL www.sony.com



Even a few stand-out features, such as MPEG movie recording, can't save the DSC-F55.

THE SPECS

WEIGHT	10 oz
RESOLUTION	1600x1200
ZOOM	None
MEMORY	MemoryStick (4MB included)
FEATURES	2.8x lens 2-inch LCD MPEG movie video-out audio charger included Lithium-ion batteries



FujiFilm MX-2700

This sleek camera is so sexy, we could imagine James Bond whipping it out to get some "surveillance" snaps of his latest target. Alas, beauty and speed don't often go hand in hand.

In fact, when you fire up the MX-2700 and start firing off frames, the first thing you'll notice is how slow it is. The lag between shots—more than twice that of the other cameras in this shootout—is downright unbearable. You'll miss a shot because the activity lights on the back of the camera weren't finished with their impressive series of flashing patterns.

The MX-2700's compact size also produces bad ergonomics. It's vertically oriented, so holding it is awkward. The superficial ridges and dimples don't provide a secure grip, especially for those of us with bigger paws, and it's all too easy to position a finger over the built-in flash. The built-in lens protector is a nice touch, but the Fujinon lens hiding underneath is just a mite bigger than Sony's stingy glass.

Despite these downers, image quality is impressive. The minor bump in megapixel count

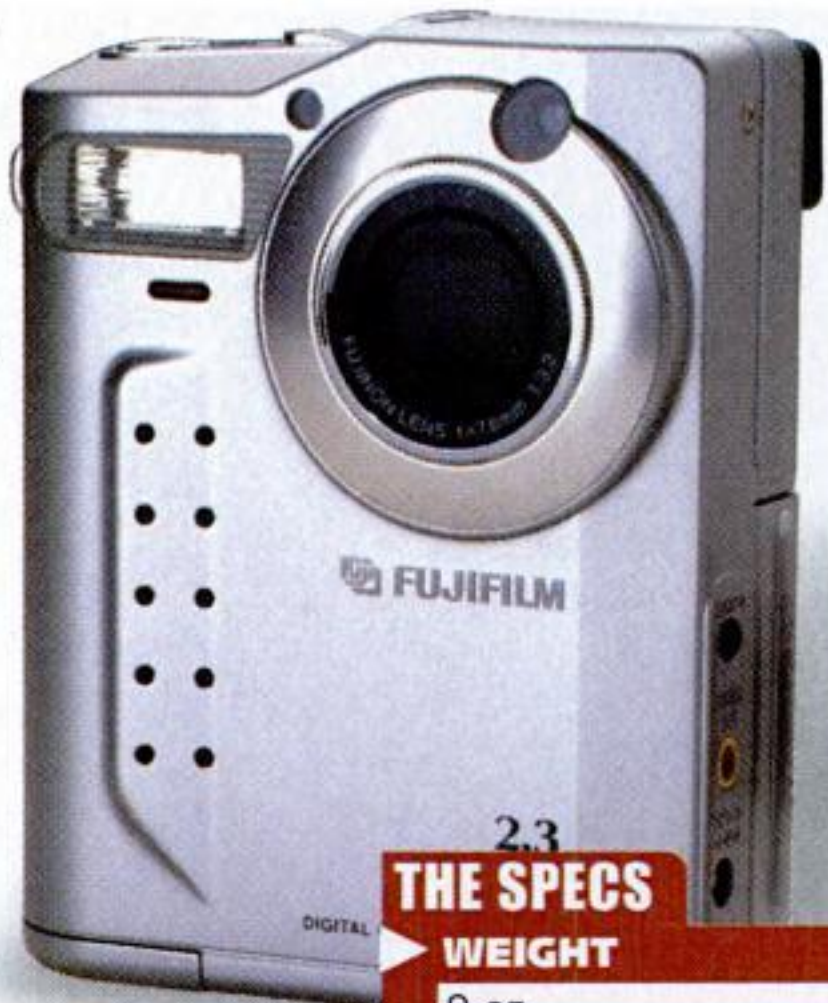
(2.3 versus the 2.1 dished up by the other cameras in this roundup) doesn't noticeably affect image quality aside from the different aspect ratio, but the MX-2700's images are still big, bright, and beautiful.

Power is provided by a lithium-ion cartridge that poses the same issues as Sony's, though the MX-2700 charger is much smaller and FujiFilm's inclusion of a rangefinder and an LCD screen also means that power problems are less likely to be an issue.

Following a string of disappointing digital cameras from FujiFilm, the MX-2700 shows tremendous improvement and makes a decent-sized splash as the company's first in-house design.

MAXIMUM PC VERDICT

Price \$799
Company FujiFilm
Phone 800.659.3854
URL www.fujifilm.com



It's pretty, but the MX-2700 feels awkward in the hand.

THE SPECS

WEIGHT	9 oz
RESOLUTION	1800x1200
ZOOM	2.5x digital
MEMORY	SmartMedia (16MB included)
FEATURES	3.2x lens 2-inch LCD rangefinder video-out Lithium-ion batteries charger included

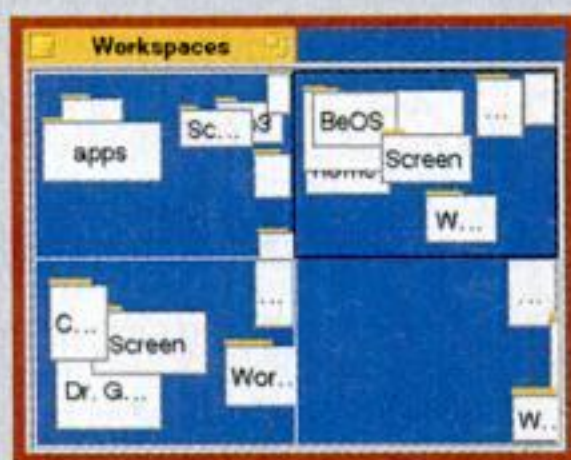


USING WORKSPACES

BeOS's built-in support for multiple workspaces is a web designer's dream and a web surfer's remedy for things that are just too small.



"Screen preferences" let you enable up to 32 Workspaces, or individual desktops. Each Workspace can have a different resolution, color depth, background, and refresh rate, giving you all the options you need to see web pages and movies at whatever resolution suits you. It's also great for artists who want to quickly see how their work will appear in multiple environments.



Moving between Workspaces is easy. The Workspaces app gives you a windowed view you can use to navigate. You can also jump to other Workspaces by hitting Alt-Fx, where x is the Workspace number you want. Moving windows from one space to another is also a snap. Grab the window as it appears in the Workspaces app, and drag it to a new location. Or, click and hold the title bar when hot-switching with the keyboard.



The task switcher, a.k.a. the Twitcher, is Workspace aware. When visible, the Twitcher denotes windows on other Workspaces by placing a motion trail next to its icon.

BeOS R4.5

JUST BE

Thanks to BeOS 4.5, OS junkies are learning that Linux isn't the only non-Microsoft OS awaiting their multiboot loaders. Perfectly suited for hardcore multimedia users, Be is remarkably stable and is SMP-enabled to take full advantage of multiple processors. And this time around, BeOS has made its OS multiboot-friendly by removing many of the bugs that plagued previous versions. Included on the CD is a "special edition" of *PartitionMagic* that helps make space for the OS, and if you choose, the program

THE SPECS

REQUIREMENTS

- Pentium-class CPU
- 160MB hard drive space
- 16MB RAM
- CD-ROM drive

PLUSES

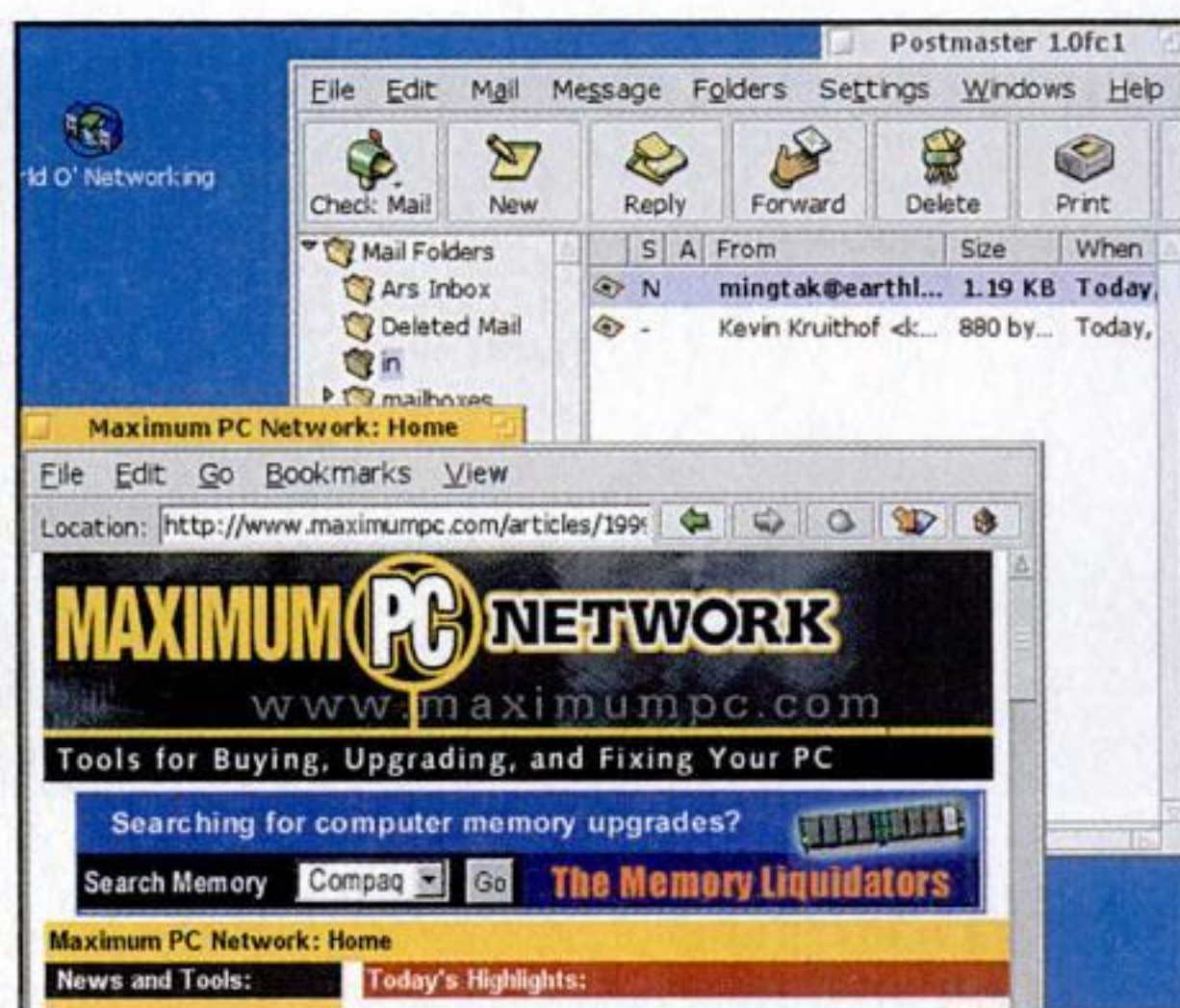
- Fast OS
- Excellent SMP support
- Engaging multimedia support

MINUSES

- Annoying font-display kinks
- Dated web browser
- Not enough commercial-grade software
- Weak driver support

installs an improved boot loader to handle your startup routine. NT users can take advantage of a utility on the CD that automatically adds BeOS to the NT loader's boot menu. One of BeOS's best features is its fast, responsive GUI, which invites users to push the OS's improved handling of multimedia content. In one instance, we had six full-motion videos playing simultaneously on a dual-CPU system without dropping frames. The updated media player now handles QuickTime and AVI formats (including compression schemes such as Indeo 5), but it's not as versatile as the Windows Media Player. Be's faster boot time—17 seconds on a P-II 450, compared to 43 seconds for Windows 98—makes switching OSes a snap. With the generally superior TCP/IP performance, you'll find yourself switching often. In a 140MB FTP download test, BeOS beat Win98 by 10 seconds.

Release 4.5 also offers greater hardware support, including decent "experimental" accelerated OpenGL support for Voodoo² and Voodoo³ cards, and excellent 2D support for the TNT (TNT2 support is in the developmental phase). Unfortunately, few games run on BeOS right now, but on the infamous *Quake II* "Crusher" demo, Voodoo² performance on BeOS closely matched that of Win98, losing by only 1fps—19fps to 20fps on a single P-II machine. Be's forthcoming



BeOS is well-known for its GUI aesthetic. With R4.5, it's becoming clear that the guts are smooth, too.

support for the Sound Blaster Live! will be welcome, although its lack of support for Aureal Vortex-based cards is disappointing; Vortex users would appreciate the new 3D Sound Mixer

that lets you spatially manipulate up to 16 channels of audio at once. Finally, USB support lets you hook up hubs, and multiple mice and keyboards. Yes, you can use *two* mice *simultaneously*!

To be a contender, BeOS needs three important changes. First, font placement and windowing is sketchy; users who run at high resolutions and want to use larger system fonts have to deal with truncated text and buried options. Second, *NetPositive*, the built-in web browser, is weak; although this release finally makes 40-bit encryption available to everyone, the lack of official support for Java and HTML 3.0 makes web browsing dull and lifeless. And third, no upgrade can account for the relatively small amount of commercial-grade software available for BeOS—though that's slowly changing. Adamation's *PersonalStudio*, a realtime software video editor; BeatWare's award-winning *e-Picture*; and *Gobe Productive*, an office productivity app, help to put off that next reboot.

We've found that overclocking brings Be systems down much easier than in Windows 98 or NT, but BeOS aficionados would tell you that after installing BeOS R4.5, overclocking isn't needed. We'll be keeping our eye out for version 5.

—Ken Fisher



BeOS handles multiple instances of multimedia gracefully. Here, six movies are playing, all sharing sound resources, and the dual-CPU's have cycles to spare.

MAXIMUM PC VERDICT

Price \$70
Company Be, Inc.
Phone 650.462.4100
URL www.be.com



Heavy Gear II

THE YEAR OF THE GEAR



It's about time someone made a mech game that isn't about hulking tanks on legs marching dumbly up to one another and unloading their weapons until one explodes—a game with more plot than plodding and more tactics than torso twists. Both *Shogo* and the original *Heavy Gear* gave us glimpses of such a game, but neither pulled it off with the panache of *Heavy Gear II*. Where other mech

THE SPECS

3D HARDWARE SUPPORT

Direct3D
DirectSound
DirectInput

MULTIPLAYER

TCP/IP
IPX/LAN

MODEM

Direct/serial

NO. OF PLAYERS

4 to 8

PLUSES

Gorgeous new graphics engine
Compelling campaign
Squad tactics
Strong AI

MINUSES

Overly complex controls
Polygon clipping problems

games use dazzling special effects to draw you away from their weak AI and limp storylines, *Heavy Gear II* delivers the full monty of stunning graphics, clever AI (from both enemies and allies), and a compelling campaign. You can credit *Heavy Gear II*'s graphical goodness to Activision's brand-new, hardware-only Dark Side engine. Capable of pushing 256x256 textures in full 32-bit color, *Heavy Gear II* benefits from the power of the Dark Side with sharply rendered mechs and terrain details, as well as eye-popping explosions that light up the landscape, and cool alpha-blended smoke effects that trail from each volley of spiraling missiles. Environmental effects, such as the splish-splash of raindrops and scene-ripping lightning bolts, pack the game's thunderstorms. Texture-mapped transparent-polygon conifers and tiny snowflakes drift in from a new particle-effects engine that turns alpine missions into winter wonderlands.

A few clipping and polygon-collision-detection glitches mar *Heavy Gear II*'s graphics, but the changing environment of each mission keeps the immersion level high. Missions take place day or night, in sleet or snow, on alien deserts, in forests and volcanic wastelands. Some missions even cut you loose in the weightlessness of space to float awkwardly about until your mission goals are accomplished. Note that the

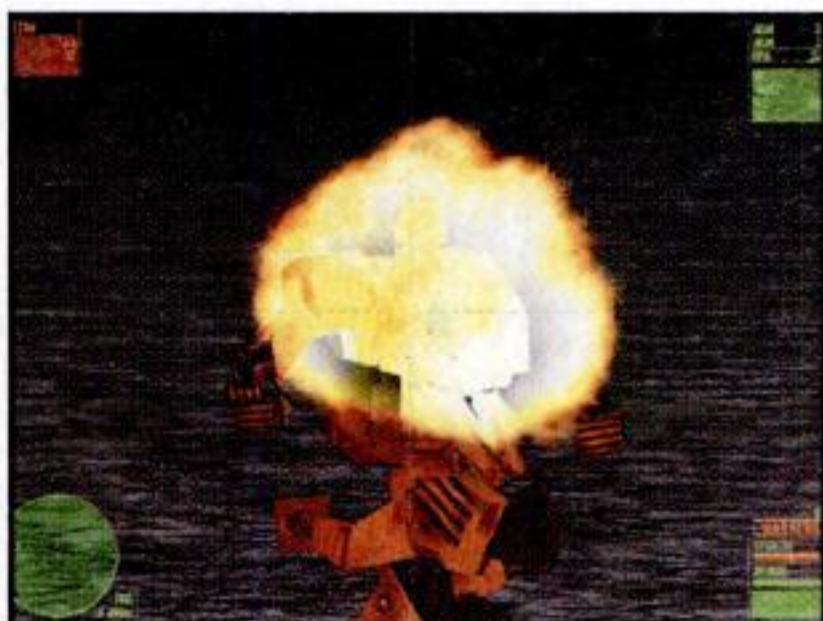
awkwardness refers to maneuvering in space, not to the framerates the game can do: We ran *Heavy Gear II* at 1024x768 on our Dell test system with a TNT2 Ultra and consistently pulled smooth 30fps action.

Heavy Gear 2 straps you into a smaller suit of armor, but lets you loose in a deeper world.

Heavy Gear II isn't a one-mech show. For most missions, you'll benefit from a backup squad that doesn't run willy-nilly around the battlefield, but actually follows orders. You can thank the game's exceptional AI, which also provides the enemy with smarter tactics such as flanking maneuvers and the tendency to stick with a single target until it drops.

While both *MechWarrior 3* and *Starsiege* carry on the tradition of battling 50-ton behemoths, *Heavy Gear II* drops you into 14-foot-tall battle armor and immerses you in a world where stealth and agility are more important than extra armor plating. And the game's revamped physics engine translates to a major increase in mobility for the smaller Gears, meaning more sidestepping, dodging, and ducking, and less charging into the fray head on. This also enables a new hand-to-hand combat system that incorporates both fists and sonic blades. Since stealth factors heavily into many *Heavy Gear II* missions, a handy stealth meter tells you when to kneel, crawl, or switch to passive radar to avoid being spotted. But no matter how many Gears you have on your side, there are some battles you just can't win.

Heavy Gear II transcends the traditional mech game by blending heavy weapons of destruction with high-speed first-person action and innovative squad-based tactics.



Heavy Gear II transcends the traditional mech game by blending heavy weapons of destruction with high-speed first-person action and innovative squad-based tactics.

—Sean Downey

MAXIMUM PC VERDICT

Price \$50
Company Activision
Phone 800.477.3650
URL www.activision.com



TAKING IT TO THE NET

While the *Heavy Gear II* multiplayer experience isn't as strong as single-player, it's easy to use and packs enough variety to make an online excursion worthwhile. A server browser with a lobby chat room is included, so you can see what you're getting into before you jump into a game. Besides basic kill-em-all death-matches, *Heavy Gear II* also has capture-the-flag, steal-the-beacon, and strategic base-against-base multi-player games.



Multiplayer match-ups are highly customizable, with weapons restrictions, game types, and gear limitations setting the stage for the exact game you want to play.

While the game supports up to eight players in one multi-player game, you don't want to attempt this at home until you get a cable modem or DSL connection. The latency is just too great on a 56K connection for any more than a five-player matchup.



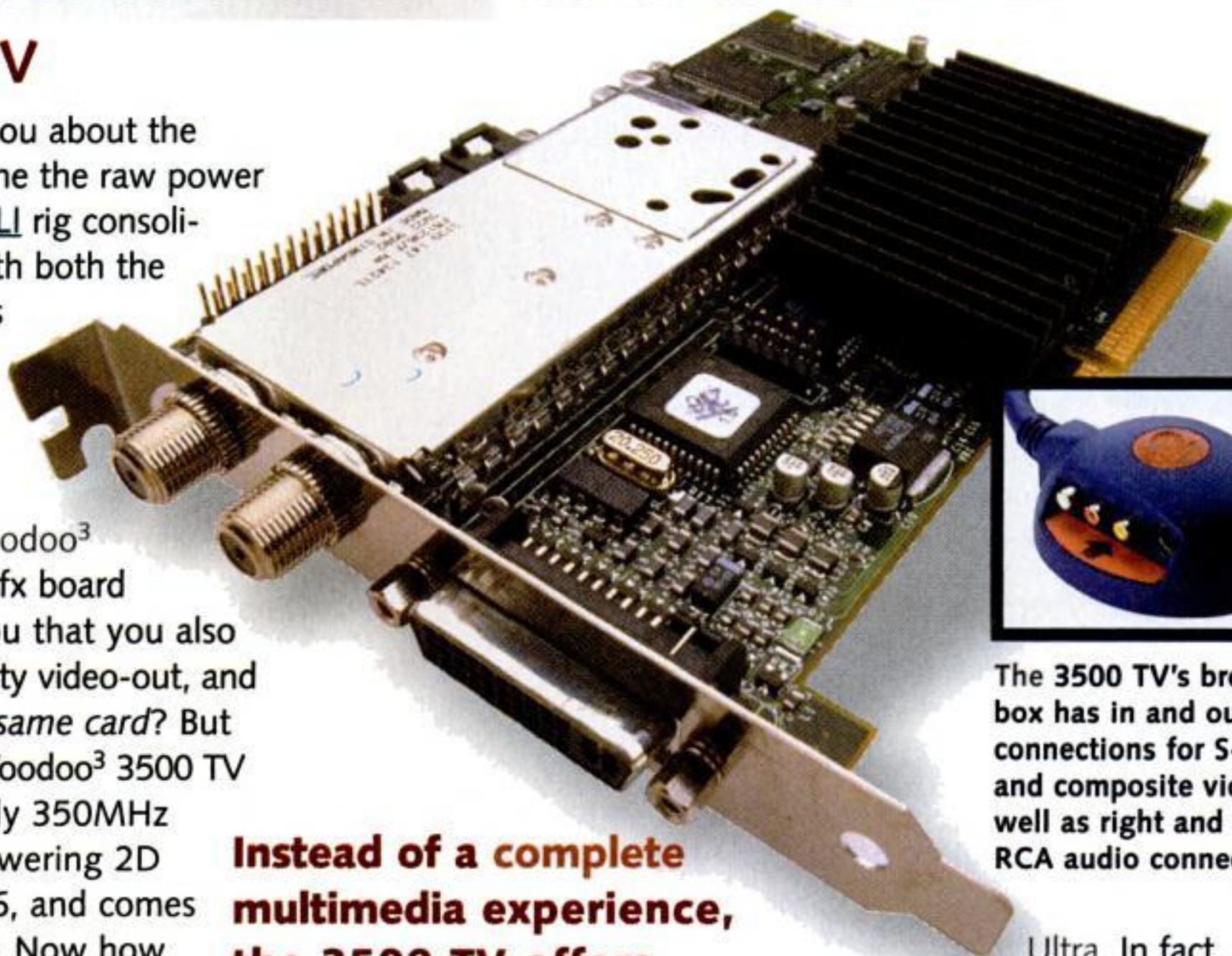
Online mech-on-mech multiplayer is hot and heavy, but you'll want a fast connection to get in on the action.

3dfx Voodoo³ 3500 TV

AS SEEN ON TV

Folks, we're here to tell you about the Voodoo³ 3500 TV. Imagine the raw power of a two-card Voodoo² SLI rig consolidated into one board, with both the memory and the graphics processors clocked to a super-speedy 183MHz. How much would you pay for a card like this? Keep in mind that the Voodoo³ 3500 TV is the fastest 3dfx board alive. What if we told you that you also get a TV tuner, high-quality video-out, and video capture *all on the same card*? But wait—there's more. The Voodoo³ 3500 TV is also armed with a burly 350MHz RAMDAC capable of powering 2D resolutions to 2046x1536, and comes with an FM-Stereo tuner. Now how much would you pay?

Before you answer, consider the limitations of the Voodoo³ architecture. You can forget about 32-bit color 3D rendering, AGP texturing, single-pass bump-mapping, and stencil buffer, and don't expect more than 16MB of onboard memory. 3dfx has banked on the fact



The 3500 TV's breakout box has in and out connections for S-Video and composite video, as well as right and left RCA audio connectors.

Instead of a complete multimedia experience, the 3500 TV offers a hodge-podge of bargain-bin features.

Ultra. In fact, without its additional multimedia features, the 3500 TV barely musters enough of a performance jump over the

Voodoo³ 3000 to warrant an upgrade. And when you consider the imminent arrival of the Matrox Marvel G400-TV, ATI's 32MB All-in-Wonder 128, nVidia's next wave of 3D processors, and even 3dfx's coming attractions, the 3500 TV just does too little, too late.

Take a closer look at the extra features designed to enhance your Voodoo³ experience. TV on your PC is pretty slick when it runs, but 3dfx's *VisualReality* software doesn't work as advertised. In addition to regularly leaving the overlay screen behind when the TV window was dragged around the desktop, *VisualReality* crashed several times while we were resizing the viewing window. And full-screen TV image quality falters at high resolutions. Nonetheless, TV-out image quality is notably good lookin', though it still doesn't match the TV-out quality of ATI's All-in-Wonder 128.

By far the biggest knock against the 3500 TV is its limited video-capture features. Yes, it can capture and compress MPEG-2 on the fly, but the software encoder mucks it up. And as if the 320x240 resolution limitation wasn't bad enough, captured video suffers from artifacting and dropped frames. Although the dropped-frame problem was somewhat remedied by new drivers from 3dfx, the image-quality issues are unacceptable for a board of this price.

Now, how much would you pay for a card like this?
—Sean Downey

THE SPECS

CLOCK SPEED

183MHz bus
183MHz memory

RAMDAC

350MHz

AGP SUPPORT

AGP 2x (no DME)

LOCAL MEMORY

16MB SDRAM

MAX 32-BIT RESOLUTION

1920x1440

MAX 16-BIT RESOLUTION

2046x1536

MAX 1600X1200 REFRESH RATE

85MHz

BUNDLE

Windows 9x & NT drivers |
InterVideo WinDVD |
Ulead VideoStudio SE |
3dfx VisualReality

VISUAL QUALITY



Quake III | 640x800

that most games don't take advantage of the next-generation features left off the Voodoo³. But this fall's hot titles just won't look their best without those features—so they're not going to shine on Voodoo³ boards.

Want an even harsher reality check? In all but the *Half-Life* timedemo, the Voodoo³ TV's frame-rates couldn't touch the current texel-tossing titan, Hercules' Dynamite TNT2

PLUSES

Fast, reliable performance
Good DVD playback
FM tuner pumps out clean audio

MINUSES

No AGP direct memory execute
No 32-bit color 3D rendering
VisualReality needs more refinement
Poor video capture quality

REAL WORLD BENCHMARKING

QUAKE II 1024x768 fps	61.5	<div style="width: 61.5%;"></div>
HALF-LIFE 800x600 fps	48.5	<div style="width: 48.5%;"></div>
EXPENDABLE 1024x768 fps	49.8	<div style="width: 49.8%;"></div>
DESCENT 3 800x600 fps	NA ¹	<div style="width: 0%;"></div>

Notes: Benchmarked on our Dell 500MHz Pentium III test system using version 1.02.13 of the 3dfx drivers. K7 benchmarks are posted online. As always, V-sync is enabled. ¹The Voodoo³ 3500 TV failed to complete our *Descent 3* timedemo due to the way the game implemented its Direct3D calls.

MAXIMUM PC VERDICT

Price \$249
Company 3dfx
Phone 888.367.3339
URL www.3dfx.com



Turn on, Tune in, Drop Out

TWO HALF-BAKED ATTEMPTS TO BRING TV TO YOUR PC

Can't wait to pipe your favorite TV shows to your PC? PCI-based TV-tuner cards have arrived, but the two we looked at suck big time. While these two boards let you watch TV in a window on your desktop, preview a slew of

channels simultaneously, and capture stills and AVIs from your favorite shows and home videos, unfortunately, we can't recommend either of these underperformers.

—Dan Simpson

ATI TV Wonder

ATI's TV Wonder coulda been a contender. After evaluating its arsenal of features, nifty gadgets, and uncompromising picture quality, we were dumbfounded by the piss-poor drivers ATI bundled with it. Problems we encountered included: Windows' inability to locate a mysterious seventh install disk; multiple reboots; alien gibberish in ATI's icon in the Start menu; and an inability to capture any video at all. We're pleased that all the requisite cables needed to hook the thing up were included, but that's not enough to save this card from sinking like a rock.

The TV Wonder's single saving grace is its easy-to-use *VideoDesk* software, a sleek app that's armed with an array of TV tuner accoutrements. Picture quality is also top-notch, even when scaling to 1280x1024. You can even zoom in on specific areas and continue watching the program in the zoomed area, rip a few stills of your favorite

PLUSES
Great picture quality
Tons of features

MINUSES
Crappy drivers
Video capture didn't work

program or movie, or watch TV as desktop wallpaper.

It's the availability of all this good stuff that makes the crudeness of the drivers so frustrating. We couldn't get the AVI capture utilities to work correctly with the drivers, and there were no updated drivers or patches available on ATI's web site. As far as we're concerned, this makes the TV Wonder an unfinished product. ATI has announced that a new release of the software utility and drivers are in the works, but there's no word on when they'll be available. Until ATI solves the driver problems, avoid this lemon.



ATI's TV Wonder gives you a great picture, but its performance is marred by shoddy drivers.

THE SPECS	
TUNER	125-channel TV tuner
INPUTS	TV, Super VHS, composite, audio
OUTPUTS	Audio

MAXIMUM PC VERDICT

Price \$79
Company ATI
Phone 905.882.2600
URL www.ati.com



STB Desktop TV

Unlike ATI, which threw every amenity under the sun into its TV tuner's box, STB has taken a decidedly no-frills approach with the Desktop TV. Not only is the Desktop TV more expensive than the TV Wonder, it also has poorer picture quality and a weaker feature set. It did, however, have working drivers that made installation a snap.

The Desktop TV has inputs for TV, FM, S-Video, and composite video, and a mini-jack input for audio. But the *VisualReality* software it's bundled with is about as exciting as white bread. It supports only minimal features, such as still and AVI capture, and channel previews, and offers a handful of picture quality controls. The picture itself suffers from horizontal noise and interference that only worsens when scaled to higher resolutions. Full-screen display is particularly dreadful, especially at resolutions above 1024x768, so if you plan to

watch TV on your computer using this card, expect to see your favorite shows in only a tiny window. The capture quality was equally awful, and playback suffered from jitters and dropped frames.

The best thing about the Desktop TV is its FM tuner. The *VisualReality* software also does a fine job at pumping local radio broadcasts through your PC, and the audio quality of both the TV tuner and FM receiver is top notch; we detected no audible hiss. But the audio capabilities simply aren't enough to convince us to recommend this card to anyone.



STB's Desktop TV is a bland card that suffers from poor picture quality.

THE SPECS	
TUNER	125-channel TV tuner
INPUTS	TV, FM, Super VHS, composite, audio
OUTPUTS	None

PLUSES
Easy to install and use
Good FM tuner

MINUSES
Poor picture quality
Poor capture utilities

MAXIMUM PC VERDICT

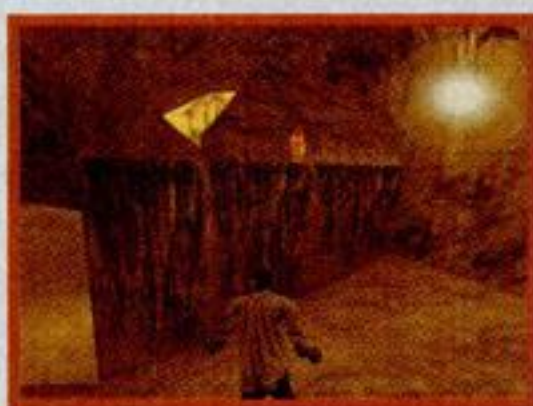
Price \$95
Company STB/3dfx
Phone 408.935.4400
URL www.3dfx.com



HINT: GOING TO THE CHAPEL

Though navigating *Shadow Man*'s world should be no problem for *Tomb Raider* fans, finding the Church early on in the Louisiana swamp can be tricky. Knowing that players would think it was a dead end, Acclaim even gives a hint in the manual, but it's still not helpful enough.

In this locale, keep going through the mine shaft/cave until you come to what appears to be a dead end. If you look up and to the left, you'll see another opening.



Go to the lower end of the ledge to the right and grab on. Since you can't pull yourself up, you'll have to slide using the Move Left key. Inexplicably, this doesn't work sometimes. When that happens, hop off and keep trying until the Move Left key kicks in and you can shimmy across the ledge.



Once you've grabbed the Cadeaux, keep shimmying over until you get directly in front of the opening. Then hit the Forward/Up key until you pull yourself up. Now walk into the Church and talk to Nettie.



Shadow Man boasts unique and compelling characters, revealed in cinematic cut-scenes, including Jaunty, a former human whose present form and predicament are the result of a bungled Voodoo experiment.

Shadow Man

ATMOS-FEAR-IC VOODOO CHILE

Known for the sports-game mojo that it conjures so well, Acclaim has worked its magic in a different genre with *Shadow Man*. The best nonsports game the company has ever released, *Shadow Man* offers immersive atmosphere, a compelling storyline, and unique characters that catapult this game above your typical *Tomb Raider* clone.

Based loosely on the Acclaim comic books of the same name, *Shadow Man* places you in the role of Mike LeRoi, a desperate dude who's been turned into the Shadow Man by a vindictive voodoo priestess. While being the Shadow Man means you're immortal, it also turns you into the priestess's zombie-warrior-love slave.

Debuting the proprietary

THE SPECS

3D CARD SUPPORT

Direct3D only

3D SOUND

DirectSound only

MULTIPLAYER

None

PLUSES

Unrivaled atmospheric gameplay

Rich, compelling storyline

Top-notch graphics

MINUSES

At times, felt like a typical shooter

Good but not great voice acting

No big difference between lower and higher resolutions and color depth

Virtually Integrated Scenic TerrAin (VISTA) engine, *Shadow Man* drops you into a world filled with the sights and sounds of Voodoo

magic, from the muffled cries of Louisiana swamp life to the painful groans of the horrific Deadside inhabitants.

The gorgeous landscapes are rendered in 32-bit color, with 256x256 texture maps bringing rich detail to each eerie location. We were excited by the 1280x1024 maximum resolution, and the VISTA engine makes for some pretty impressive visuals. VISTA's most compelling feature is that it allows you to see as far as the horizon without using a depth-cuing fog engine. At 800x600 on a

Pentium II 266MHz, *Shadow Man* ran at about 30 frames per second; at 1280x1024, that number dropped down to about 25. All of the now-standard lighting and transparency effects looked superb on our TNT2.

Throughout the game, you must navigate worlds from an over-the-shoulder, MDK-like point of view (with an optional sniper mode). But the camera can be moved to a nearly infinite number of gameplay positions. You'll spend a great deal of time running, jumping, climbing and shooting, though there were times when we felt we were



Everything in *Shadow Man* is consistent with the Voodoo feel and atmosphere, from the in-game menus to the opening credits.

missing too much of this rich world while shooting, especially since our opponents were slow-moving, AI-challenged dead guys. We'd rather have been conjuring Voodoo, solving puzzles, or navigating the levels. Power-ups

aren't just left laying around (save for the occasional soul hidden in the ubiquitous breakable pottery)—the only way to regain your strength in Deadside is to use your Shadow Gun to literally rip and absorb the souls from the attacking dead. If you get lost on your journey—which isn't so tough—pay close attention to the cut-scenes, as they will often point you in the right direction.

At a time when multiplayer is as hot as an Internet IPO, this game is surprisingly solo. However, this turns out to be a better thing than one might expect; the designers seem to have spent that much more time focused on creating a truly intense single-player experience.

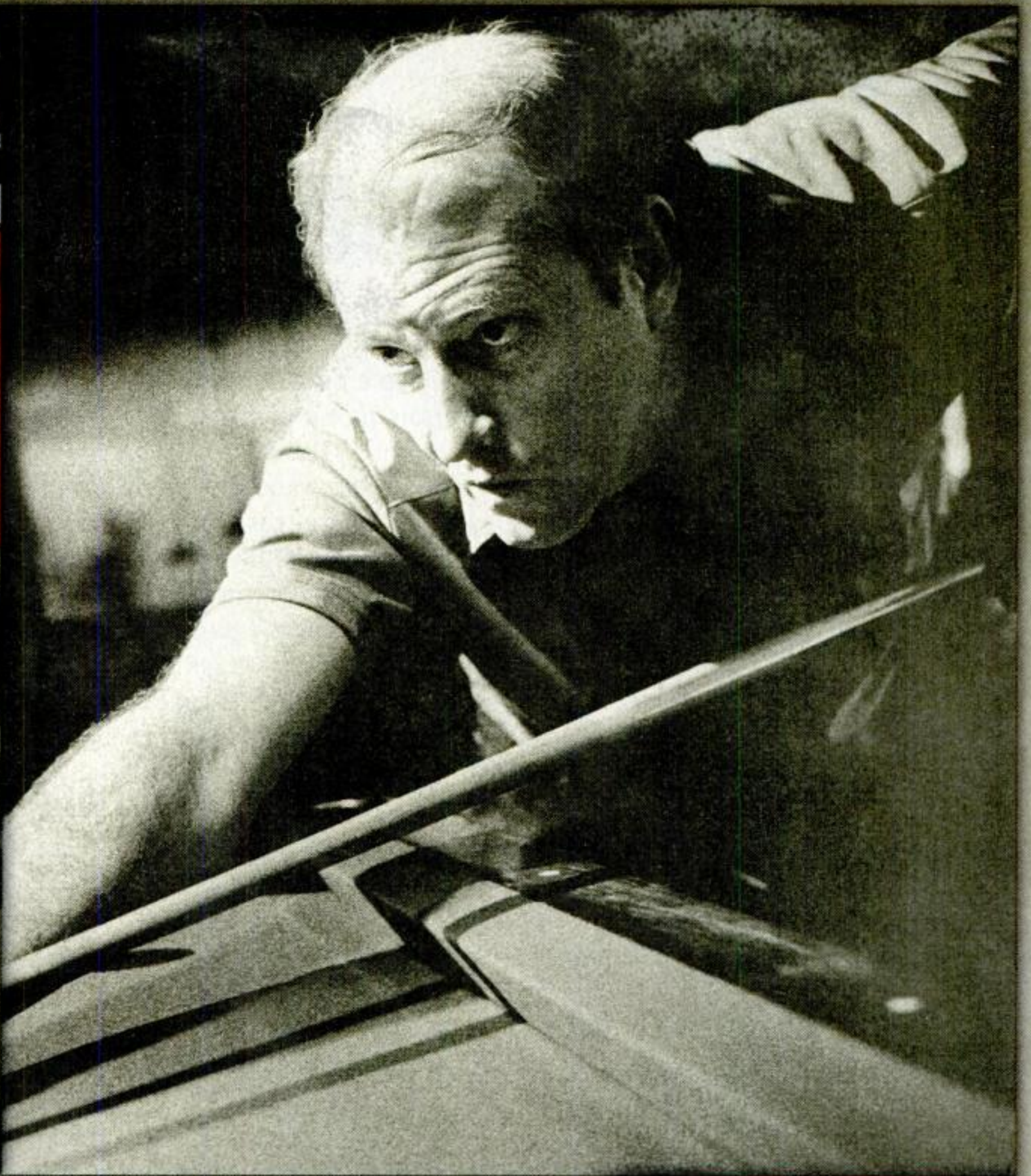
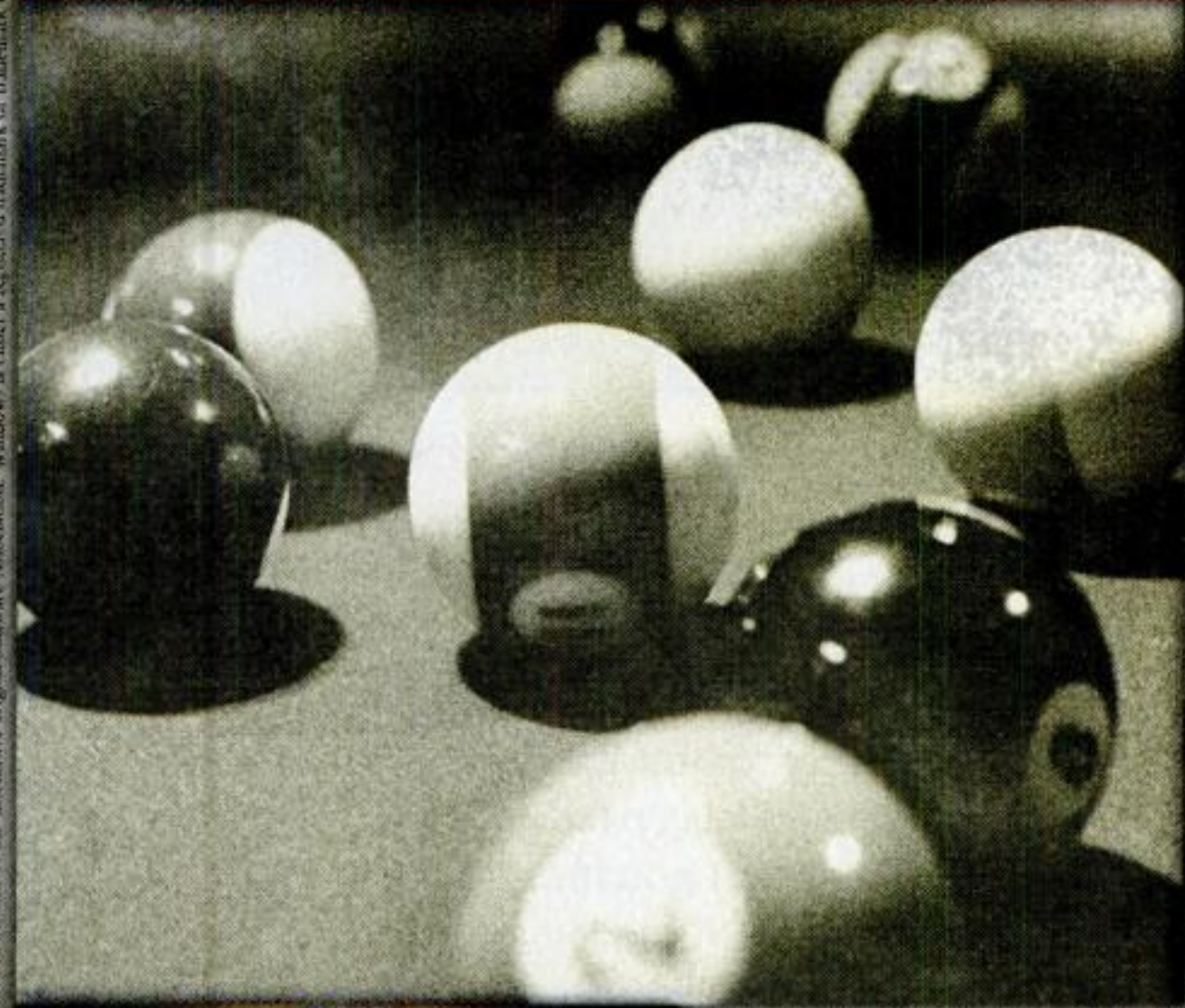
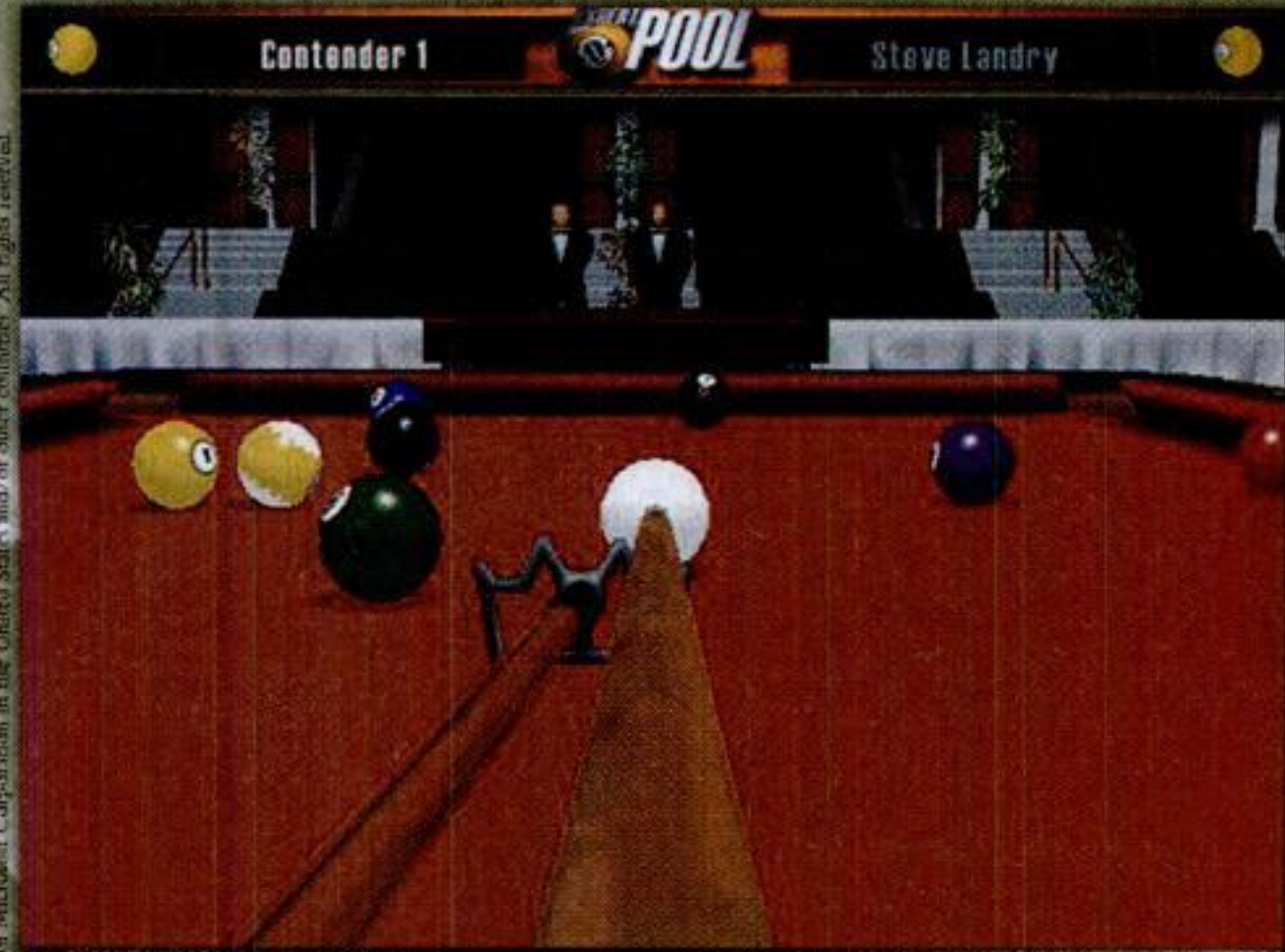
It's a rare game that can weave such a rich tapestry, filled with atmosphere and compelling subplots; it's an even rarer action game that can do so. From the cinematic opening, to the background sounds, and even to the in-game menus, *Shadow Man* offers some of the best atmospheric effects we've seen in years. Any action gamer with half a soul will gladly let *Shadow Man* work its Old Black Magic on him.

—Shane Mooney

MAXIMUM PC VERDICT

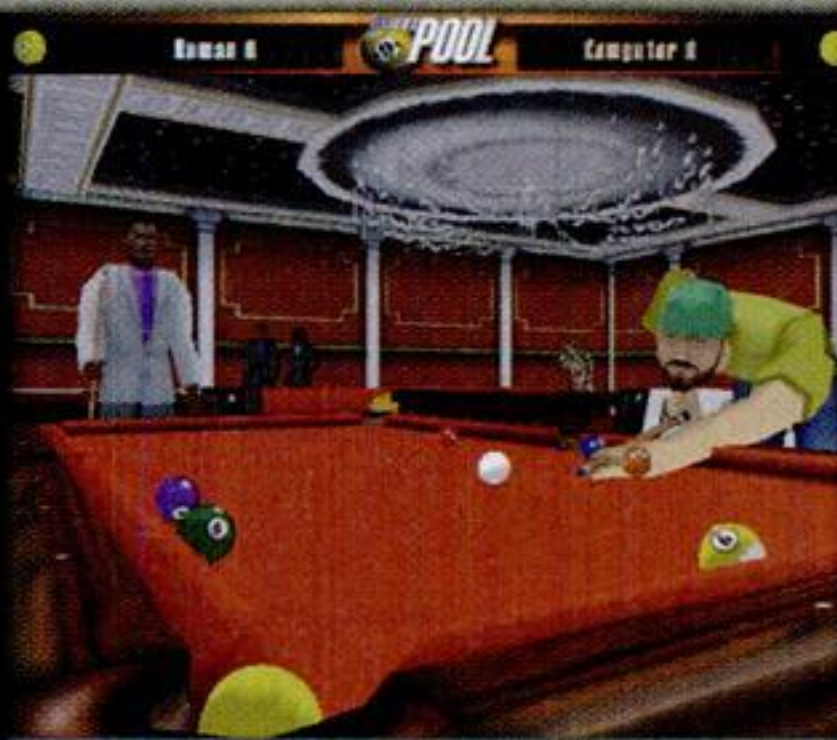
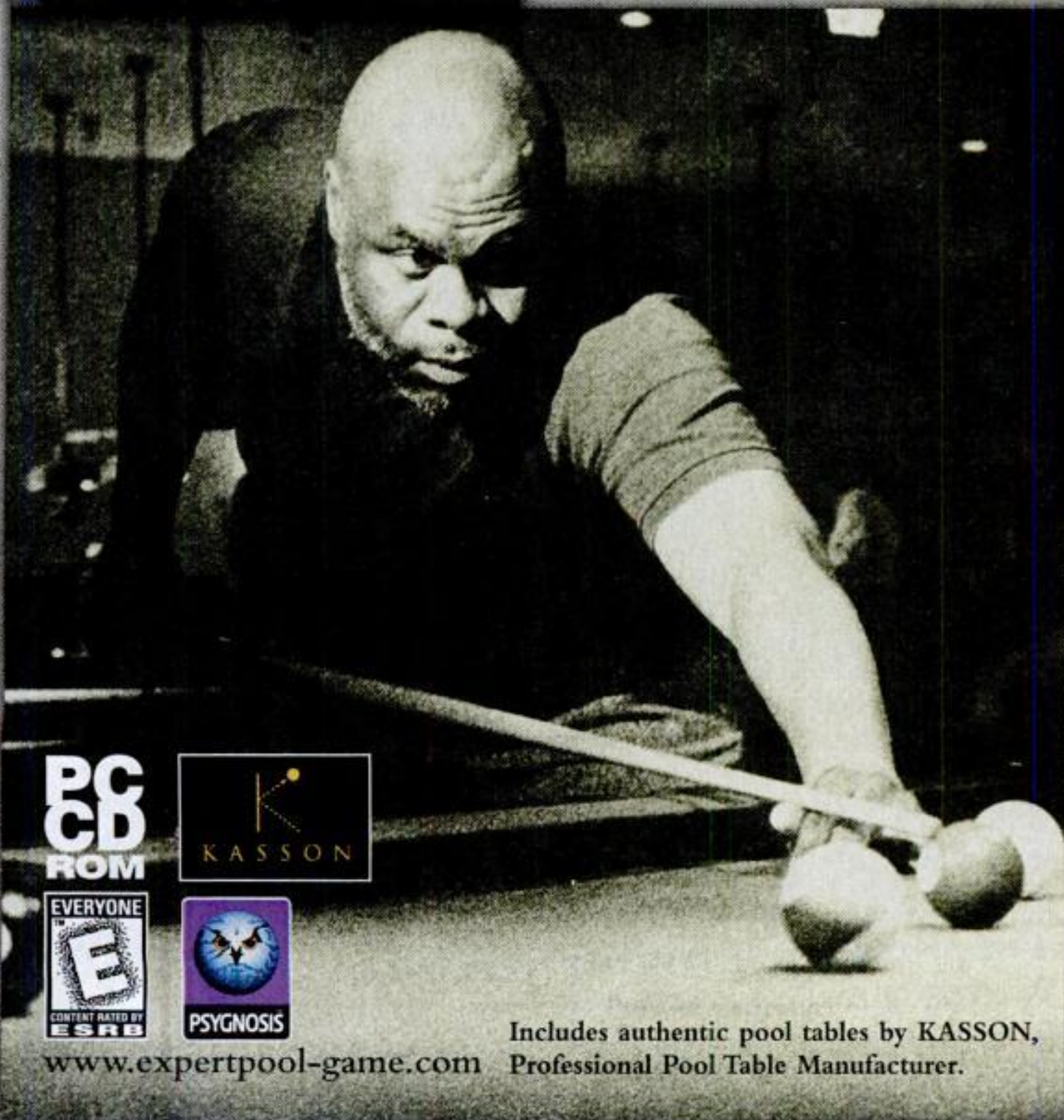
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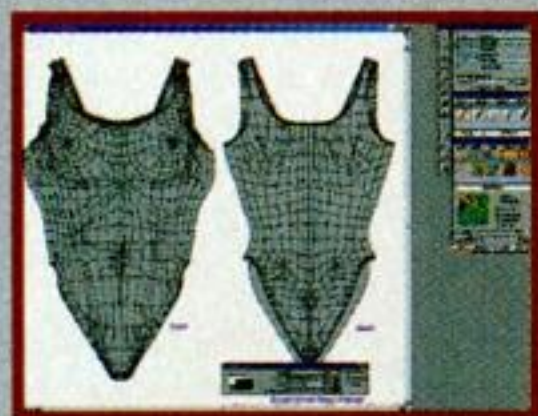


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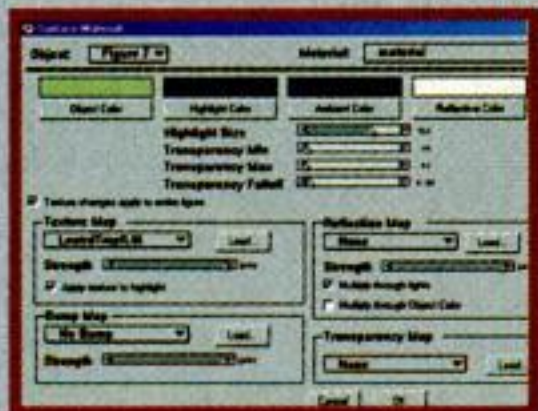
Using *Painter 3D*, which comes with *Poser*, we'll design a bathing suit for our model.



► Step 1: Launch *Painter 3D* and open the LEOTRDTMPLT.TIF in the texture folder on the *Poser* CD.



► Step 2: In the Art Materials window, select a funky pattern. In the Effects menu, select Fill, then fill with a pattern and save the image to the desktop as LEOTRDTMPLT.TIF.



► Step 3: Launch *Poser 4*, select a model, and dress it in the standard leotard. From the Render menu, select Materials, and under Object, select the figure that represents the leotard. Check the "Texture changes apply to entire figure" box in the Texture Tap settings. Choose Load and load the texture map you saved to the desktop. You can also change the object color to green.



► Step 4: Congratulations, you've just designed a new bathing suit!

Poser 4

VIRTUAL BODY BUILDING

You gotta love a product that puts an essentially naked person on its box. *Poser 4* has that and more going for it. The 3D animation and figure design app still has some kinks—such as inverse kinematics (IK) that occasionally flip out, and export formats that don't import correctly into other applications—but when you really dig into it, you'll find that *Poser 4* places a world of creative possibilities at your fingertips.

Version 4 adds a handful of new models, including three robots and very anatomically correct nude male and female models. We can only imagine what lonely users are going to be creating with this program when no one's around. And with *Poser 4* you

THE SPECS

IMPORT/EXPORT

Background image:
PICT/TIFF/JPEG/BMP
Background movie:
QT/AVI
Audio: AIFF/WAV
3D: BVH, MetaStream,
3DS, 3DMF, DXF, Detailer
Text, OBJ, RIB
Rendered image:
PICT/TIFF/JPEG/BMP

PLUSES

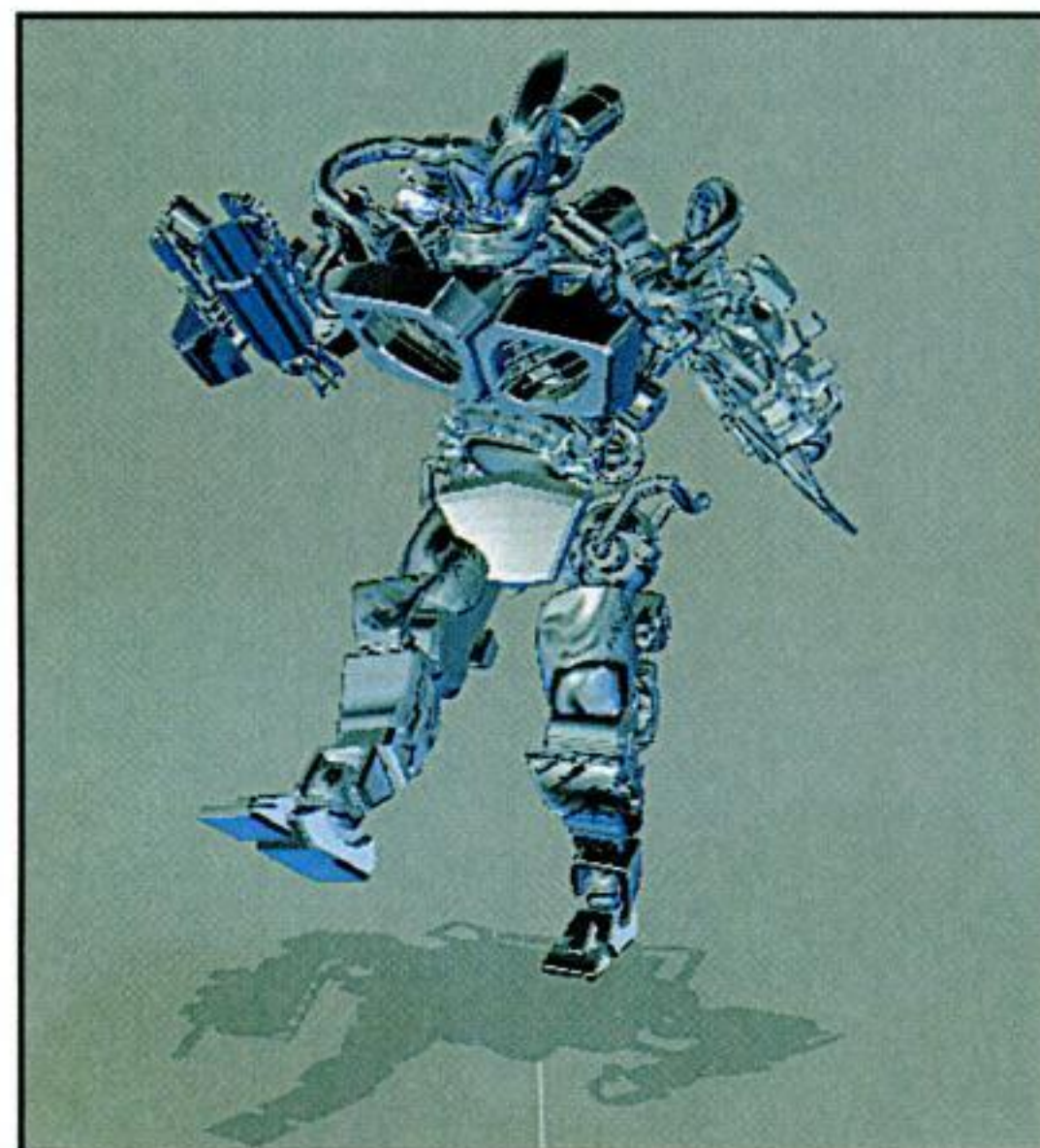
Lifelike models
Includes *Painter 3D* for *Poser*
Everything is animatable
Great lighting
Great sketch designer

MINUSES

Phong shading
Occasionally wonky IK
No right-mouse-button shortcuts
Screwy DXF export

can clothe your figures in shoes, bathing suits, work duds, or your own designs, courtesy of the supplied templates and a basic image editor. After you've posed and clothed your characters, your next task is to add realism. But because *Poser 4* inherited the previous version's phong-based renderer, an antiquated algorithm that makes your characters look somewhat cartoony, this can be a tough prospect. Fortunately, MetaCreations made up for this shortcoming by including professional texture-map and lighting tools that allow you to tweak a texture's transparency, and add texture bumpmaps and multiple lights to a scene. We encountered a weird glitch with the light effects, though. Depending on where we placed lights in our scene, we ended up with charcoal-like scars embedded in our character's skin when rendered out. Simple fix: Move the lights or turn off shading.

Poser 3's stock characters were too white bread for our diverse tastes, but this time around, MetaCreations included customizable expression settings and face templates for just about every nationality. With the facial parameter dials, you can easily make a character's mouth open and



This robot is one of the new figures that come with *Poser 4*.

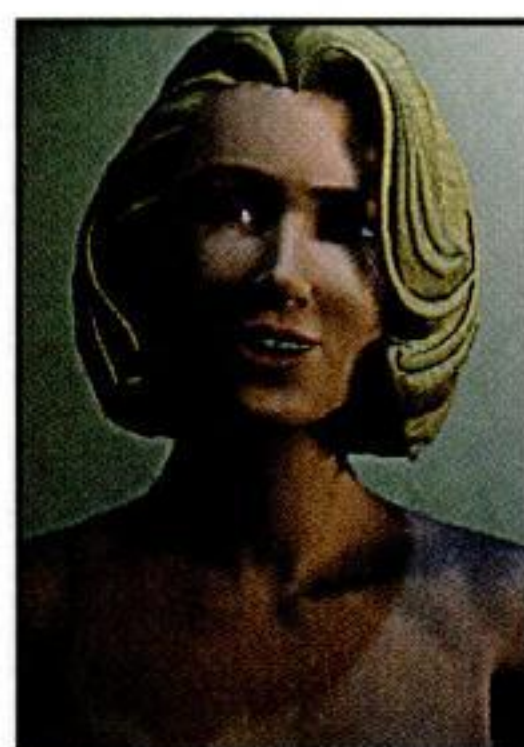
close, smile and frown. You can raise the eyebrows, widen the cheekbones, square the jaw, and generally contort the face into just about any expression imaginable.

Another bit of goodness in *Poser 4* is the sketch designer. It renders posed models in various artistic styles—from charcoal to pen-and-ink to psychedelic—each of which is fully customizable. After each adjustment, a thumbnail screen updates your changes—a nice touch, but these changes can take some time to update, even on a fast computer. A draft mode would be in order for the next version. The sketch designer is super-tweakable, and creating everything from scratch is a blast, but the artistically and time challenged who can't afford to spend hours keyframing walk cycles want this work done for them.

In future versions, we'd like to see more motion captures, facial expressions, and poses, instead of the token handful supplied in this release. We'd also like a simpler keyframe editor. The UI makes it appear easy to do, but it actually took us hours to create a semi-complex scene with a walking, talking, and blinking character.

The ease of use and speed with which you can create professional-looking animations separates *Poser 4* from other consumer animation apps. It gets our hearty recommendation.

—Rick Popko



Poser's models are getting more realistic, but they still look cartoony.

MAXIMUM PC VERDICT

Price \$399, \$129 for upgrade
Company MetaCreations
Phone 800.846.0111
URL www.metacreations.com

8

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MAXIMUM PC NETWORK
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3D Studio Max 3.0

MAXIMUM ANIMATION



3D Studio Max satisfies a 3D developer's every need. This all-in-one app packages modeling, animation, and rendering tools that put you on the way to creating 3D worlds. With 3D Studio Max, you can build three-dimensional objects, assign surface textures to those objects, build a virtual world specifying lighting and camera viewpoints, then set the world in motion through animation.

THE SPECS

IMPORTABLE FILE TYPES

3DS, AI, DWG, DXF, WRL, WRZ, STL, IGES

EXPORTABLE FILE TYPES

3DS, AI, ASCII, DWG, DXF, WRL, STL

RENDERING FILE TYPES

AVI, BMP, CIN, EPS/PS, FLC/FLI/CEL, JPG, PNG, MOV, RGB, RLA, RPF, TGA/VDA/ICB/VST, TIF

Sure, other animation packages claim they can do all that for a lot less than \$3,500, but what these less expensive apps—such as Caligari's *Truespace* and MetaCreations' *Ray Dream Studio*—can't match is Max's unparalleled rendering engine and work flow. Max is not only a Kick Ass product, it's also worth every extra penny you'll spend.

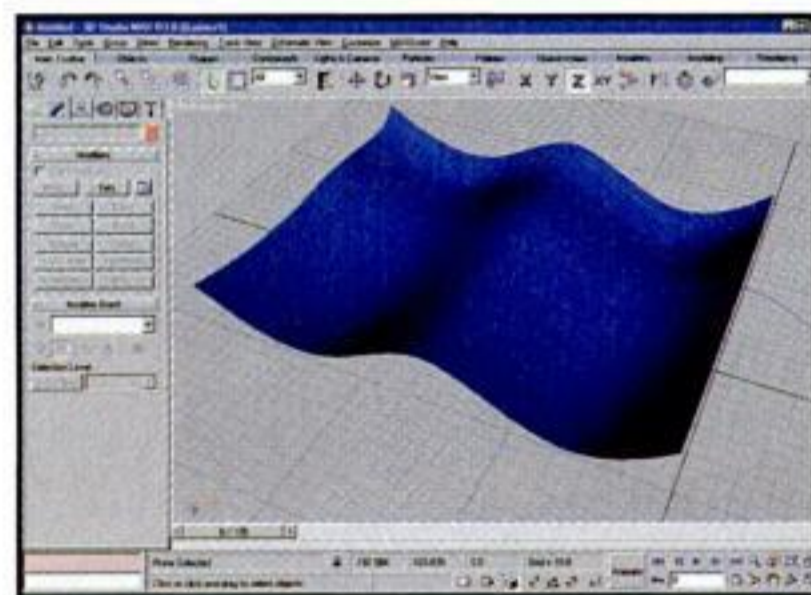
Low-cost animation apps typically have limited undo and redo capabilities. Most let users specify the number of undos, but none allows redos of more than

PLUSES

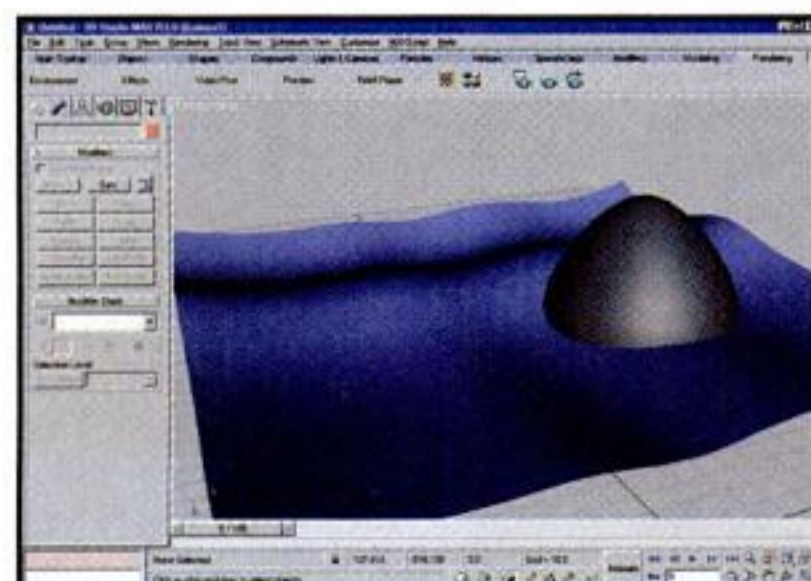
- Incredible artistic control
- Realtime RAM preview
- Organic soft selection
- Fast interactive rendering and video post proofing

MINUSES

- Learning curve still quite long
- Requires a powerful (expensive) computer
- User license cannot be transferred upon resale



The two NURBS curves are all Max needs to build a very complex surface quickly using the rail sweep tool.



By using the Attachment Controller, this buoy's flotation atop an irregular and unpredictable water surface is now a snap.

the most recent action. In Max, undos and redos are handled by the Modifier Stack, which tracks every change you've made to your document. You can return to any step in the modeling process, change its parameters, and leap to the top of the stack again. Max then rebuilds the model and applies all the succeeding steps automatically.

Max's incredibly stable boolean tool set, which lets you easily create complex objects whose geometry departs radically from a basic primitive, also elevates it above less-expensive apps. The cheaper packages all allow union, intersection, and subtraction, but often crash when performing more complex operations. In Max, not only do operations rarely fail, but the Modifier Stack also extends to booleans. The operands remain independent: If one is too small or not properly positioned in relation to the other, you can scale or move the offending operand, and Max will rebuild the boolean. Low-end programs require reconstruction.

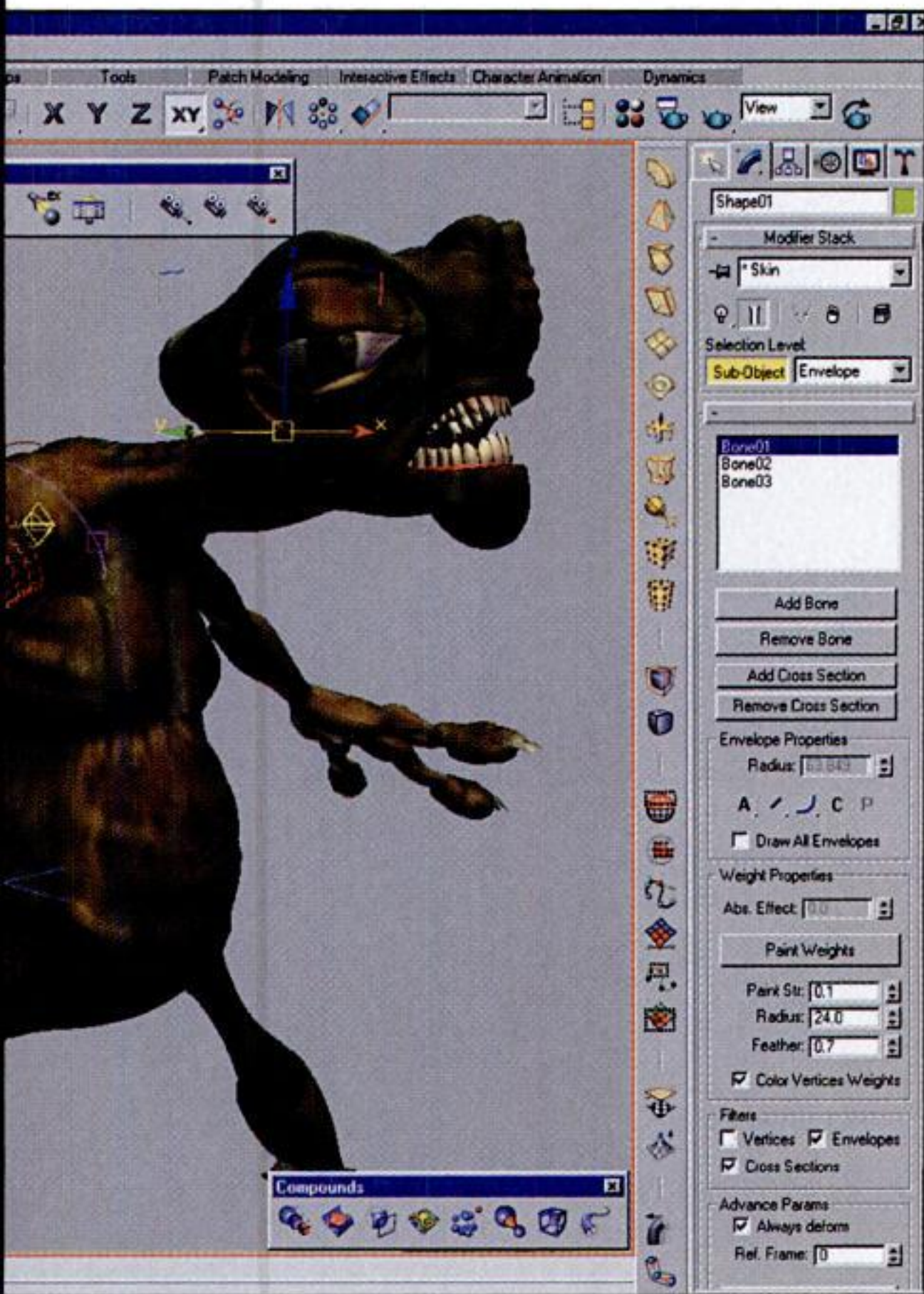
For animators, the only thing more important than a solid set of boolean tools is a trusty NURBS modeler. A NURBS object is defined by a Non-Uniform Rational B-Spline formula. Nearly all low-end packages support NURBS. A NURBS object has a smooth, easily modeled surface. In a typical scenario, you convert a polygonal mesh to a NURBS object and manipulate its shape using the old vertices as control vertices (CV). Moving a CV alters the position of an entire surface. With NURBS, you start with a primitive shape: a basic geometric shape such as a box, a cylinder, a sphere, or a plane. From there, you push and pull multiple CVs to sculpt the object, a limiting and time-consuming task. It's one thing to sculpt a cube by moving its four vertical and four horizontal CVs to push out its sides. With a human face, you'd need hundreds of CVs to achieve realism. So, Max provides U and V lofts and one- and two-rail sweeps. This streamlined operation lets you define contour lines at



3D Studio Max is powerful enough to be used by game developers and Hollywood special-effects houses.

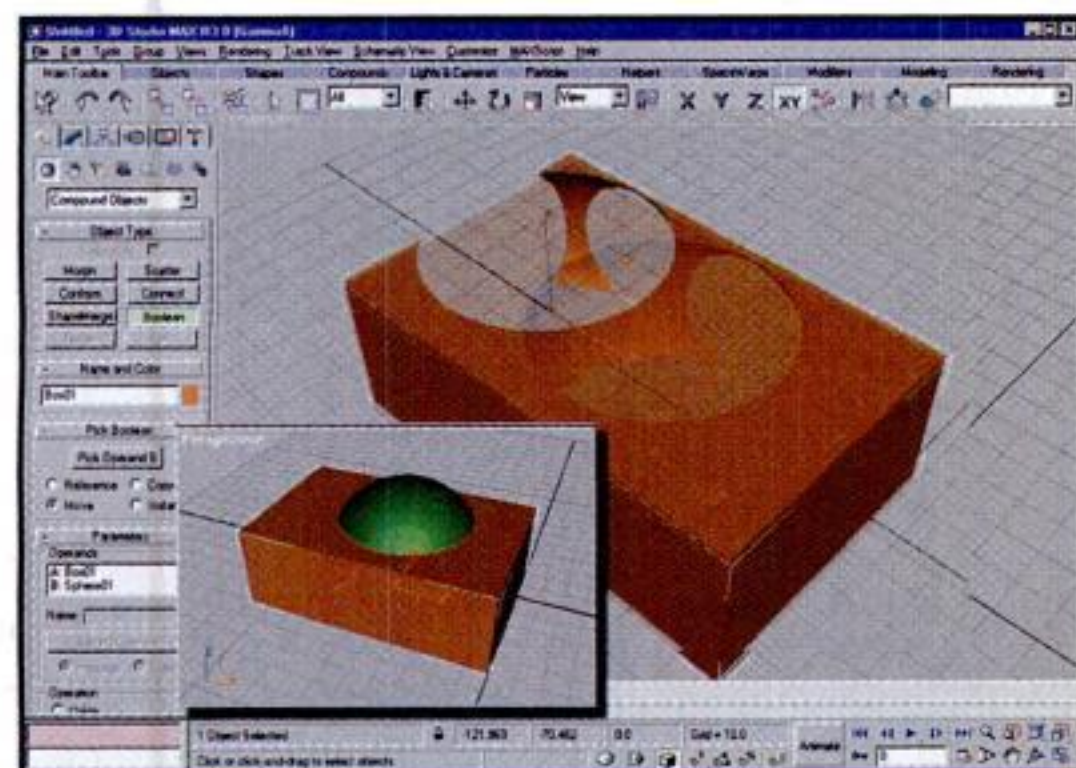
appropriate points between which Max skins automatically. Contour lines are much easier to refine than multiple CV NURBS surfaces. Result: You achieve a superior object in less time.

Max's animation tools alone are worth the price of admission. Low-priced packages all support animation, but their tools are limited. Most apps require you to set keyframes and apply transforms to objects at those keyframes in order to define the animation. This system suffices if you're dealing with only a small number of control points, but it breaks down completely when animating hundreds or thousands of points. Say you're creating convincing lip-sync, facial expressions, or organic movement. No sane person could track all those changes and keyframes, so Max simplifies it for you: You assign an object the responsibility for determining the movement of a large number of



control points based on a formula, much like a puppeteer manipulates many joints of a marionette by moving one lever. Max employs two of its most useful animation tools—Compound Controllers and Dummy Objects—to accomplish this task. The Dummy Object is an invisible object linked to a selection of control points. By manipulating this one object, all linked points move in some predictable fashion. This permits you to track hundreds, or even thousands of control points by moving only a few.

Two more animation tools—the Attachment Controller and the Noise Controller—are also stellar. Attachment, as the name suggests, “attaches” one object to the surface of another. A perfect example is a buoy floating atop an animated water surface. The water’s undulations are nearly random, and positioning the



A sphere is subtracted from a box, then the sphere is moved, resulting in an entirely new object without rebuilding the boolean.

buoy correctly over time would be impossible, as we can’t predict where the water’s surface will be from one moment to the next. The Attachment Controller lets you specify the point on the water’s surface you want the buoy to follow, and uses a bezier path to adjust how closely in position and time it mimics the motion. The result is very close to reality. The Noise Controller acts much like the noise filter in Adobe *Photoshop*, except that this noise is computed dynamically based on changes in position, rotation, or scale. A common complaint with computer-generated art is that the end result is too “perfect,” and therefore unrealistic. The Noise Controller introduces the randomness of nature. If the object follows a path, it doesn’t execute a perfect parabola, but rather undulates slightly based on specified settings. The Noise Controller regulates its effects’ strength through fractal noise in any combination of x-, y-, and z-axis values.

Max 3.0 also introduces Soft Selections, which permit you to define a region of diminishing influence for a selection. This also closely mimics nature. For example, in nature, a light breeze doesn’t spread out over a flag in a straight line, but blows over it gradually. Soft Selections permits realism virtually impossible in an inexpensive modeling program.

Finally, release 3.0 allows subtle refinements associated with common rendering effects and special effects, such as lens flares and depth of field. In the past, these “post” effects had to be applied after rendering. If you didn’t like something, you had to reset the post parameters and re-render to see the effect. The new system keeps the geometry and texturing already rendered in the background of the object you’re working on, making re-rendering unnecessary. No \$500 program gives so much artistic control with so little time investment. Other new features in Max 3.0 include a fully customizable interface, which permits users to create icons that trigger entire design processes, a new realtime RAM player, and NURMS modeling, which is a cross between the polygon MeshSmooth modeler and the NURBS modeler.

3D *Studio Max* is clearly a big-league application. Game developers have used it to create *Sim City*, *Tomb Raider*, and *Duke Nukem*, and Hollywood producers used it in the film *Lost in Space*. If you’re seriously considering a full-time career in 3D and don’t want to plunk down serious dough for Avid’s *Softimage* or Alias’ *Maya*, then Max is the place to start.

—Rick Stevens

MAXIMUM PC VERDICT

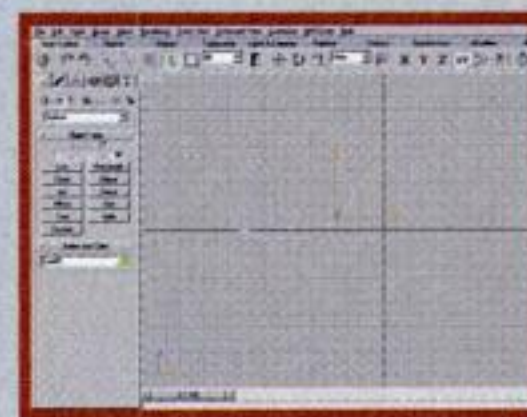
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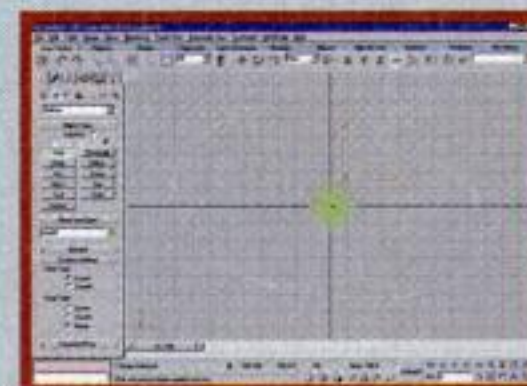
Build a spacecraft and set its path through the sky.

Step 1 ► Using the Line tool in the Create section, draw a cross-section.



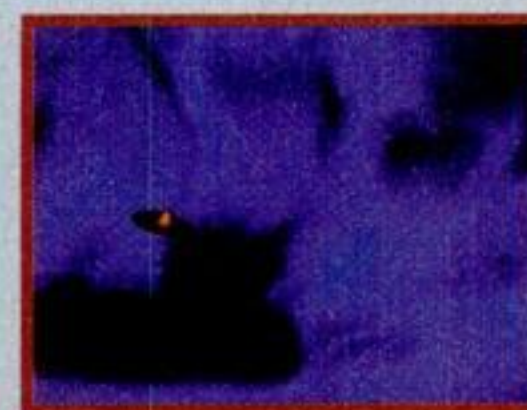
Step 2 ► With your line selected, enter the Modify section and click on Lathe. Under Align, click Max. Bump the segments up to 40. This line path becomes the spacecraft after lathing.

Step 3 ► In the top viewport, create a path using the Line tool, as shown below. Select the saucer and enter the Motion section. Under Assign Controller, select the Position transform and assign a Path Controller, making sure Position is selected. A smooth bezier path gives the best results.



Step 4 ► Click on Pick Path and select the path you created. Select the checkboxes Follow and Bank. Up the Bank amount to 4.

Step 5 ► Activate the Perspective Viewport, zoom out until the entire path is visible, and render your animation. For added realism, specify STARFLD1.TGA in Environment to get the background and a shiny chrome material for the spacecraft.



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To view the complete animation, check the Re:Print section of the web site for SPACE.AVI.



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System Shock 2

THE THINKING MAN'S QUAKE

The original *System Shock* was revered for its innovative use of *Doom*-esque action and RPG-like characters. With *System Shock 2*, Looking Glass Studios has created a worthy sequel that handles this genre-bending with equal aplomb. Though it has some hobbling faults, *SS2* succeeds at being one of the most creative titles to come along in a while.

With no memory and a dark secret, you awaken onboard a haunted vessel, the *Von Braun*, an engrossing environment that's part *Quake*, part *Resident Evil*, and part *Fallout*. Using a tricked-out version of *Thief's* Dark engine, *SS2* presents an eerie atmosphere wrought with subdued textures, volumetric fogging effects, and slick light-sourcing. Running in Direct3D at up to 1024x768, *SS2* rarely misses a beat at a rock solid 30+fps. Its only graphic weakness is thin texture resolutions, which peter out at 64x64. Coupled with character models built on a paltry 300 polygons, this results in distorted and stiff opponents. The otherwise admirable graphics are complemented by A3D- and EAX-enhanced sound effects that make the vessel's darkened corridors even spookier. The voice actors rarely sound cheesy, and the music, though repetitive, increases the tension.

Creating a character in *System Shock 2* involves choosing a military branch:

Marines, Navy, or Black Ops. Each branch excels at different skills, which affects your experience throughout play: The Marine is a complex weapons- and armor-skills pro; the Navy character brings hacking and repairing skills to the table; and the Black Ops character grants you a variety of psychic powers. As the game progresses, you can beef up your stats with cybernetic enhancements, allowing your character to learn new (and improve old) skills. Character classes aren't limited, either—you can choose to bone up on abilities outside your area of expertise, so a Marine can pick up a few psi skills, and a Techie can amass heavy artillery. Nonlinear puzzles allow for a variety of solutions: Navy techies can hack their way

through a door, while the Black Ops might be required to find a key. Overall, characters are fairly balanced in terms of their skill sets, and *SS2's* varied situations mean each will shine or slump at different times.

System Shock 2's immersive single-player experience makes multiplayer an afterthought. Four players can link up to cooperatively solve the single-player mission, but that pretty much elim-

inates the game's "isolation and fear" aspect. And at times, the level of detail in *SS2* is too much. Constant irrita-

tions such as gun repair can be aggravating—if technology has reached the point of faster-than-light travel, you'd think your weapons wouldn't fall apart after ripping through a clip or two. What bunk! Plus, uninspired opponents such as psychic vivisectioned monkeys and self-detonating droids are too absurd to be taken seriously, and some of the puzzles are cliché "find key x to open door y" setups.

Despite these quibbles, *System Shock 2* shines where it counts: in immersive gameplay that bends genres. Gamers looking for a refreshing change of pace from redundant fragging need look no further.

—Dan Simpson



Steeped in atmosphere, System Shock 2 is one hell of a creepy game.

THE SPECS

GRAPHICS
1024x768/16-bit Direct3D
SOUND
A3D EAX
MULTIPLAYER
TCP/IP IPX Modem 4-player max

PLUSES

- Nail-biting gameplay
- Excellent meld of RPG/action/horror
- Variety of character skills and abilities

MINUSES

- Low-poly-count character models
- Weapons degrade too fast
- Some corny opponents

MAXIMUM PC VERDICT

Price \$45
Developer Looking Glass Studios
Publisher Electronic Arts
Phone 800.245.4525
URL www.ea.com



The interface for *System Shock 2* is sleek and ergonomic.



Something is seriously wrong on board the *Von Braun*. It's time to take out the trash!

GETTING THE MOST OUT OF CHARACTER CLASSES

A choice of three character classes in *System Shock 2* results in a variety of skills and abilities that can work to your advantage in the bowels of the *Von Braun*.

If you decide to go Marine, bone up on your repair and maintenance skills. Functional artillery is a must. Keep plenty of maintenance tools on hand and don't forget you can use your wrench to pulp those hybrids. The Marine is a well-rounded character that can also pick up a few psi or tech skills.

The psionicist is the most versatile—and difficult—of the character classes. While weaker at lower levels, the Black Ops profession shows its might at higher levels, with powers such as teleportation and regeneration. Keep up on your psi hypos and pick up a few technical and weapons skills along the way.



A host of psychic powers are available to members of the Black Ops.

The Navy class is fun for one reason: hacking. Naval techies can explore the *Von Braun* by disabling security cameras, accessing locked crates, and cracking Value-Reps. But don't get caught with your pants down—pick up weapons and maintenance skills so you can fend off hybrids when they hunt you down.

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A USB web cam is one of the coolest toys a computer geek could want. Now you too can spy on your neighbors, check up on your unsuspecting nanny,

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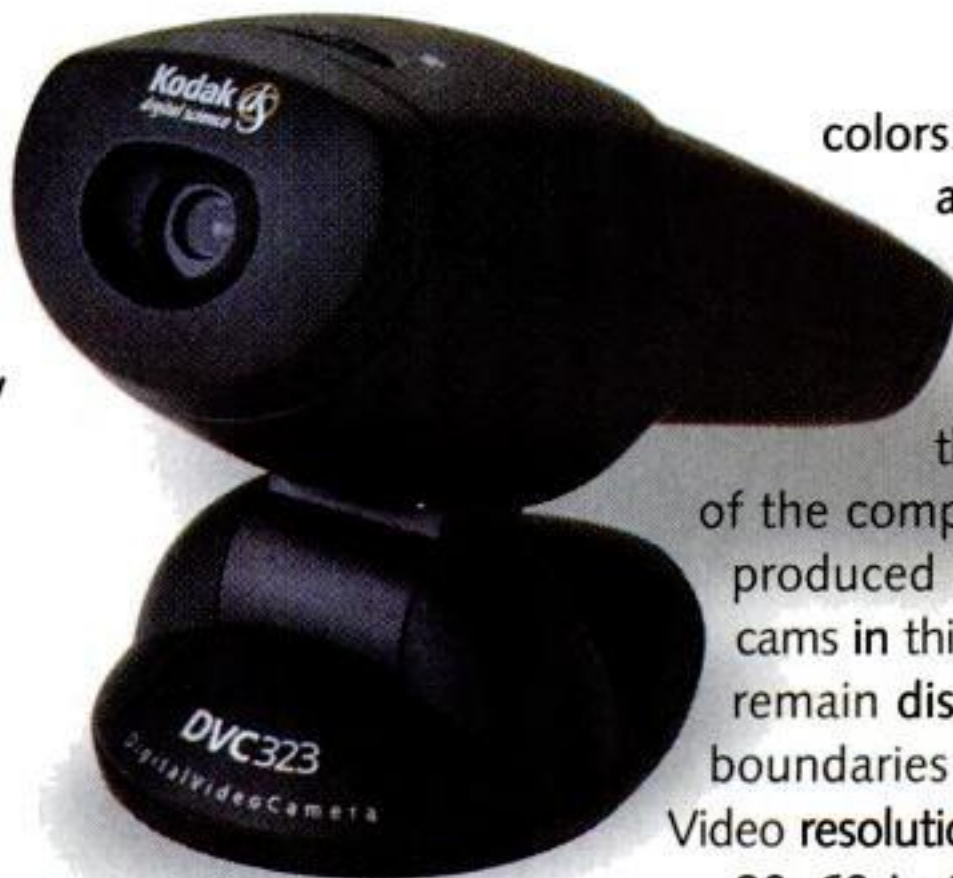
do just about everything a digital still camera can do, for a fraction of the price.

—Josh Norem

Kodak DVC 323

When Kodak released it in February 1998, the DVC 323 was the *crème de la crème* of desktop video. Now a bit long in the tooth, it still holds its own against the competition.

About the size of a small banana, the 323 travels easily. You can adjust viewing angles by a wide 30 degrees and snap the 323 off its base for handheld action and tripod mounting. It captures images in 24-bit color and saves in TIFF, BMP, JPEG, and PNG file formats. Quality of still pictures—snapped by clicking on screen or pushing the button on top of the camera—is impressive throughout the 323's 160x120 to 640x480 resolution range, with few visual artifacts and crisp



Green hues plague the Kodak's image, but it's still very crisp and lacks the compression artifacts displayed by the other cameras.

Netcard, as well as Kai's *PowerGoo SE*, Microsoft *NetMeeting*, and Kodak *Picture Easy*. *PictureWorks* is the bomb. It provides

colors. Images are a tad dark and tinged with a faint bluish-green hue, but they display none of the compression artifacts produced by the other cams in this roundup. Lines remain distinct, and color boundaries never stray. Video resolutions range from 80x60 to 320x240; the 323 produces excellent-quality video in well-lit environments, but displays an odd, colored static in low-light situations.

Using the 323 is a breeze, thanks to the first-class software package that includes *PictureWorks' Live* and

the most intuitive software we've seen in a long time: Just click on a camera or video icon to record stills or video, and watch your images float into an image gallery for saving, displaying, or dragging to the desktop. *PowerGoo* is great for making any image look totally ridiculous, and *Netcard* lets you send videos and clips to Grandma on her birthday. With *Picture Easy*, you can organize and print images, and scan photos with the included TWAIN driver.

Living up to its name in professional photography, Kodak built a great camera that outshines all others in still-image quality tests. Video conferencing and streaming video are not the 323's strong suit, but it performs elegantly enough to satisfy any digital video enthusiast.

MAXIMUM PC VERDICT

Price \$170
Company Kodak
Phone 800.508.1531
URL www.kodak.com

9

3Com HomeConnect

HomeConnect easily delivers the best natural color of all the cameras we tested, in both still-image capture and video playback. HomeConnect lets you crank the resolution from 128x96 all the way up to 1280x960 for full-screen, software-rendered still pictures, but there's no point in going over 320x240: From 128x96 to 320x240, images look impressive, with crisp color and sharp edges on all objects. But high-resolution captures aren't quite as pretty; at 640x480 and beyond, image compression results in heinous artifacts everywhere, with blurred lines and hazy borders on objects.

With a video resolution range from 128x96 to 640x480, HomeConnect delivers framerates in the high 20s at up to 320x240. The camera displays all images in 24-bit color, and supports BMP, EPS, GIF, JPEG, PCX, and TIFF file formats.

HomeConnect includes a righteous software package: *PictureWorks' Live* and

Netcard, Microsoft *NetMeeting*, *RealPlayer G2*, *Webcam 32*, and a proprietary update application called *What's Hot* that gives you quick access to the web for the latest updates, add-ons, and patches. 3Com also throws in an image viewer that allowed us to adjust a multitude of settings, such as time delay, color depth, and framerate speed, before going into *PictureWorks Live* to capture images. *Live* worked flawlessly.

A button on top of the camera allows capture by hand if you don't want to use your mouse to click the on-screen button. As an added bonus, 3Com includes a tripod mount, a phat 10-foot cord that



With the HomeConnect's superb color balance, you get great natural color, but at high resolutions artifacts abound.

unplugs from the camera for laptop use, and a removable lens that can be supplanted by a wide variety of aftermarket lenses. For video conferencing and other low-resolution tasks, 3Com's HomeConnect is a solid performer. But due to wacky compression effects, high-resolution image capturing is not this camera's forte.

MAXIMUM PC VERDICT

Price \$150
Company 3Com
Phone 800.638.3266
URL www.3com.com

8

Nogatech USB Micro Cam

Nogatech's Micro Cam is the lightest and smallest **CCD** camera we've seen, but it's also light in features and adjustments. Though you can snap images at resolutions anywhere from 80x60 to 352x288, they're always displayed and saved at 640x480. Low-resolution images appeared grainy and with an orange hue, though color balance was acceptable. Upon closer inspection, compression artifacts were visible, and the borders of some objects were blurry. The image-capturing process is ridiculous: In order to grab an image, you must click on a clip-art pic of an overweight guy with his gut hanging out of his shirt. As your image is displayed, you're greeted with a cheesy WAV file of a crowd clapping. You can then cancel, save, or "sharpen" the image, which results in an even uglier picture. Also, the lens has a slight fisheye effect, which allows for a larger field of vision, but causes a slight rounding of images at the frame's border.

Image options are slim; you get only two settings for contrast, instead of a sliding scale; a hue adjustment that we were never able to adjust; and settings for resolution and color type. Color depth is also 16-bit, not 24-bit True Color like the other cameras tested. File formats supported are JPEG, GIF, and BMP.



The Micro Cam's fisheye effect fits a larger area into the frame, but image compression creates vertical grids and blurred boundaries.

Nogatech uses proprietary software to capture stills and MGI VideoWave SE+ for video creation and editing. Though VideoWave offers more editing functions than other software,

its interface has a mild learning curve and is better suited to tweaking video footage than to quick-and-easy video capture. Microsoft NetMeeting handles video-conferencing duties.

Approximately the size of a walnut, the Micro Cam sits atop two flexible joints attached to a flat, Velcro base. The joints allow for a wide array of viewing angles, but the short USB cord limits placement options.

The Micro Cam is small, but its diminutive size certainly comes with a feature-and-quality price tag that's simply not worth it.

MAXIMUM PC VERDICT

Price \$179
Company Nogatech
Phone 408.342.1400
URL www.nogatech.com

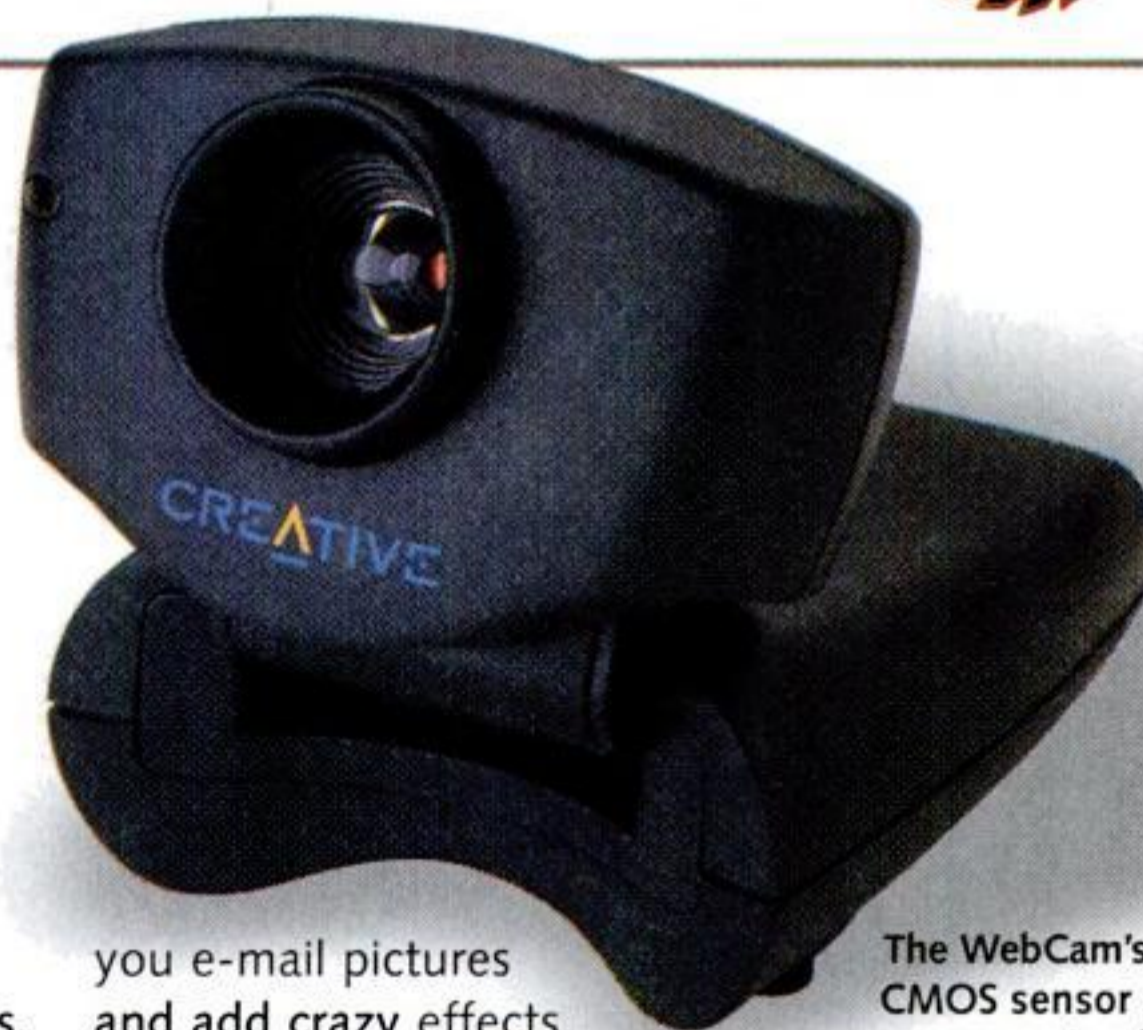


Creative Labs Video Blaster WebCam 3

The buzzword for the Video Blaster WebCam is its **CMOS** sensor, which transmits light signals into digital output, unlike the analog voltage produced by the CCD sensors of the other cameras reviewed here. A CMOS sensor helps make the camera simpler internally and keeps the price down, but it does so at the cost of image quality.

You can snap images—by manually pressing a button on the camera's "head" or through software—from 320x240 up to 640x480, but you're better off keeping resolutions low, since high-resolution images are a mish-mash of artifacts, compression blurs, and pixelated grids. Video playback was smooth, with framerates in the high twenties at 320x240. That number dropped to a choppy 3fps to 4fps at the maximum resolution of 640x480. Video and stills display at 24-bit color, and file formats supported are JPEG and BMP.

Creative gets props for its software bundle, which includes everything a home user could hope for. *WebCam Monitor* turns your PC into a security camera, using excellent motion detection software to take pictures or video of anybody who gets close to your PC. It will even e-mail notification of a breach or upload the image to a web page. Microsoft *NetMeeting* handles video conferencing, and Polaroid *PhotoMAX* lets



you e-mail pictures and add crazy effects.

About the size of a Pop Tart, the camera has four legs and a flip-up lens, giving it the appearance of a puppy.

The WebCam is a cool camera with a killer software package, but lackluster image quality keeps it from making a lasting impression.

The WebCam's CMOS sensor compensates for the bright light by making images too dark. Pixelated grids appeared at higher resolutions, creating artifacts all over the image.

MAXIMUM PC VERDICT

Price \$80
Company Creative Labs
Phone 408.428.6600
URL www.creativelabs.com



FREEZE FRAME

These images, all taken at 320x240, give you a peek inside the secret confines of the *Maximum PC* test lab. The first thing you'll notice is how radically different each camera adjusts to fluorescent lighting. The 3Com HomeConnect achieved the best color balance, while the Kodak took the gold in image quality. The Creative pic looks decent, but zooming in reveals its shortcomings. The Nogatech's fisheye effect is immediately apparent, as is the orangish hue.



Kodak DVC 323 Digital Video Camera



3Com HomeConnect



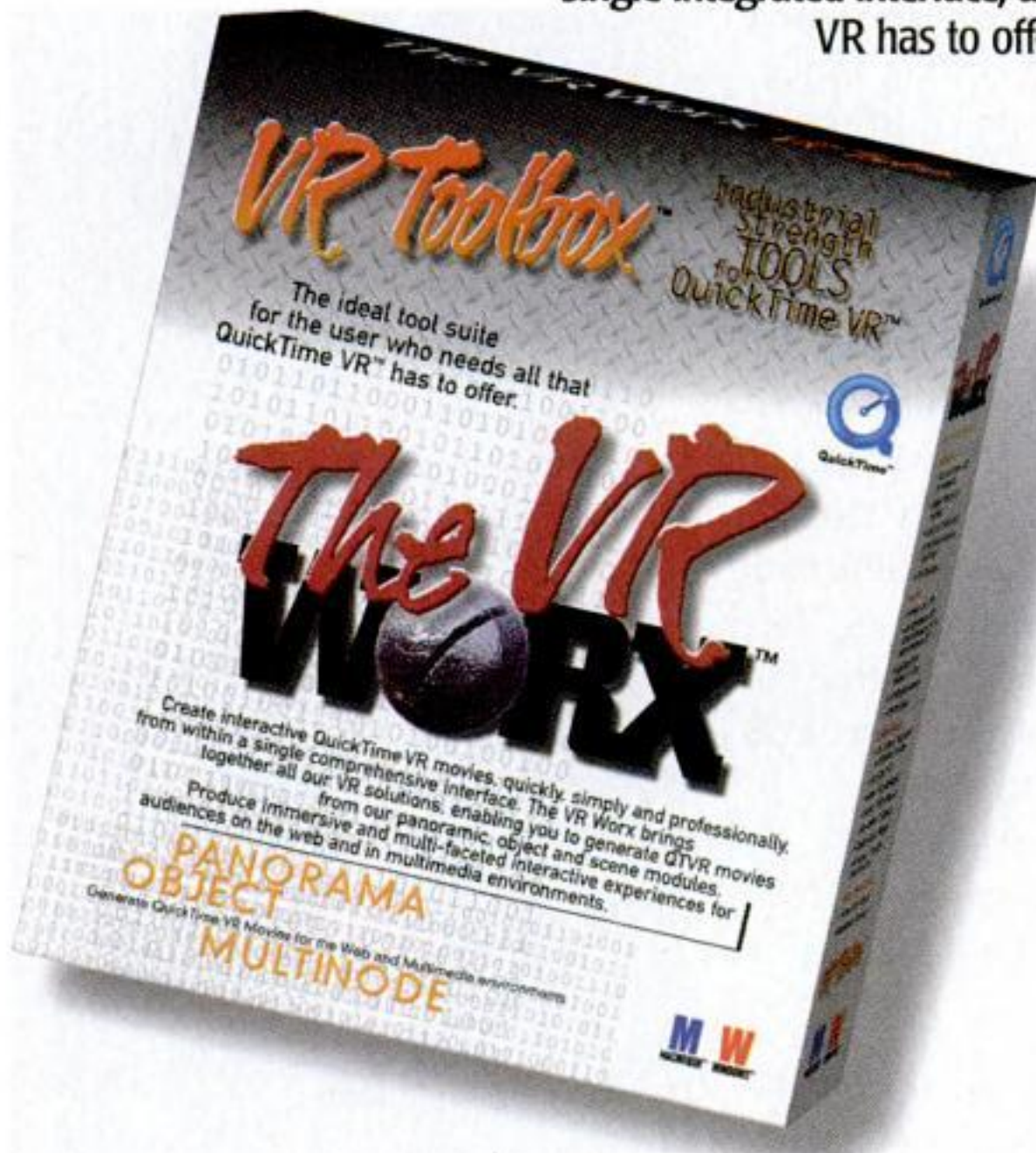
Nogatech USB Micro Cam



Creative Labs Video Blaster WebCam 3

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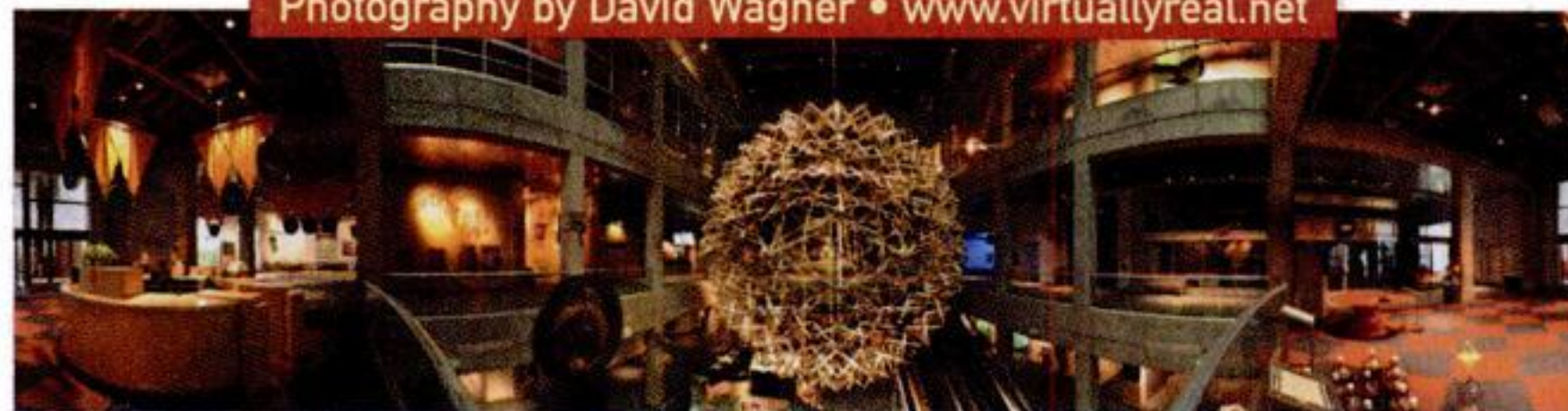
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Panoramic movies show the viewer a full 360 degrees vista. The movie is built out of a series of still photographic images, stitched together to form a single flat panoramic image which is wrapped into a barrel and seamed together. The viewer is placed inside, seeing the interior of the barrel as a panoramic vista. The viewer can look left, right, up and down, turning around to see all views of the 360 degree panoramic scene.



Photography by David Wagner • www.virtuallyreal.net

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VR ObjectWorx™



OBJECT

Object movies feature multidimensional views of a particular object. The movie is constructed out of a series of still images (usually 36 for a single band, up to 684 for a full pole-to-pole multiband object movie) which it compiles to create the illusion of a three-dimensional subject. The viewer is given the impression that they are "holding" the object in their hand. An object movie can also be an animation of movements in many directions and not necessarily circular.



3D Rendering by Dynamic Digital Design • www.dynamicdigitaldesign.com

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VR SceneWorx™



SCENE

Multi-node movies are interactive virtual environments, referred to as "scenes," built by combining panoramas, objects, still images and linear movies. Nodes are joined together via linking tools which create hot spots used for navigating from node to node. The resulting movie allows the viewer to "walk" from room to room (each with 360 degree view), pick up and examine objects, watch linear movies and read text or view still images.



Photography by Alan i Harris • www.alookaround.com

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Kingpin: Life of Crime

MURDER, MAYHEM, MEDIOCRITY

Unintentionally delivered amid the attack on the video-game industry that followed the Littleton, CO, incident, *Kingpin* is the exact type of game that critics are howling about. It's chock-full of profanity, dismemberment, flying bullets, and gory entry and exit wounds. Your goal is to become Kingpin of the organized crime community. Politically correct? No. A blast to play? Hell yes.

Though the gangland revenge plot is thin, the beautifully rendered environments and stunning character models, courtesy of the *Quake II* engine, more than compensate. Each character model has 15 segments that can be individually targeted and blown off. And Xatrix has included support for highly detailed 32-bit color textures and location damage.



In Kingpin, body-specific damage is sick and twisted.

block your path or get stuck behind doors. And if you have a tag-along thug when a new level loads, there's an 80% chance he won't be there when the next level appears. Not all is lost, however,

as *Kingpin's* levels take so long to load you'll probably forget you even had a teammate.

As expected from a game that promises to "take graphic violence to a new level," *Kingpin's* arsenal is a heavy-hitting collection of gangster weapons and military hardware, ranging from a Tommy gun and a shotgun to a bazooka and a flamethrower. Weapons can be taken from corpses or purchased at any of the Pawn-O-Matics scattered throughout the game.

Kingpin is ready for multiplayer action out of the box and supports Heat.net and GameSpy Lite. Standard deathmatch is available, as is a capture-the-flag mod called "bagman," in which teams try to collect money from the middle of the map, from the other team's safe, or off dead bodies. Deathmatch was engaging, but bagman was the only reason we'd play online. Sneaking into the enemy base to rob their safe is a real pants-wetter, always promising a hail of bullets and obscenities as you try to escape.

Kingpin separates itself from the pack with its astonishing graphics, over-the-top profanity, and body-part-specific damage system. Unfortunately, too many aspects of this very short game are unfinished. We're underwhelmed.

—Josh Norem



Clipping problems are hilarious.

THE SPECS

3D CARD SUPPORT
OpenGL

3D SOUND SUPPORT
None | Sound Blaster compatible

MULTIPLAYER
TCP/IP | LAN

NUMBER OF PLAYERS
16

PLUSES

Stunning graphics
Gore galore
Great sound and weapon effects

MINUSES

Way too much profanity
Levels take forever to load
Steep system requirements
Indistinguishable level bosses

Unfortunately, to see *Kingpin's* 32-bit textures in all their glory, you'll need major firepower. On a Pentium III 550MHz with 128MB RAM and a Diamond Viper V770 Ultra, *Kingpin* ran at a smooth 35fps and looked amazing at 1024x768. But gameplay sucked on a K6-2

450MHz with 96MB and a Voodoo³ 2000 at 800x600: We grew a beard waiting for levels to load, and there was so much sound skipping we began to think the street thugs had speech disorders. *Kingpin* also suffers from serious clipping problems: Dead bodies fly through walls, get stuck in

stairwells, and become suspended in midair in ways we haven't seen since the *Tomb Raider* series.

Graphical glitches aside, *Kingpin's* gameplay is about as visceral as it gets. Enemies spew streams of obscenities during battle, scream in pain, and lose appendages when hit point blank. Along the way you can hire thugs to help you out, but beware—their AI often causes them to

MAXIMUM PC VERDICT

Price \$50
Developer Xatrix
Publisher Interplay
Phone 949.553.6655
URL www.interplay.com



GANG WARFARE 101

To become a Kingpin, you have to be a leader. *Kingpin* includes mercenaries for hire, but you have to know how to properly handle your boys if you want to stay alive.



Big Daddy modeled for Kingpin.

Tip #1 ▶ Keep your distance: Before entering rooms or hallways where you think there might be some gunplay, be sure to issue the "park your ass" command to your thugs so they don't block you if you have to backpedal quickly.

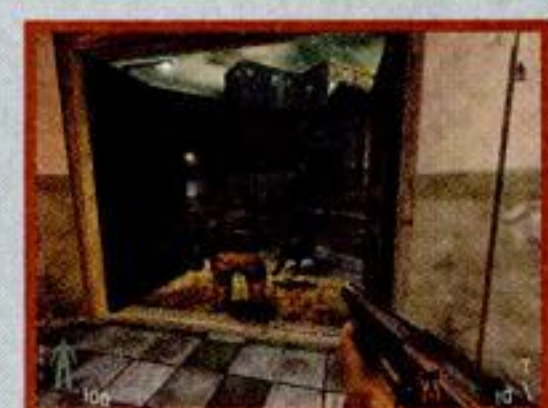
Tip #2 ▶ Set up ambushes: You know enemies are in a room, so park your thugs by the doorway. Run inside to provoke them, then run out quickly so your boys waiting by the door can cap them.



Get your man ready before opening doors.

Tip #3 ▶ Lockpickers and Safe blowers: Not all nonplayer characters (NPCs) are experts at beat downs. In level two, you need to hire someone to blow a safe in order to progress to level three, and all doors marked "Keep out" can be opened by lock pickers. NPCs will tell you their specialty before you hire them.

Tip #4 ▶ Make them human shields: There's nothing wrong with hiding behind your thugs and letting them take the heat.



Hide behind your thug while he takes care of business.

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Lexmark Z51

THIS JETPRINTER IS NO CONCORDE

We've said it before, and we'll say it again: Printers aren't sexy, but the images they produce can be. Alas, this is not the case with Lexmark's Z51. The first release in Lexmark's redesigned line of thermal inkjet

PLUSES

- USB connectivity
- No paper jams on feeds
- Peer-to-peer networking capability
- Decent text print times

MINUSES

- Light text at all resolutions
- Light ink coverage
- Consistent banding and dithering
- Only 100-sheet paper tray

printers, the Z51 targets small businesses with its rated print speeds of 10 black and 5 color pages per minute, and its built-in peer-to-peer networking. USB connectivity means your parallel port is available for other good stuff.

Criticized in the past for its paper-feeding

mechanism, Lexmark started from scratch with the Z51 by building what it calls the Accu-Feed system; it carefully reads the thickness of the media it's grabbing, so it takes only one piece at a time. In practice it looks like the paper feeds crookedly, though it exits straight. We guess this system works, because we encountered no paper jams during extended testing.

The Z51 sprays ink onto the paper in 7 picoliter droplets—almost as small as Epson's Stylus Color 740, a comparable printer that was our Gear of the Year in 1998. Unfortunately, this doesn't translate to sharp text and images. During our text tests, which

consist of printing a text-heavy, 7-page Adobe Acrobat PDF document, the Z51 produced rough text at its lowest 600x300dpi "QuickPrint" mode on plain paper in 2 minutes, compared to the 740's 2:43 (minutes:seconds) at 360dpi. Though faster than the 740, the Z51 exhibited ink coverage best described as timid. Even on better paper at its higher resolutions, the Z51 printed typically (for inkjets) blurry, but atypically light text.

On the color side, the Z51 experienced more trouble. In QuickPrint mode, the Z51 spit out a text-and-image-heavy PowerPoint document onto plain paper in 12:06, to the Epson's 12:04 at 360dpi. At the same speed on better paper, the Z51's print quality was abysmal, so we reprinted the document in "Vivid Color" mode at 600x600dpi. Lo and behold, the blues were bluer and the reds were redder, but the print time jumped to 1:01:40. Time aside, the Z51 produced washed out colors with obvious banding and dithering at the lower res, and bright colors and slight banding at the higher dpi.

On skin tones, the Z51's results varied widely, depending on the color settings. In Automatic color, the Photoshop image of our November 1998 cover model had out-of-whack red balance, so her skin looked like she'd used too much self-tanner. In



Lexmark's Z51 is a mixed bag of decent print speeds and timid ink coverage.

Vivid color, we got the same results. We finally got acceptable output in Natural color, although, as with the PowerPoint document, colors were slightly washed out and subtle shading was lost.

Lexmark says the Z51 is suited to SOHO sites, but since it took over an hour to print a typical business document like our PowerPoint file, this recommendation should be taken with a grain of salt. With acceptable speeds otherwise, but light ink coverage, the Z51 is a decent inkjet that begs to be adjusted.

—Sarah Pirch

THE SPECS

HEAD	4-color CMYK thermal 7 picoliter drop
RESOLUTIONS	600x300 600x600 1200x1200
RATED SPEEDS	10 ppm black 5 ppm color
PAPER TRAY CAPACITY	100 sheets
WEIGHT	9 lbs
INTERFACES	Parallel USB
DRIVERS	Windows 3.1x, 95, 98, NT 4.0, OS/2, DOS through Windows
BUNDLE	Corel Print House Magic I ArcSoft Photo Fun House
COST OF INK	Black \$30 Color \$38

MAXIMUM PC VERDICT

Price \$250
Company Lexmark International
Phone 888.539.6275
URL www.lexmark.com



PRINT QUALITY		The "official patrol" Guard, public, State		The "official patrol" Guard, public, State		The "official patrol" Guard, public, State		The "official patrol" Guard, public, State		The "official patrol" Guard, public, State	
600x300	1200x1200	600x300	600x600	600x600	1200x1200	600x600	1200x1200	600x600	1200x1200	600x600	1200x1200
Print Time: 2:00 At the lowest res, text is rough.	Print Time: 21:49 Even at the highest res, the Z51's text blurs.	Print Time: 12:06 Colors are washed out in QuickPrint mode.	Print Time: 1:01:40 At mid-res and on photo-quality paper, we got intense colors.	Print Time: 3:37 In Automatic color, she looks like she overdid the self tanner.	Print Time: 4:35 In Natural color, skin tones are realistic, but subtle shading is lost.						

EditDV

EVERYTHING YOU NEED TO EDIT DV

PLUSES

- Uncluttered interface
- Awesome character generator
- Smooth quick-project review
- Complete DV solution

MINUSES

- Weak audio control
- Lacks deck control and batch recapture

THE SPECS

NO. OF PORTS	3
AUDIO SUPPORT	WAV, AIFF, MP3
NO. OF VIDEO TRACKS	Unlimited
NO. OF AUDIO TRACKS	20
VIDEO FILE FORMATS	QuickTime

With EditDV, Digital Origins has combined its *EditDV* software with its EditDV IEEE 1394 (FireWire) hardware to produce a complete nonlinear video-editing package. And while you can buy the software alone to replace your copy of Adobe *Premiere*, it works only with Digital Origins' proprietary hardware. It's a perfect marriage.

EditDV serves up a streamlined interface and major speed enhancements, including keyboard and mouse shortcuts that make editing almost instinctual. Because it takes advantage

of Intel's SSE optimizations, you'll also see noticeable performance gains: Our benchmarks caught *EditDV* rendering nearly twice as fast as Adobe's *Premiere* and Apple's *Final Cut Pro*. Other tasty morsels include the options to view instant stills on your monitor and to

render composited frames, transitions, text, or 3D DVE moves in nearly realtime. The timeline handles up to 99 video layers or effects tracks and 20 audio tracks, and transitions, filters, and effects are all configurable.

EditDV's très gourmet text manipulation allows you to animate and apply filters, shadows, and blurs, and the app's speed and clean interface are award-worthy. But there's still room for improvement. The audio editing stinks like something left in the back of the fridge; where *Premiere* lets you cook up "echo," "equalize," and "reverb" effects, *EditDV* slops out "volume adjustment" and the option to rubberband tracks on your timeline. The included demo version of *SmartSound* eases the pain, but we'd prefer a healthier helping of sound tools. The video-capture setup is also half-baked: The



EditDV's Complete window shows the entire shebang at once.

editor and the capture utility can't be open simultaneously. We were left hungry for more professional features, such as time-code and batch recapture. But for the price, we'd still order up *EditDV* over Adobe *Premiere*.

—Beverly and Laurence Bartone

MAXIMUM PC VERDICT

Price \$499 for software only, \$799 for software and hardware
Company Digital Origin
Phone 800.572.3487
URL www.digitalorigin.com



ADS Pyro

BARE-BONES DV

Last year, those with a hankering for digital video needed 1,000 clams for an IEEE 1394 video-capture/editing solution. While it's more of a backyard cookout than Digital Origin's gourmet NLE feast, the 1394-ready Pyro will set you back just \$179. But don't get too fired up—the Pyro is a tempting tidbit, but some of its specs don't quite cut the mustard.

One of Pyro's biggest bummers is its stripped-down software editor, Ulead's *Video Studio*. Though it's a user-friendly version of Ulead's *Media Studio Pro*, *Video Studio* just isn't feature-rich. Its meat-and-potatoes approach lets you capture video; edit with transitions; add music, narration, and tiles; and



Pyro makes digital video editing accessible, but don't attempt anything too fancy.

output your finished production to tape, but it doesn't deliver

the ingredients, such as chroma-key effects and tweakable transitions, to cook up anything really creative. What really left a bad taste in our mouths was that the software is tied directly to the hardware, preventing users from upgrading to a better editor once they've outgrown *Video Studio*.

Pyro's hardware is also hard to swallow, because it works with only a handful of digital video cameras

THE SPECS

NO. OF PORTS	3
AUDIO SUPPORT	WAV, AIFF
NO. OF VIDEO TRACKS	1
NO. OF AUDIO TRACKS	2
VIDEO FILE FORMATS	QuickTime, RealVideo, ASF, MPEG-1, AVI

currently on the market; of the four cameras we had in-house during this review, only one was compatible. If you're considering the Pyro, we suggest you first peruse www.adstech.com's menu of supported cameras.

Because it actually works as advertised, Pyro does get a few brownie points. But if you're looking to whip up something with real panache, Pyro probably won't satisfy your craving.

—Rick Popko

MAXIMUM PC VERDICT

Price \$179
Company ADS Technologies
Phone 562.926.1928
URL www.adstech.com



PLUSES

- Easy to use and install
- Inexpensive

MINUSES

- Works with only certain cameras
- Software isn't upgradable
- Limited NLE features

Dungeon Keeper 2

IT'S NOT EASY BEING EVIL

In *Dungeon Keeper 2*, a realtime strategy game, you build dungeons and micromanage an army of evil creatures. Just like the original, *DK2* has you putting the smack down on do-gooders throughout the land. But underneath the sequel's eye-pleasing graphics, you'll find that gameplay is virtually unchanged.

With a redesigned graphics engine, *Dungeon Keeper 2* ditches software 3D for hardware acceleration. Pristine Direct3D graphics can be cranked up to 800x600, and the game runs smoothly even as it tosses out 15,000-polygon scenes. Inventive character animations and filmy lighting effects greatly enhance the already-sinister atmosphere. And this time out, the first-person perspective not only looks stunning, but can also affect gameplay. Though there are some minor clipping problems and the animated water moves like Jell-O, *DK2's* overall look is sleek and refined. But once you get past the pretty graphics, you'll find everything else familiar: Build your dungeon, train your creatures, slap them around, and march them off to beat the snot out of the sanctimonious heroes.

Lame combat was the original's biggest letdown, and it also plagues the sequel. It's too easy to pick up soldiers and



Your worthless minions toil for your happiness in *Dungeon Keeper 2*.

drop them on a horde of oncoming heroes, making defensive structures and room placements almost arbitrary. Crummy AI becomes clear when you drop your creatures into combat and they wander off, disinterested. Multiplayer is hobbled by a weak networking engine, a poor selection of maps, and a four-player limitation. Bullfrog is in the process of setting up a dedicated Internet server for *DK2* gamers, but we can't see how that would be an improvement.

With *Dungeon Keeper 2*, Bullfrog could have flexed its twisted creativity, but while its fantastic looks should keep Evil Overlords happy for a while, *DK2's* tired gameplay takes all the fun out of being naughty.

—Dan Simpson

PLUSES

Stellar graphics
The thrill of being evil

MINUSES

Lame multiplayer
Too few additions to this sequel

THE SPECS

GRAPHICS

Direct3D
800x600

SOUND

EAX

MULTIPLAYER

TCP/IP
IPX
4-player max

MAXIMUM PC VERDICT

Price \$45
Company Bullfrog/EA
Phone 800.245.4525
URL www.ea.com



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Brisbane, CA 94005

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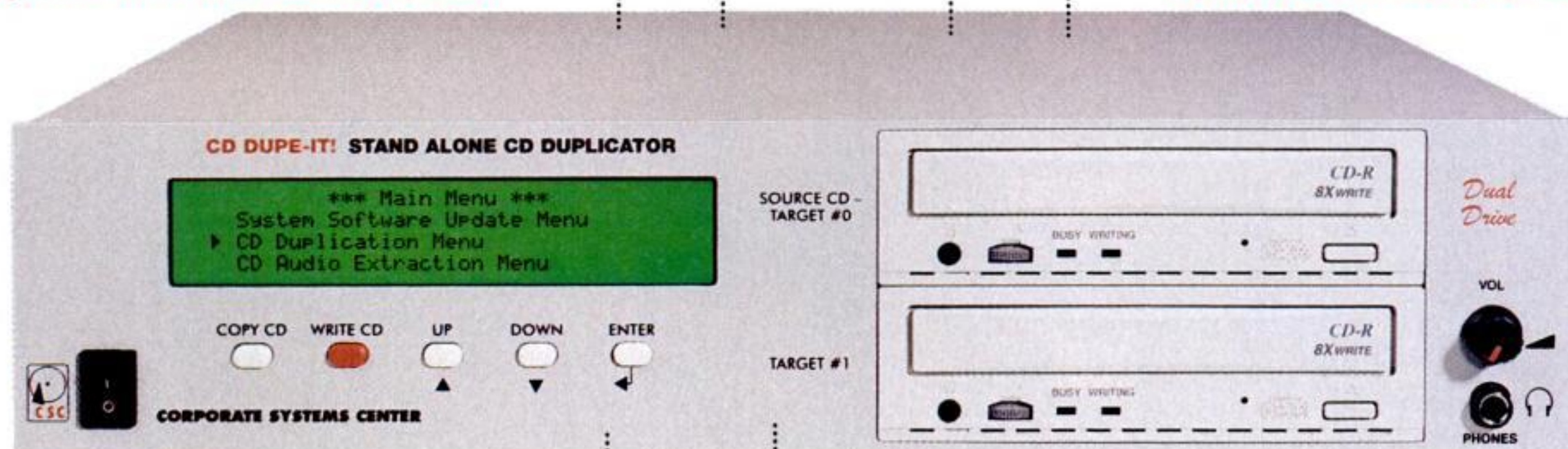
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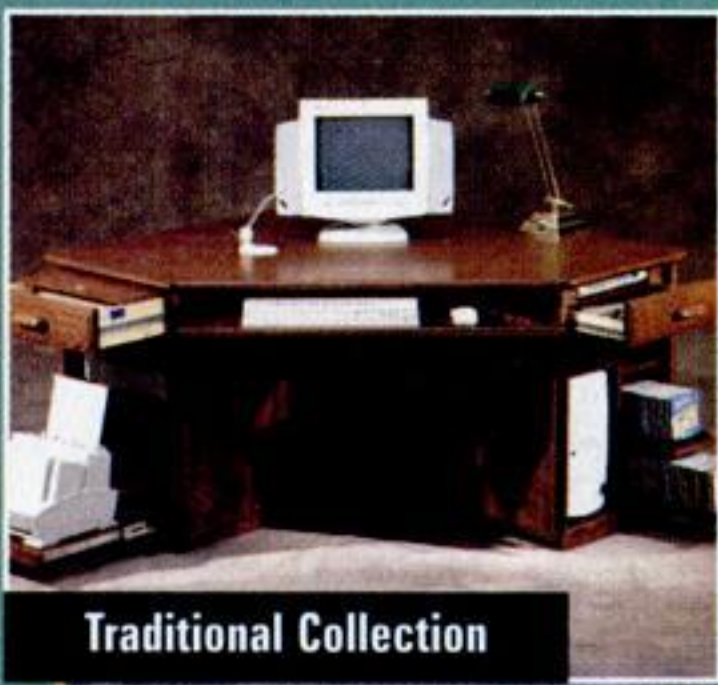


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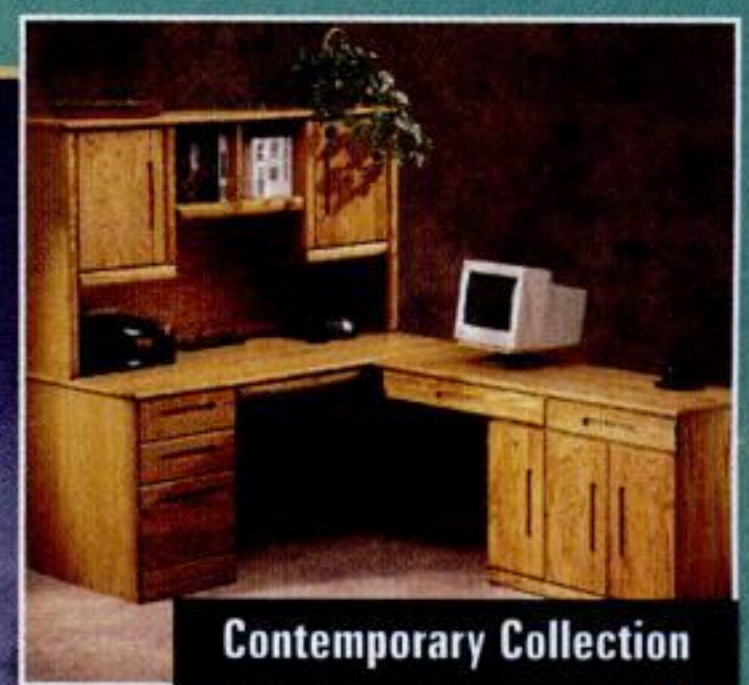
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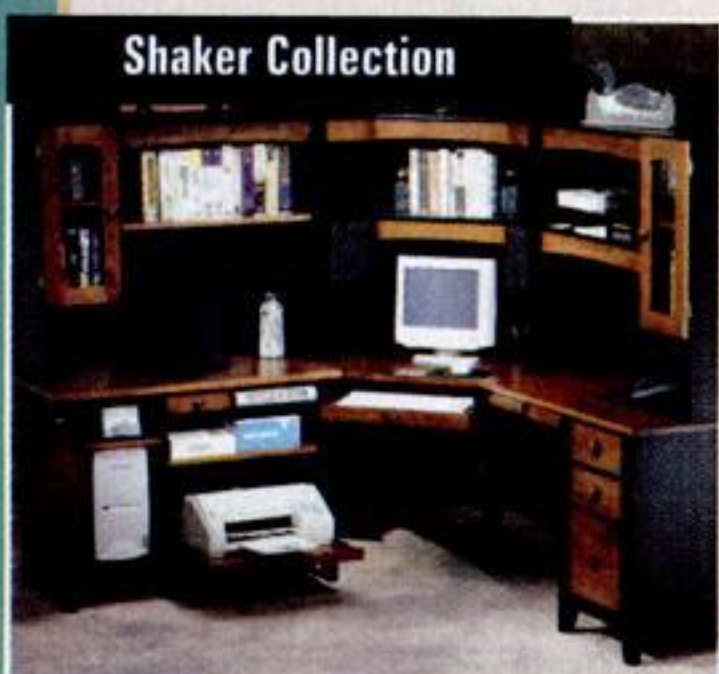
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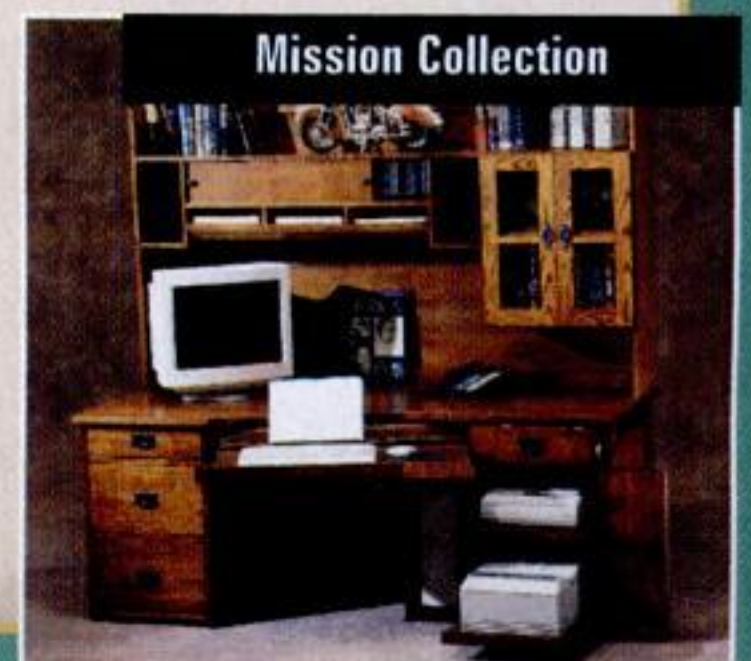


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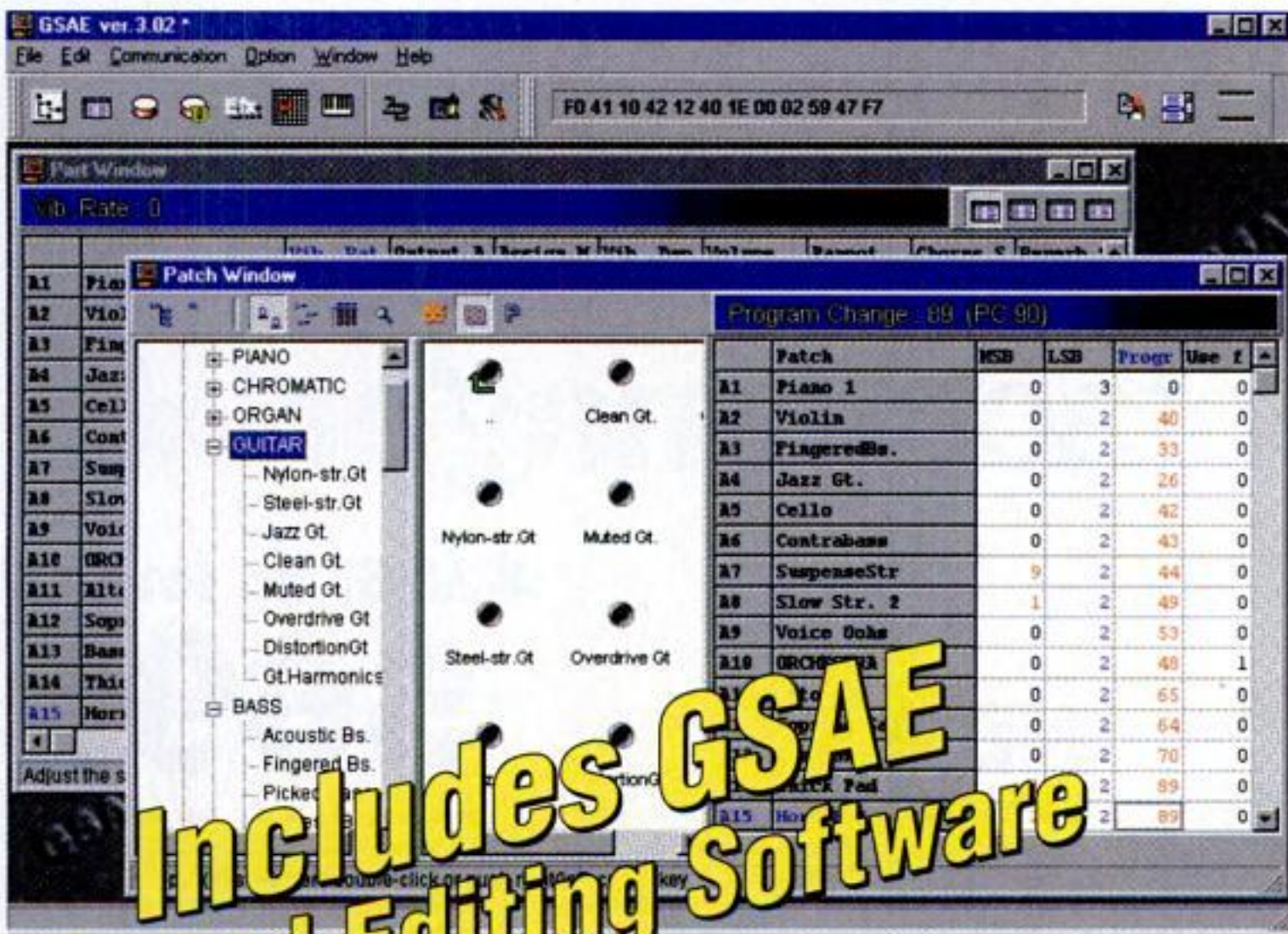
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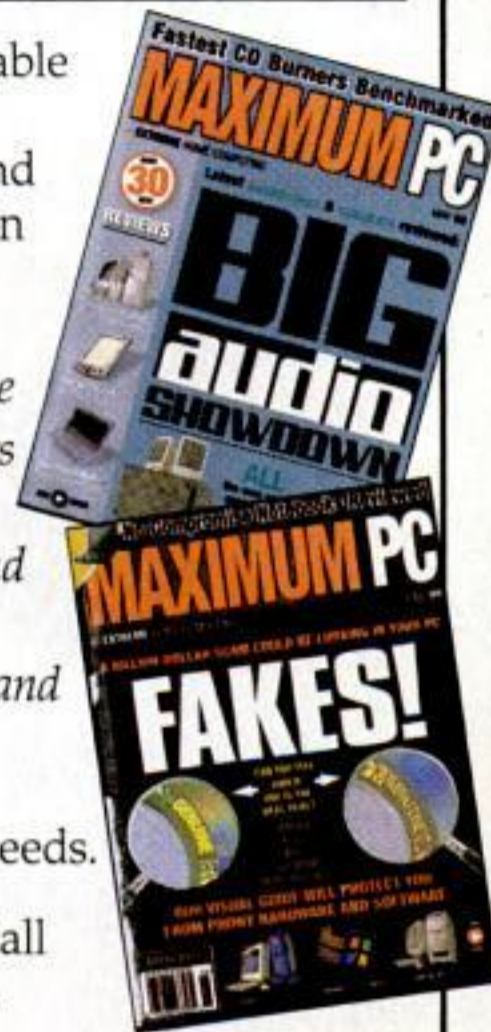
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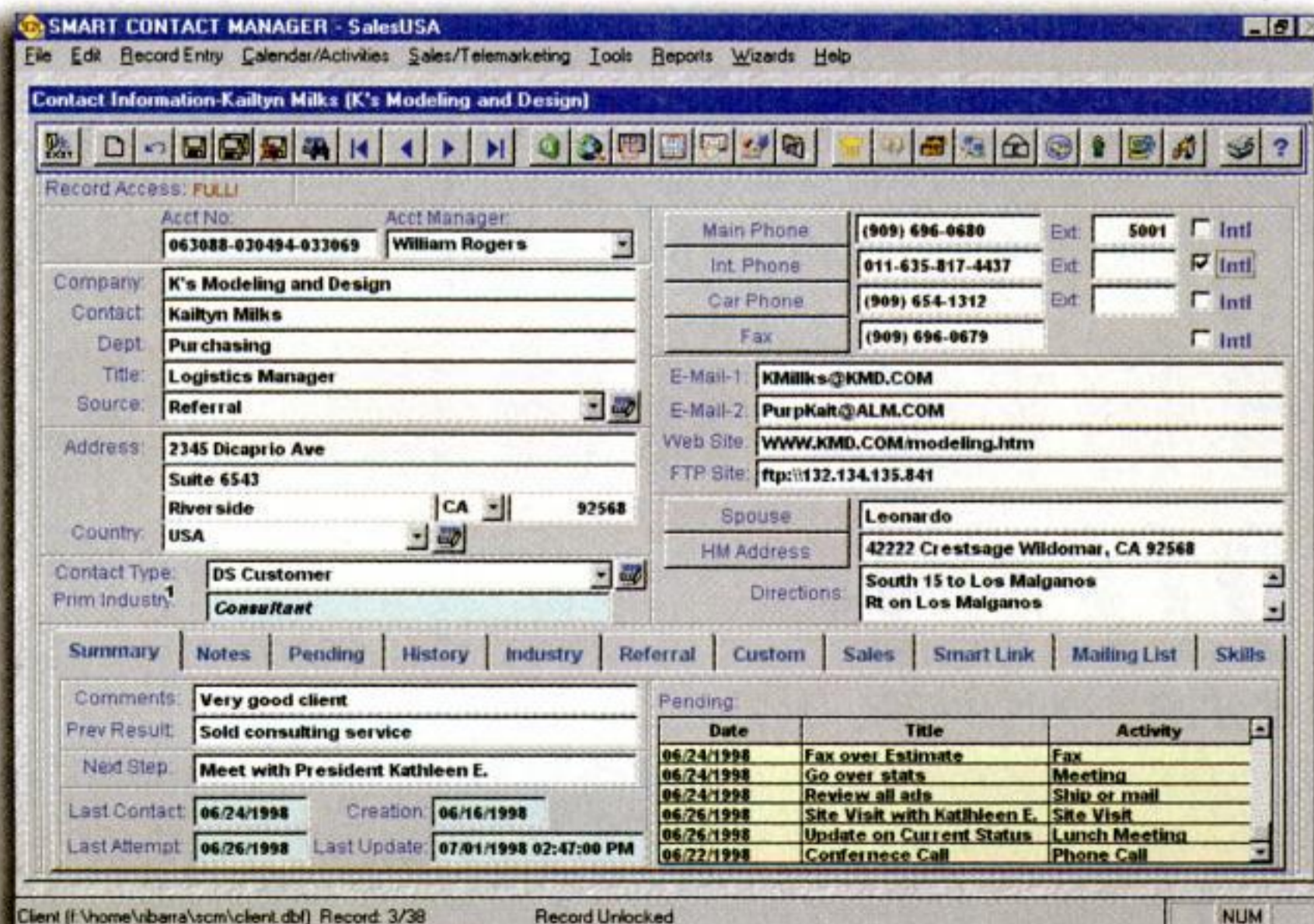
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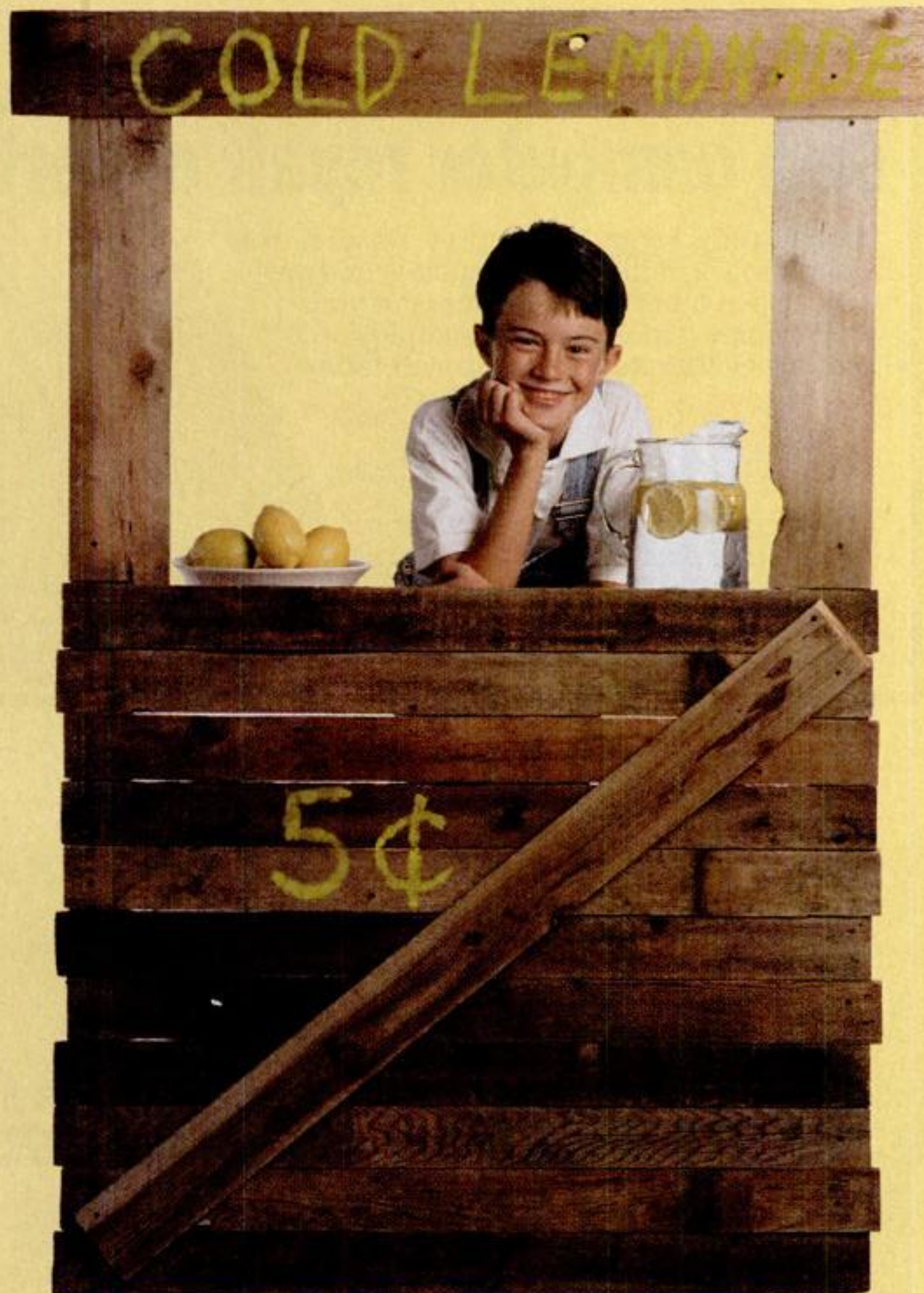
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TERMINATOR

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. Terms appearing in **blue** within the Terminator are updated definitions of previously explained concepts. The extended Terminator (with terms not found in this issue of the magazine) is also found online at www.maximumpcmag.com.

A

ADSL Asymmetric Digital Subscriber Line. A modem technology that simultaneously delivers data, video, and voice over existing copper telephone lines. It receives data at rates from 1.5Mbps to 9Mbps, and sends data upstream from 16Kbps to 640Kbps. It requires a special ADSL modem.

AGP Accelerated Graphics Port. An expansion bus developed by Intel specifically for the videocard subsystem. It operates independent of the PCI bus and normally runs at 66MHz (i.e., 1x). Whenever you see multipliers attached to AGP, such as 2x or 4x, they are referring to how much faster the bus will run—2x means 66MHz x 2, or 133MHz.

AVI Audio Video Interleave. Defined by Microsoft, it is the most common file format for audio and video on the PC.

B

bezier path A mathematically-defined, curved line controlled by points and "handles" protruding from those points to adjust its curvature and shape.

BIOS Basic Input/Output System. Software that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Your BIOS runs at startup, configures devices, and then boots the OS. Because the BIOS is so integral to getting your computer started, it's stored on a separate ROM chip, not your hard drive, to isolate it from crashes.

boolean Named after the nineteenth-century mathematician George Boole, boolean operations are mathematical relationships based on a core logic that can be represented in a Venn diagram. In 3D modeling they are: Union (the combination of two sets), Intersection (the overlapping of two sets), and Subtraction (the part of one set remaining after an intersecting set is removed).

branch prediction The ability of a microprocessor to predict the outcome of conditional branches. The sophistication of this ability varies greatly, from static prediction (always guessing a branch will fork in the same direction) to dynamic prediction (basing predictions on previous behavior).

buffer see cache

bump-mapping A visual trick that attempts to simulate a texture's roughness or smoothness, depending on how the texture reflects lights. In 3D, this is usually accomplished by laying two textures onto a polygon—a base texture for the graphics, and a second displacement texture that is mapped on the object. This second texture determines how "rough" the surface will appear.

C

cache A dedicated or reserved bank of memory that is used to improve your computer's performance. It provides a temporary storage area for instructions and data that acts as a fast swap to and from your CPU. The larger the cache, the greater the performance.

CCD Charged Couple Device. A tiny silicon wafer that's built into many of today's digital cameras and video camcorders. It's a sensor used to convert light into a video signal, made up of thousands of tiny, light-sensitive pixels that react to incoming light. Its tiny semiconductors are connected so that the output of one serves as the input of the next. From there, the light is converted into an electrical signal that can be recorded onto a videotape.

clock frequency The operating speed of a microprocessor chip or a chip interface as measured in clock cycles per second. It's regulated by a "clock" or oscillator that synchronizes operations. During each clock cycle, transistors switch on and off to redirect electrical current through a chip's circuits. The faster this happens, the faster a program runs. Synonymous with clock speed, it's usually expressed in megahertz (200 MHz equals 200 million cycles per second).

clock speed see clock frequency

clocked see clock frequency

CMOS Complementary Metal Oxide Semiconductor. Sensor used in digital cameras whose semiconductors use both negative and positive polarity circuits and require less power than CCDs.

command tag queuing A feature of the SCSI-2 protocol that allows device controllers to accept and queue multiple commands from multiple host processes without waiting for a pending I/O request to be completed, resulting in a more efficiently utilized SCSI bus. Basically, it allows devices to immediately accept and execute other commands while data that has already been read or written is sent back up the bus to the SCSI host adapter. It also allows the device controller to execute commands in a different order than they may have been received from the host adapter.

Performance improves significantly when a device is optimized to execute commands in a more intelligent order.

connect/disconnect Allows multiple connected drives to share the SCSI bus bandwidth by allowing them to disconnect individually from the SCSI bus when other drives/devices have information to send.

Coppermine Intel's forthcoming CPU technology based on a 0.18-micron manufacturing process. It will include 256K of full-speed on-die L2 cache, and allow core frequencies that easily exceed the current 600-650MHz "comfort window."

D

DDR RAM Double data rate RAM. Also known as DDR SDRAM. A type of memory that can transfer data on both edges of the clock cycle—for, you guessed it, double the performance.

decoder A block of circuitry inside a microprocessor that figures out what a program instruction is supposed to do. The processor uses this information to execute the instruction. For example, when the decoder finds a multiply instruction, it tells the appropriate function unit to multiply the numbers referenced by the instruction.

die The actual square piece of silicon that contains integrated circuits.

Digital Loop Carrier A fiber optic-based device used to link neighborhoods to the telephone system as a cheaper alternative to copper phone lines. A DLC is also known as a pair gain system.

Digital Subscriber Line A general name for the group of Internet bandwidth technologies, including ADSL, SDSL, HDSL, and G.Lite. It uses plain-old copper telephone wires to transmit data at speeds up to 1.5MB/sec.

DIMM Dual Inline Memory Module. A DIMM is a RAM module configuration that allows dual channels to be used in a single interface. On a motherboard, that would be dual 32-bit memory paths forming a single 64-bit path. Before DIMMs, RAM modules came in SIMMs (Single Inline Memory Modules), which provided a single 32-bit path. With most SIMM motherboards, memory modules needed to be installed in pairs. DIMMs can be installed individually. DIMMs tend to be faster and hold more memory than their SIMM counterparts.

DIN An oversized, 5-pin connector formerly used to attach a keyboard to a PC.

Direct Rambus Short for Direct Rambus DRAM (developed by Rambus, Inc), Rambus is a new high-speed memory technology that can transfer data at 600MHz. Both Intel

and AMD would like to use this memory with its CPUs, but manufacturing problems are slowing the memory type's introduction.

Direct3D A subset of Microsoft's DirectX Application Program Interface. This interface allows developers to use hardware acceleration for 3D graphics, which helps games run faster by offloading the 3D processing onto a dedicated piece of hardware.

DSL see Digital Subscriber Line

DVE Digital Video Effects. Visual effects that create interesting transitions between scenes rather than just switching scenes, including fading or dissolving the frame, wiping one frame over another, flipping the frame, and simulating a camera lens opening and closing (iris effect).

E

EIDE Enhanced Integrated Drive Electronics. A motherboard interface for connecting hard drives, CD/DVD-ROM drives, and removable storage devices.

F

fab A fabrication plant that makes computer chips. It's the place where the people in the dust-proof "bunny suits" work, as seen in Intel's TV commercials. Building and equipping a modern fab can cost \$1 billion to \$2 billion.

floating point A fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with floating-point numbers than with integers (whole numbers), but the higher precision of floating point is required for some operations.

FPU floating-point unit. A function unit (collection of circuits) in a microprocessor that executes floating-point instructions.

G

GUI Graphical user interface. The windows, buttons, menus, scrollbars, and other graphical screen elements that allow a user to control a program. The alternate style is called a CLI (command-line interface)—users type commands at a screen prompt, as in MS-DOS.

I

interconnect layers Metal layers in a silicon chip that wire the transistors together. Most chips have two to six interconnects. They are usually made of aluminum, but advances in manufacturing processes are leading to faster layers made of copper.

inverse kinematics A system of defining interrelationships between objects linked in a hierarchy. Each object is moved according to these relationships relative to the others. The "inverse" designation signifies that the last object in the chain is moved and the relative movement is computed from it up through the last or root object (highest in the hierarchy) rather than from the highest to the lowest in the chain (forward kinematics).

CHECK IT OUT
Online
www.maximumpcmag.com

The extended Terminator (with terms not found in this issue of the magazine) is found 24/7 online.

K

keyframe In animation, an image used at the beginning and/or end of an animation sequence as a reference point.

L

L2 cache The second-fastest memory available to a microprocessor (second only to the Level 1 cache). It usually consists of SRAM chips near the processor, although some recent processors have on-chip L2 caches. Because the CPU runs faster than the memory bus—say 400MHz versus 100MHz—cache becomes useful to temporarily store instructions and data, making sure the CPU has a steady supply of material to churn while memory catches up. Also known as secondary cache.

M

miniGL driver A software driver that interfaces between the videocard and an application that uses only part of the OpenGL instruction calls (hence the term “mini”). The videocard then can perform OpenGL commands via this driver.

multithreaded Most often referenced when talking about operating systems. Back in the DOS days, single-threaded programs predominated, that is, programs that executed only one path through their code at a time. Multi-threaded programs may have several threads running through different code paths simultaneously.

N

NIC Network Interface Card. A shortened term that refers to network adapter.

NURBS Non-Uniform Rational B-Spline. A mathematical representation of a three-dimensional object.

O

OpenGL ICD OpenGL Installable Client Driver. The original OpenGL driver model. Partial implementation allows a 3D accelerator to run OpenGL-accelerated 3D games (e.g., *Quake II*). Full implementation allows the card to support OpenGL acceleration in 3D rendering applications (e.g., *3D Studio Max*).

operands The two objects upon which a mathematical operation is performed. In 3D modeling, they are often used in booleans. One is added to (union), subtracted from (subtraction), or the overlapping region is split off (intersection).

P

PCB Printed Circuit Board. Any one of the familiar green or brown boards that features chips and other types of electronic circuitry. Motherboards, videocards, network cards—they're all PCBs.

PC133 SDRAM SDRAM that runs at 133MHz per the requirements of the industry-approved PC133 spec.

PC99 Spec A baseline specification proposed by PC manufacturers and Microsoft. PC99 mandates such things as a minimum 300MHz processor with 128KB of L2 cache and the elimination of ISA. PC99 also recommends but does not mandate the use of USB and IEEE-1394 over serial and parallel ports.

phong-based A computationally intensive 3D-graphics rendering algorithm, developed by Phong Bui Tuong, that's used to create a color gradient that is then placed over a wire-frame mesh.

.25 micron The micron is a measurement of logic elements (such as transistors) in a silicon chip. The size of these elements is determined by the process technology used to manufacture the chip. Smaller is better, because it means the transistors can be packed more densely and the chip can run at a lower voltage with a corresponding decrease in power consumption. The width of a human hair is about 100 microns.

process technology A manufacturing process for silicon chips. Chips have semiconductor layers of silicon and interconnect layers of metal. Process technologies are usually described in terms of the minimum size of the semiconductor elements: 0.25 micron, 0.18 micron, etc. Smaller is better, because the transistors can be packed more densely and the chip can run at a lower voltage with a corresponding decrease in power consumption.

R

Rambus DRAM Rambus Dynamic Random Access Memory. It's a proprietary but widely licensed memory standard controlled by Rambus that transfers data much faster than current standards such as EDO RAM and SDRAM. The latest incarnation, Direct RDRAM, supports transfer rates as high as 800MHz, compared to 66MHz for EDO RAM and 100MHz for SDRAM.

RAMDAC Random Access Memory Digital to Analog Converter. The chip on a videocard that converts the bits of a digital image into an analog signal. It maintains the color palette and determines refresh rates. The faster the RAMDAC MHz, the higher the refresh rate your system can handle.

read buffers see buffer

RIMM Rambus Inline Memory Module. The slot that accepts Rambus DRAM.

RISC Reduced Instruction-Set Computing. RISC is an architectural design style for microprocessors that was invented to supersede CISC. It tries to maximize performance by encoding program instructions in a fixed-length format and by using simpler instructions that execute in fewer clock cycles.

S

Scan Line Interleave A term used when two videocards work in tandem, with one videocard rendering the odd lines of a video output, while the other card renders the even lines. With the 3dfx Voodoo², the slave 3D card will send its rendered output via a ribbon cable into the master videocard, where the combined output is then generated on screen by the master card. Having two videocards work as one raises overall rendering performance, and in the Voodoo²'s case, allows a higher rendering resolution to be obtained.

SDRAM Synchronous Dynamic Random Access Memory. A faster type of memory that synchronizes with the CPU. Its architecture allows it to run fast enough to handle the 100MHz system bus.

sequential read The fastest way to read data from a hard drive is by reading it sequentially. This means the data is all lined up so the head doesn't have to seek it out in other places on the platter.

SIMD Single instruction, multiple data. It describes a special instruction that allows a microprocessor to perform an operation on more than one piece of

data at the same time. SIMD is especially useful for speeding up multimedia software that handles large amounts of audio, video, and graphics data.

SGRAM Synchronous Graphics Random Access Memory. A type of single-ported memory often used for videocards that synchronizes with the CPU and uses techniques to optimize graphics processing. Considered faster than its SDRAM cousin due to its ability to perform mask writes and block writes.

SLI see scanline interleave

SSE Streaming SIMD Extensions. These are the 70 new instructions and 8 new registers that Intel first added to the Pentium III processor in March 1999. Most of the instructions speed up 3D graphics, but they also accelerate other operations. See “SIMD.”

stencil buffer A small chunk of closely coupled RAM used for storing data that will be quickly compared to incoming data and changed as needed. A stencil buffer could be used to hold data for simulating realtime changes in a chunk of a scene, such as a mirror or shadows. Any changes can be quickly be changed and the output can accurately reflect these changes.

superpipelining Essential for scaling processors to higher frequencies. Similar to an automobile assembly line, superpipelining breaks up the execution of a complex instruction into multiple simple stages so that less work is done per stage and each stage completes as quickly as possible. As the frequency of the processor increases, each pipeline stage can keep pace, because its task is relatively simple. Because there are multiple simple stages, it's important to keep the pipeline operating on the correct instructions. This requires good branch prediction—if the pipeline stages are working on the wrong instructions, the entire pipeline must be flushed clean.

superscalar A superscalar microprocessor can execute more than one program instruction at a time. Multiple function units make this possible.

system bus The main input/output bus on a microprocessor. It's the interface that connects the CPU to most other system devices, such as main memory (RAM), PCI devices, the AGP card, the system chipset, and often the Level 2 (L2) cache. Also known as a frontside bus.

T

texture The surface graphics on a 3D object. Without textures, 3D objects look like naked skeletons of polygons. Textures add realism—a brick wall, the skin of a lizard, or the gleaming metal surface of a spaceship. A 3D program stores a texture as a graphics pattern and applies it to the structure of polygons.

texture compression The ability to shrink texture data down from a larger size down to a smaller size by replacing certain types of data (determined by the compressor) deemed redundant with an approximation that will be used in the lower-sized palette. This often results in lower-colored textures and could also cause some visual artifacts to be introduced, resulting in a dithered effect.

3D positional audio Gives developers the ability to position sound in 3D instead of just left-to-right placement.

The sound is often simulated and calculated with complex algorithms to determine how it will sound to most people. Major 3D APIs currently include DirectSound3D and Aureal3D.

3DNow! Introduced in 1998 with AMD's K6-2 processor, 3DNow! originally consisted of 21 new instructions that speed up 3D graphics and other tasks on x86-compatible processors. In late 1999, with the introduction of the Athlon (formerly K7) processor, AMD added 24 additional instructions to 3DNow!. The 3DNow! extensions also have the support of chipmakers Cyrix (National Semiconductor) and Centaur Technology (IDT). Notably missing from this loose alliance is Intel, which introduced its own Streaming SIMD Instructions (SSE) in early 1999.

transforms Alterations that change the position, rotation, and scale of an object.

U

Ultra2 SCSI Doubles the total bus throughput of Ultra Wide SCSI from 40MB/sec to 80MB/sec, by increasing the clock rate to 40MHz.

USB Short for Universal Serial Bus. A new, faster, digital I/O port proposed by Intel for motherboards. Taking up far fewer resources, this port can act as a serial, parallel, mouse, keyboard, joystick, and even speaker interface. Unlike other communication ports on a PC, USB can be daisy-chained up to 127 devices.

X

x86 A microprocessor architecture invented by Intel and widely copied by other companies. The 486, Pentium, Pentium Pro, Pentium II, Celeron, Xeon, AMD K6, AMD Athlon, Cyrix M II, and Centaur WinChip are all x86-compatible processors. The first x86 chip was the 8086 in 1978.

Y

Y2K Year 2000. Some people are predicting widespread computer failures after midnight on January 1, 2000 when programs that manipulate years as two-digit numbers (such as “99” for 1999) confuse 2000 with 1900.

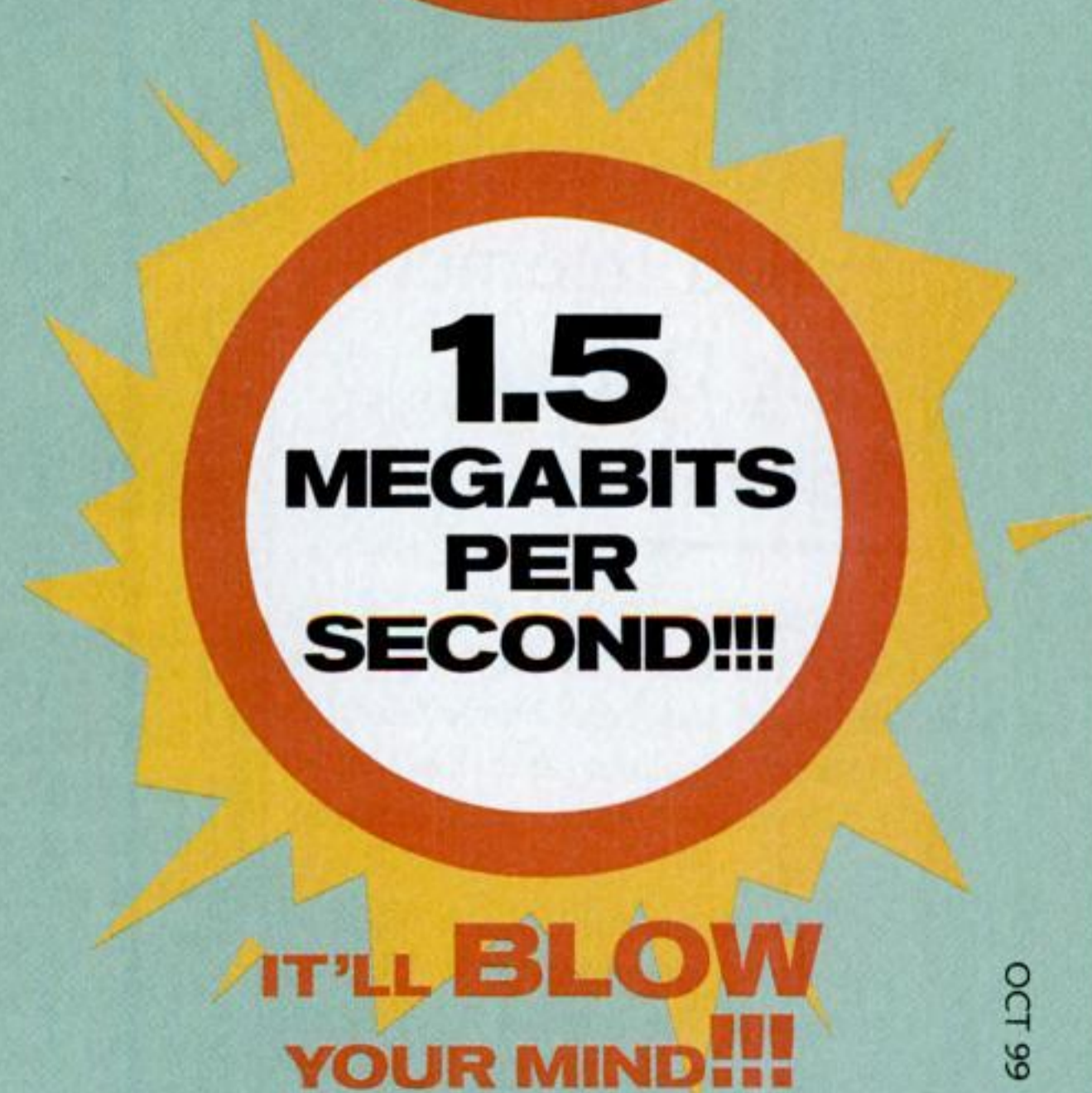
Z

z-buffer In a 3D videocard, local video memory is often used to form a frame-buffer, which stores all sorts of data required by a 3D card in order to properly render a scene onto your monitor. With the advent of texture-mapped polygons interacting in a 3D world in realtime, the need to have a buffer with which to track positioning became a necessity. A z-buffer stores the z-axis value (front to back) of a pixel on-screen—this value is compared with incoming z-value data to determine whether the pixel will be drawn or not, and how overlapping pixels will be presented. How accurate a z-buffer is dependent on how the 3D accelerator handles z-buffer calculations, and how much memory is allocated to it. Higher color-depth rendering requires more z-buffer memory, as the amount of pixel information is made larger with more color usage. It speeds up 3D gaming by not rendering the parts of a scene that are obscured by other objects.

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Vice President Gore Proud Father of New Wide Area Network

WASHINGTON D.C. — Vice President Albert Gore has announced that he is the proud father of a bouncy new Wide Area Network. At a press conference today, Gore said he named the network "The Internet," and expects his child to redefine how people communicate with each other.

The Internet, the progeny of Gore and an unknown mother, was born on March 21 at the Bethesda Naval Hospital in Maryland.

Gore said he kept the birth a secret for nine days so he and The Internet's mother could enjoy their "miracle" in peace, away from media scrutiny. Though Gore refused to clarify the mother's identity, Beltway insiders believe she is either the U.S. Military or the National Science Foundation.



Gore cradles his new bundle of ether.

The Internet is not only the Vice President's first bastard child, but also the first Information Age construct to spring from his loins. Gore and his wife Tipper are already the parents of three girls and one boy.

During the press conference, Gore gently tickled The Internet under its chin. "Coochie-coochie-coo," whispered Gore to the infant as an annoyed Tipper looked on.

Gore Finds Pornography In The Internet's Room

WASHINGTON D.C. — Vice President Albert Gore confirmed today that he has found pornography in The Internet's room, validating recent news leaks that have scandalized his office. Though just three and a half years of age, The Internet is "extremely precocious," Gore said.

"It's a time of exploration for The Internet," Gore said. "It's asking a lot of questions about the origin of life, where babies come from, that sort of thing. So I'm not surprised that it has shown an interest in human sexuality. Nonetheless, I personally do not approve of smut in the Vice Presidential Mansion."

Speaking candidly, one of the Vice President's aides said Gore was appalled by The Internet's vast pornography collection. The young Information Age construct had managed to accumulate more than 92 terabytes of hardcore JPEG and AVI files.

"The collection was hidden in a footlocker marked 'Pokemon Stuff,'" said the aide, "but when the Vice President opened up the lid, he found literally millions of image galleries of adult women in their twenties posing as 'barely legal' teenagers. The Vice President was not only shocked by the graphic content, but also very upset that The Internet was keeping secrets from him."

The Internet, the child of Gore and a still-unnamed government institution, was legally adopted by the Vice President's wife, Tipper, in 1994. While the Vice President has decided to "forgive, forget, and respect The Internet's privacy," Tipper has announced she would like to lead a committee to legally prohibit obscene material in The Internet's room.

FINANCE

Today's Contents

THE DAILY GLITCH
 VOL. CXLIII NO. 1
 SUNDAY, MAY 17, 1997 *** 2 CENTS

Gore Daughter Pulled Internet's Plug During Squabble

WASHINGTON D.C. — Sarah Gore, the Vice President's youngest daughter, has been blamed for the Internet blackout that shut down nationwide servers yesterday morning.

The Vice President's office said the Gore daughter, age 18, was furious at The Internet for disseminating "real intense personal secrets" about her love life, so she unplugged The Internet's backbone while the rest of the Gore clan was eating breakfast.

Please turn to Page A8, column 3

continued from page A1
 "Apparently, Sarah confronted The Internet around 9:30 a.m.," said an aide. "She said she had proof that The Internet had broken into her diary and surreptitiously published excerpts of the diary on various web sites. The two children squabbled back and forth, and when it became apparent that their father wasn't going to intervene, Sarah rushed upstairs and pulled The Internet's plug. She then rushed back downstairs, and threw the plug in The Internet's face, saying, 'See? See what it's like to have someone messing with your stuff?'"

Unable to communicate, The Internet

said and did nothing while Sarah stood arms akimbo, tapping her foot, waiting for an answer. The Vice President, meanwhile, grabbed the plug, ran back upstairs, and worked furiously to put the nation back online.

"Al plays favorites with The Internet," said Tipper Gore, who legally adopted her husband's illegitimate Information Age construct in 1994. "I'm not saying Sarah should have pulled the plug, but some type of punishment was in order."

In unrelated news, the Vice President has been named in a paternity suit regarding a new telecommunications technology that was born to an Atlanta research facility in April.

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E-VALUE CODE: 89176-500912

DELL INSPIRON™ NOTEBOOKS

Common features: 3D Surround Sound with Wavetable ♦ Lithium Ion Battery ♦ Touchpad
Upgrades: Canon BJC-50 Portable Printer, add \$349 ♦ Targus Defcon Notebook Alarm, add \$49

DELL INSPIRON 3500 INTEL CELERON PROCESSOR AT 366MHz

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM and Floppy Drive
- NeoMagic[®] MagicMedia™ 256AV AGP Video
- MS Works Suite 99 with Money 99 Basic

\$1799

\$54/Mo., 48-Month Purchase Plan³³

E-VALUE CODE: 89176-800917

DELL RECOMMENDED UPGRADE

64MB SDRAM, 56K Capable¹¹ V.90 Fax Modem, Deluxe Nylon Case

ADD \$199

E-VALUE CODE: 89176-800919z

DELL INSPIRON 7000 INTEL CELERON PROCESSOR AT 366MHz

Mobile Desktop

- 15" XGA Active Matrix Display
- 32MB SDRAM (384MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Mobility™ P 3D Video
- MS Works Suite 99 with Money 99 Basic

★ 64MB SDRAM, add \$99.

★ Internal 56K Capable¹¹

V.90 Fax Modem, add \$59.

★ 6.4GB⁴ Ultra ATA Hard Drive, add \$99.

\$1999

\$60/Mo., 48-Month Purchase Plan³³

E-VALUE CODE: 89176-800919

³⁴48-Mo. Purchase Plan offered through Dell Financial L.P., 14050 Summit Dr., Austin, TX 78728, to consumers. Only available in the 50 U.S. states and of Columbia, except AR & MN. Availability may be offer may vary in some states. Advertised payments on sales prices depicted for 48-mo. term at 18.99% approved credit. Excludes taxes & shipping charges (for example, based on sales price of \$2799 for system, the total of sales taxes & shipping charges day ground to Hartford City IN. would be \$234.95 [incl. of \$139.95 and shipping charges of \$95]). Taxes & charges due with 1st payment unless included in financed, in which case your monthly payment will be

ased Systems) ♦ 3.5" Floppy Disk Drive ♦ 2 Universal Serial Bus (USB) Ports ♦ McAfee VirusScan ♦ Dell QuietKey® Keyboard
 vice ♦ MS Works Suite 99 with Money 99 Basic ♦ **Upgrades:** APC Back-UPS Office, add \$99 ♦ HP® OfficeJet 710, add \$399

NEW DELL DIMENSION XPS T600
PENTIUM III PROCESSOR AT 600MHz

- 128MB 100MHz SDRAM
- 13.6GB⁴ Ultra ATA Hard Drive
- 17" (16.0" vis, .26dp) M780 Monitor
- 16MB 3DFX Voodoo3 3000D AGP Graphics
- **NEW** 8X Max¹⁰ Variable DVD ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com® USR V. 90¹¹ PCI Telephony WinModem
- Logitech MouseMan® Wheel (PS/2v)
- ★ **NEW 1-Year Dellnet Internet Access¹⁴ with 20MB Online Backup¹⁵**

\$1899

\$57/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89176-500918**

NEW DELL DIMENSION XPS T600
PENTIUM III PROCESSOR AT 600MHz

- 128MB 100MHz SDRAM
- 13.6GB⁴ Ultra ATA Hard Drive
- 17" (16.0" vis, .26dp) P780 Trinitron® Monitor
- 32MB Diamond Viper 770D nVidia AGP Graphics
- **NEW** 8X Max¹⁰ Variable DVD-ROM Drive
- SoundBlaster Live! Value 512V Sound Card
- ACS-340 Speakers with Subwoofer
- 3Com® USR V. 90¹¹ PCI Telephony WinModem
- 100MB Zip Drive
- MS IntelliMouse®
- ★ **NEW 1-Year Dellnet Internet Access¹⁴ with 20MB Online Backup¹⁵**

\$2239

\$67/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89176-500922**

NEW DELL DIMENSION XPS T600
PENTIUM III PROCESSOR AT 600MHz

- 128MB 100MHz SDRAM
- 27.3GB⁴ Ultra ATA Hard Drive
- 19" (17.9" vis, .26dp) P990 Trinitron® Monitor
- 32MB Diamond Viper 770D nVidia AGP Graphics
- **NEW** 8X Max¹⁰ Variable DVD-ROM Drive and Decoder Card with TV Out
- SoundBlaster Live! Value 512V Sound Card
- ACS-495 Dolby Surround Sound Speakers with Subwoofer
- 3Com® USR V. 90¹¹ PCI Telephony WinModem
- 100MB Zip Drive
- Logitech MouseMan Wheel (PS/2v)
- ★ **NEW 1-Year Dellnet Internet Access¹⁴ with 20MB Online Backup¹⁵**

\$2799

\$84/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89176-500927**

PRE-LOADED SOFTWARE OPTIONS

Microsoft® Office 2000 Small Business Edition:

Word 2000, Excel 2000, Publisher 2000, Outlook 2000, Small Business Financial Mgr. 2000 and Expedia Streets 2000.

Microsoft Works Suite 99:

Word 97, Encarta Encyclopedia 99, Money 99 Basic, Works 4.5a, Works Calendar, Graphic Studio Greetings and Expedia Streets 98.

SOFTWARE MULTIPACKS

New Fast Track Game Pack \$99:

Star Wars Rogue Squadron, Asteroids, Jack Nicklaus 6.0, Monopoly, Grand Prix Legends.

Quicken 99 Power Bundle \$79:

Quicken Deluxe 99, Quicken Financial Planner, Quicken Family Lawyer.

ad ♦ 3-Year Limited Warranty² ♦ Setup Video ♦ MS Windows 98, Second Edition ♦ add \$49 ♦ Home Base Kit (Port Replicator, Keyboard, Mouse), add \$189

DELL INSPIRON 7000
PENTIUM II PROCESSOR AT 400MHz

Mobile Desktop

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max¹³)
- 6.4GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Mobility™ P 3D Video
- Internal 56K Capable¹¹ V.90 Fax Modem
- MS Office 2000 Small Business plus Bookshelf
- ★ *Removable Combo 4X DVD-ROM and Floppy Drive, add \$129.*
- ★ *Inspiron 7000 Port Replicator, add \$149.*
- ★ *2X AGP 8MB ATI RAGE Mobility P 3D Video, add \$39.*

\$2699

\$81/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89176-800926m**

DELL INSPIRON 7000
PENTIUM II PROCESSOR AT 400MHz

Mobile Desktop

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max¹³)
- 10GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Mobility™ P 3D Video
- Internal 56K Capable¹¹ V.90 Fax Modem
- Microsoft Works Suite 99 with Money 99 Basic
- Deluxe Nylon Case
- ★ **NEW 1-Year Dellnet Internet Access¹⁴ with 20MB Online Backup¹⁵**
- ★ *Inspiron 7000 Port Replicator, add \$149.*
- ★ *Removable Combo 6X Max Variable DVD-ROM, add \$169.*

\$2999

\$90/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89176-800829m**

POWER UPGRADES

RECEIVE UP TO \$50 OFF WITH MAIL-IN REBATE ON THIS HP PRODUCT WHEN PURCHASED WITH A DELL DIMENSION DESKTOP AND MONITOR OR DELL INSPIRON NOTEBOOK. OFFER EXPIRES 10/2/99.²⁰

HP DESKJET 882C COLOR PRINTER

- Brilliant photo-quality printing on any paper
- Up to 9 ppm black, 6.5 ppm color
- Parallel or USB²¹ connectivity



\$299

\$50 HP MAIL-IN REBATE²⁰ Available

HP SCANJET 4200Cse SCANNER

- Push-button scanning and copying
- USB²¹ connectivity for easy installation
- 600 dpi, 9600 dpi enhanced, 36-bit color



\$199

APC SURGESTATION PRO8T2

- Helps protect your system against electrical surges
- 8 outlets with block spacing for 3 outlets
- Provides \$10K equipment protection warranty



\$39

PREMIER 3-YEAR ON-SITE³ SERVICE

- Sends a technician to your door the next business day if necessary after phone-based troubleshooting
- Protects your PC from expensive technical support costs down the road



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 Desktop Service

\$99

Notebook Service¹⁹

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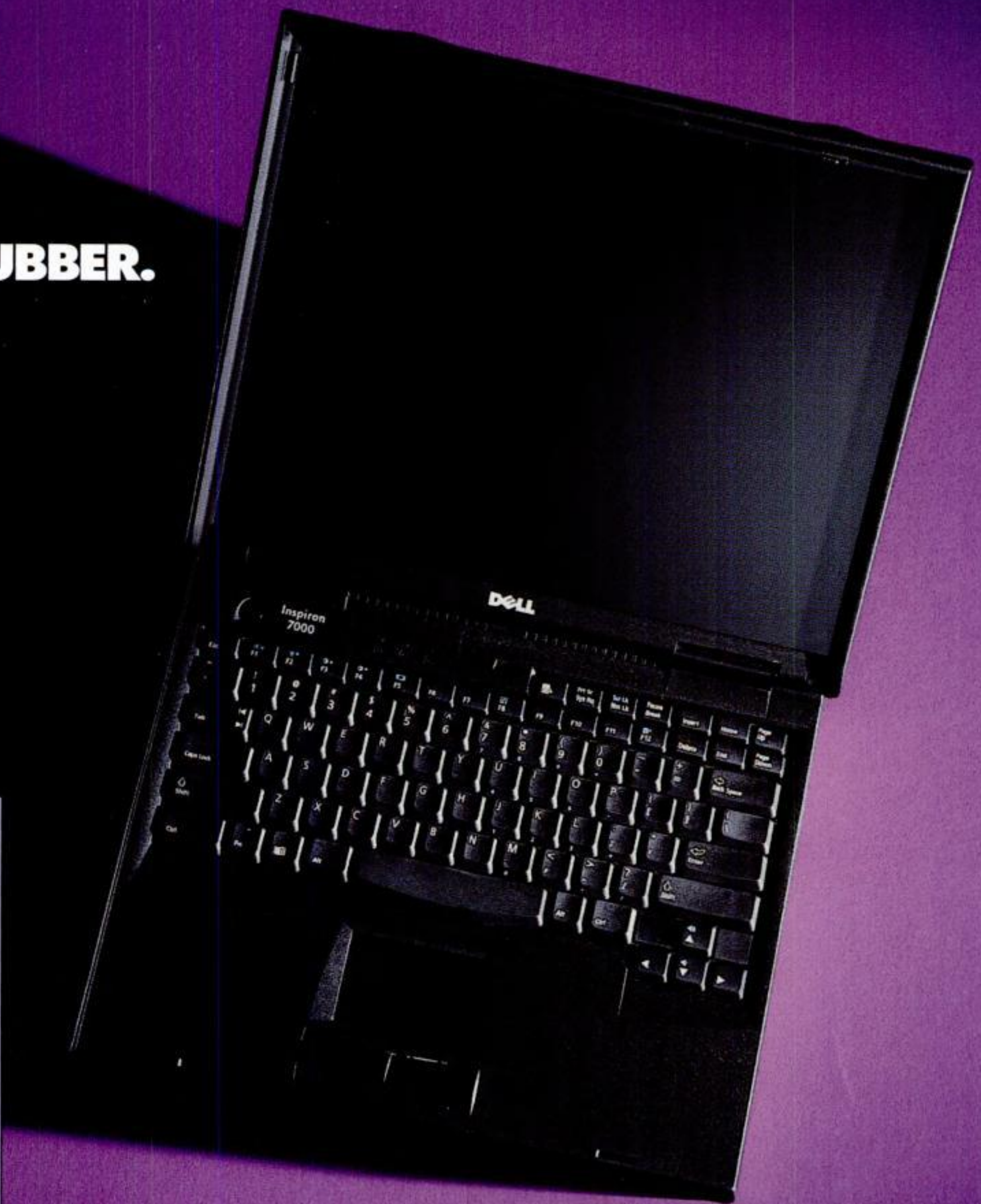
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DELL® INSPIRON™ 7000 PENTIUM® II PROCESSOR AT 400MHz


Mobile Desktop

- 15" XGA Active Matrix Display
- 64MB SDRAM (384MB Max¹³)
- 10GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE Mobility™ P 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Internal 56K Capable¹¹ v.90 Fax Modem
- MS® Works Suite 99 with Money 99 Basic
- MS Windows® 98 Second Edition
- Deluxe Nylon Case
- McAfee VirusScan 4.02
- Inspiron Setup Video
- 3-Year Limited Warranty²

★ **NEW 1-Year Dellnet Internet Access¹⁴**
with 20MB Online Backup¹⁵

\$2999

\$90/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89175-800929**



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Packed with the Pentium® II processor at 400MHz, 8MB of VRAM and a 15-inch display, the Dell® Inspiron™ 7000 notebook lets you put the pedal to the metal. After all, you won't find these kinds of numbers on just any notebook. Because this isn't just any notebook. Call us or visit www.dell.com to build yours today.

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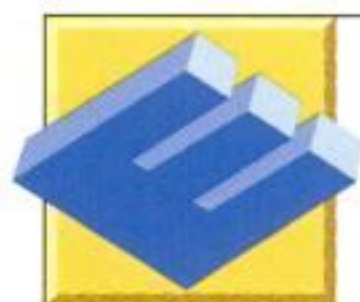
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Computer games.



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The computer graphics and sounds you've experienced before will seem like plain vanilla once you've had a taste of the Dell® Dimension® system. For starters, the 32MB Diamond Viper 770D nVidia AGP graphics card and 8X Max¹⁰ DVD-ROM transform games and Internet eye candy into a feast for the senses. And to top it all off, you can upgrade with a MS Sidewinder Precision Pro Joystick and New Fast Track Game Pack²². Whet your appetite @ www.dell.com.

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NEW DELL® DIMENSION® XPS T600
PENTIUM® III PROCESSOR AT 600MHz

- 128MB 100MHz SDRAM/13.6GB⁴ Hard Drive
- 17" (16.0" vis, .26dp) P780 Trinitron® Monitor
- 32MB Diamond Viper 770D nVidia AGP Graphics
- NEW 8X Max¹⁰ Variable DVD-ROM Drive
- SoundBlaster Live! Value 512V Sound Card
- ACS-340 Speakers with Subwoofer
- 3Com® USR V.90¹¹ PCI Telephony WinModem
- 100MB Zip Drive
- MS® Works Suite 99 with Money 99 Basic; McAfee VirusScan, MS Windows® 98 Second Edition
- Dell QuietKey® Keyboard
- MS IntelliMouse®
- 3-Year Limited Warranty²
- 1-Year Next-Business-Day At-home³ Service
- ★ **NEW 1-Year Dellnet Internet Access¹⁴ with 20MB Online Backup¹⁵**
- ★ **Dell Customized Upgrade, add \$169.**
*MS Sidewinder Precision Pro Joystick
NEW Fast Track Game Pack²²
(E-Value Code: 89174-500924g)*

\$2239

\$67/Mo., 48-Month Purchase Plan³³

 **E-VALUE CODE: 89174-500922**

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